

Section 0

Lists and structure

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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Chapter 2

About this manual

2.1 Structure of the manual

	The present Technical Product Manual (TPH) is divided into sections.
Parts of the TPH sections	<p>Each section consists of</p> <ul style="list-style-type: none">• a section overview and• several chapters.
Section overview	<p>The section overview includes</p> <ul style="list-style-type: none">• the title page of the section with the subject and the section number• the summary of changes• the table of contents of the section• the lists of figures, tables and the index as well as• - in sections containing instructions – general safety precautions.
Chapter	<p>In the chapters the numbering of pages, figures and tables relates to the chapter. For example, page 4-5 is the fifth page in chapter 4. The subject of the chapter and the chapter number are shown in the header of each page. On even pages the assignment to a section can be found in the left margin of the page.</p>

2.2 Manual conventions

	Conventions are used throughout the TPH to present information in a uniform way and to help you find similar information quickly.
Marginal notes	Marginal notes are printed in the left margin of the page and contain keywords that refer to a subject that is explained in the body text. Use these keywords to find specific text information quickly.
Cross-references	<p>Cross-references to other sources of information are printed in <i>italic</i> and refer to:</p> <ul style="list-style-type: none">• other chapters• a figure or• a table etc. <p>Example: Additional information can be found in <i>Chapter 2.3 "Cluster"</i>.</p>
Keys	<p>If an instruction tells you to press a key, the key name will be printed in [SMALL CAPITALS BOLD].</p> <p>Example: Press [ENTER] to confirm your entry.</p>

Cross-references to figures

If the text refers to a component illustrated in a figure, the reference number is printed in bold (1). Example: The type plate (1) on the tachograph shows the following details...

Actions you should carry out

Instructions relating to actions to be carried out are printed in bold, descriptions of instructional steps are printed in standard typeface. Distinguish between:

- instructional steps that are related to each other and have to be carried out one after the other and
- instructional steps that are in no specific order.

Instructional steps that are related to each other are numbered consecutively.

Example:

- 1 Press the mains switch (3) to switch the STC on.
- 2 To check the quartz:
 - Set the function key (2) to "v".
 - Press the function key (1) until the measured value is shown on the display.

The value displayed must be **4915** (± 1).

Instructional steps with no compulsory order are represented as follows:

Example:

- Ask the driver whether there are any special defects.
- Make a visual check on the tachograph:
 - Condition
 - Type
 - Sealing
 - Installation label.

Workflow descriptions

In the figure and the corresponding workflow table the numbers referring to individual steps in a workflow description are printed in white on a black background.

Example of a table:

	Sealing point	before/after step	Sealing equipment
1	Odometer	after switchover or repair	Cover plate, seal cap
2	Pulse generator, generator cable	after having checked the drive connections	Two-hole seal, locking wire

2.3 Symbols

Pictograms

Whenever you should pay special attention to a circumstance or condition, pictograms are printed in the TPH.

"Important":

Notes containing important additional information which you have to observe when carrying out the work steps are represented as follows:

Example:



Important

When testing the tachograph in running order, the fitting position must always be the same as in the vehicle.

"Condition":

Conditions that have to be met before carrying out the next work steps are represented as follows:

Example:



Condition

Before running the connection cables the following information must be available:

- Components of the tachograph system
- Special conditions for running the cables in the vehicle such as exhaust, shift axle, tilttable cab...

Symbols in tables

If symbols are used in tables, the symbols are explained in the table's key.

Example:

Key

- standard
- Additional equipment
- not available for delivery

Chapter 3

List of abbreviations

Symbols

μP Micro-processor

A

ABE General operating permit (homologation)

ADR Regulation on the Carriage by Road of Hazardous Goods (abroad)

AETR European Agreement on the Work of Crews of Vehicles engaged in International Road Transport

AMP Manufacturer of plug and socket connections

AO Field organisation

App. Nr. Device number (on the type plate)

APS Rolling Road Test System (replaced by ATC)

ASL Automatic Speed Limiter

AT Replacement

ATC Rolling Road Test Computer (former APS)

AZU Time Group Selector (extension to STC)

B

BTC Operation Test Computer

C

C Cancel key (Clear) on BTC, HTC, MTC

CAN Control Area Network

CAT Category

CD Compact Disk

CE Comité Européen

D

DES	Data Encryption Standard (data security)
DF-k	RPM constant
DIN	Deutsche Industrie-Norm (German industrial standards)
DTCO	Digital Tachograph

E

EA	Electronically adjustable
EDM	Electronic diesel consumption measuring system
EEC	European Economic Community
EEC (EC)	European Community (French/ English)
EEPROM	Electrically Erasable Programmable Read Only Memory
EG	Europäische Gemeinschaft (dt.)
EMC	Electromagnetic compatibility
ENR	Electronic level control
EU	European Union

F

FDS	Vehicle diagnosis system
FMR	Vehicle engine control
FMS	Fleet Management System
FPersG	German Law on Crew engaged in Road Transport
FPersV	German Regulation on Crew engaged in Road Transport
FTCO	Flat Tachograph 1319
FZ	Vehicle

G

GG NFZ	Commercial vehicles business division
GGVS	Regulation on the Carriage by Road of Hazardous Goods (abroad, ADR)
GND	Earth (Ground)
GWL	Warranty

H

HTC	Hand Test Computer
HW	Hardware

I

i	Gear ratio
IC	Integrated Circuit
ID No.	Identification number
imp/km	Pulses per kilometre (EA systems)
IP	International Protection
IS	Installation Service
ISE	Installation Service – authorised fleets
ISO	International Organisation for Standardization

K

k	Constant for adjusting the vehicle's speed/ RPM to the tachograph
Kfz	Motor vehicle
KITAS	Kienzle Tachograph Sensor
K-LINE	Serial asynchronous interface
km	Kilometre or kilometres
km/h	Kilometres per hour
k_{old}	Device constant (EA tachographs)

K

KTCO	Compact Tachograph 1318
k_{test}	Test constant k = 8,000 imp/km

L

L	Effective circumference of the tyres in mm
LED	Light Emitting Diode
LK	Light commercial
LT	Light van

M

MB	Mercedes Benz
MFS	Multi-stylus system
MK	Mannesmann Kienzle
mph	miles per hour
MTC	Mobile Test Computer
MTCO	Modular Tachograph

N

n	Rotational frequency RPM; unit of measurement [revs/min]
NEC	Non EC (tachograph)
NFU	Tracked clock
NFZ	Commercial vehicle CV
NL	Agency

P

PA 2000	Automatic test unit (for drawing up the test chart automatically)
per cent	Rate or number per cent (= for each hundred)
PG	Pulse generator
Pl.-Nr.	Seal number
PTB	German Federal Office for Physical and Technical Control
PU	Packaging unit

R

RAS	Repair Exchange System
REP	Repair
revs/km	revolutions/km
RNL	Regional agency
ROM	Read only memory
rpm	Revolutions per minute
RS	Repair Service

S

SAS	Stylus lifting system
SDS	Service Diagnosis System
SI	Service Information
SK	Heavy goods vehicle
STB	Current limiter
STC	Stationary Test Computer
StGB	German Criminal Code
StVZO	German Regulations Authorising the Use of Vehicles for Road Traffic

T

T.W	Terminal "W" (rpm pick up at vehicle generator)
TCO	Tachograph
TPH	Technical Product Manual
TSU	Speedometer Simulator Unit
TU	Technical documentation

U

UTC	Universal Time Co-ordinated
------------	-----------------------------

V

v	Speed; unit of measurement [km/h]
V24	Interface designation (on STC/ MTC)
VDO IC	VDO Information system/ Cockpit systems
VH	Authorised dealer
VIN	Vehicle identification number
VO	Sales organisation

W

w	Characteristic coefficient expressed as imp/km (tachograph systems)
W	Terminal "W" (rpm pick up at vehicle generator)
w_{adjusted}	Control value for adjusting tachograph systems
WT	Working time

Z

zGG	Maximum permissible weight
ZS	Additional stylus
ZuE	Additional equipment

Chapter 4

Glossary

Symbols and figures

0 hour mark	Marking on the → tachograph chart indicating 00:00 hours. The 0 hour mark is required for analysing the tachograph chart automatically using the readers of the FAS 1300-XX product family.
1+2-driver tachograph	Tachograph with two recording instruments for recording data for → driver 1 and → driver 2. If the vehicle is manned by one driver only, a → blank chart can be inserted which replaces the second tachograph chart.
1-driver tachograph	Tachograph with recording instrument for recording the data for one driver. A 1-driver tachograph can only be installed in vehicles manned by one driver.
1 day tachograph chart	Tachograph chart used to record data for a period of a maximum of 24 hours. 1 day tachograph charts are available with or without → 0 hour mark.
7 day tachograph chart	Pack of tachograph charts consisting of seven → tachograph charts that are placed in the → tachograph; one tachograph chart is used to record the details of one day. The tachograph chart pack does not comply with EEC Regulations.
1 day tachograph	Non EC Tachograph with a recording capacity of a maximum of 24 hours. → 1 day tachograph charts are used for data recording.
7 day tachograph	NEC Tachograph with a recording capacity of a maximum of 7 x 24 hours. → 7 day tachograph charts (pack) are used for data recording.
§ 57b StVZO Regulation	German regulation implementing Directive (EEC) No. 3821/85. → In accordance to the UK T.C.M. (Tachograph Centre Manual).

A

Additional equipment	Optional functions of the → tachograph; divided into → additional equipment A and B. Abbreviation "ZuE".
Additional stylus	Optional additional → stylus for recording two or three pre-defined bars.
AETR	Acronym for "European Agreement on the Work of Crews of Vehicles engaged in International Road Transport". AETR aims at harmonising certain social legislation relating to road transport at European level.
Assignment	Fixed allocation of the various → tachograph chart types to the → tachograph type.
Authorised workshop	Workshop that has been approved for checking → tachograph systems, → EC Tachographs and → NEC tachographs.
Auto-diagnosis	Function of 1318, 1319 and 1324 tachographs where a built-in electronics constantly monitors the correct functioning of the → EA tachograph with regard to voltage breaks and defects in the → pulse generator system.
Automatic working time recording	Function of the 1319 tachograph for recording the → period of availability of → driver 2 automatically. When the time group knob for driver 2 is set on → "Rest period" or → "Other periods of work", the tachograph records such "periods of availability" automatically while the vehicle is moving.

B

B chart	→ Tachograph chart for Automatic EC Tachographs with bar recording; the B chart has been replaced by the → K chart.
Bar tachograph chart	→ Tachograph chart for → automatic EC tachographs with bar recording.
Blank chart	→ Tachograph chart made of plastic used to protect the → styli if, for example, only one driver is onboard the vehicle equipped with a → 1+2-driver tachograph and if a tachograph chart for driver 2 is not required.
Break	Breaks in work for the crew prescribed by law.
Buffer battery	Secondary power source used to avoid losing clock module data.

C

CAN bus	CAN is a standard synchronous → serial interface. It is used for networking different control devices by means of the so-called CAN bus, → Instrument interface from the recording unit to the indicator unit.
Chart	→ Tachograph chart
Circuit diagram	→ Connection and wiring diagram
Clock generator	Component for controlling the additional stylus (special equipment).
Cluster	→ Indicator unit which displays, monitors and controls the vehicle functions. An electronic speedometer featuring the same functions as the Electronic Speedometer 1323.01 is also integrated in the Cluster.
Combi tachograph chart	→ Tachograph chart for Automatic and Standard EC Tachographs; replaces the step tachograph chart.
Combination	Here: Possibility of using different → additional equipment in conjunction with → EC-Tachographs and → NEC Tachographs at the same time.
Connection and wiring diagram	Adhesive label on the → tachograph showing the → connection diagram. The connection and wiring diagram is also called a circuit diagram.
Connection diagram	Circuit diagram showing the point of connection, external electrical and mechanical connections between the → tachograph and the vehicle.
Constant	The constant "k" is a fixed value required by the → tachograph in order to indicate speed or → RPM correctly. With mechanical tachograph systems, the constant "k" must be expressed either in "revs/km" or "1/min" and is fixed to 1,000/ 623. → EA Tachographs are adjusted by means of the variable tachograph constant which can be expressed either in "imp/km" or "imp/min". The tachograph is adjusted using the → range switch and the → setting potentiometer (1310, 1314 and 1315). Electronic adjustments are made using the → DIP switches (1318) or by programming (1319).

C

Correction value	Here: Factor for correcting the length of the → measuring track; the correction value takes the "load of the vehicle" and the "condition of the tyres" which affect the adjustment of the tachograph into consideration.
Crew	Obsolete term for → "driver 2".
Current limiter	→ Additional equipment for vehicles used for the carriage of hazardous goods (→ GGVS).
Current odometer reading	The current odometer reading of the vehicle is the reading indicated by the → distance recorder.

D

Driver 1	Any person driving the vehicle (driver).
Driver 2	Any other person onboard the vehicle who is able to drive the vehicle (crew).
Driving mechanism	Type of tachograph drive. Driving mechanisms are divided into mechanical driving mechanisms using a → drive shaft and electronically adjustable driving mechanisms using a → pulse generator and a pulse cable.
Driving time	Driving time means the → working time spent on driving the vehicle.

E

EC Tachograph	Recording equipment approved by the EU, → from the MTCO 1324 range of products
EEC Tachograph	EEC approved recording equipment that records the periods of work of max. 2 drivers as well as speed and distance travelled.
EC Tachograph/ NEC Tachograph inspection	Periodic checks prescribed by law for → EC Tachograph and NEC Tachograph systems (at least once within a period of 2 years).
EDM	Acronym for "Electronic Diesel Measuring System" used for recording diesel consumption. On vehicles equipped with an EDM the → tachograph records the fuel consumption on the → tachograph chart using → additional equipment.
EEC tachograph chart	→ Tachograph chart complying with EEC Regulations for use in vehicles equipped with an → EC Tachograph.
Ejection mark	Recording on the → tachograph chart which is made when the tachograph chart for driver 1 is removed from the 1319 tachograph. All other → tachographs record an → opening mark on the tachograph chart.

E

Electrical system	Here: Electrical connection between the → tachograph system and the vehicle.
Electronic Speedometer	→ Electronic indicator unit displaying speed and distance travelled. The → daily trip recorder and clock can also be displayed digitally (this function is optional) → Indicator unit of the new tachograph systems (MTCO and KITAS).
Engine speed	RPM expressed as "1/min" relating to the engine speed of the vehicle.

F

Fitting angle	Fitting position of the → tachograph relating to the horizontal.
Function control	Automatic and continuous function check performed by the → tachograph. If the device detects a malfunction, the warning LED lights up.

G

Gear ratio	Ratio between the input and the output value of → adjustment equipment; the gear ratio is expressed as → "i".
Generator	→ Pulse generator
GGVS vehicle	Motor vehicle used for the carriage of hazardous goods by road.

I

Indicator (of the tachograph)	Analogue indicator element on the → tachograph that indicates the current speed, RPM, distance travelled and time.
Inherent error	Deviation of the reference value from the actual value determined for speed reading/ indicator, speed recording, clock etc. when checking the → tachograph. The deviation must be within the tolerances permitted by law.
Installation label	Sealed label according to § 57b of StVZO (prescribed by law).
Interface	Data communication interface (V24) for data interchange between the → EA Tachograph and the test equipment.

K

K chart	Short for → Combi tachograph chart.
k label	Sealed adhesive label on the type plate of → EA Tachographs showing the new setting of the constant → "k" (red = speed constant; green = RPM constant).
KITAS	<u>K</u> ienzle- <u>T</u> achograph <u>S</u> ensor → Intelligent pulse generator → Tamper-proof unit.
K-Line	K-Line is a → standard, asynchronous serial interface, → instrument interface from the recording unit to the indicator unit.

L

Limiter	Special equipment that detects pre-defined maximum and minimum values; limiting is done by means of switches.
----------------	---------------------------------------------------------------------------------------------------------------

M

Measuring points	Speed values expressed in "km/h" that have been defined for checking the tachograph using a → test bench or an MTC.
Measuring range	Range that can be indicated by the → tachograph or be recorded on the → tachograph chart. The maximum value of the measuring range is called "upper limit of the measuring range".
Measuring track	The distance prescribed by law for checking the tachograph; the measuring track must have a minimum length of 20 metres; it must be even, straight, paved and be marked accordingly. → Correction value
Micro-processor	Abbreviation "μP", it is used in conjunction with tachograph type 1318 (variant with micro-processor technique).
MTCO 1324	Recording unit of the new tachograph systems, → EC Tachograph, type 1324 (radio compartment format).
MTCO 1390	Recording unit of the new tachograph systems, → NEC tachograph, type 1390 (radio compartment format).

N

NEC Tachograph	→ Tachograph from the → MTCO product range approved as recording unit by national authorities.
NEC Tachograph	→ Tachograph approved as recording equipment by legal bodies at national level for recording speed, distance travelled, driving and stopping times etc. The device does not record the crew's periods of work.

P

Period of availability	→ Time period that is recorded by the → tachograph as → working time. Period of availability means any "other time of attendance".
Personal Record	Forms prescribed by law for recording the → working times of the crew engaged in the carriage of goods or passengers by road. The personal record contains daily control sheets and weekly reports.
Pulse cable	Electrical connection between the → pulse generator and the → tachograph for transmitting speed, distance and → RPM pulses.
Pulse generator	The pulse generator transforms mechanical revolutions (e.g. movement of the vehicle) into electrical signals. Abbreviation: "PG".

R

Period of time (time group)	Personal → working times.
Record sheet	Official term for → tachograph chart; legally prescribed data carrier for recording the details of vehicle movement and the → working time of the crew.
Recording capacity	Maximum time expressed in hours that can be recorded on the → tachograph chart by the → tachograph. A → 1 day tachograph chart (for → EC Tachographs and → NEC Tachographs) has a recording capacity of 24 hours. A → 7 day tachograph chart (for NEC Tachographs only) has a recording capacity of 7 x 24 hours.
Recording equipment	→ EC Tachograph
Recording instrument	→ Styli
Recording variant	Form of recording working time on the → tachograph chart. Bar and step recordings are possible.
Regulation	Regulations describe modes of procedure prescribed by law.
Regulation	Here: Provisions adopted by the Council of the European Communities relating to the use of → tachographs (e.g. Regulations (EEC) 3820/85 and 3821/85).
Repair Exchange System	Uniform provisions for the repair of → tachographs. Acronym "RES".
Rest period	Period of time for the crew engaged in the carriage of passengers or goods by road during which the crew members are not allowed to drive. Rest periods are prescribed by law and must be observed. → Working time; → AETR.
Retaining ring	Ring to fix the pack of → 7-day tachograph charts (→ NEC tachographs with 7-day recording only).
RPM	Revolutions of the vehicle engine per minute.

S

S chart	→ Tachograph chart for step recording; to be replaced by the → combi tachograph chart.
Seal	Protection that cannot be removed without being visibly damaged.
Seal sign	Stamp identifying a → seal, showing the manufacturer, country and inspecting workshop.
Sensor	An intelligent → pulse generator for the new tachograph system including the MTCO 1324 (→ KITAS).
Separating plate	Component of → 1+2-driver tachographs which separates the → tachograph charts of → driver 1 and → driver 2.
Service Diagnosis System	General term for diagnosis systems from VDO Kienzle; acronym "SDS". SDS's include → STC, → MTC, → HTC etc.
Setting wheel	Wheel for setting the → tachograph clock.
Shift gear	Electrically triggered gear which allocates two fixed gear ratios "i" to the → tachograph system. A shift gear must be fitted to tachograph systems installed in vehicles with rear axle shift, since the characteristic coefficient → "w" of the vehicle changes when the axle is shifted.
Social legislation	Legal provisions on → working time of the crew engaged in the carriage of goods by road in EEC member states and → AETR member states.
Special equipment	Equipment added to the → tachograph system such as a → current limiter for → GGVS vehicles.
Special mark	Function of 1324 tachographs where a special recording is made on the → tachograph chart in case of exceptional events and defects.
Speedometer	Indicator for speed and distance travelled.
Styli	Styli inside the → tachograph used for recording the details of the vehicle movement and the → working times of the crew; styli also record additional recordings on the → tachograph chart.

T

Tachograph	General term for → EC tachographs and → NEC tachographs.
Tachograph chart	Data carrier in disc form which is used in the → tachograph for recording the data prescribed by law, such as speed, distance travelled and → working time using → styli.
Tachograph chart analyser	Device for analysing and checking the recordings on the → tachograph chart.

T

Tachograph chart type	Tachograph charts are available as → 1 day tachograph chart with or without → 0 hour mark (→ for NEC tachographs and → EC tachographs complying with EEC Regulations) and as a → pack of 7 day tachograph charts for NEC tachographs with or without 0 hour mark (the pack does not comply with EEC Regulations).
TCO	Obsolete type designation for a tachograph.
Test adapter	Aid for checking the tachograph.
Test bench	Drive unit for checking the tachograph, prescribed by law (e.g. → STC).
Test certificate	Legally approved form where the results of the inspection are entered.
Test Certificate	The test certificate consists of the → test chart and the corresponding form called → 'Test certificate'. It proves that the inspection acc. to § 57b of StVZO has been carried out correctly.
Test chart	Test document prescribed by law that must be kept; → tachograph chart that is written during the inspection and that must be kept together with the → test certificate.
Test constant	Fixed constant $k = 8,000$ to which the → tachograph must be set when checked using the → STC test bench (standard version).
Test template	Aid to compare the reference and actual recordings on the → test chart.
Test terminal	Terminal for connecting measuring devices.
Time group switch	Switch mechanism used to set the → periods of time (→ working times) on the → tachograph.
Timed recording	Recording on the tachograph chart which corresponds to the current time indicated by the clock.
Tracked clock	Tachograph chart turntable → Recording time is updated automatically to match the system time of the tachograph. → Time of day shown on the display.
TSU 1391	<u>T</u> achometer <u>S</u> imulator <u>U</u> nit → Interface between the pulse generator and the indicator unit, type 1390 (radio compartment format).
Type code	Code describing the type and construction details of the → tachograph.
Type plate	Adhesive label showing the manufacturing details of the → tachograph such as manufacturer, year of manufacture, manufacturing number, constant, approval mark and approval number.

O

Odometer	Recorder recording the distance travelled in "km" (totaliser) → Distance recorder.
Other periods of work	→ Working time of the crew for work that cannot be recorded under → driving time or → period of availability (e.g. loading and unloading the vehicle).

U

Upper limit	Maximum value for speed and → RPM that can be indicated by the → tachograph and recorded on the → tachograph chart.
--------------------	---------------------------------------------------------------------------------------------------------------------

V

Vehicle registration number	Registration number of the motor vehicle.
Visual check	Inspection by sight.

W

Warning signal	Indicator (warning LED) on the → tachograph indicating that the preset speed or RPM limits have been exceeded.
Wiring diagram	→ Connection and wiring diagram
Working time	Personal time period divided into the following periods of work as prescribed by law → Driving time, → Period of availability, → Other periods of work and → Break/ → Rest period.

Z

Zero line	Speed reference line which is recorded on the → tachograph chart when the vehicle is not moving.
------------------	--------------------------------------------------------------------------------------------------



Section 1

MTCO 1324 EC

Technical Product Manual
MTCO EC/ NEC and TSU
Installing/ Fitting/ Checking

Any changes will be notified by service information or circular.

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General safety precautions

Kienzle Tachographs and the vehicles into which the tachographs are installed are quality products manufactured to comply with recognised rules of engineering.

The products comply with the quality assurance standards currently in force and are officially authorised for use on public roads.

The products left the factory in a perfectly safe condition.

In order to maintain them in this condition you must carry out your work as an engineer

- in accordance with the descriptions in these instructions,
- correctly and with great accuracy and
- by observing the Health and Safety regulations for safety and accident prevention at work.

Designated use

Kienzle Tachographs may only be used for the purpose for which they have been constructed.

Fitting instructions

There is no need to have access to the safety technology of the vehicles to fit Kienzle Tachographs.

Correct installation will not involve any changes to or affect the structure or driving properties of the vehicle.

- Before installing the tachograph consult the vehicle documentation to find out exactly what sort of vehicle it is and whether it has any special characteristics.
- Refer to the vehicle drawings to identify the position of fuel, hydraulic and compressed air lines and electrical cables.
- Ask the vehicle owner or the driver about any (private) changes to the vehicle which must be taken into consideration when installing the unit.
- During installation and removal, avoid damaging lines and cables and severing line and cable connections.
- Only use original Siemens VDO parts and original Siemens VDO accessories for fitting.
- Only fit undamaged parts to a vehicle.
- When installing the tachograph and its cables, ensure that these parts do not affect or prevent the proper operation of the vehicle and that the parts are not damaged.

General safety precautions

- Do not reduce the cross section of a line; this can lead to the corresponding section of the cable becoming overheated.
- Only solder the new cable connections with soft solder.
- Check all (!) vehicle functions before handing the vehicle back to the customer.

Vehicle hand-over

- Instruct the customer in the operation of the tachograph and give him the relevant operating instructions.

Summary of changes

Date	Chapter/page	Subject, change, measure

Section 1: MTCO 1324 EC • Edition 03/2002

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Chapter 1

System overview

1.1 General system description

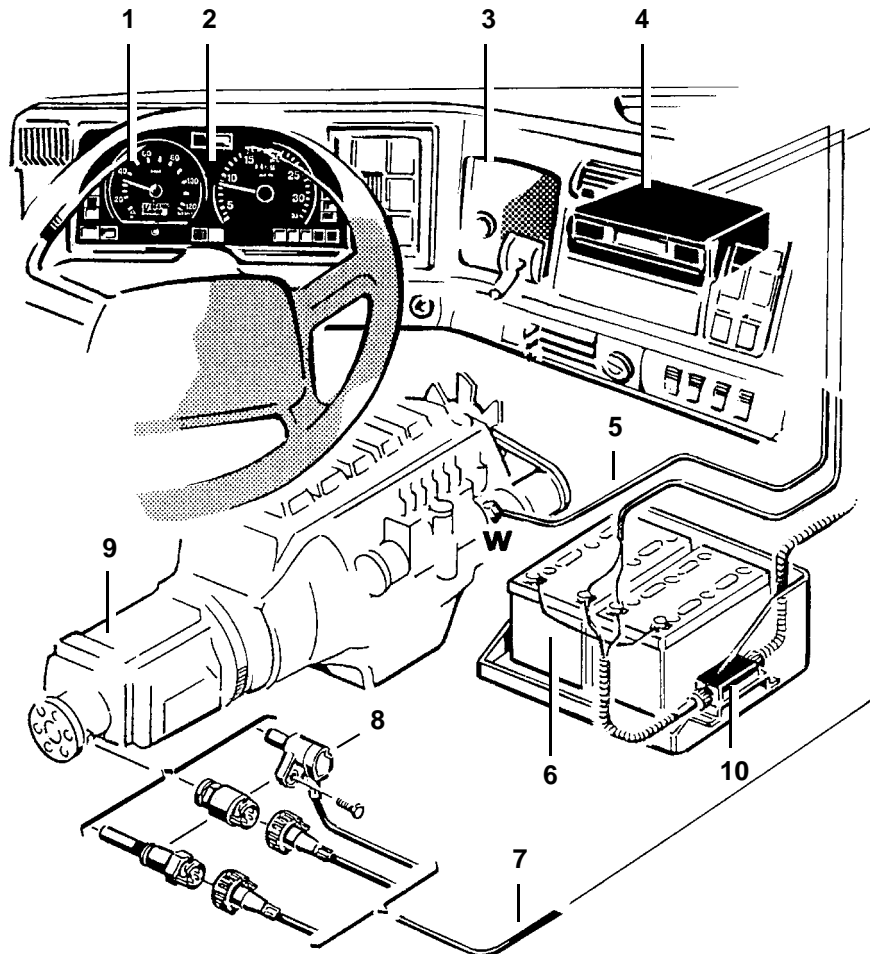


Fig. 1-1: MTCO 1324 system components with speed recording
(RPM recording optional)

- 1 Electronic Speedometer 1323.01 or indicator unit (integrated in the Cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 MTCO 1324 modular tachograph (installed into the in-dash radio opening)
- 5 Pulse cable for RPM generator or terminal "W" on vehicle generator (optional)
- 6 Vehicle battery
- 7 Sensor cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EC Directive 95/54 EMC)
- 8 KITAS 2170/ 2171 sensor
- 9 Gearbox
- 10 STB 3 current limiter for ADR tachograph systems (optional)

The "new generation" of tachograph systems has a modular structure and consists of the following individual components:

- Recording unit
- Indicator unit
- Sensor and sensor cable.

The new tachograph system which includes the MTCO 1324 modular tachograph, Electronic Speedometer 1323.01 or Cluster and the intelligent Kienzle Tachograph sensor KITAS 2170/ 2171 forms a tamper-proof system unit for quickly and efficiently checking on legally required provisions.

The MTCO 1324 detects operating errors or system malfunctions, indicates these errors to the driver and stores them in the error memory.



Important

The MTCO 1324 is subject to legal testing obligations. The installation label on the tachograph must be sealed and affixed inside the vehicle in such a way that it can be read easily.

The KITAS sensor must be sealed properly so that the screws cannot be undone.

In response to market requirements, there are different versions of the MTCO 1324, Electronic Speedometer 1323.01 and Cluster available.

1.1.1 Recording unit: MTCO 1324 with NFU

Equipment type acc. to Regulation (EEC) No. 3821/85 Appendix 1

The MTCO 1324 Modular Tachograph with Tracked Clock (NFU) has been constructed in accordance with the requirements set out in the European Commission's Regulation (EEC) No. 3821/85 Appendix 1. Its dimensions correspond to the dimensions prescribed for DIN/ ISO 7736 radio openings. The unit thus offers a wide range of application possibilities.

Tamper-proof recording

As well as the data relating to speed and distance travelled, the MTCO 1324 records the driving, working times and rest periods.

The driver and the co-drivers can easily select the working time group using the operating keys on the MTCO 1324 and display the date, time of day, distance travelled, all the working time groups, programming data as well as the settings for daylight saving time/ standard time switching on the tachograph's LC display.

Auto-diagnosis function

The MTCO 1324 tachograph carries out a constant auto-diagnosis to check for:

- voltage breaks
- defects in the sensor signal cables
- system errors and
- operating errors.

1.1.2 Indicator unit: *Electronic Speedometer 1323 or Cluster*

The MTCO 1324 transmits the speed pulse to a separate indicator unit located in such a way that it can be read easily by the driver. The driver can see the current speed and the total distance travelled.



Important

According to provisions currently in force, the recording unit and the indicator unit form a complete system unit and have been granted a single PTB approval number.

The following indicator units can be used:

- Electronic Speedometer 1323.01 or
- an approved indicator unit integrated into the Cluster.

Electronic Speedometer 1323.01

The Electronic Speedometer 1323.01 indicates the speed and the distance travelled as standard. The daily trip recorder and the clock are optional. The warning LED indicates error messages shown on the MTCO 1324 LC display, e.g. missing tachograph charts, sensor malfunctions etc.

Cluster

The Clusters are specific to the vehicle. The Cluster indicates, monitors and controls the vehicle functions. An electronic speedometer offering the same functions as the Electronic Speedometer 1323.01 is integrated into the Cluster. Depending on the vehicle, the MTCO 1324 triggers the electronic speedometer using the K-Line or CAN bus interfaces.

1.1.3 Sensor technology

Intelligent sensor

KITAS 2170/ 2171 (Kienzle Tachograph Sensor), the intelligent pulse generator transforms the gearbox revolutions into pulses and transmits these as real-time signals to the MTCO 1324 recording unit together with the data encoded by an integral micro controller.

Sensor cable acc. to DIN 72551 Kfz

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz.

1.1.4 Capability characteristics of the system

Basic characteristics

- Separate indicator and recording units
- Versions for different vehicle voltages (12 V and 24 V)
- EC Tachograph versions
- MTCO housing dimensions complying with the dimensions for radio compartments specified by DIN/ ISO 7736
- Versions with locked or fold down tray for loading tachograph charts

- Additional mounting sleeve for installing in radio compartment
- Multi-functional two-line LC display with 2 x 16 characters
- 2 key blocks for operating the MTCO 1324
- Read-only Memory for storing required parameters, such as housing variant, "w", "k" etc.
- Automatic recording of passive working times for driver 2
- Automatic **clock tracking** and switchover to rest period if the vehicle has not been moved for 25 hours (power saving function)
- Battery buffered real time clock with automatic, country-specific daylight saving time/ standard time switchover settings, programmed for 5 years
- Interfaces from the recording unit to the indicator unit:
 - Interface 1: CAN type connected to connector A
 - Interface 2: K-Line type (instrument interface) and optional K-Diagnosis, Dyna-Fleet and Info-Interface connected to connector D
- Automatic display of system malfunctions on the LC display: Defects detected in electronic or mechanical components, instruments, interfaces and in the sensor
- Automatic recording of system malfunctions on the tachograph chart, e.g. line disconnections in the sensor cable are indicated in form of a bar inscribed up to approx. 40 km/h (125 km/h measuring range)
- New KITAS 2170/2171 sensor technology
- Special interference-free (EMC) KITAS sensor cable with twisted wires
- Special transmission procedure between the KITAS 2170/ 2171 sensor and the MTCO 1324; an armoured tube is no longer necessary.

Options/ Additional equipment

- Vehicle-specific MTCO 1324 front covers
- Vehicle-specific LC display illumination:
 - Colours: yellow, orange, blue and green
 - Dimming using CAN or PIN A2
- Vehicle-specific operating key illumination:
 - Colours: yellow, orange and red
- RPM recording without display:
 - As with existing tachographs, the rotational frequency is controlled using terminal "W" on the vehicle generator or an RPM generator connected to connector C.
 - RPM recording on the back of the tachograph chart for driver 1
- Additional stylus for recording blue flashing light and emergency siren operations, fuel consumption etc.

1.2 Data transmission within the system

1.2.1 Data transmission between MTCO 1324 and KITAS 2170/ 2171

According to EEC Regulation

To comply with Regulation (EEC) No. 3821/85, the sensor (generator) and the tachograph must form a tamper-proof system unit.

Tamper-proof unit

The KITAS 2170/ 2171 sensor and the MTCO 1324 meet these requirements:

- The serial number of the sensor is transmitted to and checked by the MTCO 1324
- Data security through DES (Data Encryption Standard)
- The real-time signal is compared with the encoded data signal stored in the MTCO 1324.

The MTCO 1324 thus detects any attempts of fraudulent use, i.e. attempts to tamper with the transmission line between the sensor and the MTCO 1324.

Data transmission. General.

The KITAS 2170/ 2171 sensor and the MTCO 1324 interchange data at regular intervals by sending the following data:

- Real-time signals and
- data signals.

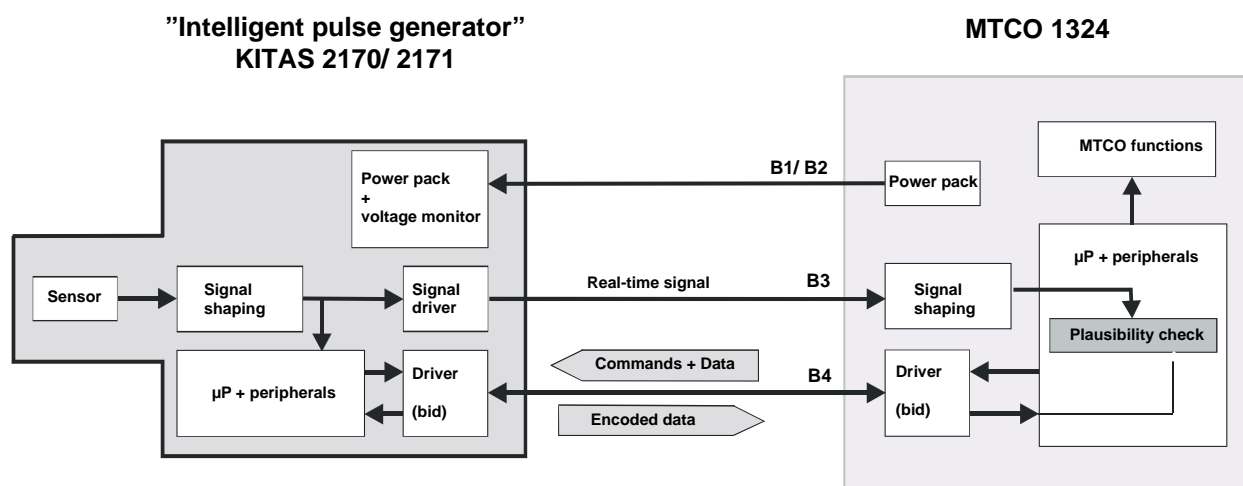


Fig. 1-2: MTCO 1324 - KITAS 2170/ 2171 interfaces (diagram)

Real-time signal

The real-time signal sent on cable B3 is proportional to the speed and is required to record the speed and the distance travelled (as with existing tachographs).

Data signal

The data signal sent on cable B4 is used for communication between the MTCO 1324 and the KITAS sensor. After the MTCO, the master, has sent a data request the sensor returns cumulated encoded data.

Basically, the data transmission process can be differentiated as follows:

- Data transmission during initialisation
- Data transmission during operation.

During initialisation

Factory programming

The serial number of the sensor is pre-programmed into the KITAS 2170/ 2171 sensor at the factory and a so-called master code is stored both in the KITAS sensor and the MTCO 1324.

Programming in the vehicle

After installation in the vehicle and during the first set up of the system, the KITAS-sensor and the MTCO 1324 are adjusted so that these units can communicate with each other. The units are adjusted by selecting the "ACTIVATE KITAS" menu item when programming the unit using an MTC/ATC (see Chapter 3.8.2 "Activating KITAS 2170/ 2171", page 3-28).

During operation

During operation the MTCO 1324 sends commands and data to the KITAS sensor at regular intervals of approx. 10 seconds.

Encoded data record

Based on the command code received, the KITAS sensor compiles an encoded data record and returns it to the MTCO 1324.

Then the MTCO 1324 compares the data received with the original data record. If the data differs, the system records a transmission error.

Transmission errors

The MTCO 1324 detects a transmission error:

- if no data has been sent within a defined period of time or
- if an error occurs during transmission, e.g. wrong acknowledgement byte, wrong checksum etc.

If the data is not transmitted correctly within the pre-defined period of time, the sensor is reset, which means that the data lines are set to "Low" for 2 seconds.

If, after three consecutive attempts, the data transmitted is still faulty, the MTCO 1324 displays an error.

In addition to the fetch cycles, the sensor pulses (real-time signals) sent by the KITAS 2170/ 2171 sensor are checked for accuracy. If the sensor pulses are not correct, the system records a data error and the MTCO 1324 is set to error mode (see Chapter 6.1 "Error messages", from page 6-2).

Data errors

Data errors include:

- Wrong serial number/ transmitted random number and
- faulty real-time signals (pulse errors). If the pulses are faulty, the MTCO 1324 generates an error bit that is queried later and indicates an error.

These data errors do not interrupt the command sequence stored in the MTCO 1324. As soon as the error is corrected, the MTCO 1324 returns to normal operation mode.

1.2.2 Data transmission between MTCO 1324 and indicator unit

Data transmission. General.

Three types of data are transmitted between the MTCO 1324 and the indicator unit:

- Function signals
- "v" pulses and
- data signals on the instrument interface.

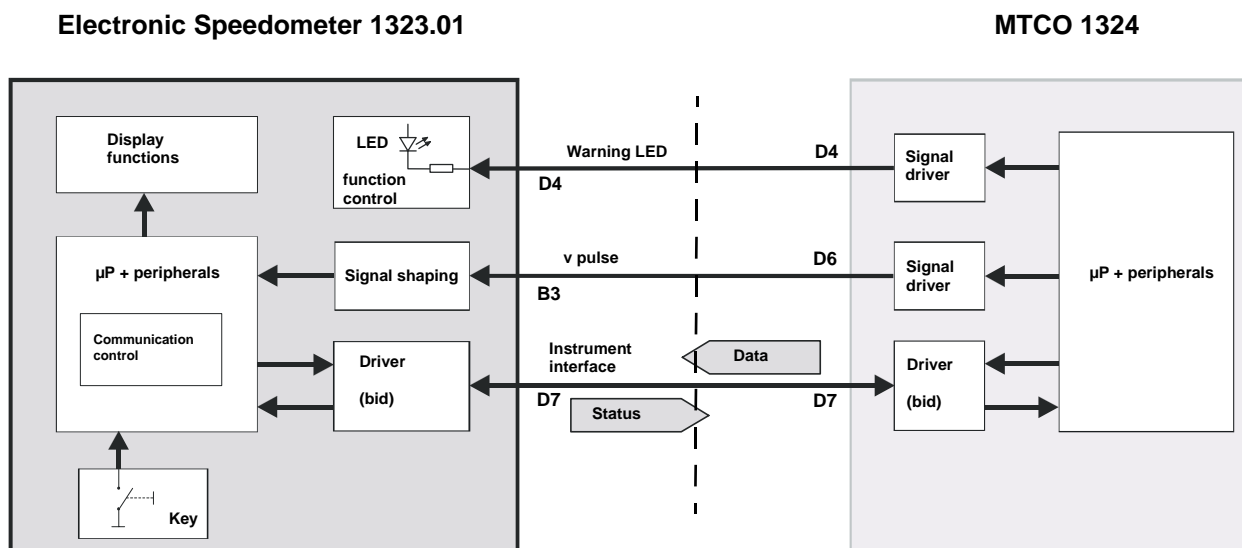


Fig. 1-3: MTCO 1324 - indicator unit interfaces; Example: Electronic Speedometer 1323 (diagram)

Function signal

The MTCO 1324 uses the function signal to trigger the warning LED on the indicator unit directly. As soon as an entry is added to the event memory, the LED lights up; at the same time, an error message is displayed on the MTCO display.

"v" pulse

The MTCO 1324 generates the "v" pulse from the real-time signal sent by the KITAS sensor and the pre-programmed characteristic coefficient (imp/km) "w". The indicator unit converts the pulse, which is proportional to the speed, into a generator signal.

Data signals

The instrument interface (K-Line) is used for the constant data interchange between the MTCO 1324 and the indicator unit. The MTCO 1324, the master, transmits the current status of the odometer, daily trip recorder and the system clock to the indicator unit. The indicator unit sends the reset of the daily trip recorder to the MTCO 1324.

During initialisation, i.e. when the ignition is switched on, the MTCO 1324 sends the stored characteristic coefficient (imp/km) to the indicator unit automatically. To check correct transmission, the MTCO 1324 waits for an acknowledgement to be received within 0.5 seconds. If no acknowledgement is received, the MTCO 1324 generates an error message.

During operation the MTCO 1324 sends the current data to the indicator unit at regular intervals of 0.5 seconds. If the data has been received correctly, the indicator unit returns the current status of the setting key to the MTCO 1324 immediately.

If the data received cannot be interpreted, the indicator unit sends a negative acknowledgement to the MTCO 1324. Then the MTCO 1324 decodes the information received. A corresponding error message is shown on the display. At the same time, an entry is added to the error memory.

1.2.3 MTCO 1324 data transmission using the CAN bus

CAN (Controller Area Network) is a serial bus concept that is used to network various control units. The CAN bus provides high data transmission speed and ensures high data security. Therefore, the Can bus is particularly suitable for real-time applications. It offers the following features:

- Maximum transmission rate 1 Mbit/s
- High reliability if interference from other sources is high
- Open concept.

Data transmission. General.

Data content

When transmitting data on the Can bus no station is addressed, but the data content (e.g. speed display) is identified using a unique identifier. As well as the content identification the identifier also determines the priority level of the message. This is important for bus allocation if several stations want to access the bus.

If the CPU wants to send a message to one or several stations, it forwards the data, its identifier and the transmission request to the CAN controller. The CAN controller then creates and transmits the message. As soon as the CAN

controller has access to the bus ("send message") all the other stations on the CAN network are recipients ("receive message").

Acceptance check

After all the stations have received the message correctly, they carry out an acceptance check ("select") and check the identifier to determine whether the data received is relevant for them or not. If the data is important for the station, the information is processed ("accept"). If not, it is ignored.

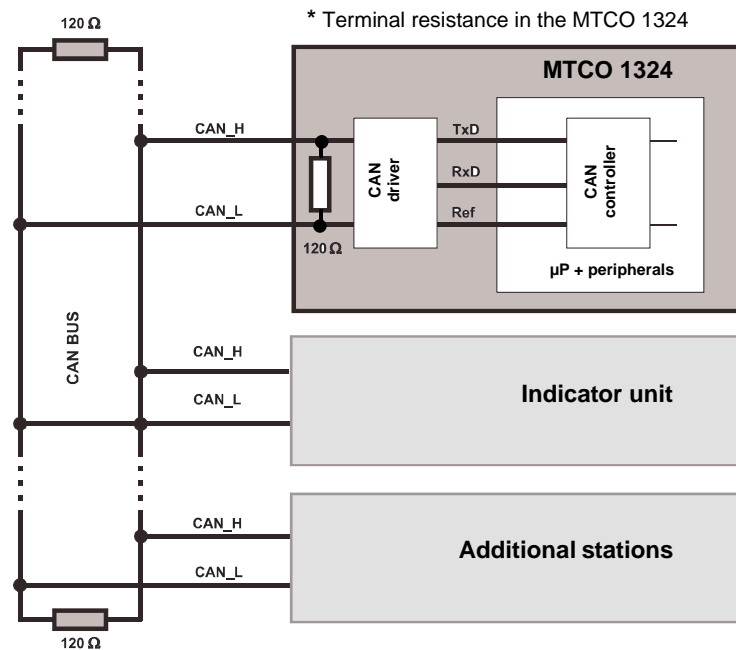


Fig. 1-4: CAN network and MTCO 1324 (diagram)

1.3 System variants

The following variants of the new MTCO 1324 modular tachograph system are available:

- MTCO - K-Line and Electronic Speedometer 1323.01 or Cluster
- MTCO - CAN-bus and Cluster.

1.3.1 MTCO - K-Line and Electronic Speedometer or Cluster

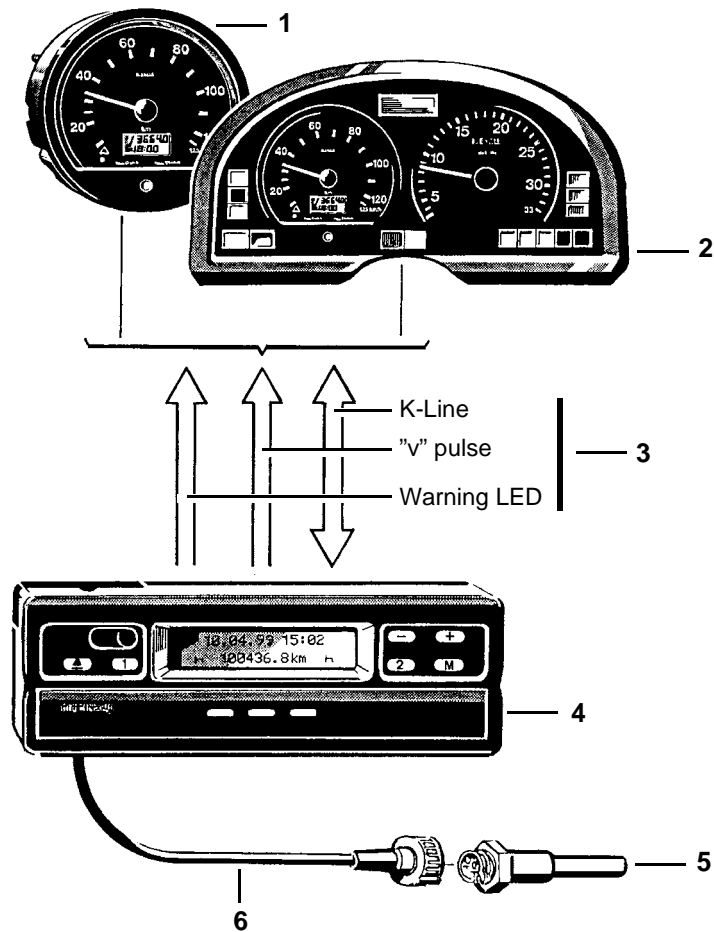


Fig. 1-5: System variant: MTCO - K-Line and Electronic Speedometer/ Cluster

- | | |
|----------------------------------|---------------------------|
| 1 Electronic Speedometer 1323.01 | 4 MTCO 1324 |
| 2 Cluster | 5 KITAS 2170/ 2171 sensor |
| 3 K-Line (serial interface) | 6 Sensor cable |

K-Line

K-Line is a standard asynchronous serial interface with a specific physical structure. It is used for interchanging digital data and is available as:

- Instrument interface between the MTCO and Electronic Speedometer 1323.01
- Diagnosis interface, e.g. vehicle diagnosis systems and suitable diagnosis test devices or
- K-Diagnosis for reading out the MTCO 1324 error memory.

1.3.2 MTCO - CAN bus and Cluster

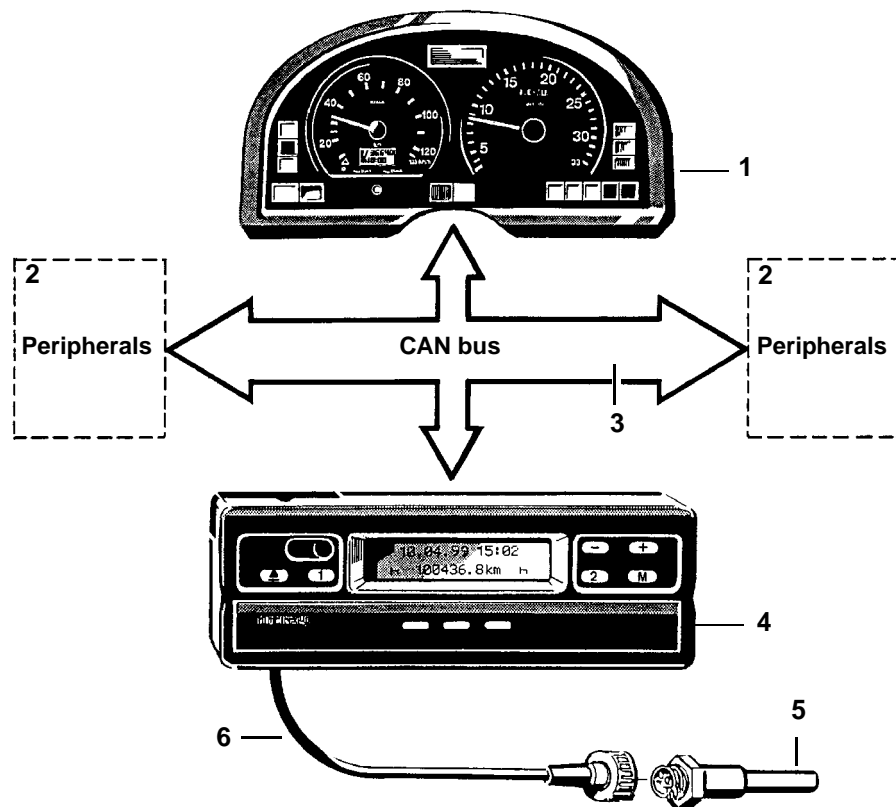


Fig. 1-6: System variant: MTCO - CAN bus and Cluster

- | | |
|-------------------------------|---------------------------|
| 1 Cluster | 4 MTCO 1324 |
| 2 Further vehicle instruments | 5 KITAS 2170/ 2171 sensor |
| 3 CAN bus (serial interface) | 6 Sensor cable |

CAN bus

CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus provides high data transmission speed and ensures high data security. Therefore, it is particularly suitable for real-time applications.

Chapter 2

Product description/ description of functions

2.1 MTCO 1324 with NFU

2.1.1 Product description

The dimensions of the Modular Tachograph (MTCO) 1324 correspond to the dimensions prescribed for DIN/ ISO 7736 radio compartments. Thus, the MTCO 1324 can be integrated into the dashboard of modern commercial vehicles. Depending on the type of vehicle, the unit features a customised front cover and customised instruments.

The MTCO 1324 records the journey and crew data for driver 1 and driver 2 on tachograph charts.

The tachograph's speed and RPM (optional) are adjusted and programmed using an MTC/ ATC.

Setting ranges

- Speed: 4000 - 25000 imp/km
- RPM: 2000 - 64000 imp/1000 revs/min.

EC Tachograph

The MTCO 1324 is an EC tachograph with automatic driving time recording for vehicles with mandatory recording equipment according to Regulation (EEC) No. 3821/85.

Variants

The MTCO 1324 variants can be differentiated by their operating voltage, final measuring range value, interfaces, additional equipment etc. and tray type:

- Locked tray and mounting frame for installation into the in-dash radio compartment
- Fold down tray and mounting frame for installation into a storage box, e.g. above the sun visor.

When used for retrofitting, the MTCO 1324 is expanded to include a mounting console if the vehicle does not have a radio compartment/ storage box.

Tachograph chart(s)

The rules governing the use of tachograph charts are the same for all EC tachograph types and also apply to the MTCO 1324. Detailed information on tachograph charts, the assignment of tachograph charts etc. can be found in *Chapter 2.5 "Tachograph charts"*, from page 2-52. Also refer to the *separate MTCO 1324 Operating Manual* for specific information on tachograph charts that can be used in combination with the MTCO 1324.

Display and recording malfunctions

Auto-diagnosis function

The MTCO 1324 tachograph carries out a constant auto-diagnosis to check for:

- voltage breaks
- defects in the KITAS sensor and its cable
- communication errors between the MTCO and the indicator unit
- system errors and
- operating errors.



Important

The auto-diagnosis function is only performed when the ignition is on.

When the MTCO 1324 detects an operating error or a malfunction, it does not distinguish between operating errors, malfunctions or warning messages. Regardless of the cause of the fault, the MTCO 1324 always

- adds an entry to the event or error protocols
- indicates the error/malfunction on the display
- triggers the warning LED on the indicator unit.

Depending on the error type, the error/malfunction is also recorded on the tachograph chart for driver 1.

Displaying events and malfunctions

Thus, system errors are indicated to the driver by the warning LED on the indicator unit and on the MTCO 1324 display.

Recording system malfunctions

As prescribed by law, the unit also records system malfunctions on the tachograph chart automatically. For example:

- A line disconnection in the sensor cable by a bar inscribed up to approx. 40 km/h (125 km/h measuring range)
- Voltage breaks shortly after start off by a thick trace up to "v_{max}".

Additional information

Detailed information on error messages/ recordings as well as recommended measures for error correction can be found in *Chapter 6 "Fault analysis"*.

Tachograph description

Front of MTCO 1324
with locked tray

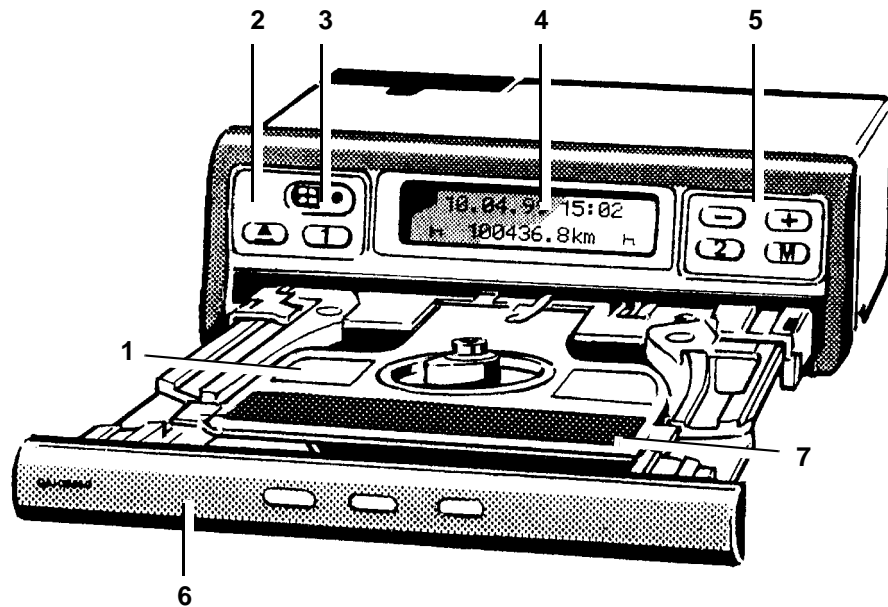
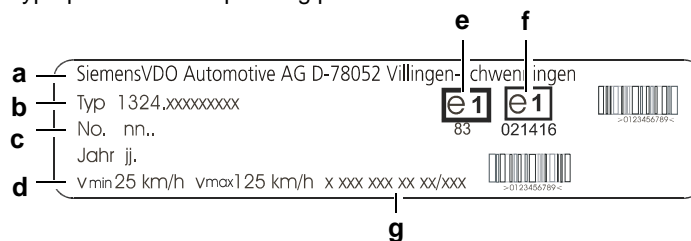


Fig. 2-1: MTCO 1324: Front of unit with locked tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Left keypad:
 - Key **1** selects the working time group for driver 1
 - Key **▲** unlocks the tachograph chart tray
- 3 Seal plate: protects the test/ programming interface
- 4 Display: illuminated when ignition is on
- 5 Right keypad:
 - Key **2** selects the working time group for driver 2
 - Key **+** selects the next menu item
 - Key **-** selects the previous menu item
 - Key **M** selects the desired menu item
- 6 Locked tray/ tachograph chart turntable
- 7 Type plate on the separating plate



- (a) Manufacturer
- (b) Device type
- (c) Serial number
- (d) Speed measuring range
- (e) EC Tachograph approval signs e1-83 or e1-85 with "n" recording
- (f) EMC approval sign
- (g) Third party item number

**Front of MTCO 1324
with fold down tray**

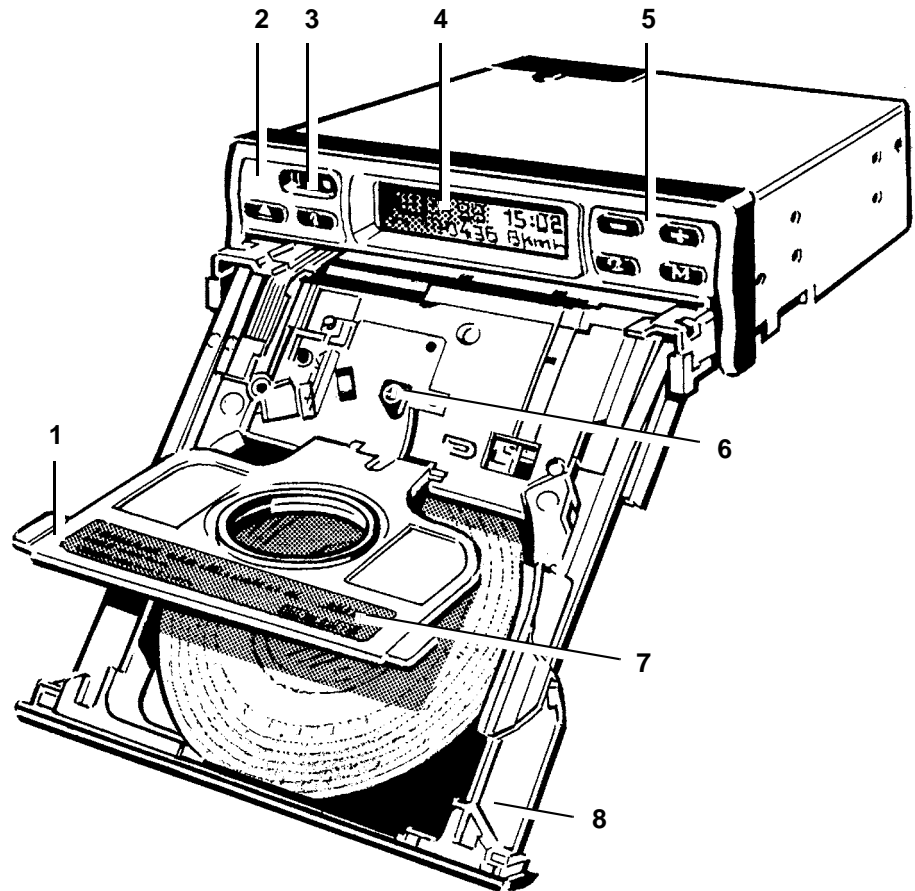


Fig. 2-2: MTCO 1324: Front of unit with fold down tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Left keypad:
 - Key **1** selects the working time group for driver 1
 - Key **▲** unlocks the tachograph chart tray
- 3 Seal plate: protects the test/ programming interface
- 4 Display: illuminated when ignition is on
- 5 Right keypad:
 - Key **2** selects the working time group for driver 2
 - Key **+** selects the next menu item
 - Key **-** selects the previous menu item
 - Key **M** selects the desired menu item
- 6 Time marking for driver 1 tachograph chart
- 7 Type plate on the separating plate
- 8 Fold down tray/ tachograph chart turntable

Back of unit with
battery compartment
up to firmware
version 003.xx
(serial no. 450.000)

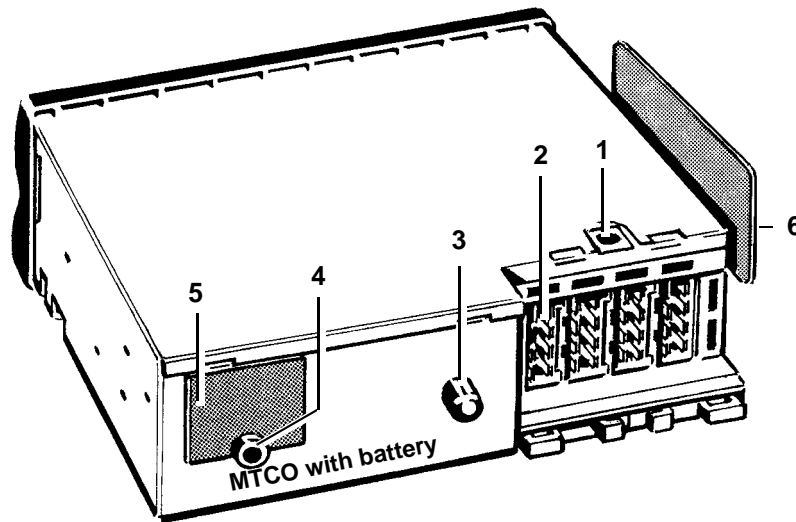


Fig. 2-3: MTCO 1324: Back of unit with battery compartment

- | | | | |
|---|----------------------------------|---|-----------------------------------------------------------------------------|
| 1 | Housing cover seal | 4 | Battery compartment seal |
| 2 | Connector sockets A, B, C and D | 5 | Battery compartment |
| 3 | Fixing screw (radio compartment) | 6 | Circuit diagram with voltage indication,
serial no., device type (label) |



Caution

Only authorised workshops that have been given authorisation to repair the MTCO 1324 are entitled to remove the unit's housing cover seal (1).

If the housing cover seal is removed by unauthorised persons, the guarantee will be invalid.



Important

As load, temperature etc. vary, the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.

MTCO 1324 with battery compartment (5)

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Additional information

Detailed information on how to replace the battery can be found in *Chapter 7.1 "Replacing the MTCO 1324 buffer battery", page 7-2.*

**Back of unit without
battery compartment
from firmware
version 004.xx
(serial no. 450.000)**

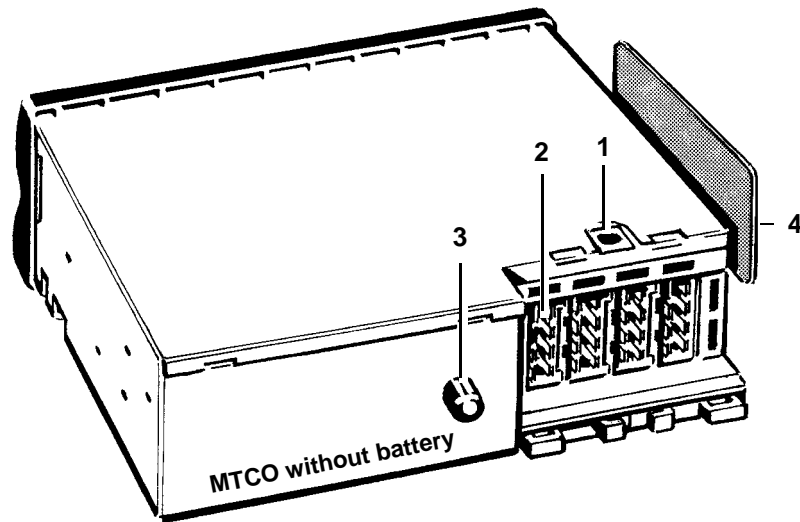


Fig. 2-4: MTCO 1324: Back of unit

- | | |
|-----------------------------------|----------------------------------------------------------------------------|
| 1 Housing cover seal | 3 Fixing screw (radio compartment) |
| 2 Connector sockets A, B, C and D | 4 Circuit diagram with voltage indication, serial no., device type (label) |



Caution

Only authorised workshops that have been given authorisation to repair the MTCO 1324 are entitled to remove the unit's housing cover seal (1).

If the housing cover seal is removed by unauthorised persons, the guarantee will be invalid.



Important

As load, temperature etc. vary, the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.

MTCO 1324 without battery compartment

From firmware version 04.xx, serial no. 450.000/ year 01 the buffer battery is integrated in the circuit board. The battery compartment is no longer necessary.

If no voltage is supplied to the unit and if the date and the clock stop, the MTCO 1324 **must** be replaced by a replacement tachograph.

Only authorised workshops that have been given authorisation to repair the MTCO 1324 are entitled to replace the battery.

Display



Important

The ignition must be on to display information on the MTCO 1324 display.

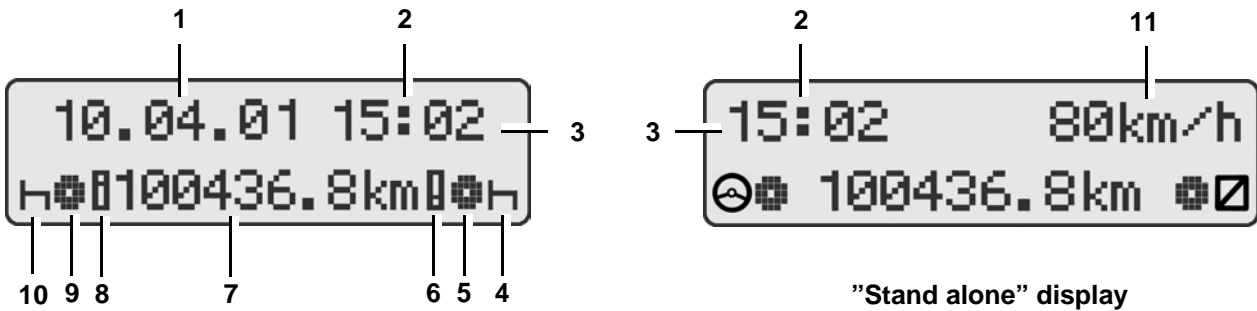
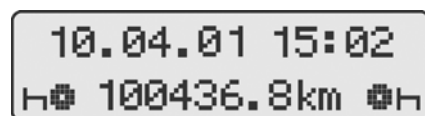


Fig. 2-5: MTCO 1324: Display (General)

- 1 Date
- 2 Tachograph chart turntable running control (colon) (flashes when driven correctly)
- 3 System time
- 4 Driver 2 working time group symbol
- 5 "Tachograph chart inserted" (driver 2) symbol
- 6 "Error active" symbol
- 7 Total odometer reading
- 8 "Test and programming interface active" symbol; **only** when transmitting data using the MTC
- 9 "Tachograph chart inserted" (driver 1) symbol
- 10 Working time group symbol for driver 1
- 11 Digital speed display (MTCO 1324 "Stand alone"**only**)

Basic display

If no messages are stored, the basic display is shown.

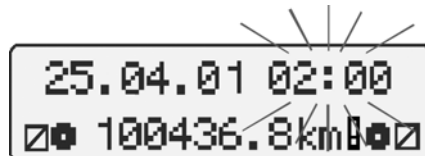


Daylight saving time switchover:

Flashing time display

The MTCO 1324 sets the beginning and the end of daylight saving automatically. The flashing time display tells the driver that the tachograph chart turntable must be set to the current system time.

Track the tachograph chart turntable.



Important

The clock stops flashing when the tachograph chart turntable has been tracked (i.e. open the tray, remove both tachograph charts and close the tray again; the tachograph chart turntable is set to the current system time automatically).

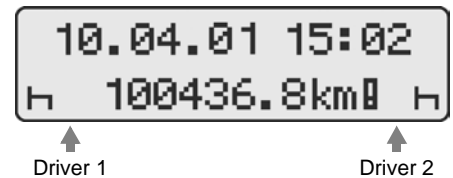
Ejecting

A progress bar tells the driver how much time has elapsed before the tray is unlocked.

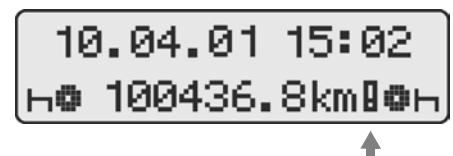


Operating error messages e.g.

- driver 1 tachograph chart is missing, "Left tachograph chart" symbol is missing and/or
- driver 2 tachograph chart is missing, "Right tachograph chart" symbol is missing



System or tachograph error messages



Additional information

You will find detailed information on error messages and recommended measures for error correction in *Chapter 6 "Fault analysis"*.

2.1.2 Operation

The following paragraph describes the MTCO 1324 operating functions:

- Inserting and removing tachograph charts
- Customer-specific sleep mode
- Menu functions (driver and service modes).

Additional information

Descriptions on how to set the working time groups, driver change etc. can be found in the *separate MTCO 1324 Operating Manual*.

Inserting and removing tachograph charts

The rules governing the use of (the) tachograph chart(s) are the same for all tachograph types and also apply to the MTCO 1324. Detailed information on tachograph charts, the assignment of tachograph charts etc. can be found in *Chapter 2.5 "Tachograph charts"*, from page 2-52.



Condition

The tachograph charts can only be inserted and removed if:

- the vehicle is stationary, i.e. no distance pulses are stored and
- the ignition is turned on.

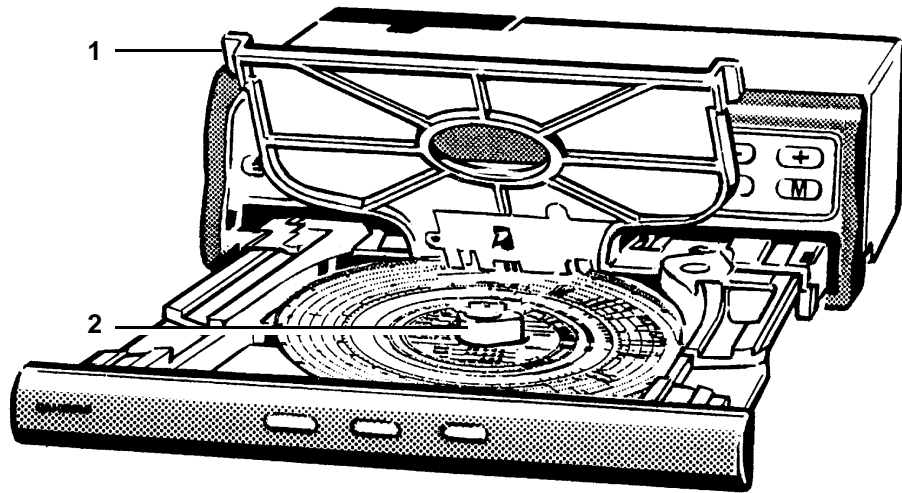


Fig. 2-6: MTCO 1324: Open with locked tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Tachograph chart turntable

Inserting tachograph chart(s)

! Important

The tachograph charts used must not be damaged. Curled, wrinkled or torn tachograph charts may cause malfunctions.

When inserting the tachograph chart(s) make sure the chart(s) is/are placed under the retaining clip.

- 1 **Insert the labelled tachograph chart(s) into the open tray, with the labelled side face up.**

The tachograph chart for driver 1 must be placed on the separating plate, the tachograph chart for driver 2 is put under the separating plate. When inserting the tachograph charts, make sure to insert the driver 1 tachograph chart in such a way that the time shown by the clock and the time marking on the chart correspond.

If not, remove the tachograph chart and track the tachograph chart turntable:

 - **Push the tray without any tachograph charts into the unit until it locks into place.** The MTCO 1324 adjusts the tachograph chart turntable to the current system time automatically.
 - **Open the tray again and insert new tachograph charts, if necessary.**

! Important

When closing the tray of tachograph variants with fold down tray, make sure that the tray is folded up and locked into place after the tachograph chart(s) has/have been inserted.

- 2 **Push the tray into the unit until it locks into place.**

Removing tachograph chart(s)

Removal after 24 hours at the latest

When changing drivers/vehicles, at the end of the daily working period and after 24 hours at the latest the tachograph chart must be removed from the MTCO 1324.

- Press the Unlock key .




"Ejecting" (represented by the symbol for "Tachograph chart inserted" and a progress bar) appears on the display. An ejection mark is recorded on the tachograph chart. After the time needed for inscribing the ejection mark (shown by the progress bar) has elapsed, the tray is unlocked.



Important

Wait until the tray is unlocked and the basic display appears.

As long as "Ejecting" is shown on the display, do **not** turn the ignition off.

- If you have switched the ignition off, follow these steps:
 - Switch the ignition on again.
 - Press the Unlock key  again and
 - wait until the tray is unlocked (chart is ejected).

MTCO with locked tray

- 1 Pull out the tray until it will not go any further.
Do not fold the tray down.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Push the tray in again until it locks into place.

MTCO with fold down tray

- 1 Pull out the tray to the stop and fold it down, if necessary.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Fold the tray up again until it locks into place.
- 4 Push the tray in again until it locks into place.

VW customer-specific power saving function

The MTCO 1324 with power saving function ("sleep mode") reduces the current consumption of the 1324 tachograph system automatically if the vehicle is stationary for more than 27 hours.



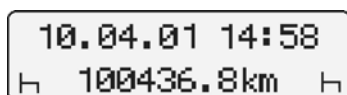
Important

Currently this customised "sleep mode" is **only** available for MTCO types **1324.630452100400 VW** and **1324.630552100400 VW**.

Activating the sleep mode

Before parking the vehicle the 1324 tachograph system "sleep mode" must be activated.

- 1 Remove the tachograph chart(s) from the MTCO 1324.
- 2 Close the tray.
- 3 Then set the working time groups for both drivers on "H".



MTCO 1324 with activated sleep mode

After 27 hours the MTCO 1324 switches to "sleep mode" automatically.

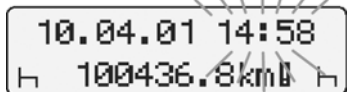


(i.e. the display is off and tachograph chart turntable drive is switched off).



Important

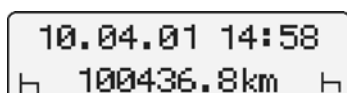
By pressing any key on the MTCO 1324 when the "sleep mode" is active, the basic display appears for 20 seconds. At the same time:



- the "Error active" symbol lights up
- and the time is flashing.

Switching the sleep mode off

- 4 Switch the vehicle ignition on.
The MTCO 1324 terminates the "sleep mode" and carries out "tachograph chart turntable tracking" automatically.
Wait until the "Error active" symbol disappears and the time stops flashing.
- 5 When automatic tachograph chart turntable tracking is complete the MTCO 1324 is ready for operation again.



Additional information

Descriptions on how to set the working time groups, change drivers etc. can be found in the *separate MTCO 1324 Operating Manual*. You will find detailed information on error messages and recommended measures for error correction in *Chapter 6 "Fault analysis"*.

MTCO 1324 menu functions

There are two categories of functions and, depending on the user, different menu functions can be called up:

- Driver mode
- Service mode (for service engineers).

! Important

The separate menu functions can only be called up if:

- the vehicle is stationary, i.e. no distance pulses are stored and
- the ignition is turned on.

When driving the basic display appears automatically.

Driver mode menu functions

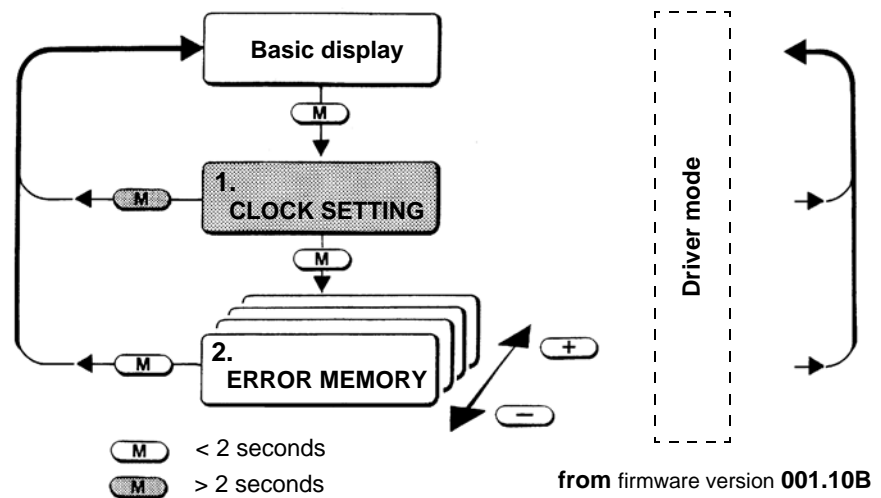


Fig. 2-7: MTCO 1324: Overview of menu structure (driver mode)

Driver functions

The driver can access the following menu functions:

- "1. Clock Setting"
- "2. Error Memory" download.

! Important

The driver can call up the "2. Error Memory" menu function.

The driver can only see the active errors.

Clock setting (menu 1.)



Important

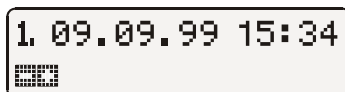
The date will be corrected automatically when setting the clock back or forward (0.00 hours).

When re-setting the clock:

- the time offset displayed (menu 3 "UTC Information/ Version ") is modified
- the programmed UTC time is not affected.

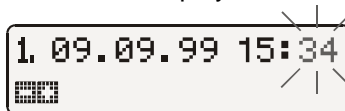
Setting the clock

- 1 Press the **M** key to select the "CLOCK SETTING" menu.



Changing the minutes

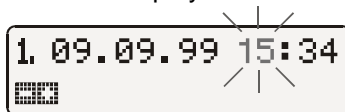
- 2 Use the **+** or **-** key to activate clock setting.
The minute display flashes.



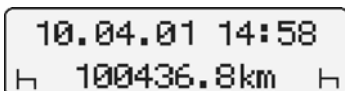
- 3 Use the **+** or **-** key to select the minutes.
- 4 Press the **M** key:
 - for more than 2 seconds to confirm the minutes setting or
 - briefly to set the hours.

Changing the hours

- 5 Use the **+** or **-** key to select the hours.
The hour display flashes.



- 6 Press the **M** key (for more than 2 seconds) to confirm the new clock setting.
The basic display appears once more.




Important

Track the tachograph chart turntable.

If you set the clock and the tachograph chart(s) is/are inserted, the error symbol appears on the display and the time flashes.

Tracking the tachograph chart turntable

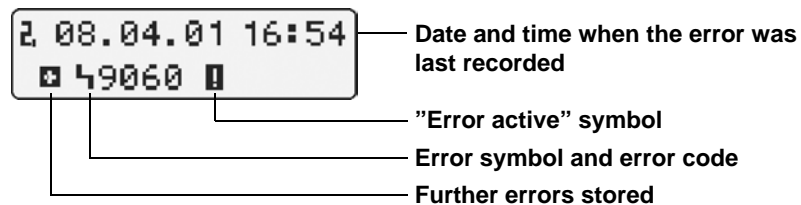
- 1 Press the **Unlock key** .
Wait until the tray is unlocked.
- 2 Pull out the tray until it will not go any further.
- 3 Remove the tachograph chart(s) from the tray.
- 4 Close the tray.
When the tray is closed the MTCO 1324 tracks the tachograph chart turntable automatically and adjusts it to the current system time.
The system time no longer flashes on the display and the error symbol disappears. Insert new tachograph charts, if necessary.

Additional information

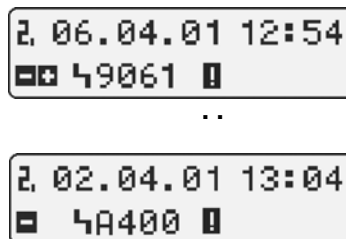
A description of error messages and measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-11.

Displaying the Error Memory (menu 2.)

- 1 Press the **M** key to select the "ERROR MEMORY" menu.



- 2 Press the **+** or **-** key to call up further error entries.



Important

When calling up the "ERROR MEMORY" function in driver mode the number of active errors is not displayed.

Additional information

A detailed description of error messages and recommended measures for error correction can be found in *Chapter 6 "Fault analysis"*.

Service mode menu functions

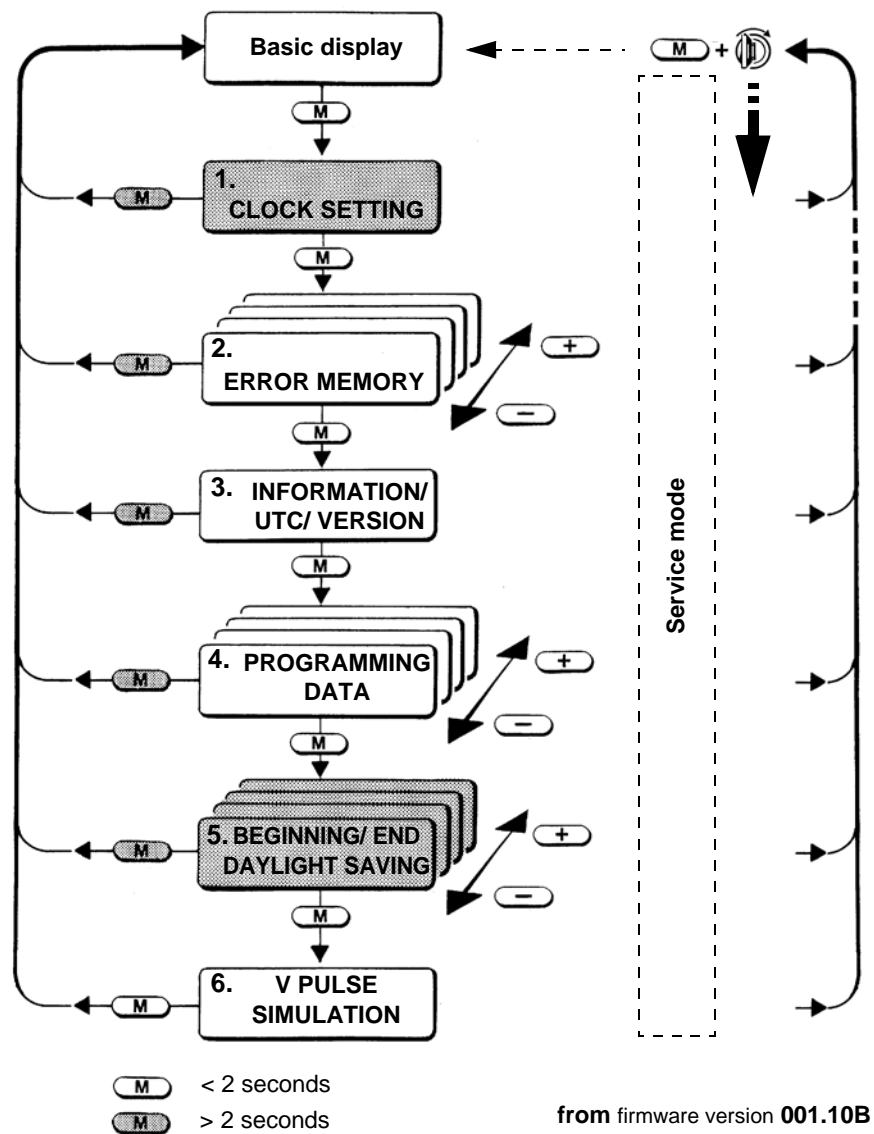


Fig. 2-8: MTCO 1324: Overview of menu structure (service mode)

Service functions

The service engineer can access the following menu functions:

- "2. Error Memory"
- "3. Information/ UTC/ Version"
- "4. Programming Data"
- "5. Beginning/ End Daylight Saving Time"
- "6. v Pulse Simulation".



Important

These functions can only be called up if:

- the ignition is on and
- the vehicle is stationary.

If no key is pressed for 20 seconds or no message is displayed, the MTCO 1324 displays the basic display automatically.

Selecting a menu function

From firmware version 001.10B

From firmware version **001.10B** the "service" mode must be activated first to access menus 2. to 6.

1 Activating the service mode:

- Press the **M** key and keep it pressed; at the same time switch the ignition on. This has to be done within 2 seconds.
- Release the **M** key when the ignition has been turned on.

If the ignition is switched off and on again, only the "driver mode" is active (access to menus 2. to 6. is blocked).

2 Press the **M** key repeatedly until the desired functions 1 to 6 are displayed.

3 Use the **+** and **-** keys to browse in the sub-menus (forward/ backward) and to make any settings.

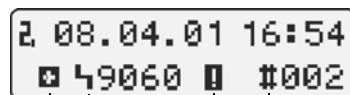
Returning to the basic display

- Press the **M** key for more than 2 seconds.

If no messages are stored, the basic display appears again.

Displaying the Error Memory (menu 2.)

- 1 Press the **M** key to select the "ERROR MEMORY" menu.



Date and time when the error was last recorded

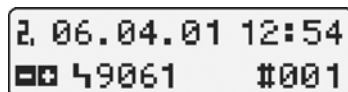
Error frequency, i.e. how often the error occurred, max. 126 entries

"Error active" symbol

Error symbol and error code

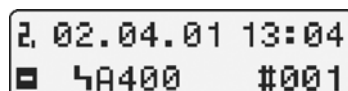
Further errors stored

- 2 Press the  or  key to call up further error entries.



2.06.04.01 12:54
49061 #001

..



2.02.04.01 13:04
4A400 #001

Additional information

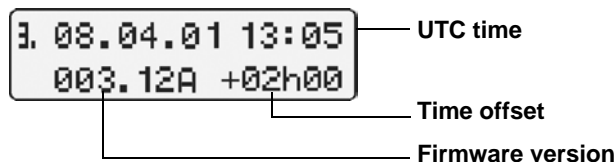
A detailed description of error messages and recommended measures for error correction can be found in *Chapter 6.1 "Error messages", page 6-2.*

Displaying the UTC time and the firmware version (menu 3.)

UTC time and time offset

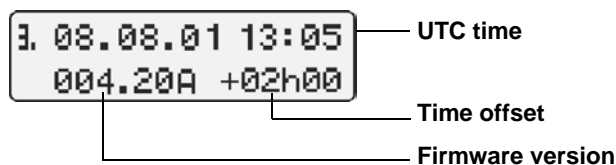
The MTCO 1324 stores all the time settings as UTC (**Universal Time Coordinated**) time. To display the official time of the country where the vehicle is registered on the MTCO 1324 the so-called time offset must be stored in the MTCO 1324.

- 1 Press the  key to select the "INFORMATION/ UTC / VERSION" menu.



3.08.04.01 13:05 — UTC time
003.12A +02h00 — Time offset
— Firmware version

From serial number
450.000 without
battery compartment



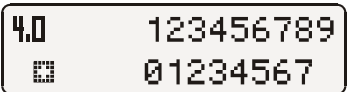
3.08.08.01 13:05 — UTC time
004.20A +02h00 — Time offset
— Firmware version

Additional information

Detailed information on how to program UTC time can be found in *Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time", from page 3-39.*

Displaying the programming data (menu 4.)

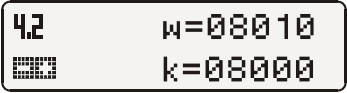
- 1 Press the **M** key to select the "PROGRAMMING DATA" menu.
- 2 Use the **+** or **-** key to select the programmed data.



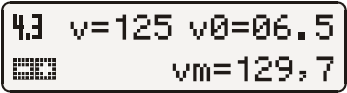
Vehicle identification number
(max. 17 digits)



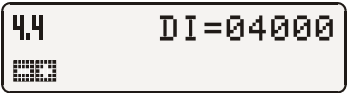
MTCO 1324 product code



"w" = characteristic coefficient [imp/km]
"k" = device constant [imp/km]



v = measuring range [km/h]
v0 = minimum measuring range
vm = maximum measuring range



DI = RPM pulse [imp/ 1000 revs/min]



n = measuring range [revs/min]
n0 = minimum measuring range
nm = maximum measuring range

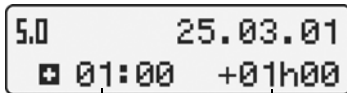
Displaying Beginning/ End Daylight Saving Time (menu 5.)

The switchover settings for the beginning/ end of daylight saving time as defined by the EU member states have been programmed into the MTCO 1324 for a period of five years in advance. This function displays the programmed switchover settings and the corresponding correction values.

Additional information

Detailed information on how to program the beginning/ end of daylight saving can be found in *Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time", from page 3-39.*

- 1 Press the **M** key to select the "BEGINNING/ END DAYLIGHT SAVING" menu.

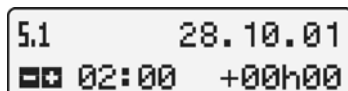


Switchover date

Correction value

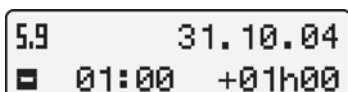
Switchover setting in UTC time

- 2 Use the  or  key to select the desired entries.



5.1 28.10.01
02:00 +00h00

..



5.9 31.10.04
01:00 +01h00


V Pulse Simulation (menu 6.)

If the vehicle is equipped with a road speed limiter, this function can be used to check the speed limiter's setting range from **75 - 120 km/h**.



Important


When executing this function error entries or error messages can be recorded in other electronic components of the vehicle. Cause: "v" pulse emitted while the vehicle is stationary. Refer to the vehicle documentation before executing this function.

- 1 Press the  key to select the "V PULSE SIMULATION" menu.

- 2 Simulate "v" pulses using the  or  key.

The "v" value can be adjusted in 1 km/h steps.

If the pre-set speed of the speed limiter is reached, the engine is limited automatically (at approx. 90 km/h).



6. 075.0 km/h

..



6. 085.0 km/h

"v pulse active" symbol

2.1.3 Interfaces

Interface overview

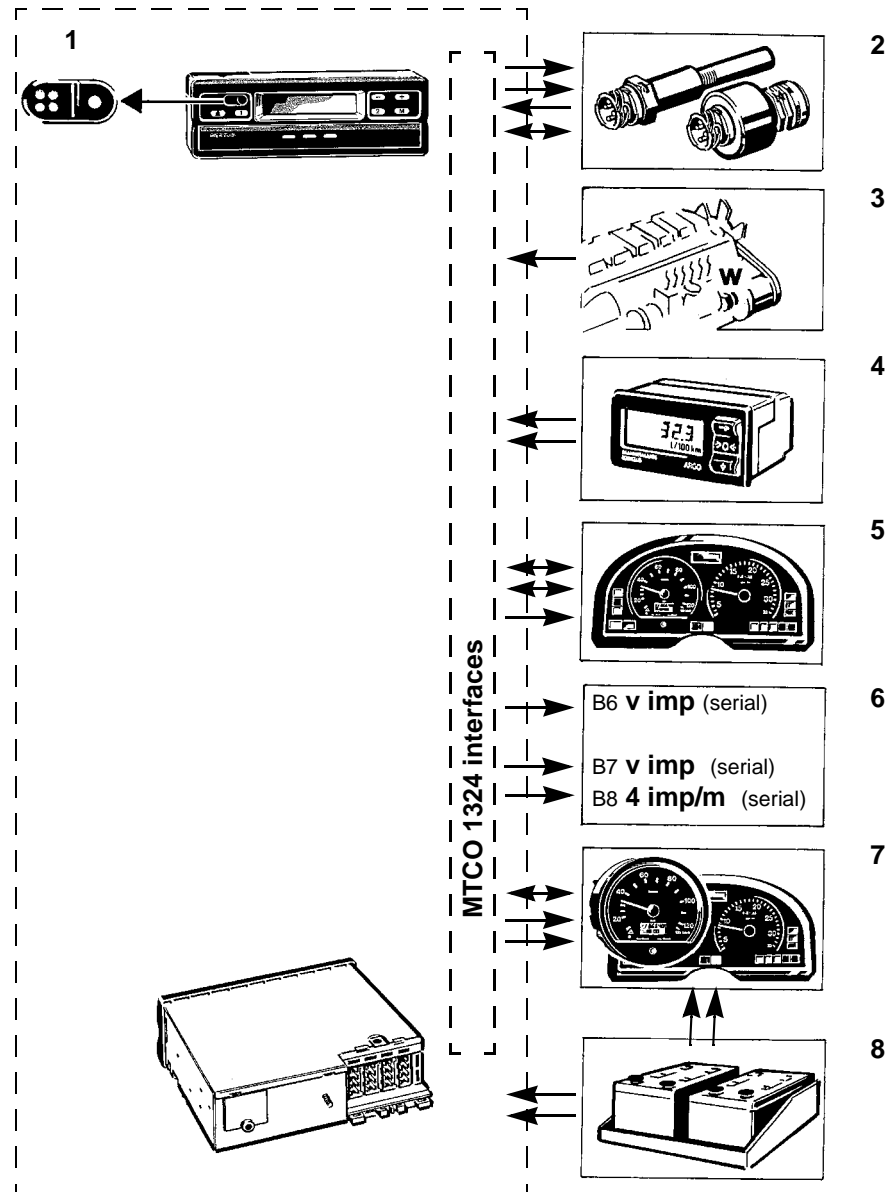


Fig. 2-9: MTCO 1324: Interface overview (all interfaces connected, not possible in real-time operation)

- 1 Test and programming interface
- 2 Speed sensor, KITAS 2170/ 2171
- 3 RPM generator (optional); pulse generator 2155/ 2159 or terminal "W"
- 4 Additional stylus (optional); e.g. EDM
- 5 CAN bus for Cluster and optional: K-Diagnosis (D7), Dyna-Fleet (D7), Info-Interface (D8)
- 6 Outputs (e.g. "v" pulse, 4 imp/m)
- 7 K-Line for Electronic Speedometer/ Cluster (as instrument interface, D7) and optional: Info-Interface (D8)
- 8 Vehicle supply voltage (vehicle battery)

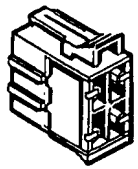
- CAN interface (A4, A8)** CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus has a high data transmission speed. Therefore, it is particularly suitable for real-time applications.
- An identifying address which identifies the message content (e.g. engine speed) is assigned to the data transmitted on the CAN bus. A station connected to the CAN bus interprets the address to find out whether the data is relevant or not. If so, the data is processed; otherwise the message is ignored.
- K-LINE interface (D7)** K-Line is a standard asynchronous serial interface with a specific physical structure for exchanging digital information. It serves as an instrument interface between the MTCO 1324 and the Electronic Speedometer 1323.01 for:
- Function Control LED signal Direct control of the warning LED on the indicator unit. When the MTCO 1324 detects a system event (error/malfunction), it sends a signal directly to the warning LED so that it lights up.
 - "v" pulse The Electronic speedometer 1323.01 interprets these pulses sent by the MTCO 1324 as its "v" generator signals.
 - K-LINE data cable The MTCO 1324 and the Electronic Speedometer 1323.01 use this line for constant data exchange. The MTCO (master) constantly transmits the current status of the odometer, the daily trip recorder and the system clock to the Electronic Speedometer 1323.01. The Electronic Speedometer (slave) sends the reset of the daily trip recorder to the MTCO 1324.

Optional, customised interface

- K-Diagnosis (D7)** K-Diagnosis is a standard asynchronous serial interface with a specific physical structure for interchanging digital information. It serves as a diagnosis interface, e.g. vehicle diagnosis systems and suitable diagnosis test devices.
- Dyna-Fleet (D7)** Dyna-Fleet is a vehicle-specific serial data interface for VOLVO vehicles equipped with the Dyna-Fleet on board computer.
- Info-Interface (D8)
from firmware
version 004.xx
(serial no. 450.000)** It is a customised data interface for fleet management systems. The data transmission speed is 10.4 kBd at a repetition rate of 1 second. The data is also transmitted when the ignition is off. The current data is transmitted:
- Date, time, k constant, current error messages
 - speed, engine revolutions, odometer and daily trip recorder readings, working times for drivers 1 and 2
 - additional information and vehicle identification number.

2.1.4 Interface specification

Connector A

Connector contact	Parameters	Values			[Unit]	Connector A
		min.	typ.	max.		(natural white)
						Remarks
						
A1 O						T. 30 constant voltage (relating to A5)
Battery +	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current		30		mA	"v" standby
				350	mA	Total "v" current
			40		mA	"v + n" standby
				380	mA	Total "v + n" current
	12 V					
	Voltage	10.8	12	15	V	
				16		Short term (max. 1 h)
	Current		50		mA	"v" standby
				400	mA	Total "v" current
			70		mA	"v + n" standby
				500	mA	Total "v + n" current
	Fuse			8	A	
Standby definition: no RPM, work status on break time and ignition off						
A2 I						T. 58d (relating to A6, signal input)
Illumination	Voltage			32	V	
	PWM frequency	150			Hz	24 V / direct current level
		50				12 V / direct current level
A3 O						
Battery + ignition	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current		70		mA	"v" display on
				500	mA	Total "v" current
			80		mA	"v + n" standby
				600	mA	Total "v + n" current
	12 V					
	Voltage	10.8	12	15	V	
				16		Short term (max. 1 h)
	Current		50		mA	"v" display on
				450	mA	Total "v" current
			70		mA	"v + n" standby
				470	mA	Total "v + n" current
	Fuse			8	A	
Total current is defined including trav discharge.						

2 Product description/ description of functions

Connector contact	Parameters	Values			[Unit]	Connector A (natural white)
		min.	typ.	max.		Remarks
A4 O						(relating to A7)
CAN_H						Technical description according to ISO/WD 16844
A5 O						T. 31a (relating to A6)
Battery -						
A6 O						T. 31 (relating to A2, A3)
GND						
A7 O						(optional)
CAN_GND						Galvanised / capacitive connection
A8 O						(relating to A7)
CAN_L						Technical description according to ISO/WD 16844

Table 2-1: Interfaces: Connector A (current and CAN bus connection)

Connector B

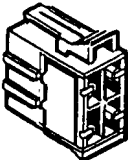
Connector contact	Parameters		Values			[Unit]	Remarks	<div>Connector B km/h MPH (yellow)</div> 
			min.	typ.	max.			
B1 O KITAS 2170/ 2171 reference								
	Voltage		6.5		9	V		
B2 O T. 31, minus internal bridge with A5								
B3 I KITAS 2170/ 2171 reference								
"v" signal (real time)	Voltage	Low High	3.8		1.0 8.0	V	I = -250 µA I = -150 µA	
B4 KITAS 2170/ 2171 reference Bi-directional data signal								
I	Voltage	Low High	5.2		1.2	V	I = -1 mA I = -0.5 mA	
O	Voltage	Low High	5.4		1.0	V	I = 1 mA I = -20 µA	
	Baud rate		1164		1236	Bd		
B6 O Standard (cf. definition of B7) or customised								
"v" pulse								
B7 O Instrument interface/ K-Line (relating to A6)								
"v" pulse	Voltage	Low High	5.5		1.5	V	I = 1 mA I = -1 mA	
	Frequency				1.5	kHz		
	Pulse length		0.64		4	ms	±1%	
	Tachograph constant		4000		25000	imp/km		
B8 O								
4 imp/m	Voltage	Low High	5.5		1.5	V	I = 1 mA I = -1 mA	
	Frequency				244	Hz	v = 220 km/h	
	Pulse length		1.6		4	ms		

Table 2-2: Interfaces: Connector B "km/h MPH"

Connector C

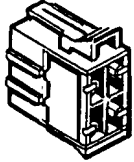
Connector contact			Values			[Unit]	Connector C rev/min RPM	
							Remarks	
			Parameters	min.	typ.		max.	
C2 O								
GND						T. 31, minus internal bridge with A6		
C3 I								
						"n" signal input (relating to C2)		
T. W	Voltage	Low			2.0	V	Alternating current generator	
		High	3.5		40			
	Current				15	mA		
	Frequency				4	kHz		
	Pulse length		125			ms		
	RPM constant		2000		64000	imp/1000revs/min		

Table 2-3: Interfaces: Connector C "revs/min RPM" (optional)

Connector D

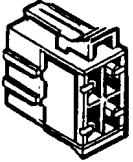
Connector contact	Parameters		Values			[Unit]	Connector D ZuE (brown)	
			min.	typ.	max.		Remarks	
D1 O			Additional stylus 1 (relating to A6)					
Status input 1	Voltage	Low High	8		2 32	V		
D2 O			Additional stylus 2 (relating to A6)					
Status input 2	Voltage	Low High	8		2 32	V		
D4 O			Instrument interface (relating to A6)					
General warning signal	Voltage	Low High		1.5		V	I = 5 mA	
	Current			20		mA	Lower current limit (open collector)	
D6 O			Instrument interface (see definition of B7)					
"v" pulse								
D7 I/O			Instrument interface/ K-LINE (relating to A6)					
Data transmission							Technical description according to ISO 14230 Part 1	
D8 I/O			Info-Interface (optional) (relating to A5)					
Data transmission	Voltage	Low High	5.5		1.5	V V	I = 1 mA	
							I = -1 mA	

Table 2-4: Interfaces: Connector D ZuE, especially input / output stages (optional)

2.1.5 Overview of variants

MTCO 1324 device types

1324	.	7	1	0	3	1	5XX	01	00
------	---	---	---	---	---	---	-----	----	----

	Device types
1324.5xxx	2 driver EC tachograph, 24 V, locked/ fold down tray
1324.6xxx	2 driver EC tachograph, 12 V, locked/ fold down tray
1324.7xxx	2 driver EC tachograph, 24 V, ADR, locked/ fold down tray

Table 2-5: MTCO 1324: Overview of device types

MTCO 1324 vehicle-/ manufacturer-specific versions (tray)

1324	.	7	1	0	3	1	5XX	01	00
------	---	---	---	---	---	---	-----	----	----


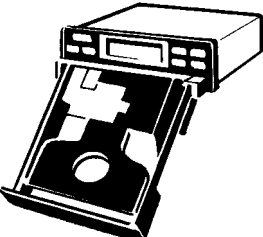
	Vehicle-/ manufacturer-specific versions	
2xx	with tracked clock (NFU) locked tray	
5xx	with tracked clock (NFU) fold down tray	

Table 2-6: MTCO 1324: Vehicle-/ manufacturer-specific versions (tray)

**MTCO 1324 vehicle-/ manufacturer-specific versions
(illumination and configuration)**

The MTCO 1324 vehicle-/ manufacturer-specific versions can be differentiated by their display and keypad illumination, front cover etc. as well as vehicle-specific versions and firmware version.

1324	.	7	1	0	3	1	X14	03	00	
▼	Vehicle type	Special version	Factory configuration Byte 1 Byte 2		Firmware version	Illumination Display Dimming Keys			Cover lettering	SIM*
X14	DC Actros	ADR, ...	0000 0001	0000 0001	004.20A	yellow	CAN	none	Kienzle	

* SIM = seal caps with specific marking: Sealing required in France **only**.

This is an example to explain the following table "MTCO 1324: Overview of vehicle-/ manufacturer-specific versions (illumination, configuration)".

2 Product description/ description of functions

AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X01	IVECO	none	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	none	Kienzle	
X02	not defined								
X03	Buses	none	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	PIN A2	Kienzle	
X04	MAN	none	0000 0000 0000 0001	0000 0000 0000 0000	003.10B 003.11	orange	PIN A2	Kienzle	
X05	DC Sprinter	none	0000 0000 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	yellow	PIN A2	Kienzle	
X06	NISSAN	none	0000 0000 0000 0001	0000 0000 0000 0000	003.10B 003.11	green	none	Kienzle	X
X07	MAN	none	0000 0000 0000 0001	0000 0000 0000 0000	003.10B 003.11	orange	PIN A2	Kienzle	X

AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X08	IVECO	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	none	Kienzle	X
X09	NISSAN	with galvanised separation	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	none	Kienzle	
X10	VW	Power down switching (power saving function)	0000 0000 0000 0000	0000 0000 0000 0001	003.14 004.20A	blue	PIN A2	none	
X11	IVEKA	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	PIN A2	IVEKA	
X12	Neoplan EvoBus VanHool	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	yellow	PIN A2	Kienzle	X
X13	DC Sprinter	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	yellow	PIN A2	Kienzle	X
X14	DC Actros	ADR plus cut off	0000 0000 0000 1000 0000 1000 0000 1000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	yellow	CAN	Kienzle	

2 Product description/ description of functions

AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X15	DC Actros	none	0000 0000 0000 1000 0000 1000 0000 1000 0000 1000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	yellow	CAN	none Kienzle	X
X16	not defined								
X17	VOLVO	none	0010 0011 1000 0011	0000 0000 0000 0001	003.13 004.20A	yellow	PIN A2	none	
X18	VOLVO	none	0010 0111 1000 0111	0000 0000 0000 0001	T0.03G 004.20A	yellow	CAN	none	
X19	VOLVO	none	0010 0011 1000 0011	0000 0000 0000 0001	003.13 004.20A	yellow	PIN A2	none	X
X20	VOLVO	ADR plus/ minus cut off	0010 0010 1000 0010	0000 0000 0000 0001	003.13 004.20A	yellow	PIN A2	none	X
X21	VOLVO	none	0010 0111 0010 0111 1000 0111	0000 0000 0000 0000 0000 0001	003.13 T0.03G 004.20A	yellow	CAN	none	X

AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X22	VOLVO	ADR plus cut off	0010 0110 1000 0110	0000 0000 0000 0001	003.13 004.20A	yellow	CAN	none	X
X23	VOLVO	ADR plus cut off	0010 0110 1000 0110	0000 0000 0000 0001	003.13 004.20A	yellow	CAN	none	
X24	Siemens VDO VOLVO	ADR plus/ minus cut off	0000 0000 0000 0000	0000 0000 0000 0001	003.12A 004.20A	yellow	CAN	none	
X25	not defined								
X26	RVI	ADR plus cut off	0010 1100 1000 1100 1001 1100 1001 1100	0000 0000 0000 0001 0000 0001 0000 0001	003.16 004.20A T0.04B 004.21	orange	CAN	none	
X27	RVI	ADR plus cut off	0010 1100 1000 1100 1001 1100 1001 1100	0000 0000 0000 0001 0000 0001 0000 0001	003.16 004.20A T0.04B 004.21	orange	CAN	none	X
X28	RENAULT passenger car	Power down switching (B6 = 45 mA)	0000 0000 0000 0000	0000 0000 0000 0001	003.14 004.20A	yellow	PIN A2	Kienzle	X

2 Product description/ description of functions

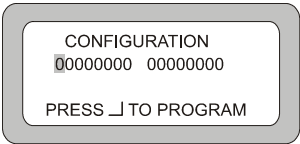
AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X29	NISSAN	with galvanised separation	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	none	Kienzle	
X30	MAN	none Caution! On ADR vehicles byte 1 has to be set to xxxx xxx0	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	CAN	none	
X31	MAN	none Caution! On ADR vehicles byte 1 has to be set to xxxx xxx0	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	003.10B 003.11 003.12A 004.20A	orange	CAN	none	X
X32	DAF LEYLAND Siemens VDO	ADR plus cut off	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	PIN A2	none	
X33	DAF LEYLAND	ADR plus cut off	0000 0000 0000 0001 0000 0001 0000 0001 0000 0001	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	PIN A2	none	X
X34	Citroen Fiat Peugeot	none	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	none	Kienzle	
X35	Citroen Fiat Peugeot	none	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	none	Kienzle	X

AV	Vehicle type	Special version	Factory configuration		Firmware version	Illumination		Cover lettering	SIM
			Byte 1	Byte 2		Display	Dimming		
X36	DAF LEYLAND	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	PIN A2	Kienzle	
X37	DAF LEYLAND	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	orange	PIN A2	Kienzle	X
X38	IVECO	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	PIN A2	IVECO	
X39	IVECO	none	0000 0000 0000 0001 0000 0001 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	PIN A2	IVECO	X
X40	IVECO	ADR plus/ minus cut off	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.10B 003.11 003.12A 004.20A	green	PIN A2	IVECO	
X41	IVECO	ADR plus/ minus cut off	0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000 0000 0000 0000 0001	003.12A 004.20A	green	PIN A2	IVECO	X
X42									

[illegible]

Table 2-7: MTCO 1324: Overview of vehicle-/ manufacturer-specific versions (illumination, configuration)

**Explanation of MTCO factory configuration:
BTC (SDS unit) display reading and meaning**



BTC display reading

Byte 1	Byte 2	Meaning of Byte 1
xxxx xxx0	xxxx xxxx	0 = "v" pulse, monitoring (B7) off
xxxx xxx1	xxxx xxxx	1 = "v" pulse, monitoring (B7) on
xxxx xx0x	xxxx xxxx	0 = CAN instrument communication monitoring on
xxxx xx1x	xxxx xxxx	1 = CAN instrument communication monitoring off
xxxx x0xx	xxxx xxxx	0 = CAN dimming values stored temporarily
xxxx x1xx	xxxx xxxx	1 = CAN dimming values stored
xxxx 0xxx	xxxx xxxx	0 = Daimler Chrysler diagnosis extension off
xxxx 1xxx	xxxx xxxx	1 = Daimler Chrysler diagnosis extension on
xx0x xxxx	xxxx xxxx	0 = standard CAN error detection speed
xx1x xxxx	xxxx xxxx	1 = extended CAN error detection speed
0xxx xxxx	xxxx xxxx	0 = standard CAN error detection speed
1xxx xxxx	xxxx xxxx	1 = extended CAN error detection speed
Byte 1	Byte 2	Meaning of Byte 2
xxxx xxxx	xxxx xxx0	0 = "v" motor, 68 ohms up to and including firmware version 003.xx
xxxx xxxx	xxxx xxx1	1 = "v" motor, 175 ohms from firmware version 004.xx (from serial number 450.000)

Section 1: MTCO 1324 EC • Edition 03/2002

2.1.6 Type key

Device type	1324	Modular Tachograph
Device variant	5 - 7	see Table 2-5
Interface 1 CAN bus (PIN A: 4, 7, 8)	0	without interface
	1	CAN with terminal resistance of 120 ohms
	2	CAN without terminal resistance
	3	CAN VW-HW without terminal resistance
Interface 2 K-LINE (PIN D: 4, 6, 7, 8)	0	without interface
	1	K-LINE used as instrument interface to E-Speedometer (D7)
	2	K-LINE (diagnosis interface)*; (D7)
	3	Dyna-Fleet (data interface to VOLVO on board computer), (D7)
	4	Info-Interface (from firmware version 004.xx), (D8)
Additional equipment	0	without additional equipment
	1	RPM recording (without display)
	2	Additional stylus
	3	RPM recording (without display) and additional stylus*
	4	Looped generator pulse on PIN B6
	5	Additional stylus and looped generator pulse on PIN B6
	6	Digital "v" display (Stand alone)
	7	Additional stylus and digital "v" display ("Stand alone")
Measuring range	1	125 km/h (standard)
	2	100 km/h
	3	140 km/h
	4	--
	5	180 km/h
Vehicle-/ manufacturer-specific versions see Table 2-6 and Table 2-7		
Firmware/ Cluster connection		
CAN	00	without firmware/ Cluster connection
	01	CAN/ Basis ISO/TCO 1 repetition rate 50 ms
	02	CAN/ Basis ISO/TCO 1 repetition rate 10 ms
	03	CAN/ Basis ISO/TCO 1 repetition rate 20 ms
	04	CAN/ VW TCO 1 repetition rate 20 ms
Interface/ customer firmware		
K-Line	00	without customised firmware
	01	Electronic Speedometer 1323.01 (D7)
	02	Standard diagnosis* (D7)
	03	Dyna-Fleet (VOLVO), (D7)
	04	Info-Interface (from firmware version 004.xx), (D8)
1324	.	7
1	0	3
1	514	03
00		

Table 2-8: MTCO 1324: Type key

2.1.7 Technical data

"v" measuring range	125 km/h (standard)		
Display (LCD)	2 lines, 16 characters per line, illumination controlled by ignition		
Character height	6.3 mm		
Operating voltage	12 V or 24 V (depending on vehicle voltage)		
	at	DC 12 V	DC 24 V
"v + n" current consumption	Standby	105 mA	40 mA
	Operation max.	350 mA	250 mA
Current consumption without "n"	Standby	50 mA	30 mA
	Operation max.	500 mA	380 mA
External fusing	Connectors "A1", "A3"	8 A	8 A
Operating temperature	-25 °C to +70 °C		
Storage temperature	-40 °C to +80 °C		
Adjustment range	"v" 4000 to 25000 imp/km; max. 1.5 kHz		
	"n" 2000 to 64000 imp/ 1000 revs/min; max. 4 kHz		
Inputs	"v" sensor, "n" pulse generator*, additional stylus*		
Outputs	2 x "v" pulses, 1 x 4 imp/m Triggered by external warning LED		
Interfaces	Test and programming interface, K-LINE (ISO 9141 instrument interface), CAN interface*, Info-Interface for OBC on PIN D8*		
Accuracy	Speed ± 3 km/h Distance ± 1 % Clock (electronic) ± 5 sec/day Recording ± 2 min/day		
EMC	Directive 95/94/EU ISO 7637 e1 021416		
Noise	5 to 150 Hz, $0.02 \text{ g}^2/\text{Hz} = 1.7 \text{ g RMS}$		
Buffer battery	Lithium		
Housing	Galvanised sheet steel		
Weight	1,350 g		
Additional and special equipment	ADR, customised cover and display illumination, keypad, data bus CAN interface, Info-Interface, RPM recording with upper measuring range limit of 3,300 revs/min, additional stylus, "v" final measuring range value: 100, 140, 180 km/h		

* optional

Table 2-9: MTCO 1324: Technical data

2.2 Electronic Speedometers 1323.01 and 1323.02

The Electronic Speedometer 1323 has the form of a standard tachograph and a diameter of Ø 140 mm. It is available with different front covers: round or rectangular KTCO and FTCO design. Further vehicle-/ manufacturer-specific versions are possible.

Basic functions

Basic functions of the Electronic-Speedometer displaying:

- speed (analogue)
- odometer reading and time (digital).

2.2.1 Product description 1323.01 (for MTCO 1324)

Electronic-Speedometer 1323.01 (KTCO design, round in combination with MTCO)

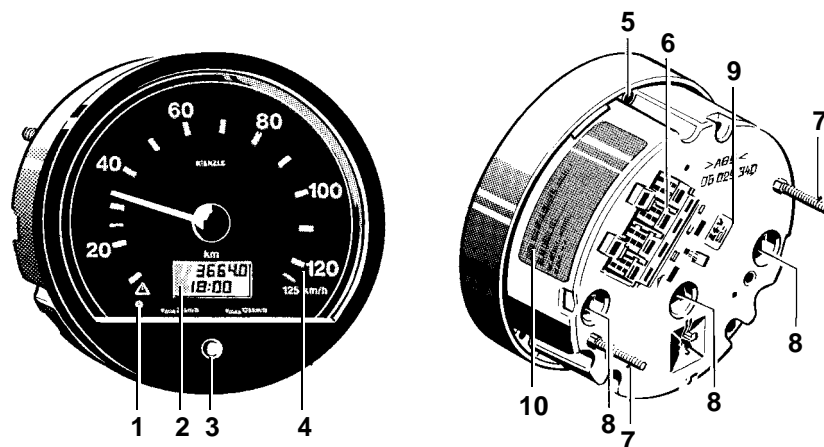


Fig. 2-10: Electronic Speedometer 1323.01: Front and back (KTCO design, round)

- 1 Warning LED:
The LED lights up when an error or malfunction is detected in one of the system components. At the same time, a message (code) is shown on the MTCO 1324 display.
- 2 Odometer/ clock display:
7-digit display of total odometer reading; the last digit indicates 100 m.
Either the time of day or the distance travelled per day (optional) are displayed in the bottom line.
- 3 Setting key for switching between clock/ daily trip recorder (optional)
- 4 Speed dial
- 5 Sealing point
- 6 Connector sockets A, B, C and D
- 7 Fixing screws
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Voltage label
- 10 Type plate

**Electronic-Speedometer 1323.01
(KTCO design;
rectangular in
combination
with MTCO)**

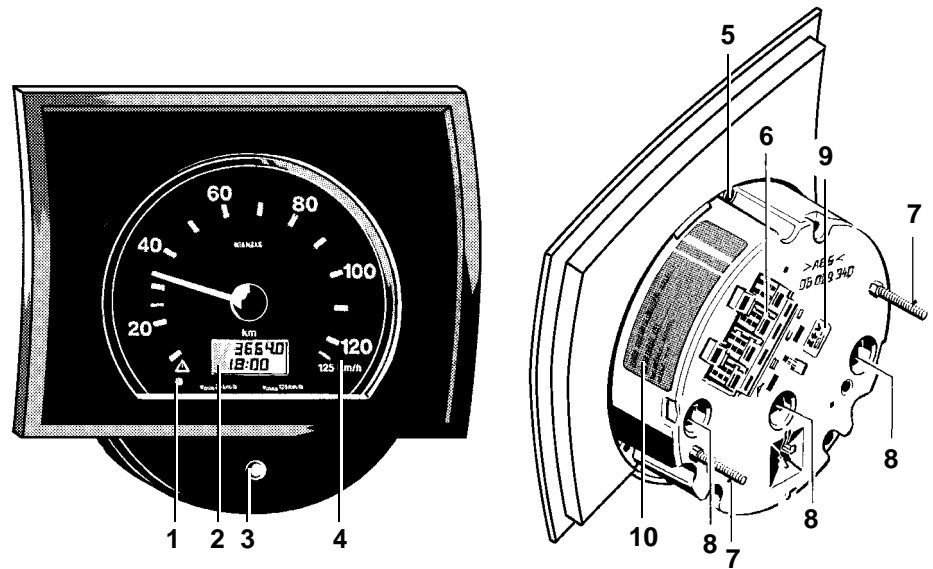


Fig. 2-11: Electronic Speedometer 1323.01: Front and back (KTCO design, rectangular)

- 1 Warning LED:
The LED lights up when an error or malfunction is detected in one of the system components. At the same time, a message (code) is shown on the MTCO 1324 display.
- 2 Odometer/ clock display:
7-digit display of total odometer reading; the last digit indicates 100 m.
Either the time of day or the distance travelled per day (optional) are displayed in the bottom line.
- 3 Setting key for switching between clock/ daily trip recorder (optional)
- 4 Speed dial
- 5 Sealing point
- 6 Connector sockets A, B, C and D
- 7 Fixing screws
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Voltage label
- 10 Type plate

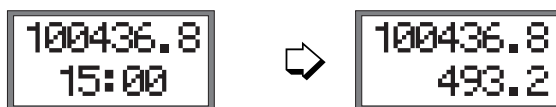
Operation

The Electronic Speedometer 1323.01 features the following operating functions:

- Setting the display to clock or daily trip recorder
- Resetting the daily trip recorder to zero.

When the ignition is on, the Electronic Speedometer 1323.01 is ready for operation. The display indicates the total odometer reading and the clock or the daily trip recorder.

Setting the display to clock or daily trip recorder



- Press the setting key (3, Fig. 2-8) briefly.

In the bottom line of the display either the "clock" or the "daily trip recorder" are displayed, depending on the previously selected option.

Resetting the daily trip recorder to zero



- Press the setting key for more than 2 seconds when the "daily trip recorder" is displayed.
The daily trip recorder is reset to "0".

2.2.2 Product description 1323.02 "Stand alone"



Important

The Electronic-Speedometer "Stand alone" cannot be fitted together with an MTCO 1324. It can be used in combination with traditional pulse generators.

The "Electronic Speedometer" upgrade kit (No. 1062-89-901-00) which includes a programming cable is required for setting parameters in and checking the Electronic Speedometer "Stand alone".

Electronic Speedometer 1323.02 (KTCO design, round, not for use in combination with the MTCO 1324)

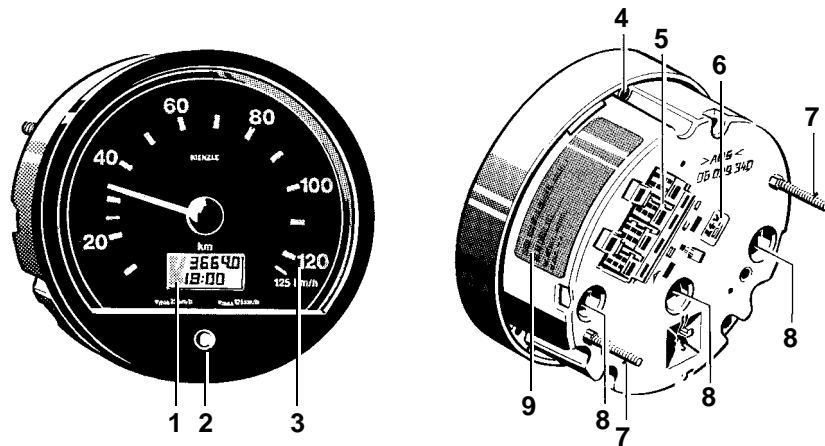


Fig. 2-12: Electronic Speedometer "Stand alone": Front and back (KTCO design, round)

- 1 Odometer/ clock display:
7-digit display of total odometer reading; the last digit indicates 100 m.
Either the time of day or the distance travelled per day (optional) are displayed in the bottom line.
- 2 Setting key:
– For setting the clock and
– for switching the bottom line display between clock/ daily trip recorder (optional).
- 3 Speed dial
- 4 Sealing point
- 5 Connector sockets A, B, C and D
- 6 Voltage label
- 7 Fixing screws
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Type plate

**Electronic
Speedometer 1323.02
(FTCO design,
rectangular, not for
use in combination
with the MTCO 1324)**

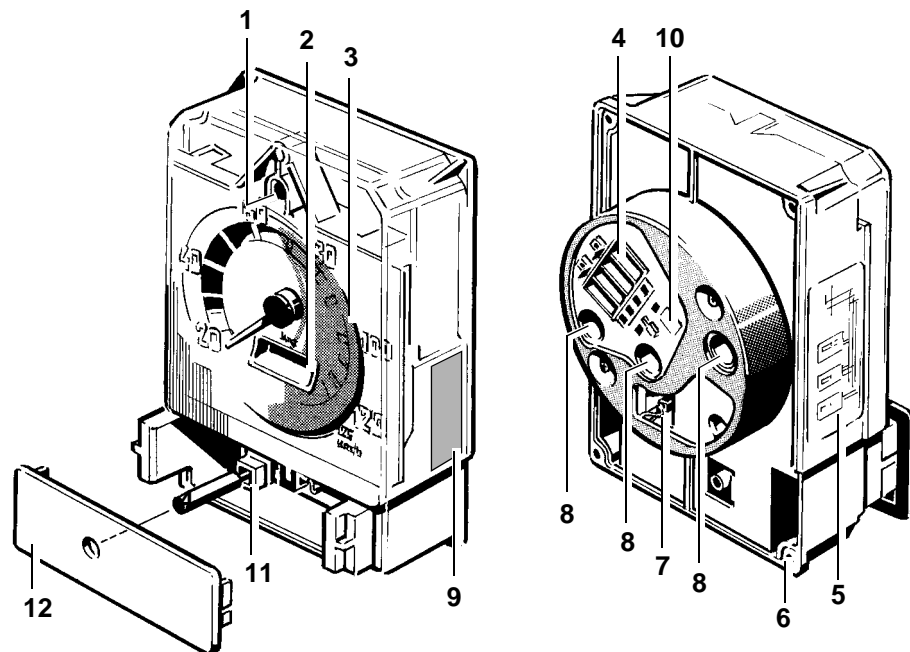


Fig. 2-13: Electronic Speedometer "Stand alone": Front and back (FTCO design)

- 1 Sealing point
- 2 Display of odometer and clock/daily trip recorder (optional):
7-digit display of total odometer reading; the last digit indicates 100 m.
- 3 Speed dial
- 4 Connector sockets A, B, C and D
- 5 Connection diagram (label)
- 6 Fixing holes (4 x)
- 7 Connector with two connection leads for setting key
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Type plate
- 10 Voltage label
- 11 Setting key for switching between clock/ daily trip recorder (optional)
- 12 Front cover (remove during installation)

Operation

The Electronic Speedometer "Stand alone" features the following operating functions:

- Setting the display to clock/ daily trip recorder
- Resetting the daily trip recorder to zero
- Setting the clock.

The "Setting the display to clock/ daily trip recorder" and "Resetting the daily trip recorder to zero" operating functions are the same as for the Electronic Speedometer 1323.01 (see *Chapter 2.2.1 "Product description 1323.01 (for MTCO 1324)" page 2-40*).

Special feature of the "Stand alone" unit

When the ignition is off and the setting key is pressed briefly, the Electronic Speedometer 1323 "Stand alone" displays the current:

- total kilometre reading (mileage) and
- time of day/ daily trip recorder reading, depending on the previously selected option.

Setting the clock



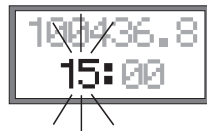
Condition

The clock on the Electronic Speedometer "Stand alone" can **only** be set if the ignition is on and the "Clock" display mode has been selected.

How to set the clock



- 1 If the time of day is not displayed, press the setting key to switch to the "clock" display mode.



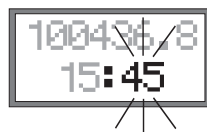
- 2 Press the setting key for at least two seconds.
The unit switches to setting mode and the hours flash.



- 3 Press the setting key again and keep it pressed until the current hour setting is flashing on the display. Then release the key.



- 4 Press the setting key again briefly.
The hours are stored and the minutes flash on the display.



- 5 Press the setting key again and keep it pressed until the current minute setting is flashing. Then release the key.



- 6 Press the setting key again briefly.
The new time of day is stored and the setting mode is terminated. The display switches to display mode.




Important

When the Electronic Speedometer 1323 "Stand alone" is in setting mode and the setting key is not pressed for one minute, the function is aborted automatically. The Electronic Speedometer 1323 "Stand alone" switches to display mode without storing any changes made.

2.2.3 Overview of variants


Electronic Speedometer 1323.01 (for MTCO 1324)

Device type 1323.01 only in combination with the MTCO 1324 (examples)		
	1323.01 01000001 03	125 km/h, 12 V, daily trip recorder + clock, with round front cover in KTCO design
	1323.01 01001159 23	125 km/h, 24 V, daily trip recorder + clock, with rectangular KTCO design front cover

Please contact your Siemens VDO partner for up-to-date information on the Electronic Speedometer 1323.01 device variants available.

Table 2-10: Electronic Speedometer 1323.01: Examples of variants

Electronic Speedometer 1323.02 "Stand alone" (not to be used in combination with the MTCO 1324)

Device type 1323.02 "Stand alone" (examples)		
	1323.02 01000001 23	125 km/h, 24 V, daily trip recorder + clock, with round front cover in KTCO design
	1323.01 01000104 23	125 km/h, 24 V, daily trip recorder + clock, with rectangular FTCTO design front cover

Please contact you Siemens VDO partner for up-to-date information on the Electronic Speedometer 1323.02 "Stand alone" device variants available.

Table 2-11: Electronic Speedometer "Stand alone": Example of variant

2.2.4 Type key

Device type	1323	Electronic Speedometer											
	Version	01	with MTCO 1324, dial with warning LED										
		02	"Stand alone", dial without warning LED										
	Additional equipment	00	without additional equipment										
		01	Daily trip recorder with clock										
		02	Daily trip recorder without clock										
	Variant	00	none										
		01	Installed in driver's workplace										
		02	For inductive sensor										
Vehicle-/ manufacturer-specific versions		see Table 2-10 and Table 2-11											
Measuring range/ voltage		02	100 km/h, 12 V										
		03	125 km/h, 12 V										
		04	140 km/h, 24 V										
		21	80 km/h, 24 V										
		23	125 km/h, 24 V										
		24	140 km/h, 24 V										
		53	180 km/h, 12 V										
<table><tr><td>1323</td><td>.</td><td>01</td><td>01</td><td>00</td><td>0001</td><td>03</td></tr></table>							1323	.	01	01	00	0001	03
1323	.	01	01	00	0001	03							

Table 2-12:Electronic Speedometer 1323: Type key

2.2.5 Technical data

Electronic Speedometer				1323.01	1323.02
Measuring range	125 km/h (standard)			●	●
Display	7-digit, 4-digit (optional)			●	●
Character height	5 mm			●	●
Operating voltage	12 V or 24 V (depending on vehicle voltage)			●	●
Current consumption	at	12 V	24 V	●	●
	Standby Operation max.	3 mA 55 mA	6 mA 58 mA		
Operating temperature	-25 °C to +70 °C			●	●
Storage temperature	-40 °C to +85 °C			●	●
Pulse range	4000 to 25000 imp/km			●	●
Inputs	"v" pulse, warning LED			●	--
	Inductive sensor			--	●
Outputs	None			●	--
	2 x v pulse, 1 x 4 imp/m, driving-stopping signal			--	●
Interface	K-LINE (instrument interface)			●	--
Accuracy	Speed display within the legally required tolerance of ± 3 km/h			●	●
EMC	Directive 95/94/EEC ISO 7637			●	●
Housing	Acrylonitrile-butadiene-styrene (ABS)			●	●
Weight	470 g			●	●
Optional extras	Daily trip recorder, clock display, vehicle-specific design of front frame and display, "v" upper limit of measuring range: 100, 140, 160, 180 km/h			●	●
	Daily trip recorder, clock display, vehicle-specific design of front frame and display, "v" upper limit of measuring range: 80 km/h			--	●

Table 2-13: Electronic Speedometer 1323: Technical data

2.3 Cluster

2.3.1 Product description

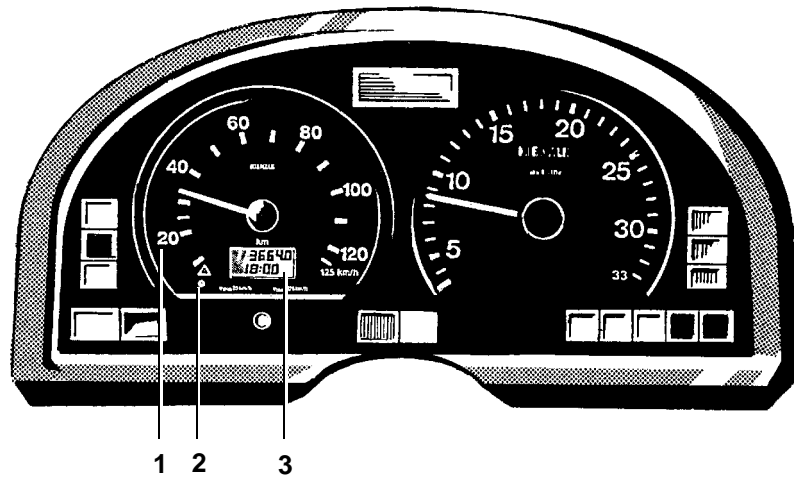


Fig. 2-14: Cluster: Front (standard)

- 1 Speed display
- 2 Warning LED with warning triangle
- 3 Display showing odometer and clock/ daily trip recorder

Indicator elements

Clusters feature the following indicator elements:

- Speedometer dial (km/h or mph)
- Odometer
- RPM dial
- Time
- Fuel gauge
- Temperature gauge and
- further function control indicators.


Operating elements

The operating elements on the Cluster (e.g. Reset key for resetting the daily trip recorder) are specific to the vehicle.

2.3.2 Overview of variants

As with the Electronic Speedometer 1323 clusters are available as system and "Stand alone" versions for 12 V or 24 V.


System versions (for MTCO 1324)

	System units for MTCO K-Line	
	1551-600xxx	km/h, left-hand drive
	1551-600xxx	km/h, right-hand drive
	1551-600xxx	mph, left-hand drive
	1551-600xxx	mph, right-hand drive

Please contact your Siemens VDO partner for up-to-date information on the device variants available.

Table 2-14:Cluster: Device variants for MTCO K-Line system variants

"Stand alone" versions (not for use with MTCO 1324)

	"Stand alone" units	
	1551-601xxx	km/h, left-hand drive
	1551-601xxx	km/h, right-hand drive

Please contact your Siemens VDO partner for up-to-date information on the device variants available.

Table 2-15:Cluster: "Stand alone" product variants

2.4 KITAS 2170/ 2171

Sensor cable acc. to DIN 72551 Kfz

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz. Main differences between the new sensor cable and existing pulse cables are:

- The cable may only be used up to 50 V direct voltage; existing cables can be used up to 230 V alternating voltage.
- The cables are twisted 15 revolutions per metre which means that the sensor cable complies with EU Directive 95/54 EMC.

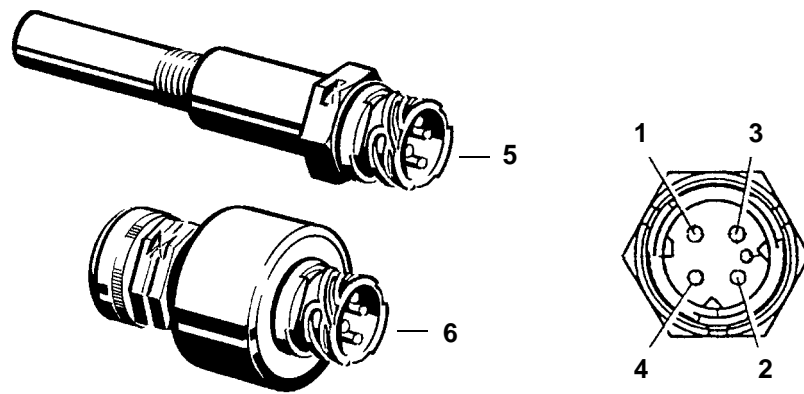


Fig. 2-15:KITAS 2170/2171: Sensors

- | | |
|----------------------------|--------------------------------|
| 1 Sensor supply (+ U_E) | 4 Data signal I/O |
| 2 Sensor supply (- U_0) | 5 Integrated sensor 2170/ 2171 |
| 3 "v" real time signal | 6 Standard sensor 2170/ 2171 |

Additional information

You will find detailed information on KITAS 2170/ 2171 in *Section 4 "Sensors and pulse generators", Chapter 1 "Kienzle sensors"*.

2.5 Tachograph charts

2.5.1 Front of tachograph chart

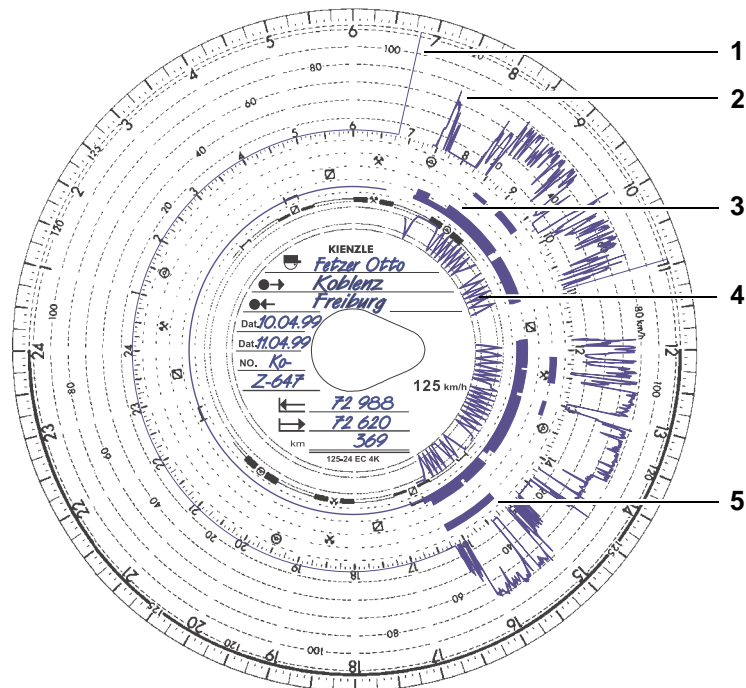
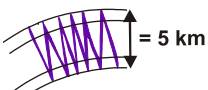


Fig. 2-16: Tachograph chart recordings for driver 1

- 1 Ejection mark: Each time the tray is opened the MTCO 1324 records this on the tachograph chart for driver 1.
- 2 Speed recording [km/h]
- 3 Working time recording:
 - ⌚ Driving times
 - ✕ Other periods of work
 - ▢ Periods of availability (waiting times, co-driver etc.)
 - ☐ Breaks and rest periods
- 4 Distance recording (distance travelled)



A distance of 5 km corresponds to one trace drawn up and one down.
- 5 Additional recordings (optional, e.g. blue flashing light, siren etc.)

Specific recording features

Interrupted distance recording



When the working time for both drivers is set to rest period and the ignition is off, the distance recording is (4a) interrupted.

When the ignition is switched on again, the recording of the distance travelled continues at the correct time.

Upper speed limit 180 km/h



An MTCO 1324 with an upper speed limit of 180 km/h records the additional recordings in the area of (5a).

2 driver operation



The working times for driver 2 (6) are recorded on the tachograph chart for driver 2.

2.5.2 Back of tachograph chart

The revolution frequency is recorded on the back of the tachograph chart for driver 1 if an MTCO 1324 with optional RPM recording is used.

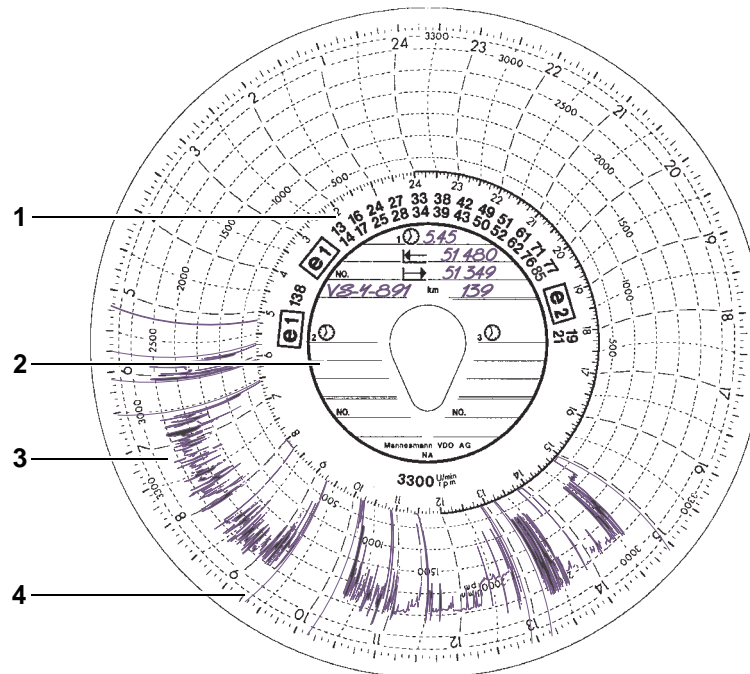


Fig. 2-17: Recordings on the back of the tachograph chart

- | | |
|-------------------------------------------|------------------------------------|
| 1 Field for approval mark (approval sign) | 3 RPM recording |
| 2 Inner field | 4 Markings when ignition is on/off |

2.5.3 Tachograph chart versions

According to the law, the tachograph chart ("record sheet") is a suitable sheet that is placed in the tachograph and on which the recording instruments of the tachograph inscribe an indelible record of the movement data to be recorded for the vehicle and the crew (if applicable). To meet this requirement there are different tachograph chart versions available for the various tachograph types.

Distinguishing characteristics

Tachograph charts are differentiated:

- by their capability to record rotational frequencies, regardless of whether the "EC control unit" tachograph version is used
- by their recording capacity, capability and form of recording working times, if an "EC control unit" tachograph is used.

Versions and variants

Depending on the type of recording, tachograph charts are divided into:

- Bar tachograph charts and
- combi tachograph charts.

2.5.4 Handling and storing tachograph charts



Important

When using tachograph charts, the following rules must be observed:

- **Basically**, only those tachograph charts that have been approved for the tachograph can be used. *Table 2-17, page 2-56* shows an overview of the EC tachograph charts for the MTCO 1324.
- With EC control units the tachograph chart replaces the "personal control record" and is therefore always **driver specific**.
- According to the German Criminal Code (StGB), **recordings** on the tachograph chart are "technical recordings" and protected by § 268 of the StGB; this means that they **must no be tampered with in any way**.

Handling

Tachograph charts have to be protected against:

- Contamination
- Damage
- Direct sunlight.

Storage

Obligation to carry tachograph charts

The driver must be able to produce the tachograph charts (record sheets) whenever requested by an authorised inspecting office to do so:

- for the current week and
- in any case for the last day of the previous week on which he drove.

Length of storage

Tachograph charts must be kept for at least 1 year.

2.5.5 Assignment of tachograph charts

!

Important

Generally, only those tachograph charts can be used where the **approval sign** and the **upper limit of the measuring range** correspond to the tachograph type used.

EC tachograph chart type key

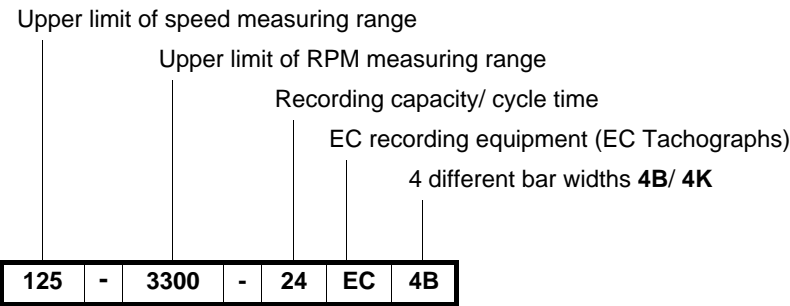


Table 2-16:EC tachograph charts: Type key

The correct EC tachograph chart for the MTCO 1324

Combi chart	Tachograph chart for electronic analysis	Approval sign
100-24 EC 4K	100-24/2 EC 4B	e1-83
100-3300-24 EC 4K	100-3300-24/2 EC 4B	e1-85
125-24 EC 4K	125-24/2 EC 4B	e1-83
125-3300-24 EC 4K	125-3300-24/2 EC 4B	e1-85
140-24 EC 4K	140-24/2 EC 4B	e1-83
----	180-24 EC 4B	e1-83


 Tachograph chart for device version with RPM recording, e.g.
MTCO **1324.710315140300**

Table 2-17: Tachograph charts for the MTCO 1324



Important

Use approved EC tachograph charts only.

Chapter 3

Installation instructions

3.1 Necessary equipment

3.1.1 Service Diagnosis Systems

The following service diagnosis systems can be used for setting the parameters for and checking the MTCO 1324 tachograph system:

- MTC (checking/ parameter setting inside the vehicle)
- ATC (checking/ parameter setting inside the vehicle)
- STC (checking/ parameter setting outside the vehicle).

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1 "Test equipment and service diagnosis systems"* as well as in the separate *"MTC 1602.04" operating instructions and supplements*.

Upgrade kit for MTCO 1324

An upgrade kit can be used for retrofitting the above service diagnosis systems for use in combination with the MTCO 1324 tachograph system.

Interface firmware version 06.00

The upgrade kit for the MTCO 1324 is based on the interface firmware version 06.00. Interfaces with older firmware versions must be updated to version 06.00 (see circular dated 14.08.1997).

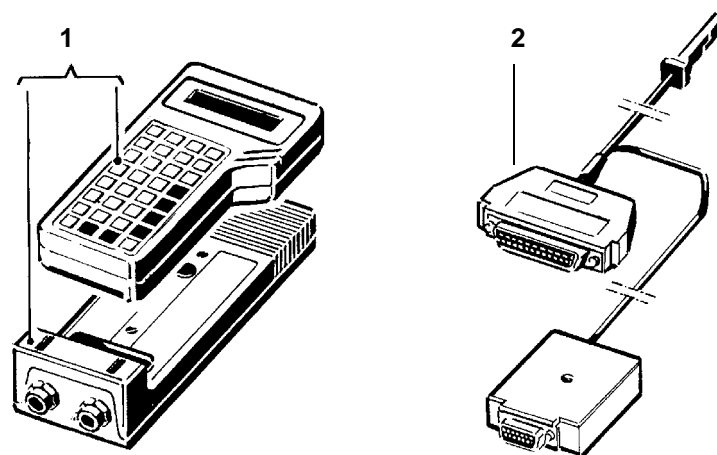


Fig. 3-1: MTC/ ATC service diagnosis systems and upgrade kit for MTCO 1324

- 1 MTC or ATC consisting of interface and BTC
- 2 Upgrade kit for MTCO 1324

The MTCO 1324 upgrade kit includes:

- a programming cable
- BTC software version **07.xx**
- MTCO 1324 programming instructions.

Additional information

The order numbers for the various diagnosis systems and accessories can be found in the appendix Section 6.

3.1.2 Special tools/ sealing tools

Special tools

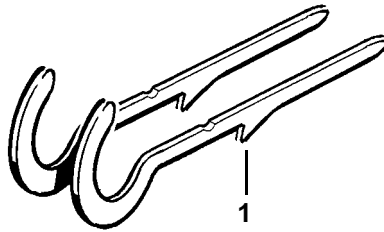


Fig. 3-2: Special tools for MTCO 1324

- 1 MTCO 1324 special removal tools



Important

To disassemble dashboard components vehicle specific tools may be required.

Sealing tools

Original Siemens VDO tools and sealing equipment must be used for sealing.

Additional information

A complete overview of the necessary sealing tools can be found in *Section 6, Chapter 2.2 "Special tools"*, from page 2-5.

3.2 Installation workflow overview

3.2.1 Check list

				Section/ Chap./page
1	Determine the installation site/ installation position	Tachograph system	<ul style="list-style-type: none"> Determine (when retrofitting) 	3-6
2	Running cables and making connections	MTCO 1324 and Electronic Speedometer 1323.01	<ul style="list-style-type: none"> Determine the connector allocation and wiring diagram Run connection cables 	3-8
		KITAS 2170	<ul style="list-style-type: none"> Run the sensor cable 	3-15
3	Installing the sensor	KITAS 2170	<ul style="list-style-type: none"> Install Seal 	Section 4 1-7
4	Installing the tachograph	MTCO 1324	<ul style="list-style-type: none"> Connect the unit using the connectors Seal the back of the unit Install 	3-16
5	Installing the Electronic Speedometer	Electronic Speedometer 1323.01	<ul style="list-style-type: none"> Connect Install 	3-22
6	Commissioning the tachograph system	MTCO 1324 and sensor	<ul style="list-style-type: none"> Adjust the units to each other 	3-28
		Characteristic coefficient (imp/km)	<ul style="list-style-type: none"> Determine "w" [imp/km] 	3-30
		MTCO 1324	<ul style="list-style-type: none"> Program installation data 	3-31

Table 3-1: Installation check list

3.2.2 Installation site requirements

The tachograph system 1324 must be fitted to the vehicle in such a way that:

- the driver has a clear view of the speedometer, odometer and clock from his seat.
- all components including the transmission elements are protected against accidental damage (see *Regulation (EEC) No. 3821/85*).



Important

Drawing up a test chart is not prescribed for new MTCO 1324 tachographs manufactured or checked not more than one year ago. Nevertheless, we recommend that you draw up a test chart.

3.3 Overview of installation site/ position

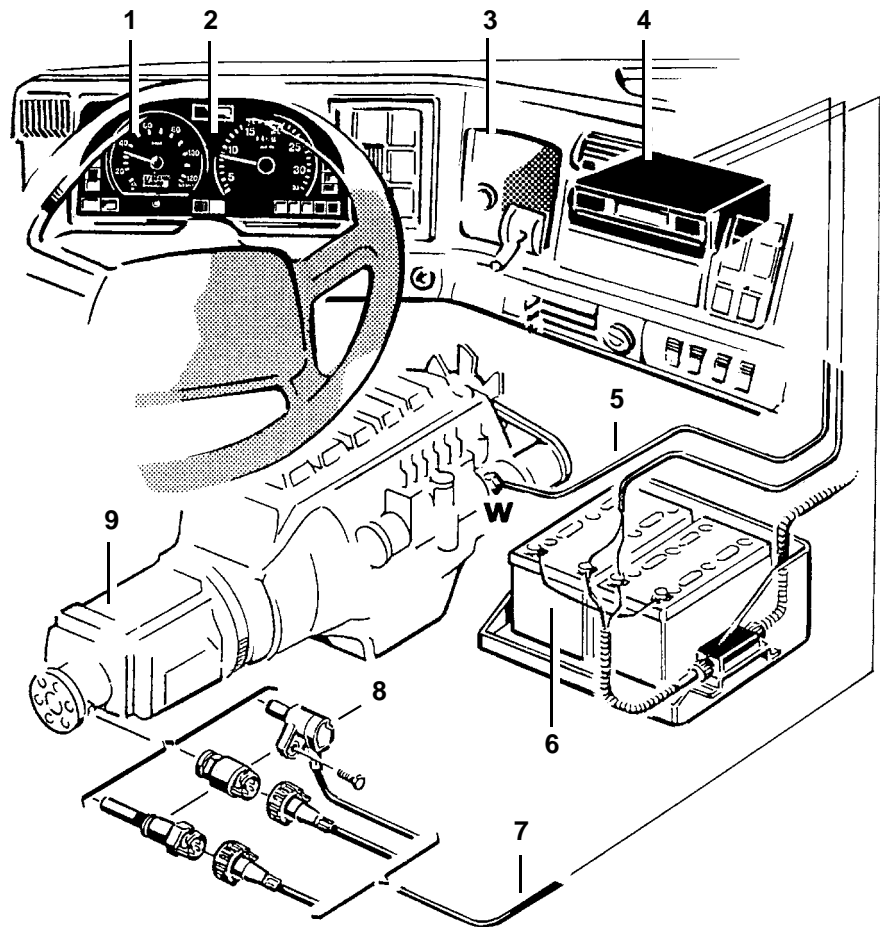


Fig. 3-3: Tachograph system 1324 installation overview

- 1 Electronic Speedometer 1323.01 or indicator unit (integrated in the Cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 Modular Tachograph MTCO 1324 (installed into the in-dash radio compartment)
- 5 Pulse cable for RPM generator or terminal "W" on vehicle generator (optional)
- 6 Vehicle battery
- 7 Sensor cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EC Directive 95/54 EMC)
- 8 KITAS 2170/ 2171 sensor
- 9 Gearbox



Important

Refer to the current ordering documents for complete order numbers and spare part types.

3.4 Installation criteria for retrofitting

Older 1314-1319 tachograph systems

When retrofitting a tachograph system 1324 into older 1314-1319 tachograph systems first check:

- possible installation sites in the cab
- any legal provisions.

Regardless of the 1314-1319 tachograph system fitted to the vehicle, the following components must be installed:

- Electronic Speedometer 1323.01
- KITAS 2170 sensor with sensor cable and
- data cable (K-Line) from the MTCO 1324 to the Electronic Speedometer 1323.01.



Important

When installing an MTCO 1324 tachograph system for the first time, the installation position, sensor type etc. have already been defined by the vehicle manufacturer.

3.4.1 Adjusting the MTCO 1324 system to existing tachograph systems

KITAS sensor

- Determine the type of pulse generator installed and its length:
 - Is the generator screwed onto or into the gearbox output?
 - If it is screwed into the gearbox output, how long must it be?

Electronic Speedometer 1323.01 installation site

- Determine the KITAS sensor type that can be fitted.
 - Which tachograph (design) is installed?
 - Where must the Electronic Speedometer 1323 be fitted? (form, dimensions etc.)

MTCO 1324 installation site

- Determine the installation site for the MTCO 1324.



Important

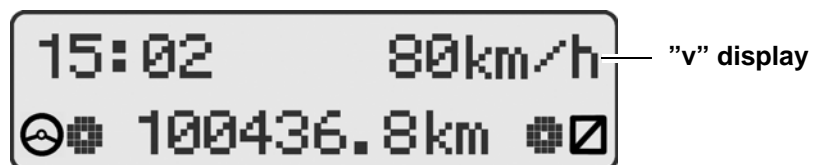
We recommend that you use the existing tachograph's installation site for fitting the Electronic Speedometer 1323.01. If this is not possible, make sure that the Electronic Speedometer 1323.01 is positioned in such a way that the driver can see it directly.

The MTCO 1324 has been designed for installation in the DIN ISO 7736 radio compartment. The installation site must:

- provide easy access to the unit for easy operation (inserting/ removing tachograph charts)
- be positioned in such a way that the driver can see and operate the unit directly
- ensure optimum legibility (non dazzling); please note the display angle
- ensure that there is enough room between the unit and any in-dash ventilation/ heating vents
- provide quick and easy access to the unit for service operations.

3.4.2 Adjusting the MTCO "Stand alone" to existing tachograph systems

What is special about the MTCO "Stand alone" is the speed display on the LCD display. The MTCO "Stand alone" can thus be used without fitting a separate indicator unit (e.g. electronic speedometer).



KITAS sensor

- Determine the type of pulse generator installed and its length:
 - Is the generator screwed onto or into the gearbox output?
 - If it is screwed into the gearbox output, how long must it be?



Important

The MTCO "Stand alone" can only be triggered by a KITAS 2170/ 2171 sensor or an X10-415-000-013 adapter specially approved for it.

MTCO 1324 "Stand alone" installation site

- Only position the MTCO 1324 "Stand alone" in the driver's direct field of vision.



Important

Do not remove an existing in-dash indicator instrument from the vehicle. This can either be triggered together with the MTCO "Stand alone" or by the "v" pulse B6/ B7 outputs.

3.5 Running cables and making connections

Connection cables are necessary:

- for connecting the MTCO 1324 to the vehicle battery
- for connecting the recording unit to the indicator unit
- for transmitting data/ pulses (e.g. "v"/ "n" pulses, electronically triggered special equipment etc.).



Important

Vehicles used for the carriage of hazardous good that are fitted with a battery disconnection switch and a current limiter must comply with specific safety regulations (ADR). The electrical circuit of the tachograph system placed in such vehicles must be intrinsically safe according to EN 50020 and EN 50014. Additional information on tachograph systems with STB can be found in *Chapter 8.1 "Tachograph system with current limiter (STB)"*, from page 8-2.

3.5.1 Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired "side effects" such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

3.5.2 Making connection cables



Important

Electrical connection leads must have a cross section of 0.75 mm^2 .

All "positive" wires must be protected with:

- 8 A with an operating voltage of 12 V
- 5 A with an operating voltage of 24 V.

Depending on the conditions in the vehicle, you must make your own connection cables or adapt the cables contained in the accessory kit.

Example: MTCO 1324 connection cables

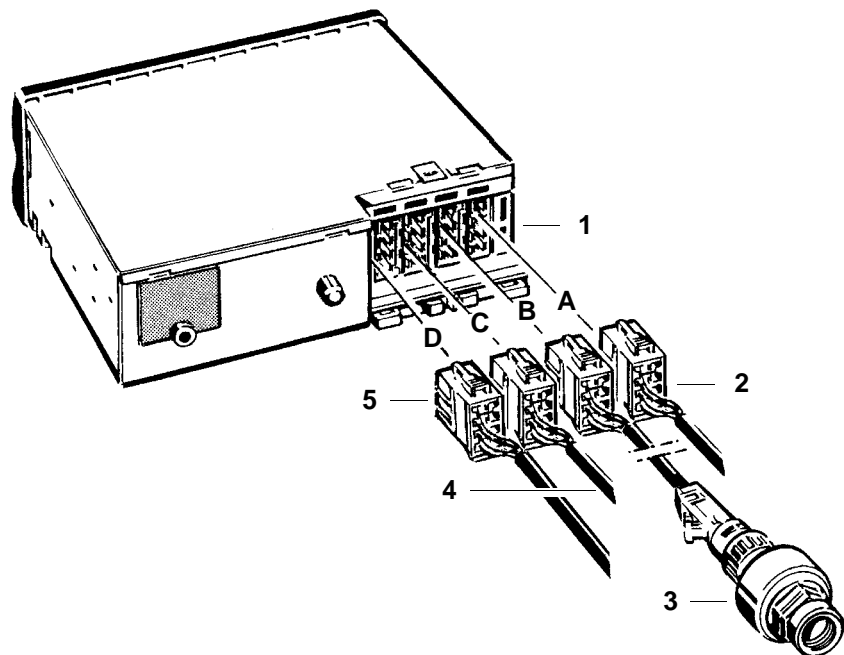


Fig. 3-4: Example: MTCO 1324 connection cable overview

- | | |
|----------------------------------------------------|-------------------------------------------------------------|
| 1 MTCO 1324 connector sockets | 3 KITAS 2170/2171 with connection cable |
| 2 Connector with connection cable (voltage supply) | 4 Connector with connection cable for "n" generator/ signal |
| | 5 Connection cable to Electronic Speedometer 1323 |

Making connection cables

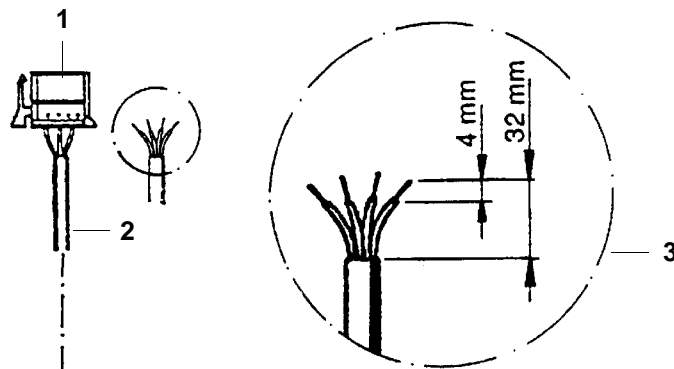


Fig. 3-5: Making connection cables (example)

- | | | | |
|---|----------------------------------------|---|------------------------------|
| 1 | Connector | 3 | Cable sheathing (bared ends) |
| 2 | Connection cable connectors A, B, C, D | | |

- 1 Cut the connection cable to the required length.
- 2 Strip the insulation on the lead ends as shown in the figure.
- 3 Crimp the cable shoes onto the lead ends and insert them into the connector socket until they lock into place.

Disengaging the mini-timer connector

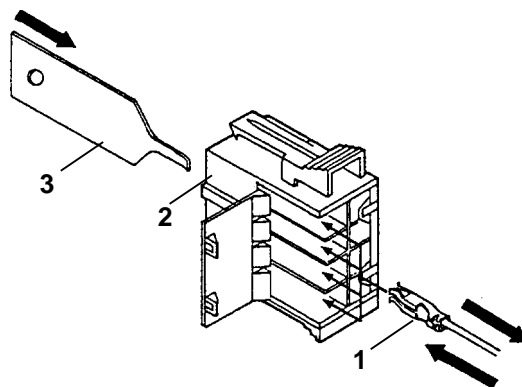


Fig. 3-6: Disengaging the mini-timer connector

- | | | | |
|---|------------------------|---|------------------|
| 1 | Cable shoe (with lead) | 3 | Disengaging tool |
| 2 | AMP connector socket | | |

- 1 Insert the disengaging tool (3) into the correct connector socket.
- 2 Pull the lead out of the AMP connector socket (2).

3.5.3 K-Line connection diagram

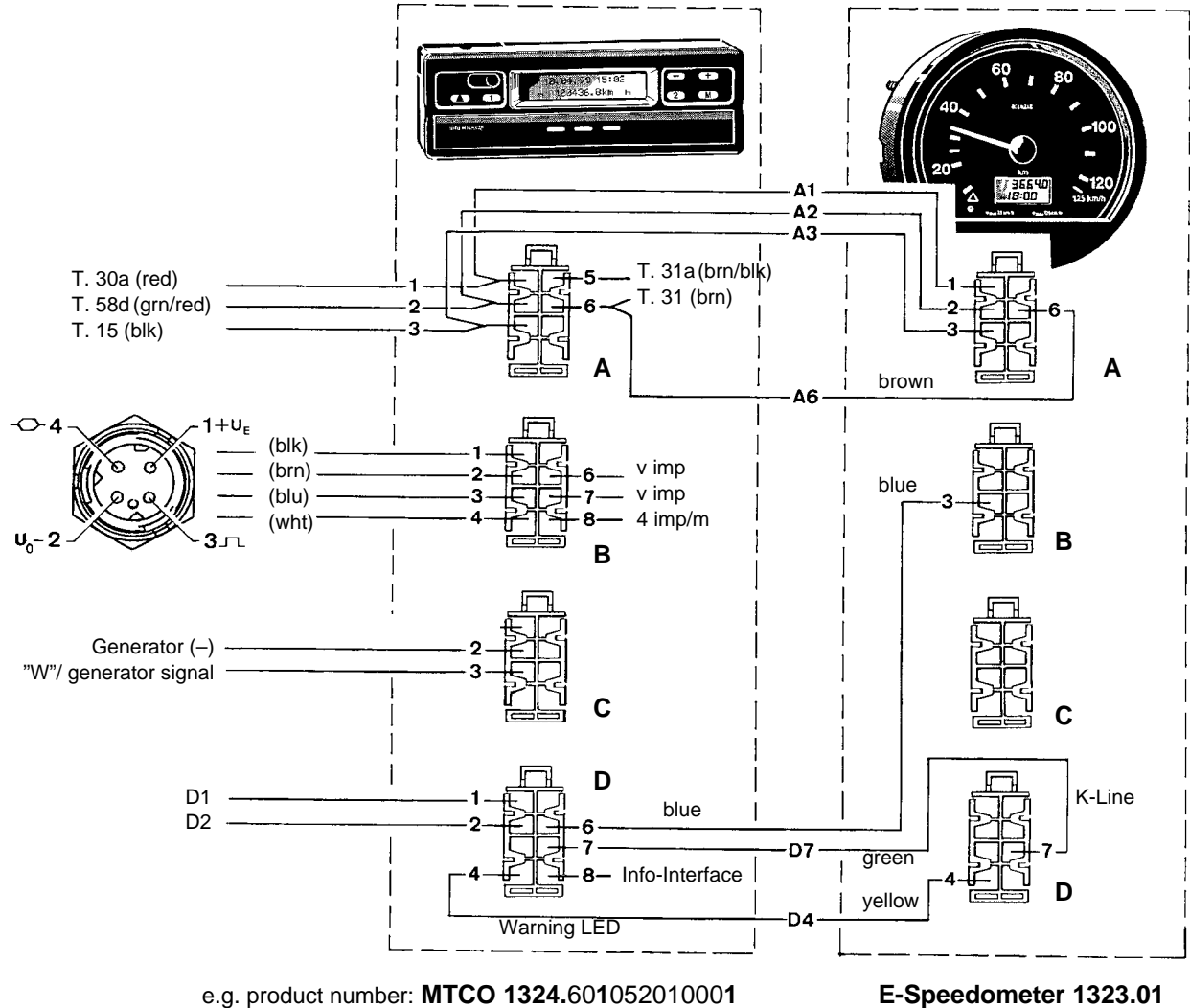
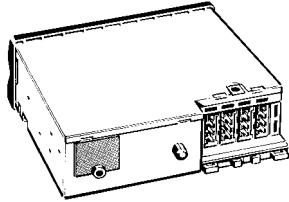


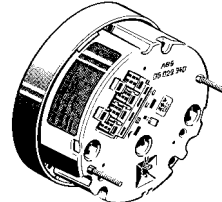
Fig. 3-7: Tachograph system 1324: Connection diagram with K-Line

K-Line connector assignment



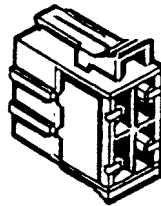
MTCO 1324

- A 1 - T. 30a (red) Constant voltage
- A 2 - T.58d(grn/red) Illumination
- A 3 - T. 15 (blk) Ignition
- A 4 not used
- A 5 - T.31a(brn/blk) Minus
- A 6 - T. 31 (brn) Earth
- A 7 not used
- A 8 not used



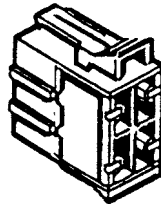
Electronic Speedometer 1323.01

Connector A white



- A 1 - MTCO - A 1 Constant voltage (red)
- A 2 - MTCO - A 2 Illumination (grn red)
- A 3 - MTCO - A 3 Ignition (blk)
- A 4 not used
- A 5 not used
- A 6 - MTCO - A 6 Earth (brn)
- A 7 not used
- A 8 not used

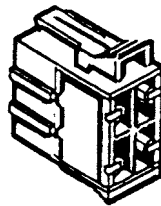
Connector B yellow



- B 1 - + (blk) "v" sensor supply
- B 2 - - (brn) "v" sensor supply
- B 3 - (blu) Real-time signal
- B 4 - (wht) Data signal I/O
- B 5 not used
- B 6 - "v" pulse output
- B 7 - "v" pulse output
- B 8 - 4 imp/m signal output

- B 1 not used
- B 2 not used
- B 3 - MTCO - D6 "v" pulse**
- B 4 not used
- B 5 not used
- B 6 not used
- B 7 not used
- B 8 not used

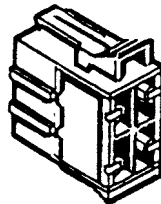
Connector C red



- C 1 - not used
- C 2 - (-) "n" pulse generator supply
- C 3 - "n" generator signal, terminal "W"
- C 4 not used
- C 5 - "n" generator signal (inductive)
- C 6 not used
- C 7 not used
- C 8 not used

- A 1 not used
- A 2 not used
- A 3 not used
- A 4 not used
- A 5 not used
- A 6 not used
- A 7 not used
- A 8 not used

Connector D brown



- D 1 - Additional stylus
- D 2 - Additional stylus
- D 3 not used
- D 4 - External warning LED**
- D 5 not used
- D 6 - E-Speedo B3 "v" pulse
- D 7 - K-Line (instrument interface)**
- D 8 (optional) Info-Interface**

- D 1 not used
- D 2 not used
- D 3 not used
- D 4 - MTCO - D4 Externalwarning LED**
- D 5 not used
- D 6 not used
- D 7 - MTCO - D7 K-Line (instrument interface)**
- D 8 not used

Table 3-2: MTCO 1324: K-Line connector assignment with E-Speedometer 1323.01

3.5.4 CAN bus connection diagram

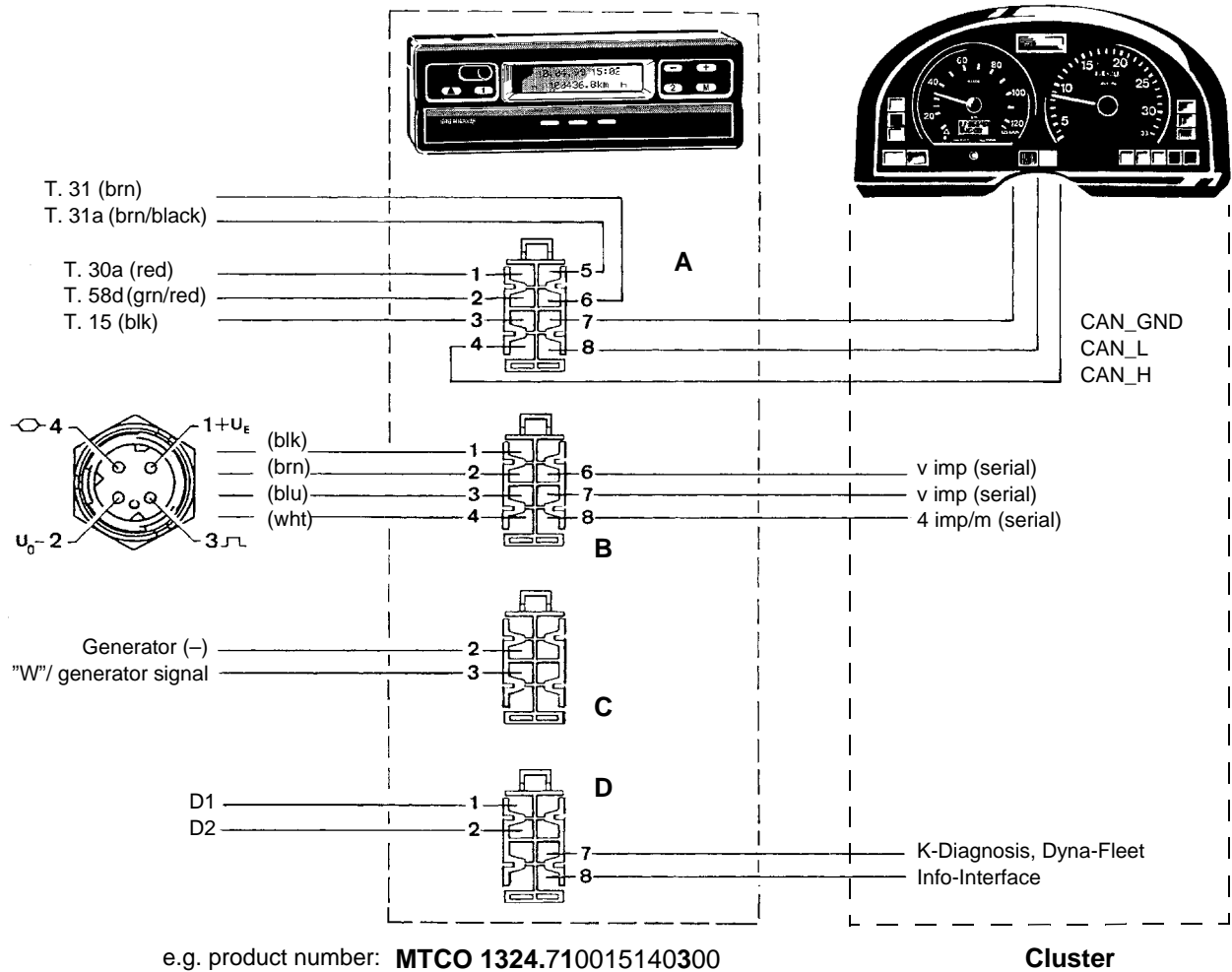
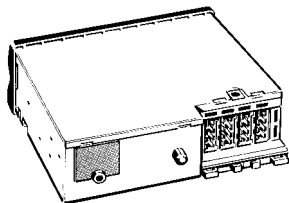


Fig. 3-8: Tachograph system 1324: Connection diagram with CAN bus

CAN bus connector assignment



MTCO 1324

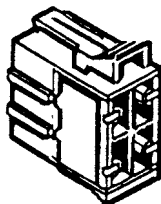
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T. 15 (blk)	Ignition
A 4 -		CAN_H
A 5 -	T.31a (brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7 -		CAN_GND
A 8 -		CAN_L

B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	Real-time signal
B 4 -		(wht)	Data signal I/O
B 5			not used
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

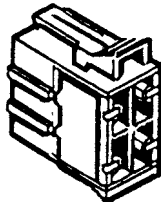
C 1			not used
C 2 -	(optional)		"n" pulse generator supply
C 3 -	(optional)		"n" generator signal, terminal "W"
C 4			not used
C 5			not used
C 6			not used
C 7			not used
C 8			not used

D 1 -	(optional)		Additional stylus
D 2 -	(optional)		Additional stylus
D 3			not used
D 4			not used
D 5			not used
D 6			not used
D 7 -	(optional)		K-Diagnosis, Dyna-Fleet
D 8 -	(optional)		Info-Interface

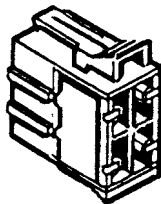
Connector A white



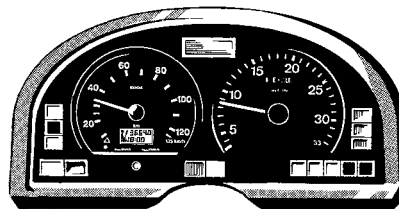
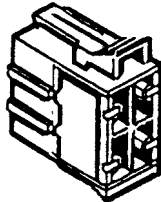
Connector B yellow



Connector C red



Connector D brown



Cluster

T. 30	Constant voltage
T. 58d	Illumination
T. 15	Ignition
T. 31	Earth
	CAN_H
	CAN_L
	CAN_GND
	Warning LED

Table 3-3: MTCO 1324: CAN bus connector assignment with Cluster

3.5.5 Running connection and sensor cables

Connection cables



Condition

Before running connection cables the following information must be available:

- Components of the tachograph system
- Special conditions for running the cables in the vehicle such as exhaust, shift axle, tiltable cab...



Important

When running and connecting connection cables make sure that the connection cables are:

- fixed at short intervals (approx. every 500 mm) and in such a way that they do not vibrate
- not exposed to tensile, compressive or shearing forces
- protected with rubber grommets when run through sheet metal or plastic.

Sensor cable



Important

When running and connecting the sensor cable ensure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cabs
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

3.5.6 Installing KITAS 2170/2171

Additional information

More detailed information and instructions on making connection cables and installing the KITAS sensor can be found in *Section 4, Chapter 1.2 "Running cables and making connections"*, page 1-5 and *Section 4, Chapter 1.3 "Installing KITAS 2170/2171"*, from page 1-7.

3.6 Installing/ removing the MTCO 1324

3.6.1 Fitting dimensions and permissible fitting position

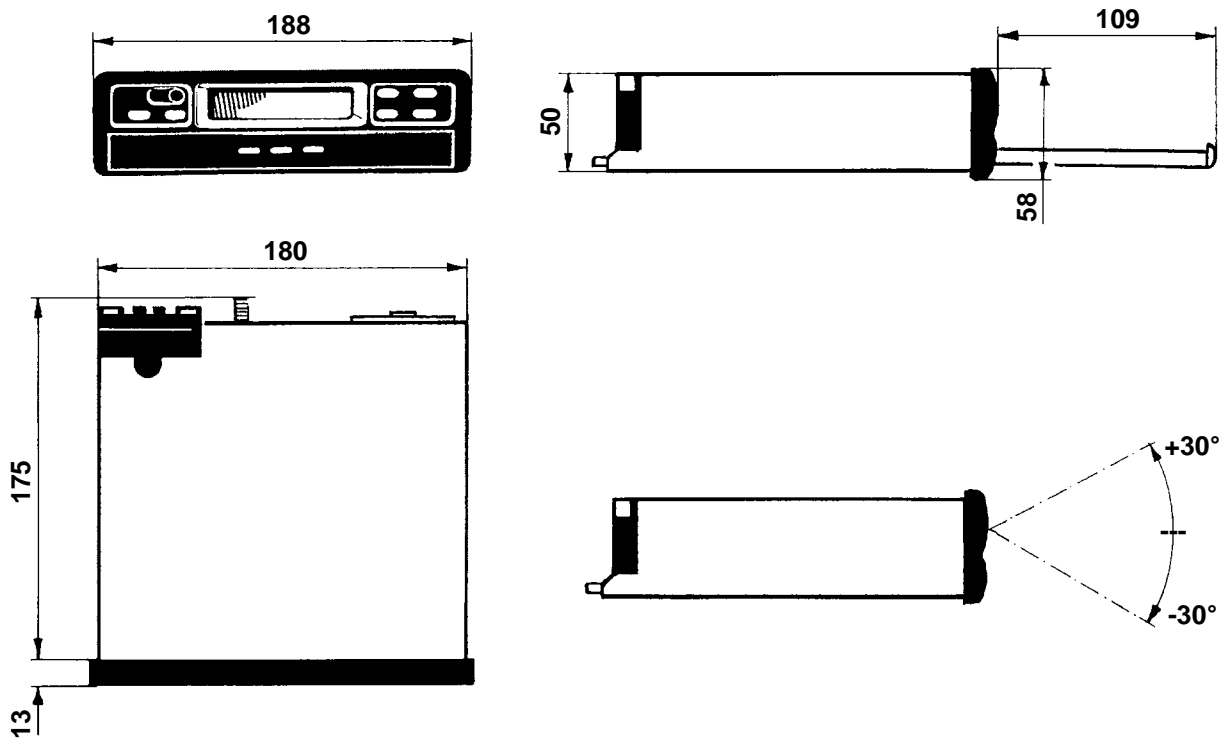


Fig. 3-9: MTCO 1324: Housing dimensions



Important

Dimensions complying with DIN/ ISO 7736 radio compartment. The fitting position depends on the legibility of the display. The optimum fitting position is $\pm 30^\circ$.

3.6.2 Installation accessories

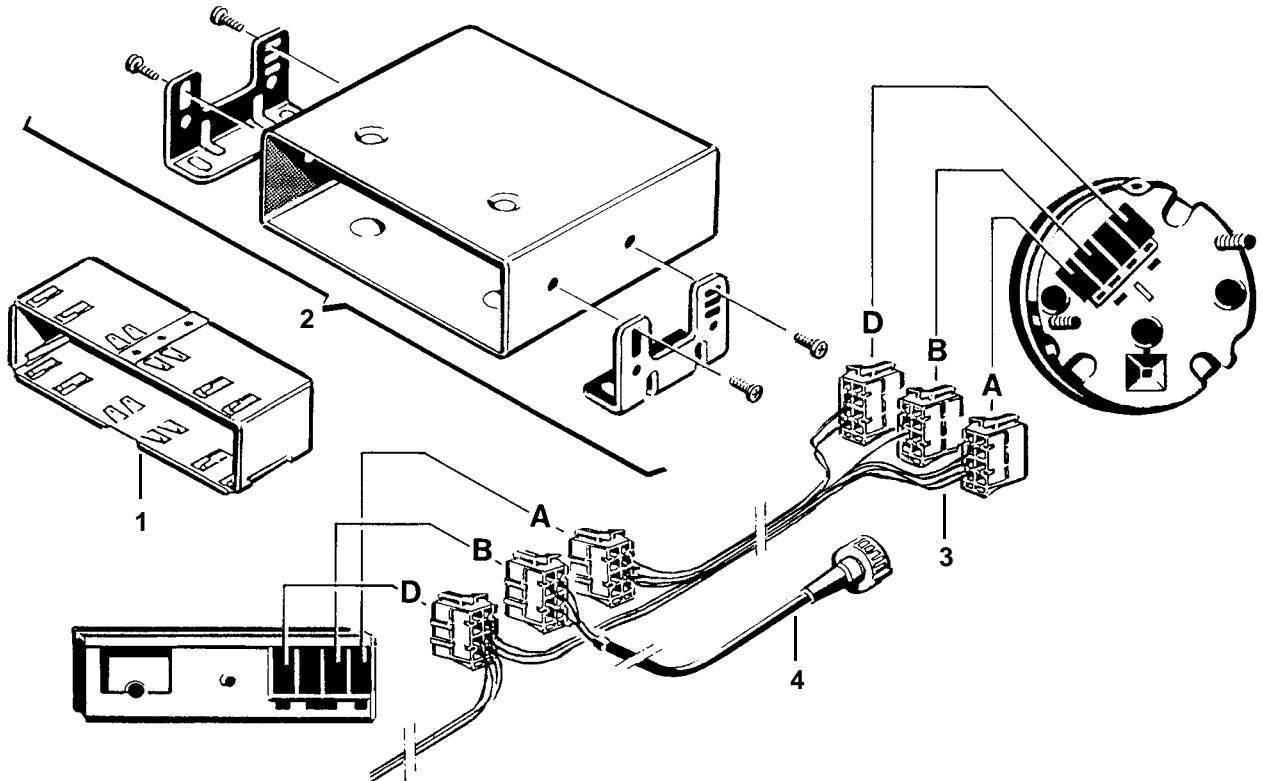


Fig. 3-10: MTCO 1324: Installation accessories

- | | |
|--------------------|----------------------------------|
| 1 Mounting frame | 3 E-Speedometer connection cable |
| 2 Mounting console | 4 Sensor cable |

3.6.3 Removal instructions

The steps for removing the MTCO 1324 depend on the vehicle. Observe the instructions contained in the vehicle's service manual when removing the unit.

Before removal



Important

Before removing the MTCO 1324 you will have to determine the following:

- Current odometer reading of the vehicle
- The following additional details in case of warranty claims:
 - Installation date
 - Kilometre reading (mileage) of the MTCO 1324.

- Determine the vehicle's current total odometer reading and write it down:
 - Refer to the display reading on the tachograph.
 - When the display is defective ask the vehicle owner.
- In case of a warranty claim, use an MTC to determine the date of installation via the "INSTALLATION DATA" program.

The "INSTALLATION DATA" program description can be found in *Chapter 3.8.4 "Programming the MTCO 1324"* from page 3-31.

Removal

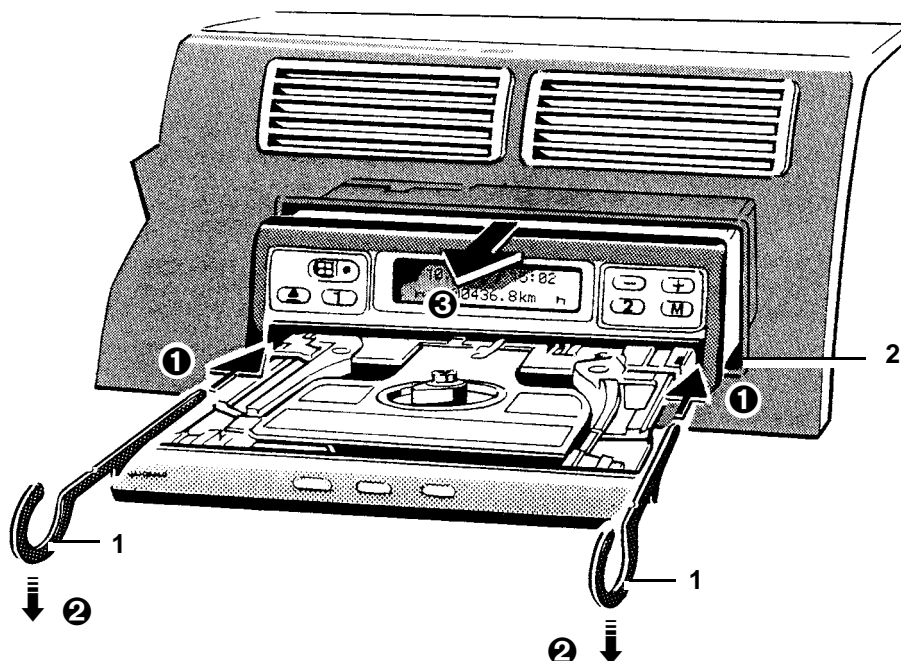


Fig. 3-11: MTCO 1324: Removing the unit from the radio compartment

1 Special removal tools

2 Mounting frame



Important

MTCO 1324 units from serial number 87145 have removal guides that make it easier to unlock the unit in the radio compartment before removal.

Instructions for subsequently converting the unit can be found in the following section *"Retrofitting removal guides"*, on page 3-19.

- 1 Insert the special removal tools (1) into the left and right space between the tray and the MTCO 1324's front cover until they will go no further.
- 2 Push the special removal tools (1) down and keep them down.
- 3 Then pull the MTCO 1324 out of the mounting frame or radio compartment.

Retrofitting removal guides



Important

Removal guides can also be retrofitted/ fitted inside the vehicle.

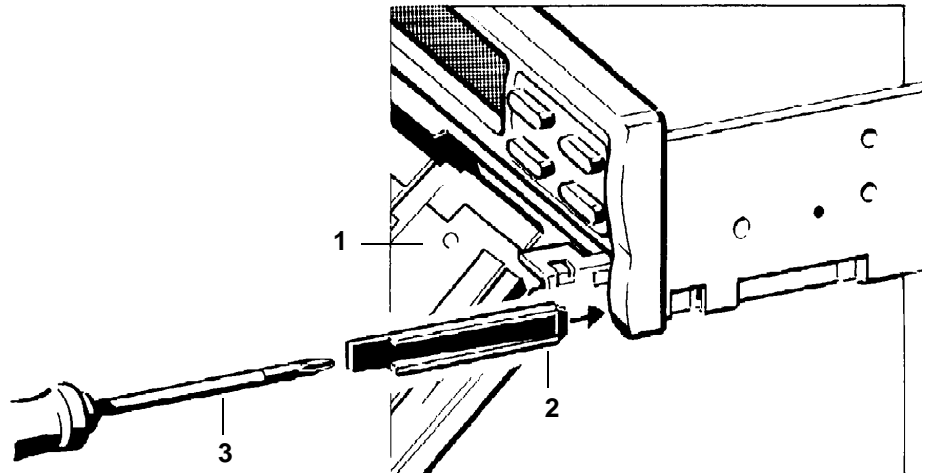


Fig. 3-12: MTCO 1324: Retrofitting removal guides

- | | |
|-------------------------------------------|--------------------------------------------------------------|
| 1 MTCO tray (open) | 3 Accessory for retrofitting
(e.g. 3 mm Torx screwdriver) |
| 2 Removal guide (guide pointing outwards) | |

- 1 **Open the MTCO 1324's tray (1).**
- 2 **Insert the removal guide(s) (2) with the guide pointing outwards into the space on both sides of the tray until they click into place.**
A 3 mm Torx screwdriver or a hexagon key, for example, are suitable accessories for inserting the removal guides.
- 3 **Close the tray.**

3.6.4 Installation instructions

The installation site for the MTCO 1324 depends on the vehicle. Observe the instructions contained in the vehicle's service manual when fitting the unit.

Before fitting the unit



Important

Before installing the components into the driver's cab, run all necessary connection cables. When installing the MTCO 1324 into the radio compartment, the connection cables must be shortened so that they can be connected and removed safely.

Installing the mounting frame into the radio compartment

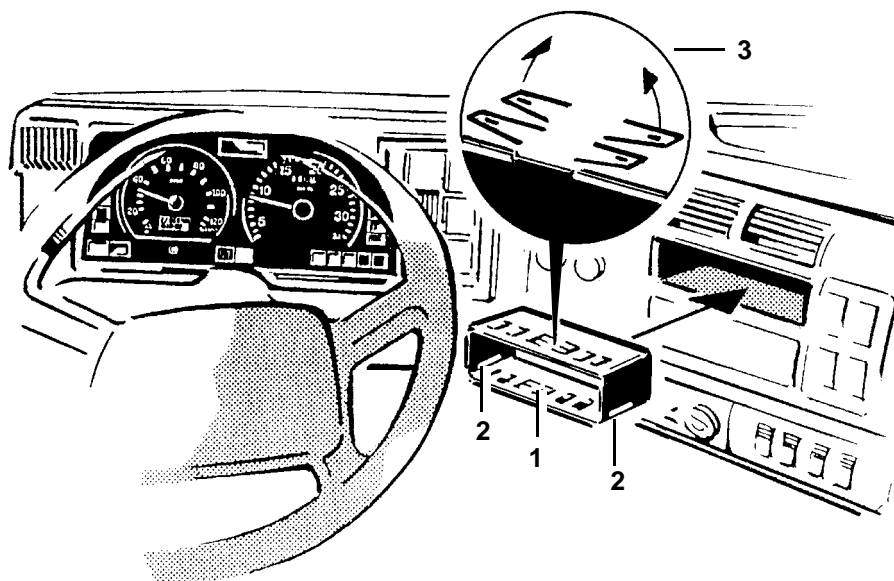


Fig. 3-13: MTCO 1324: Mounting frame for radio compartment

- | | | | |
|---|----------------|---|-------------------------|
| 1 | Mounting frame | 3 | Tabs for securing frame |
| 2 | Catch springs | | |
-
- 1 Slide in the mounting frame (1).**
Make sure that the catch springs (2) are at the bottom.
 - 2 Bend the tabs (3) up using a screw driver to secure the frame in the dashboard.**
The mounting frame must sit firmly in the radio compartment.

Connecting and sealing the MTCO 1324

- 1 **Plug connectors A, B, C (optional) and D into the MTCO 1324's sockets on the back.**
For connector assignments and connections refer to the "Tachograph system wiring diagram" in Fig. 3-7, page 3-11 and Fig. 3-8, page 3-13.
- 2 **Put the seal hood on and seal it correctly.**
If an X10-415-000-013 pulse shaper is fitted to the tachograph system 1324 instead of a KITAS sensor, the seal hood **must** be sealed.

Installing the MTCO 1324

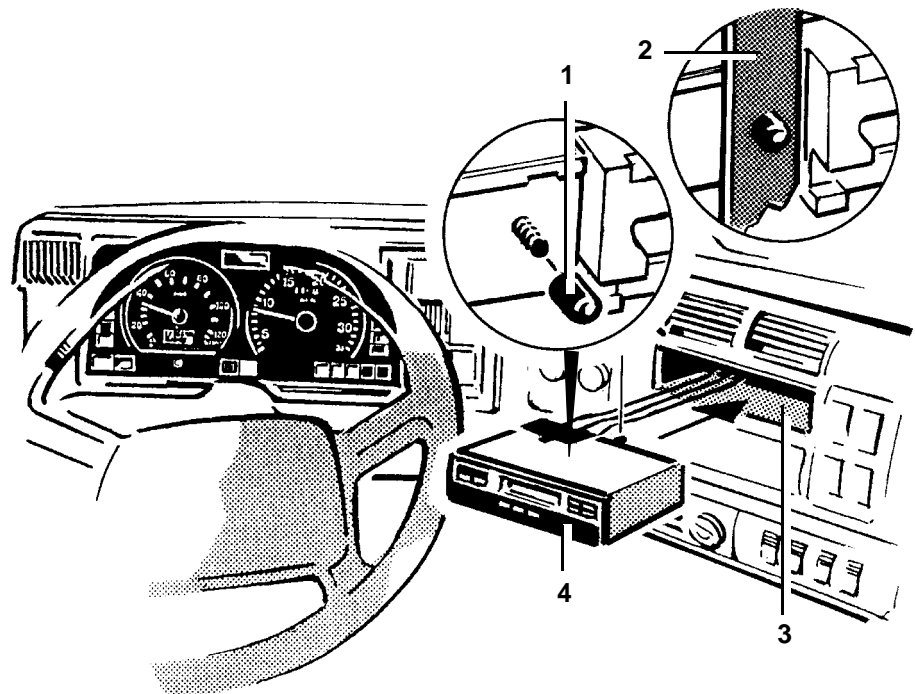


Fig. 3-14: MTCO 1324: Installing into the radio compartment

- | | | | |
|---|--------------------------------------|---|-------------------|
| 1 | Fixing cap | 3 | Radio compartment |
| 2 | Holding bracket in radio compartment | 4 | MTCO 1324 |

- 1 **Press the fixing cap (1) onto the screw on the back of the MTCO 1324 (4).**
- 2 **Slide the MTCO 1324 (4) into the mounting frame (3) until the unit locks into place and the front cover is flush with the dashboard.**
Generally, there is a holding bracket (2) with a drilled hole on the radio compartment's back panel. When sliding the MTCO 1324 into the radio compartment, the fixing cap (1) fits into this hole and holds the unit in place.

3.7 Removing/ installing the Electronic Speedometer 1323.01

3.7.1 Electronic Speedometer fitting dimensions

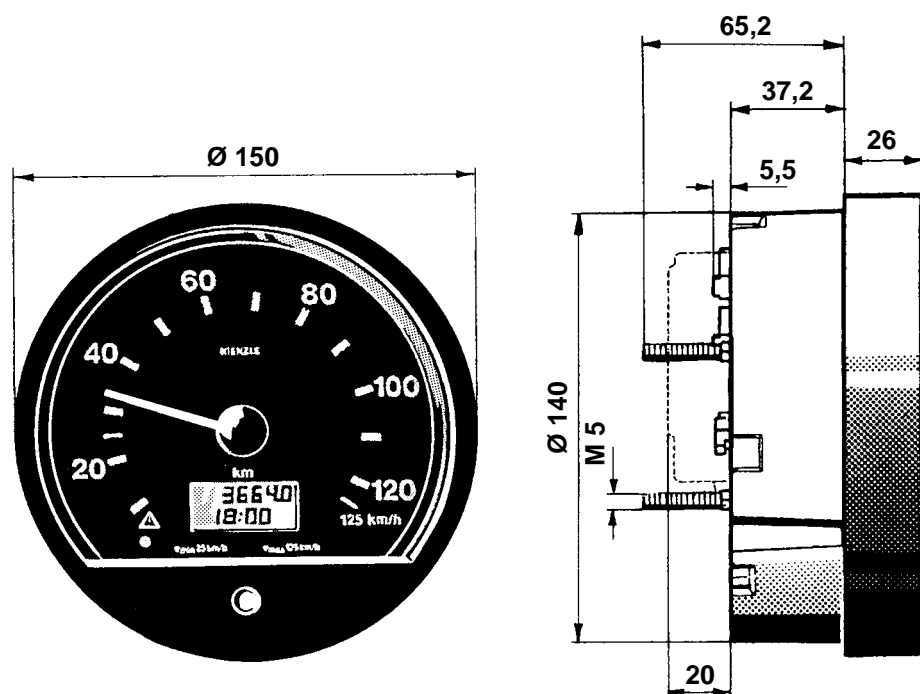


Fig. 3-15: Electronic Speedometer 1323.01: Housing dimensions



Important

Vehicle-/manufacturer-specific versions with different housing dimensions and designs are possible.

3.7.2 Electronic Speedometer installation accessories

When installing the electronic speedometer into the vehicle's dashboard, use the following tools which are the same as for older tachographs:

- Mounting brackets
- Collars or profile brackets.

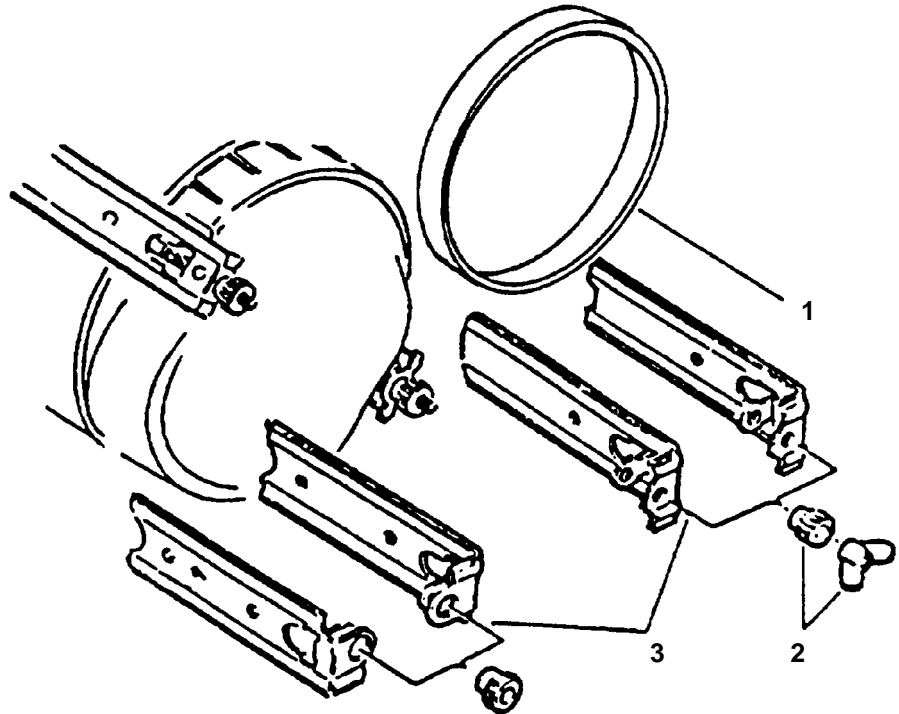


Fig. 3-16: Electronic Speedometer 1323.01: Installation accessories

- | | |
|-------------------------|---------------------|
| 1 Collar | 3 Mounting brackets |
| 2 Knurled nut/ wing nut | |



Important

Only tighten the mounting bracket's knurled nut manually, maximum torque 0.5 Nm.

Installation

If collars are used to adapt the unit to the dashboard, only fit these with the correct mounting brackets.

Removal

When using profiles for fixing the Electronic Speedometer 1323 must not be pulled out. Just press firmly on the back to remove it.

3.7.3 Instructions for installing/ removing the Electronic Speedometer



Important

The steps for installing the Electronic Speedometer 1323.01 depend on the vehicle. Observe the instructions contained in the vehicle's service manual when fitting the unit.

Installation instructions

Follow these two steps to install the unit:

- Install the Electronic Speedometer 1323 into the dashboard
- Replace the dashboard/ components.

Installing the Electronic Speedometer 1323.01 into the dashboard

- 1 **Connect the electronic speedometer using the connectors.**
- 2 **Put the seal hood on and seal it correctly.**
According to the law, the connectors on the Electronic speedometer 1323.01 need not be sealed (see Chapter 4.2.2 "Sealing plan for the Electronic Speedometer 1323", page 4-5).
- 3 **Mount the electronic speedometer into the dashboard.**

Mounting dashboard/ components again

- **Before fixing the dashboard check:**
 - that all connectors, switches etc. are fitted correctly
 - the position of the wiring harness.

The wiring harness must not exert pressure on the back of the electronic speedometer.



Important

Check whether all units and switches on the dashboard function correctly when the dashboard is fixed.

Removal instructions

The Electronic speedometer 1323.01 is removed by undoing the brackets on the back first and then removing the unit.



Important

Refer to the vehicle's service instructions for a detailed description on how to remove the dashboard and its components.

3.8 Commissioning the tachograph system

When commissioning the unit all the modular components of the MTCO 1324 tachograph system are adjusted to each other. This ensures that the tachograph system 1324 forms a unit that is ready for operation.

The commissioning completes the initialisation of the individual components which have already been pre-set at the factory (see *Chapter 1.2 "Data transmission within the system"*, from page 1-6. It is carried out when programming the system using an MTC/ ATC.

The following service diagnosis systems are used to set the parameters for and program the MTCO 1324 inside the vehicle:

- MTC 1602.04, including the following accessories:
 - Interface with software version 6.00
 - BTC software version 07.xx
 - Programming cable (1602-78-170-00)
- Automatic measuring track, including MTC accessories such as light barrier, Start/ Stop reflectors and light barrier cable or
- Rolling Road Test Computer (ATC) with programming cable.



Important

The SDS software versions are displayed when pressing the [–] key on the BTC.

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1.3 "Mobile Test Computer (MTC)"* from page 1-8 as well as in the separate *"MTC 1602.04" operating instructions and supplements*.

Commissioning workflow overview



Important

When the tachograph system is fitted to the vehicle and all electrical connections are made, the vehicle must be made roadworthy again so that it can be moved safely.

- 1 Prepare programming.
- 2 Activate KITAS 2170/ 2171.
- 3 Determine the wheel circumference and the vehicle's characteristic coefficient "w" (imp/km).
- 4 Set the parameters for the MTCO 1324:
 - Enter/ set the determined vehicle and installation data.
 - Set the date and the clock.

MTC 1602.04 menu structure

MTC MEASUREMENT

- └─ AUTOM. MEAS. TRACK
- └─ MANUAL MEAS. TRACK
- └─ CHECK K MEASURING
- └─ W-ADAPTED
- └─ DEVICE TESTING

PROGRAMMING

MTCO installation data

- └─ v constant
- └─ n constant
- └─ Wheel circumference
- └─ Distance counter
- └─ VIN (vehicle identification number)
- └─ Configuration
- └─ CAN configuration
- └─ Product code
- └─ Drive shaft PPR
- └─ Initial installation
- └─ Calibration date
- └─ Seal number

Date - Time

- └─ Programming TCO
 - Prog-Time Zone
 - Prog-System time
- └─ Programming BTC
 - Time zone
 - Change-over times 01/ 05 ..

Activate KITAS

Manufacturing data

Distance covered

Erase error memory

- └─ DFK MEAS. (see MTC programming instructions)

3.8.1 Preparing programming

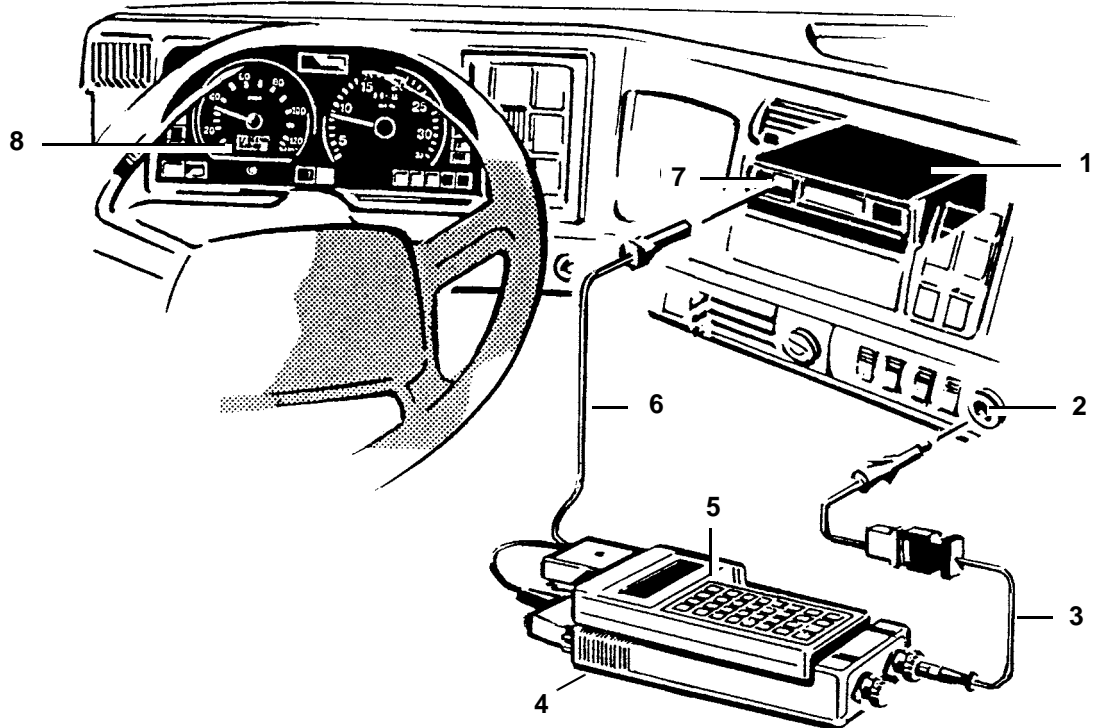


Fig. 3-17: MTCO 1324: MTC connection overview

- | | |
|---------------------|-----------------------------------|
| 1 MTCO 1324 | 5 BTC |
| 2 Cigarette lighter | 6 Test cable |
| 3 Power cable | 7 Test and programming interface |
| 4 MTC interface | 8 Electronic Speedometer/ Cluster |



Condition

The tachograph charts can only be inserted or removed when the ignition is on and the vehicle is stationary. And the MTCO 1324 must not display an error message indicating a malfunction.

- 1 **Turn the ignition on.**
The basic display appears. If not, all errors/ malfunctions in the MTCO 1324 must be corrected until no message is shown on the display (see *Chapter 6.4 "Error correction measures"*, from page 6-11).
- 2 **Unlock the tray.**
- 3 **Insert the tachograph charts into the MTCO 1324.**
For a description on how to insert and remove the tachograph charts please refer to *Chapter 2.1.2 "Operation"*, from page 2-9.
- 4 **Close the tray.**

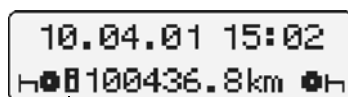
5 Access the programming interface (7) on the MTCO 1324:

- Remove the seal cap.
- Undo the screw and remove the seal plate.

6 Connect the MTC to the MTCO's programming interface (7) using the test cable (6).

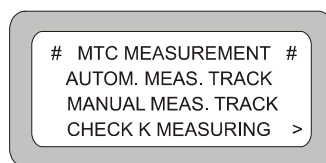
7 Connect the MTC to the vehicle's electrical system using the power cable (3).
When the MTC is connected to the vehicle's electrical system, the program starts automatically and the main menu is displayed. The program uses the programming cable to detect that an MTCO 1324 is connected.

As well as the "basic display" the "test and programming interface active" symbol appears on the MTCO 1324's display (during data transmission **only**).



"Test and programming interface active"

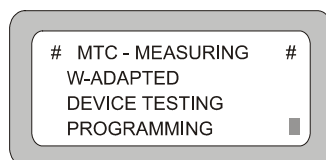
8 Start programming.



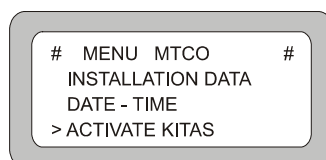
Use the DOWN arrow key to move the cursor to the next page of the main menu.

3.8.2 Activating KITAS 2170/ 2171

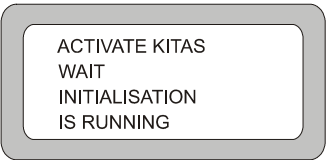
When both components are installed into the vehicle, the KITAS sensor and the MTCO 1324 must be adjusted to each other. The units are adjusted by selecting the "ACTIVATE KITAS" menu item when programming the unit using an MTC/ATC.



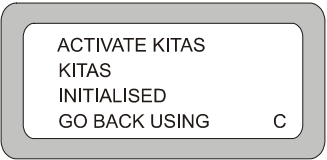
Select the "PROGRAMMING" menu and press **[Enter]** to confirm.



Select the "ACTIVATE KITAS" menu and press **[Enter]** to confirm.



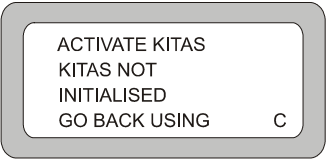
Initialisation can take up to 30 seconds.



Press **[C]** to return to #MENU MTCO#.

Error message

When the sensor cannot be initialised an error message is displayed:



KITAS cannot be initialised or KITAS is not connected.

Press **[C]** to return to #MENU MTCO#.

3.8.3 Determining the vehicle's wheel circumference and characteristic coefficient "w" (imp/km)

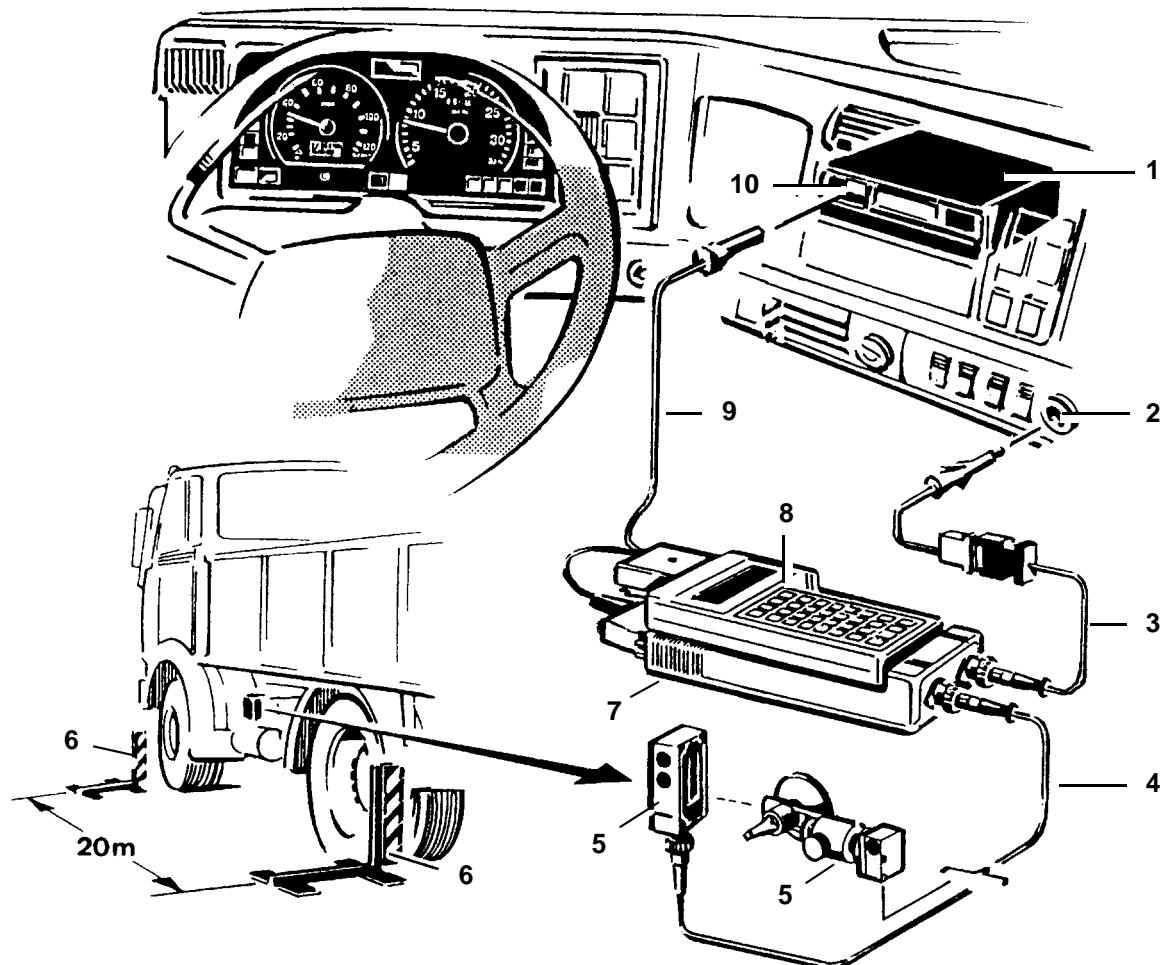


Fig. 3-18: MTCO 1324: MTC connection overview with automatic measuring track

- | | | | |
|---|---------------------|----|--------------------------------|
| 1 | MTCO 1324 | 6 | Start/ Stop reflectors |
| 2 | Cigarette lighter | 7 | MTC interface |
| 3 | Power cable | 8 | BTC |
| 4 | Light barrier cable | 9 | Test cable |
| 5 | Light barrier | 10 | Test and programming interface |
- 1 Attach the light barrier (5) to the vehicle and connect it to the MTC using the light barrier cable (4).
 - 2 Check that the measuring track is set up correctly.

Additional information

A detailed description of the measurement workflow and instructions on how to determine the wheel circumference and the vehicle's characteristic coefficient "w" (imp/km) can be found in *Chapter 5.5.2 "Determining the characteristic coefficient "w" (imp/km)"*, page 5-16.

3.8.4 Programming the MTCO 1324

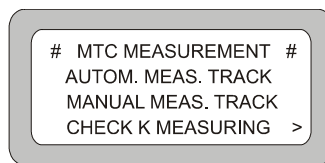


Condition

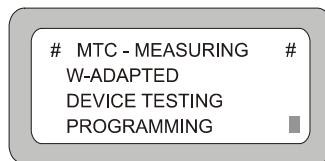
Make sure that:

- the MTC and the MTCO 1324 are connected by the test cable
- both tachograph charts are inserted into the MTCO 1324
- the "basic display" is shown on the MTCO 1324.

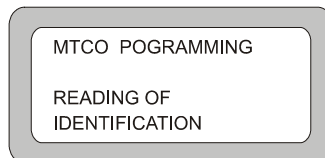
■ Start programming.



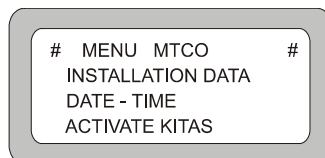
Use the DOWN arrow key to move the cursor to the next page of the main menu.



Select the "PROGRAMMING" menu and press **[Enter]** to confirm.



When "PROGRAMMING" is selected this mask is displayed for approx. 2 seconds.



The "INSTALLATION DATA" menu is already selected. If not, select it and press **[Enter]** to confirm.

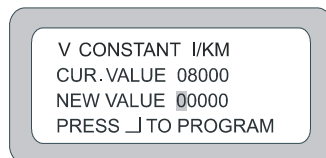
MTCO 1324 installation data

■ Program the installation data:

Summary

- | | |
|---------------------------------------|-------------------------|
| 1 v constant | 7 CAN configuration |
| 2 n constant | 8 Product code |
| 3 Wheel circumference | 9 Drive shaft PPR |
| 4 Distance counter | 10 Initial installation |
| 5 VIN (vehicle identification number) | 11 Calibration date |
| 6 Configuration | 12 Seal number |

1 Program the v constant.



"MTCO INSTALLATION" menu

The "V CONSTANT" menu is already selected. If not, select it and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (03200-25000 imp/km).

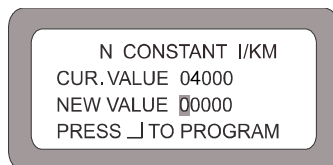
Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

2 Program the n constant.

"MTCO INSTALLATION" menu



Select the "N CONSTANT" menu and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (02000-62000 imp/km).

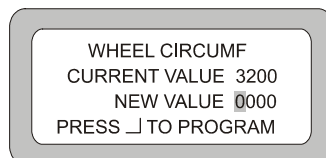
Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

3 Program the wheel circumference.

"MTCO INSTALLATION" menu



Select the "WHEEL CIRCUMF." menu and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (1000-7200 mm).

Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

4 Program the distance counter.



Important

From firmware version 001.07 the threshold is 1000 km. This means that:

- if the odometer reading is **0 - 999** km any value can be programmed
- if the odometer reading is **1000 - 899999** km the value that can be programmed **must** be equivalent to or higher than the previous odometer reading
- if the odometer reading is **900000** km or higher the odometer reading cannot be modified.

"MTCO INSTALLATION" menu

```

DISTANCE COUNTER
ACT      0000025 KM
NEW      0000000 KM
PROGRAM VIA  →
    
```

Select the "DISTANCE COUNTER" menu and press **[Enter]** to confirm.

Enter the odometer reading:

- Select the decimal in the entry field
- Enter figures (up to 7 digits).

Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

5 Program VIN.

```

# MTCO INSTALLATION #
ODOMETER
> VIN
CONFIGURATION
    
```

"MTCO INSTALLATION" menu

Select the "VIN" menu and press **[Enter]** to confirm.

```

VIN
RE-ENTER F1
123456789ABCDEFGH
PRESS → TO PROGRAM
    
```

Press **[F1]** to enter a new vehicle identification number. For the vehicle identification number enter letters and figures (up to 17 digits).

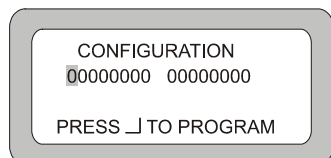
Press **[Enter]** to confirm your entry.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

6 Query the configuration.

"MTCO INSTALLATION" menu



Select the "CONFIGURATION" menu and press **[Enter]** to confirm.

Display configuration.

Press **[C]** to return to #MTCO INSTALLATION#.



Important

The values can be found in *Chapter 2.1.5 "Overview of variants", section "Explanation of MTCO factory configuration: BTC (SDS unit) display reading and meaning"*, page 2-37.



Caution

Please note when replacing units

When replacing units featuring:

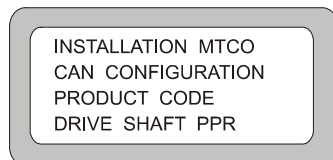
- the same firmware version the configuration must be checked. If necessary, the values stored in the removed unit have to be programmed into the new one.
- a higher firmware version the factory configuration must be accepted. If a "v pulse output error (B7) (code 9430)" occurs, the configuration byte 1 stored in the removed unit must be accepted. **The configuration byte 2** stored in the replacement unit **must not be modified**.

7 Set the CAN priority by selecting CAN configuration.



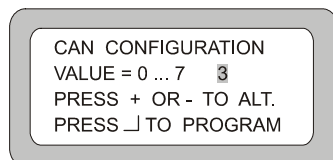
Important

The CAN configuration is a vehicle and manufacturer specific configuration. Please note the manufacturer's instructions when setting the CAN configuration. Currently the CAN priority (value = 3) set at the factory must not be modified.



"MTCO INSTALLATION" menu

Select the "CAN CONFIGURATION" menu and press **[Enter]** to confirm.



If necessary, select a new value:
Press **[Enter]** to confirm a value from 0 to 7.

*If programming has been **successful** the following message is displayed:*

CAN CONFIGURATION
PROGRAMMING
WAS SUCCESSFUL !
PRESS C TO RETURN

Press **[C]** to return to #MTCO
INSTALLATION#.

If programming has not been **successful** the following error message is displayed:

SOFTWARE VERSION
COULD NOT BE
IDENTIFIED
PRESS C TO RETURN

Press **[C]** to return to #MTCO
INSTALLATION#.

8 Set variants by selecting the product code.



Important

The 8th to 16th digit of the product code is used to store variants in the MTCO 1324.

Please refer to the product key for the corresponding values (see *Table 3-4: "MTCO 1324: Product code"*, page 3-36).

"MTCO INSTALLATION" menu

Select the "PRODUCT CODE" menu and
press **[Enter]** to confirm.

PRODUCT CODE
ALTER F1
1324.110010000100
PRESS C TO RETURN

Change the product code.
Press **[F1]** to confirm.

Press **[C]** to return to #MTCO
INSTALLATION#.

PRODUCT CODE
1324.110010000100
PRESS **[]** TO PROGRAM

Enter the new value:

- Select the decimals 8 - 16 in the entry field
- Enter a numerical value.

Press **[Enter]** to confirm.

If programming has been successful the new
product key is displayed.

If the values entered were not correct
#WRONG ENTRY# is displayed.

Press **[C]** to return to #PRODUCT CODE F1
CHANGE#.



Important

A new type plate must be affixed when modifying the product code (see
Chapter 7.2.4 "Replacing the MTCO 1324 type plate", page 7-8).

MTCO 1324 product code

Additional equipment	0	without additional equipment
	1	RPM recording (without display)
	2	Additional stylus
	3	RPM recording (without display) and additional stylus
	4	Looped generator pulse on PIN "B6"
	5	Looped generator pulse on PIN "B6" and additional stylus
	6	Digital "v" display ("Stand alone")
	7	Additional stylus and digital "v" display ("Stand alone")
Measuring range	1	125 km/h (standard)
	2	100 km/h
	3	140 km/h
	4	--
	5	180 km/h
Vehicle-/ manufacturer-specific versions		
IMPORTANT: Do not modify any settings.		
Firmware/ Cluster connection	CAN	
	00	without firmware/ Cluster connection
	01	CAN/ Basis ISO/TCO 1 repetition rate 50 ms
	02	CAN/ Basis ISO/TCO 1 repetition rate 10 ms
	03	CAN/ Basis ISO/TCO 1 repetition rate 20 ms
Interface/ customer firmware	K-Line	
	00	without customised firmware
	01	Electronic Speedometer 1323.01 (D7)
	02	Standard diagnosis* (D7)
	03	Dyna-Fleet (VOLVO), (D7)
	04	Info-Interface (from firmware version 004.xx),(D8)

1324	.	7	1	0	3	1	514	01	00
------	---	---	---	---	---	---	-----	----	----

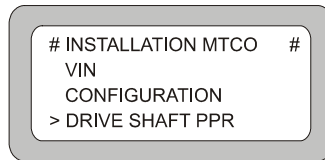
Table 3-4: MTCO 1324: Product code

9 Program the drive shaft PPR.



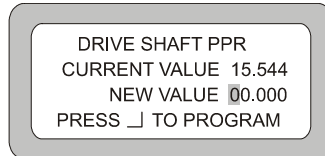
Caution

There are specific vehicle types where a gearbox specific factor has to be set. If a value (imp/revs) is programmed into the MTCO, the same value must be set when using a replacement tachograph. If this value can no longer be read out, contact the vehicle manufacturer to find out which value has to be set.



"MTCO INSTALLATION" menu

Select the "DRIVE SHAFT PPR" menu and press **[Enter]** to confirm.



If necessary, enter a new value:

- Select the entry field before/ after the decimal point,
- Enter a value for each decimal (0-64.255 imp/revs).

The MTCO sends this value (imp/revs) to the CAN bus; depending on the vehicle type, the value is needed to control the retarder (this does not affect the MTCO).

Press **[Enter]** to confirm.

*If programming has been successful the new value is displayed. Press **[C]** to return to #MTCO INSTALLATION#.*

10 Program the commissioning date.



Important

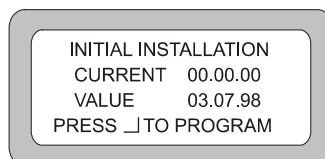
When the unit is installed the current date which is the commissioning date has to be programmed into the MTCO 1324. If the target value on the BTC display does not match the current date, update the date first using the BTC service program (see the separate "MTC 1602.04" operating instructions, "Setting the operating system").



Caution

The commissioning date can only be programmed once into the MTCO 1324.

"MTCO INSTALLATION" menu

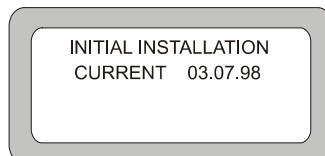


Select the "INITIAL INSTALLATION" menu and press **[Enter]** to confirm.

Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.



When selecting "INITIAL INSTALLATION" again, the current date is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

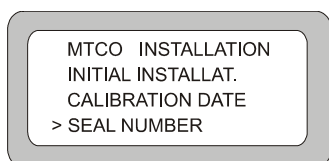
11 Program the calibration date.



Important

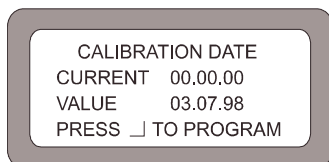
After commissioning and after each periodic check the current date, i.e. the calibration date, must be programmed into the MTCO 1324.

If the target value on the BTC display does not match the current date, update the date first using the BTC service program (see the separate "MTC 1602.04" operating instructions, "Setting the operating system").



"MTCO INSTALLATION" menu

Select "CALIBRATION DATE" and press **[Enter]** to confirm.



If necessary, enter the target date or press **[Enter]** to confirm the displayed date.

If programming has been successful the "CURRENT" field shows the current date.

Press **[C]** to return to #MTCO INSTALLATION#.

12 Program the seal number.

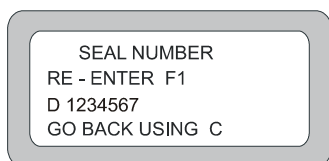


Important

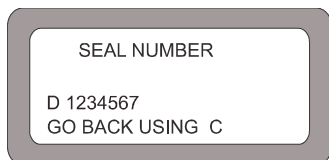
After commissioning or a routine check the workshop's seal number must be programmed into the MTCO 1324.

"MTCO INSTALLATION" menu

Select the "SEAL NUMBER" menu and press **[Enter]** to confirm.



If necessary, enter a new value (up to 8 digits) or press **[Enter]** to confirm the value displayed.



If programming has been successful the new seal number is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

13 Press [C] to terminate programming.

Adjusting date and time

- Program the date and time (MTCO):
 - Prog-Time Zone
 - Prog-System time
- Enter the date and time (BTC):
 - Time zone
 - Switchover settings 01/ 05 ..

Local time

The "DATE – TIME" menu item is used to adjust the local time to UTC time. To display the official time of the country where the tachograph system is installed or the vehicle is registered, the following parameters must be stored in the MTCO 1324:

- The time zone offset and
- the switchover setting for the beginning and end of daylight saving time.








Important

Program the time zones by entering values with opposite signs.

At the factory the MTCO 1324's clock is set to the local time at the time of manufacture. Deviations can be detected when checking the MTCO 1324 and be corrected when programming the MTCO 1324.

Checking date and time (MTCO)

- Check the system time (MTCO).
 - Press the  key to select menu 1 "CLOCK SETTING".
- Check the time zones (MTCO).
 - Press the  key to select menu 3 "INFORMATION/ UTC/ VERSION".
- Check the switchover setting (MTCO).
 - Press the  key to select menu 5 "BEGINNING/ END DAYLIGHT SAVING".
 - Use the  or  key to select the desired entries.

Additional information

Detailed information and instructions on how to select the menu functions can be found in *Chapter 2.1.2 "Operation", section "MTCO 1324 menu functions"*, from page 2-13.

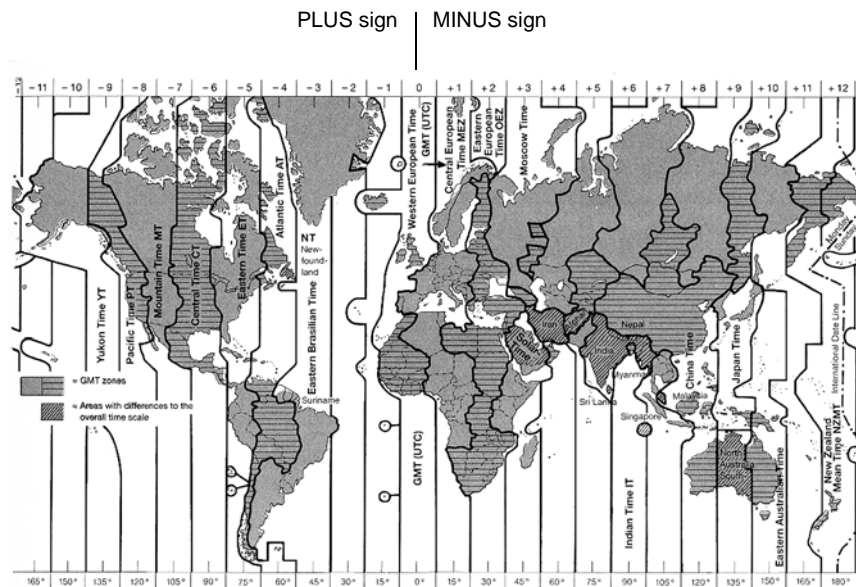


Fig. 3-19: The 24 international time zones

Entry for beginning and end of daylight saving time

At the factory the switchover times that are currently valid in the EU member states and the corresponding offset values are stored in the test unit for a period of 5 years.

Offset years	Beginning of daylight saving time	Offset	End of daylight saving time	Offset
2001	25th March 2:00	+1 hour	28th October 2:00	0 hour
2002	31st March 2:00	+1 hour	27th October 2:00	0 hour
2003	28th March 2:00	+1 hour	26th October 2:00	0 hour
2004	28th March 2:00	+1 hour	31st October 2:00	0 hour
2005	27th March 2:00	+1 hour	30th October 2:00	0 hour

Table 3-5: Beginning and end of daylight saving time from 2001 to 2005

These switchover settings are stored in the MTCO 1324 during programming.

! Important

When programming switchover settings you have to distinguish between countries in the northern and southern hemispheres (the beginning/ end of daylight saving time is different).

If necessary, you can change the stored switchover setting using the "ENTRY" sub menu and add new settings continuously.

Northern hemisphere

"Select "N" for northern hemisphere using the "+" or "-" key (BTC)

Winter	Beginning	Summer	End	Winter
Jan Feb March	April May June July Aug Sept	Oct Nov Dec		
Summer ends	Winter	Summer begins		

Southern hemisphere

"Select "S" for southern hemisphere using the "+" or "-" key (BTC)

Time zone offset

Formula	EU member states	Entry value
Local time = UTC time ±Time zone offset If you take Germany as an example this means: Local time = UTC time +1 hour for time zone offset UTC time = local time - 1 hour for time zone offset In this example, the time zone offset "- 1:00 hour" must be set in the test unit. IMPORTANT: The time zone offset corresponds to the time zone value (see table) with the opposite sign.	Austria	-1:00 hour
	Belgium	-1:00 hour
	Germany	-1:00 hour
	Denmark	-1:00 hour
	Spain	-1:00 hour
	France	-1:00 hour
	United Kingdom	0:00 hour
	Greece	-2:00 hours
	Italy	-1:00 hour
	Ireland	0:00 hour
	Luxembourg	-1:00 hour
	The Netherlands	-1:00 hour
	Portugal	0:00 hour
	Sweden	-1:00 hour
	Finland	-2:00 hours

1 Set the Prog-Time zone (MTCO).

#DATE-TIME#

Press **[Enter]** to select the menu.

#PROGRAMMING TCO#

Press **[Enter]** to select the menu.

PROG - TIME ZONE
TCO : -01:00 h
F1 CHANGE TIME ZONE
PRESS _J_ TO CONTINUE

If you do not want to change the time zone set in the BTC, press **[Enter]** to continue; otherwise press **[F1]**.



Important

The set time zone offset corresponds to the time zone where the MTCO 1324 was installed. Generally, you have to accept this value.

The time zone offsets stored in the MTCO and in the test unit can differ if the MTCO 1324 was installed in a country that belongs to another time zone, for example.

Program the time zones by entering values with opposite signs.

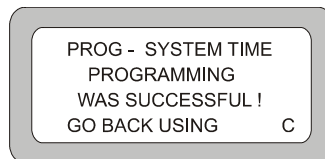
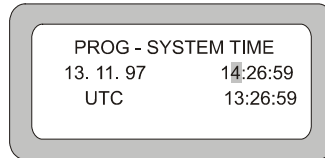
PROG - TIME ZONE
CHANGE USING + ODER -
-01:00 h
PRESS _J_ TO CONTINUE

To change the MTCO's time zone:

Select the corresponding time zone offset (+11:00 hours ... - 12:00 hours).

Press **[Enter]** to confirm.

2 Set the Prog-System time.



If the time setting is correct:

- Press **[Enter]** to confirm or
- press **[F1]** to update the clock.

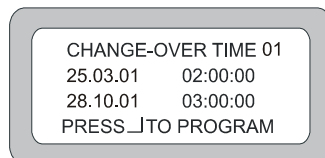
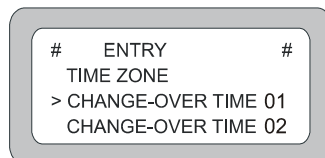
Select the fields and/ or decimals, enter figures, then press **[Enter]** to confirm "PROGRAMMING".

Press **[C]** to return to #DATE-TIME#.

3 Change the switchover settings for the beginning and end of daylight saving time.

#DATE-TIME#

#PROGRAMMING BTC#



Press **[Enter]** to select the menu.

Press **[Enter]** to select the menu.

Select "CHANGE-OVER TIME 01", for example, and press **[Enter]** to confirm.

The display shows:

- Beginning of daylight saving
- End of daylight saving

To change the switchover settings:
Select the fields and/ or decimals, enter figures, then press **[Enter]** to confirm the new values.

Press **[C]** to return to #ENTRY#.

Programming Date-Time (BTC)

Use this menu item to transmit the values stored in the test unit such as time zone offset and switchover settings to the MTCO 1324.



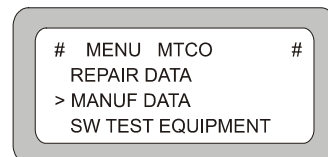
Important

Any values modified using this menu item are only stored in the test unit and must be programmed into the MTCO 1324 using the "PROGRAMMING TCO" menu.

Additional information

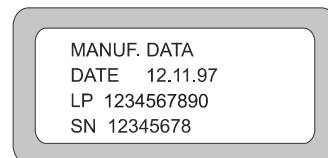
Detailed information on the "time zone offset" and "switchover settings for beginning/ end of daylight saving time" can be found in the separate "MTCO 1324" Programming instructions".

Displaying manufacturing data



"MENU MTCO" menu

Select the "MANUF DATA" menu and press **[Enter]** to confirm.



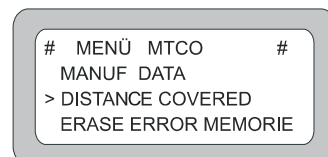
The following information is displayed:

- Date = test date
- LP = PCB number
- SN = serial number.

Press **[C]** to return to #MENU MTCO#.

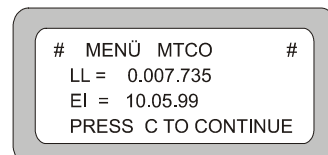
Displaying the distance covered

Inside the MTCO 1324 there is an internal counter which shows the tachograph's kilometre reading (mileage). No matter how often the odometer has been corrected, this counter always shows the actual distance covered (total of all kilometres driven and transmitted to the tachograph).



"MENU MTCO" menu

Select the "DISTANCE COVERED" menu and press **[Enter]** to confirm.



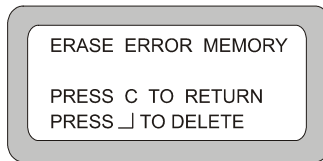
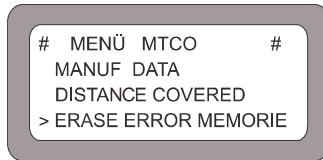
The following information is displayed: The MTCO's actual kilometre reading (mileage):

- LL = kilometre reading
- EI = commissioning data.

Press **[C]** to return to #MENU MTCO#.

Clearing the error memory

Select this menu item to clear the error memory.



"MENU MTCO" menu

Select the "ERASE ERROR MEMORY" menu and press **[Enter]** to confirm.

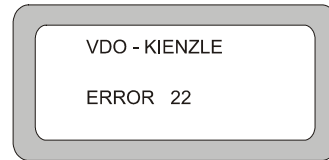
Press **[Enter]** to clear the error memory
or

press **[C]** to return to #MENU MTCO#.

When the memory has been deleted successfully "ERROR MEMORY CLEARED" appears in the display field.

Press **[C]** to return to #MENU MTCO#.

Error correction



If an error occurs during programming, the MTCO 1324 displays a coded error message.

System errors

Code	Cause	Remedy
01	Cannot open file	Reset the test unit: Press the [F12] , [+] , [-] , [F12] keys one after the other
02	Cannot read file	
03	Cannot write to file	
04	Cannot open file	
05	Cannot modify the test unit's time setting	
06	Cannot read the test unit's time setting	
07	Cannot close file	
08	Cannot load mask	

Transmission errors

Code	Cause	Remedy
20	Checksum error	Restart the program.
21	Negative response from test unit	Repeat programming.
22	Interface interrupted	Plug in the MTCO's programming cable again and repeat programming.
23	Unknown unit connected	Check if the connected tachograph is wrong.

Sensor errors

Code	Cause	Remedy
33	Generator not responding	Check the v sensor cable, check the sensor and replace it, if necessary
34	Generator serial number is missing	



Important

If an error cannot be corrected with the listed measures, contact your nearest Siemens VDO partner.

3.9 Electronic Speedometer "Stand alone"

3.9.1 Fitting dimensions

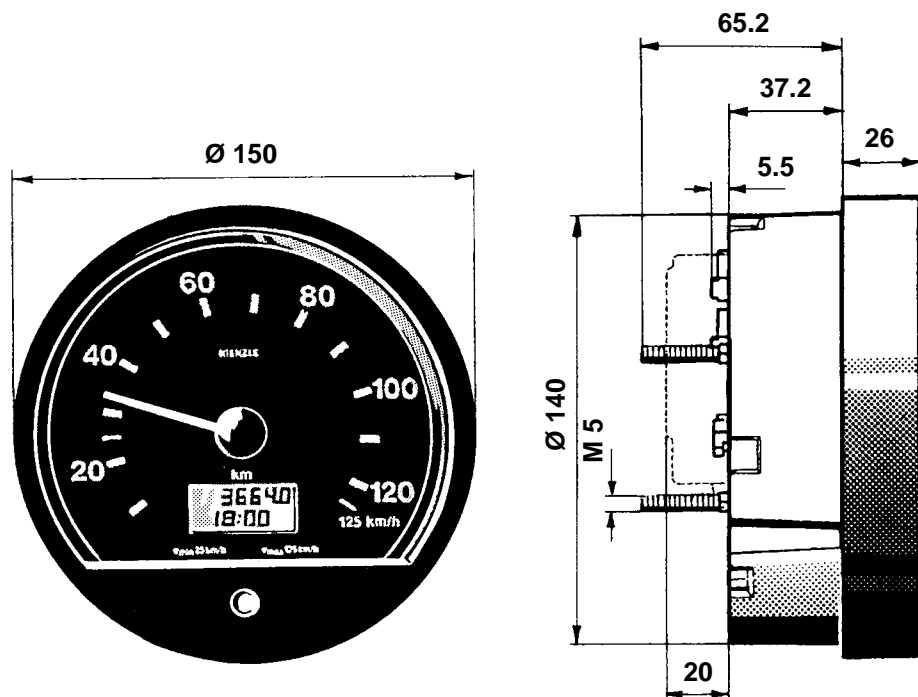


Fig. 3-20: Electronic Speedometer "Stand alone": Housing dimensions

! Important

Vehicle-/manufacturer-specific versions with different housing dimensions and designs are possible.

3.9.2 Electrical connections

! Important

Electrical connection leads must have a cross section of 0.75 mm².

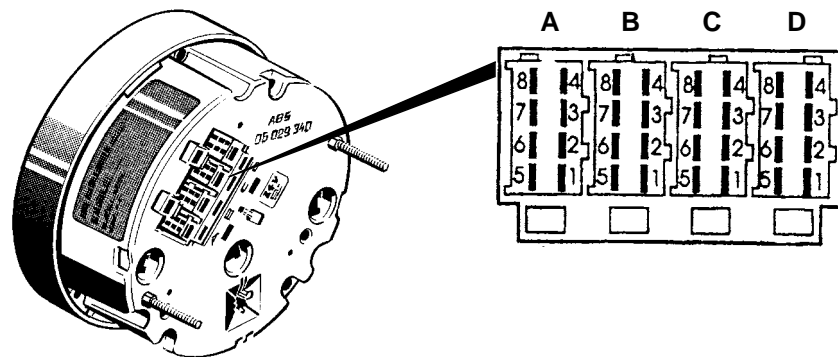
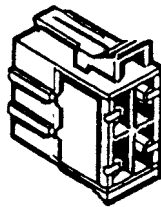


Fig. 3-21: Electronic Speedometer "Stand alone": Electrical connections

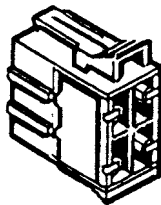
Voltage supply - Connector A



A white

A 1 -	T. 30	Constant voltage
A 2 -	T. 58	Illumination
A 3 -	T. 15	Ignition
A 4	not used	
A 5	not used	
A 6 -	T. 31	Earth
A 7	not used	
A 8	not used	

Speed – Connector B

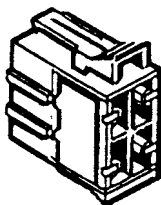


B yellow

B 1 -	(+)	"v" generator supply
B 2 -	(-)	"v" generator supply
B 3 -		"v" generator signal
B 4	not used	
B 5 -		K Diagnosis
B 6	not used	
B 7 -		"v" pulse output
B 8 -		4 imp/m signal output

RPM - Connector C (not used)

Connector D



D brown

D 1	not used	
D 2	not used	
D 3 -		"v" pulse output
D 4	not used	
D 5	not used	
D 6	not used	
D 7 -		K Diagnosis
D 8 -		Stopping signal

3.9.3 Installation accessories and adjustment equipment

Electronic Speedometer "Stand alone" installation accessories



Important

Additional information on installation accessories can be found in *Chapter 3.7.2 "Electronic Speedometer installation accessories"*, page 3-23.

When installing the Electronic Speedometer "Stand alone" into the vehicle dashboard the same instructions as described in *Chapter 3.7.3 "Instructions for installing/ removing the Electronic Speedometer"*, page 3-24 apply.

Electronic Speedometer "Stand alone" adjustment equipment

Various pulse generators can be fitted to the gearbox output to adjust the electronic speedometer's speed display.



Condition

Before fitting a pulse generator make sure that the gearbox output or the thread are not damaged.

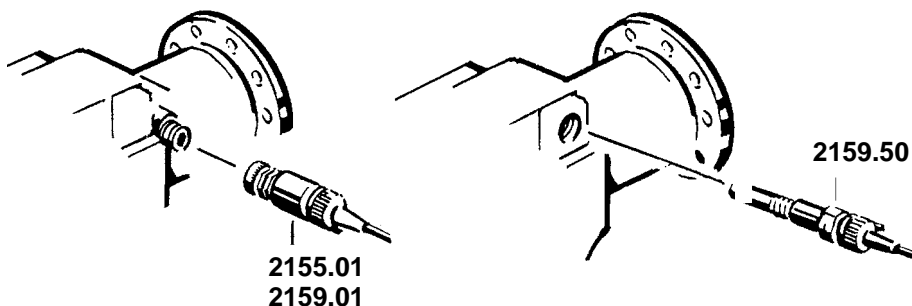


Fig. 3-22: Electronic Speedometer "Stand alone": Examples for installing "v" pulse generators

Additional information

More detailed information on pulse generators that can be used can be found in vehicle manufacturer's service instructions.

3.9.4 Removal instructions

The steps for removing an Electronic Speedometer 1323.02 "Stand alone" depend on the vehicle. Observe the instructions contained in the vehicle's service manual when fitting the unit.

Removing the Electronic Speedometer "Stand alone"

Before removal

Before removing the Electronic Speedometer "Stand alone" you will have to determine the following:

- Current odometer reading of the vehicle
- The following additional details in case of warranty claims:
 - Installation date
 - Electronic speedometer kilometre reading (mileage).

■ **Determine the vehicle's current total odometer reading and write it down:**

- **Refer to the multi-function display on the electronic speedometer**
- **If the multi-function display is defective ask the vehicle owner.**

Removal

Follow these two steps to remove the Electronic Speedometer "Stand alone":

- Undo the brackets on the back
- Remove the electronic speedometer.



Important

Refer to the vehicle' service instructions for a detailed description on how to remove the dashboard and its components.

3.9.5 Programming installation data

Programming is necessary to determine the electronic speedometer's installation data parameters and variant settings.

Installation data

- Final speed value
- Odometer (kilometre reading (mileage))
- Driving-stopping signal
- Variant.



Important

If programming errors cannot be corrected, please contact your local Siemens VDO partner.

Preparing programming

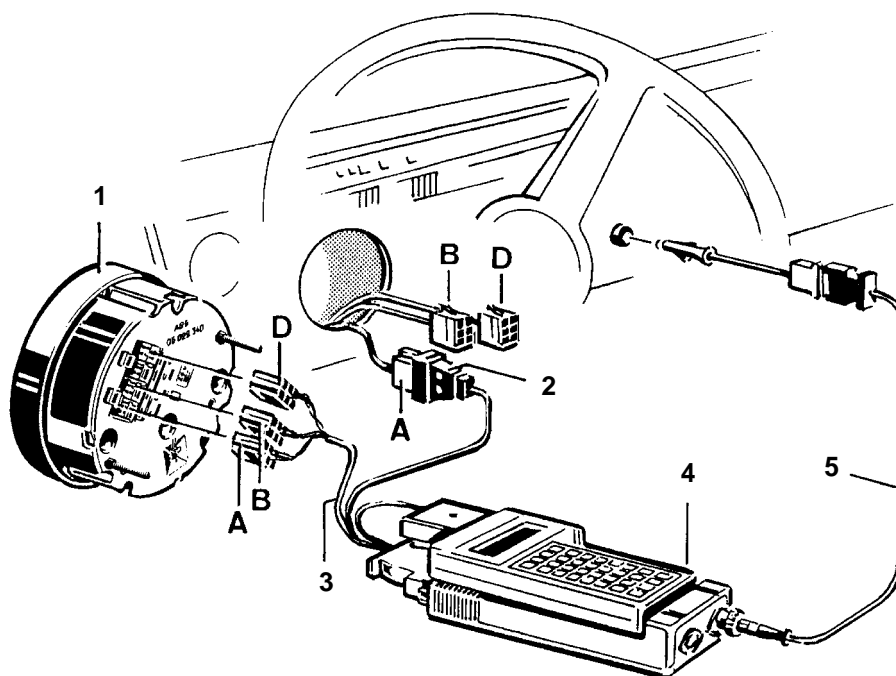


Fig. 3-23: E-Speedometer "Stand alone": Connection diagram for programming

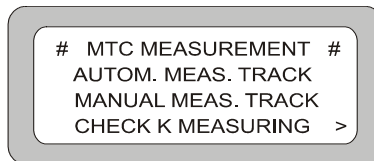
- | | | | |
|---|------------------------------|---|-------------------------------------------|
| 1 | E-Speedometer "Stand alone" | 4 | MTC 1602.04 |
| 2 | Voltage supply (Connector A) | 5 | Vehicle voltage cable (Cigarette lighter) |
| 3 | Programming cable | | |

- 1 Connect the MTC to the electronic speedometer using the programming cable (3).
- 2 Connector A (white) on the electronic speedometer's wiring harness must be used for supplying voltage to the programming cable.
- 3 Connect the MTC to the vehicle's electrical system (5).

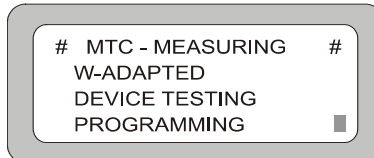
MTC 1602.04 programming workflow

When the MTC is connected to the vehicle's electrical system, the program starts automatically and the main menu is displayed. The program uses the programming cable to detect that an electronic speedometer is connected.

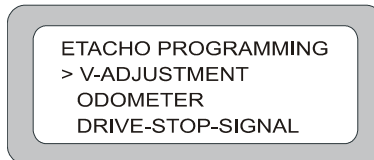
1 Start programming.



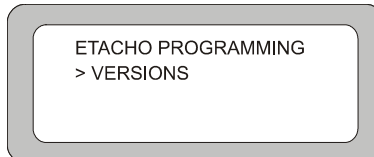
Use the DOWN arrow key to move the cursor to the next page of the main menu.



Select the "PROGRAMMING" menu and press **[Enter]** to confirm.

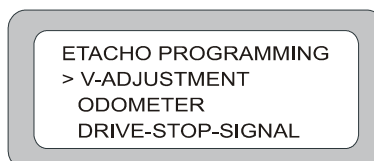


Basic menu:
"ETACHO PROGRAMMING"

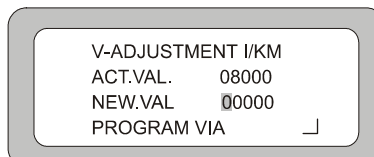


Use the arrow keys to select the corresponding sub menu and press **[Enter]** to confirm.

2 Adjust the final speed value.



The "V CONSTANT" menu is already selected. If not, select it and press **[Enter]** to confirm.



If necessary, enter a new value:
- Select the decimal in the entry field
- Enter figures (02400-40000 imp/km).

Press **[Enter]** to confirm.
If programming has been successful, the new value is displayed.

Press **[C]** to return to the basic menu.

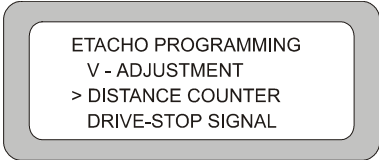
3 Set the odometer.



Important

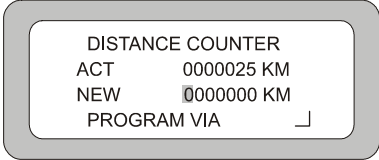
Depending on the current odometer reading, please note the following when programming:

- If the odometer reading is **0 - 100 km** there is no limit as to how often the odometer can be programmed.
- If you want to program an odometer reading that is **higher than 100 km**, this can be done **only once**.
- If the current odometer reading is **higher than 100 km**, the odometer **can no longer be programmed**.



```
ETACHO PROGRAMMING
V - ADJUSTMENT
> DISTANCE COUNTER
DRIVE-STOP SIGNAL
```

Select the "DISTANCE COUNTER" menu and press **[Enter]** to confirm.



```
DISTANCE COUNTER
ACT      0000025 KM
NEW      0000000 KM
PROGRAM VIA  ──▶
```

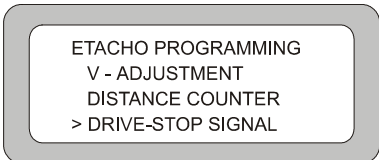
Enter the odometer reading:
- Select the decimal in the entry field
- Enter figures (up to 7 digits).

Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

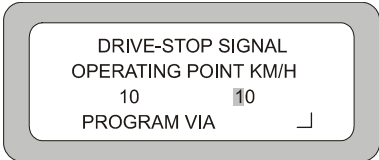
Press **[C]** to return to the basic menu.

4 Set the driving-stopping signal.



```
ETACHO PROGRAMMING
V - ADJUSTMENT
DISTANCE COUNTER
> DRIVE-STOP SIGNAL
```

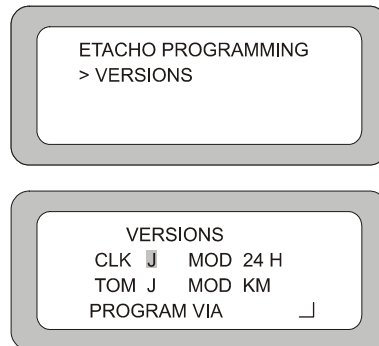
Select the "DRIVE-STOP SIGNAL" menu and press **[Enter]** to confirm.



```
DRIVE-STOP SIGNAL
OPERATING POINT KM/H
10      10
PROGRAM VIA  ──▶
```

Enter the desired switching threshold (1-15 km/h) and press **[Enter]** to confirm.
If programming has been successful the new value is displayed. Press **[C]** to return to the basic menu.

5 Set the variant parameters.



Select the "VERSIONS" menu and press **[Enter]** to confirm.

Set the variant:

- Select the variant
(clock or daily trip recorder)
- Select the desired parameter.

Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

6 Press **[C]** to terminate programming.



Important

When programming is complete select "DEVICE TESTING" and use the "VARIABLE SPEED" menu item to check the correct speed display on the electronic speedometer.

3.9.6 Installation instructions



Condition

Before fitting the electronic speedometer the speedometer constants must be programmed (additional information on how to do this can be found in *Chapter 3.9.5 "Programming installation data"*, from page 3-50).

Installation

Follow these two steps to install the unit:

- Install the electronic speedometer into the dashboard and then
- replace the dashboard/ components.

Electronic Speedometer "Stand alone"

- 1 **Connect the electronic speedometer using the connectors.**
- 2 **Carefully place the electronic speedometer into the brackets on the dashboard.**

Dashboard

- 3 **Before fixing the dashboard check:**
 - **that all connectors are fitted correctly**
 - **the position of the wiring harness.**

When the dashboard is fixed the wiring harness must not exert pressure on the back of the tachograph.

Chapter 4

Sealing

4.1 General sealing provisions

All removable mechanical and electrical connections of the tachograph systems 1324 as well as all setting and adjustment elements on the tachograph must be sealed.



Caution

The **German Federal Office for Motor Traffic** has granted the MTCO 1324 recording equipment the EEC type approval certificates e1-83 and e1-85.

The following seals are prescribed:

- Seal plate on the test and programming interface
- Seal on the MTCO 1324 housing cover
- Seal on the battery compartment and
- locking wire with seal on the KITAS sensor **on** the gearbox.



Important

When checking the unit the tested part can be sealed after each testing step.

Sealing

When sealing make sure that:

- the seal is put on correctly
- the sealing pliers are set correctly
- only the assigned mark is used
- the locking wire is as short as possible when sealing bayonet connections
- the locking wire does not cause any short circuits.

Effective sealing

Sealing must be done in such a way that the parts protected with seal caps, locking wire and two-hole seals cannot be removed or put out of operation without ruining or visibly damaging them.

4.2 Sealing equipment and sealing plans



Important

Original Siemens VDO tools and sealing equipment must be used for sealing.

The sealing equipment order numbers can be found in *Chapter 6 "Appendix", Chapter 2 "Sealing equipment and accessories order overview"*.

4.2.1 MTCO 1324 sealing plan

Sealing points on the tachograph system 1324

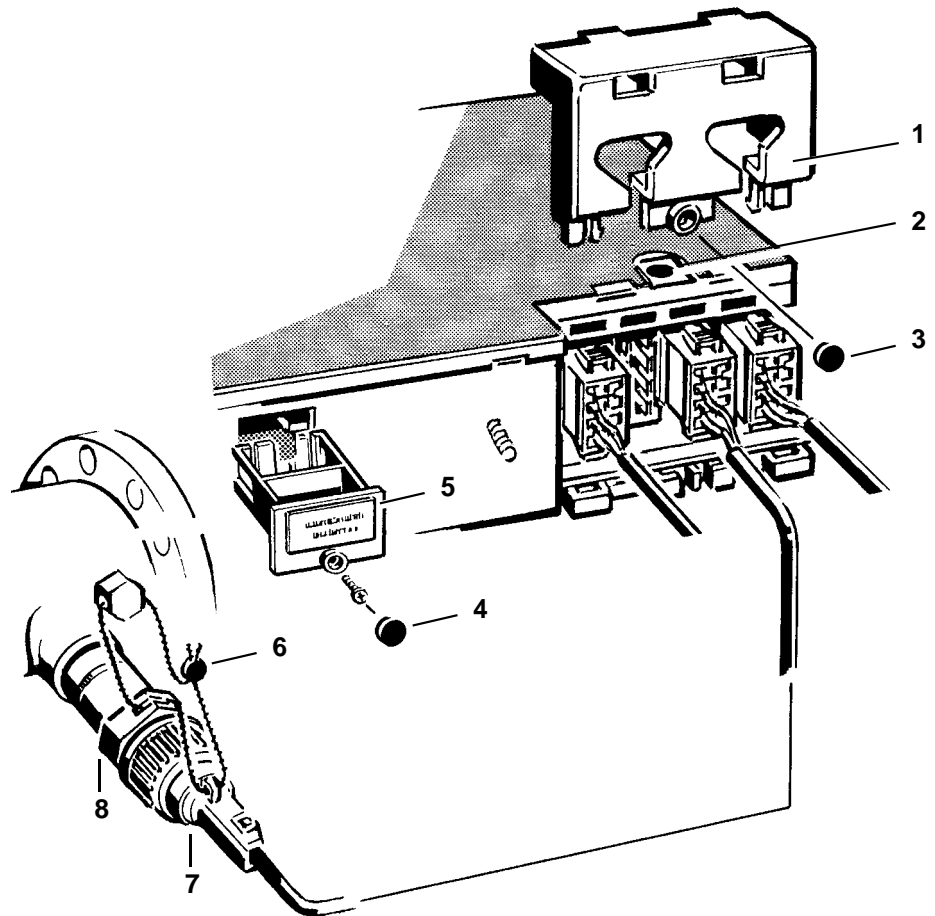


Fig. 4-1: Sealing equipment for and sealing points on the tachograph system 1324

- | | |
|--------------------------------|-----------------------------------|
| 1 Connector hood | 5 Battery compartment |
| 2 MTCO 1324 housing cover seal | 6 Two-hole seal with locking wire |
| 3 Connector hood seal | 7 Sensor cable (KITAS plug) |
| 4 Battery compartment seal | 8 KITAS 2170/ 2171 |

! Important

The Federal Office for Motor Traffic in Germany (KBA) no longer requires the back of the tachograph (connector hood (1)) and the sensor cable (KITAS plug(7)) to be sealed.

Nevertheless, we recommend that you seal the back of the MTCO 1324 and the KITAS 2170/ 2171 sensor cable for security reasons.

In any case, the battery compartment (5), if available, must be sealed (from firmware version 04.xx it is no longer available).

The KITAS sensor (8) itself **must** be protected against being pulled out and must be sealed.

Sealing points on the front of the tachograph

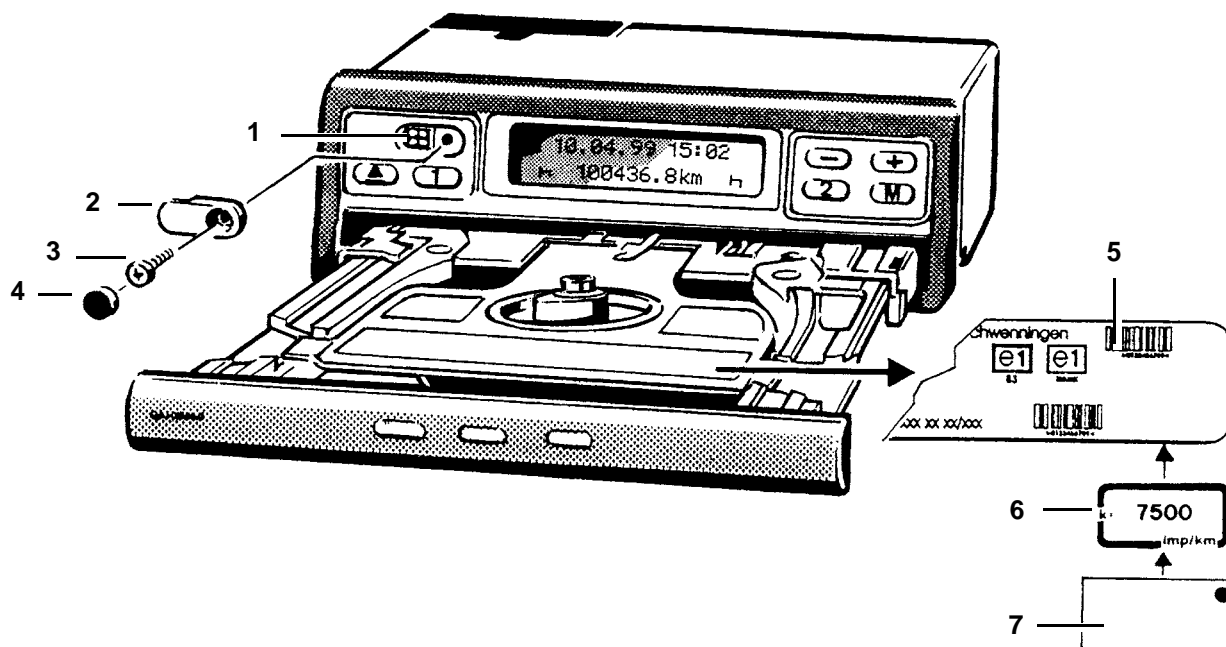


Fig. 4-2: Sealing equipment for and sealing points on the front of the MTCO

- | | |
|-------------------------------|----------------|
| 1 Test/ programming interface | 5 Type plate |
| 2 Seal plate | 6 "k" label |
| 3 Screw | 7 Sealing foil |
| 4 Seal cap (red) | |

Sealing point	before/after step	Sealing equipment
KITAS sensor, sensor cable gearbox side	after checking the tachograph system	Two-hole seal, locking wire
Connections/ plug and socket connections, back of tachograph	after checking the tachograph and before the test drive	Seal hood and seal cap
Programming interface	after the test drive	Seal plate and seal cap
"k" label	at the end of the test	Sealing foil
Installation label	at the end of the test	Sealing foil

Table 4-1: Tachograph system 1324: Sealing steps

4.2.2 Sealing plan for the Electronic Speedometer 1323

!

Important

According to the law, the back of the electronic speedometer need no longer be sealed (Regulation (EC) No. 1056/97). Nevertheless, we recommend that you seal the back of the Electronic Speedometer 1323 for security reasons.

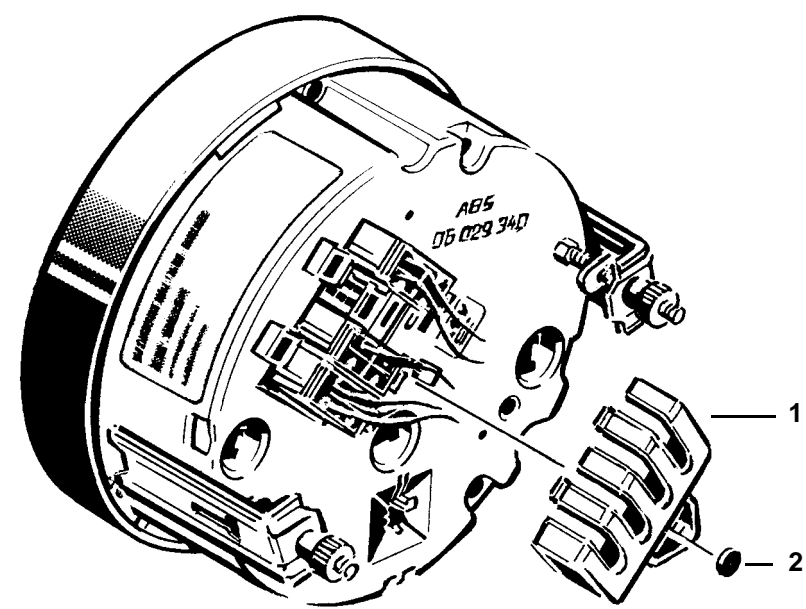


Fig. 4-3: Sealing equipment for and sealing points on the E-Speedometer 1323

- 1 Sealed connector hood
- 2 Seal cap

Sealing point	before/after step	Sealing equipment
Connections/ plug and socket connections, back of electronic speedometer	after checking the electronic speedometer	Sealed connector hood and seal cap

Table 4-2: Electronic Speedometer 1323: Sealing steps

Chapter 5

Test instructions

5.1 Overview of test workflow

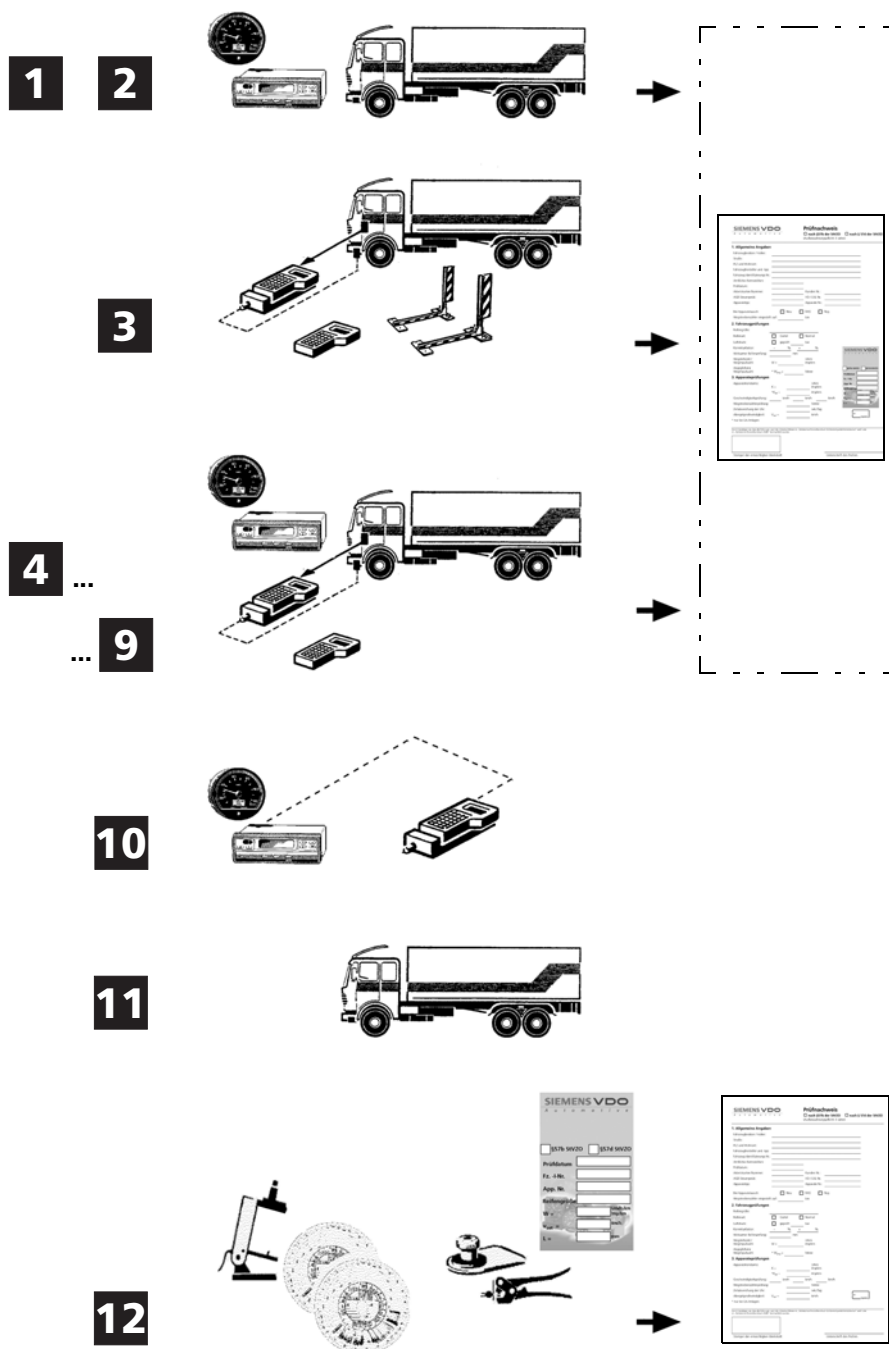


Fig. 5-1: Overview of test workflow

				Section/ Chap./ page
1	Prepare the test certificate according to § 57b StVZO	Vehicle data	<ul style="list-style-type: none"> Determine (vehicle owner, vehicle manufacturer, registration number...) Enter on the test certificate 	5-5
2	Carry out the initial check	Electronic Speedometer 1323/ Cluster	<ul style="list-style-type: none"> Make a visual check Check the multi-function display 	5-8
		MTCO 1324	<ul style="list-style-type: none"> Make a visual check Check the display Check system time and date Read out the error code Remove the MTCO Check the seals Install the MTCO Remove the installation label 	5-9
3	Check the tachograph system	Vehicle	<ul style="list-style-type: none"> Check the test conditions Determine the effective tyre circumference 	5-14
		Characteristic coefficient (imp/km)	<ul style="list-style-type: none"> Determine "w" using the "AUTOM. MEAS. TRACK" program Determine the "k_{old}" constant using the "CHECK K MEASURING " program Program the "k" constant 	5-15
<i>Tachographs manufactured not more than one year ago need not be checked for permissible inherent errors (steps 4 to 8). We recommend that you draw up a test chart to prove that the recordings comply with legal stipulations (step 9).</i>				
4	Check the tray, tachograph chart turntable, operating keys and display	MTCO 1324	<ul style="list-style-type: none"> Unlock and open the tray Insert the tachograph charts Check the correct recording time Close the tray Check the working time group keys [1] and [2] for driver 1 and driver 2 Check the ejection mark 	5-18
5	Check the warning equipment	MTCO 1324	<ul style="list-style-type: none"> Check the display 	5-22
		Electronic Speedometer 1323/ Cluster	<ul style="list-style-type: none"> Check the warning LED 	
6	Check the clock	MTCO 1324	<ul style="list-style-type: none"> Determine the time difference using the "CLOCK TEST" program Enter the value on the test certificate 	5-24
7	Check the speed display	Electronic Speedometer 1323/ Cluster	<ul style="list-style-type: none"> Determine the measuring range Carry out a "SPEED TEST" 	5-25
	Check speed recording	MTCO 1324	<ul style="list-style-type: none"> Enter the value on the test certificate 	

8	Check the odometer	MTCO 1324	<ul style="list-style-type: none"> Check the odometer using the "DIST. COUNTER TEST" program Enter the value on the test certificate 	5-29
9	Draw up the test charts	MTCO 1324	<ul style="list-style-type: none"> Prepare the test charts Draw up the test charts using the "TEST CHART" program Analyse the test charts 	5-31
10	Program the MTCO 1324	MTCO 1324	<ul style="list-style-type: none"> Program installation data Check date and time, program again, if necessary 	5-35
11	Test drive	MTCO 1324	<ul style="list-style-type: none"> Insert the test charts Check the recording time Set the driver 1 and driver 2 working time groups 	5-37
		Tachograph system	<ul style="list-style-type: none"> Drive along the test track (minimum length 1 km): <ul style="list-style-type: none"> Check the steady display on the Electronic Speedometer / Cluster Monitor the units' LC displays Check additional functions Complete the test drive: <ul style="list-style-type: none"> Check the initial position of the pointers Analyse the test drive recordings 	5-37
12	Complete the test	Tachograph (MTCO 1324)	<ul style="list-style-type: none"> Seal the test and programming interface Complete the test certificate Fill in/ print the test certificate and installation label Stick the installation label into the driver's cab 	5-39
		Test certificate § 57b StVZO	<ul style="list-style-type: none"> File the test certificate and test charts 	5-39

Table 5-1: Test workflow check list



Important

The following instructions only describe how to check tachograph systems with MTCO 1324.

Generally, the same provisions as for older tachographs apply when checking tachograph systems with MTCO 1324.

5.2 Testing conditions

A check according to § 57b StVZO should only be carried out if the following conditions are met:

- the vehicle must be in a roadworthy condition
- the size of the tyres fitted to the vehicle must comply with the specifications on the vehicle certificate
- the tyre pressure must comply with the vehicle manufacturer's specifications
- the vehicle owner's order and the vehicle certificate should be available.

Recommendation: Work sheet:

We recommend that you complete a work sheet for each check according to § 57b StVZO.



Important

Vehicle defects relating to roadworthiness or the tyre size fitted are reasons for not carrying out the check. Discuss any defects with the vehicle keeper before the check.

5.3 Preparing the test certificate

Before the check enter the vehicle data from the vehicle certificate on the test certificate to ensure that the MTCO 1324 (tachograph system 1324) and the vehicle can be easily identified during the test.



Important

Upon series production of the MTCO 1324 a new test certificate including an integral, vignette-type installation label is introduced at the same time. The test certificate and the installation label can either be filled in manually or be printed using a PC with printer.

**Test certificate
(back)**

A check list printed on the back of the form summarises all the necessary work steps for checking the tachograph and includes a field where any extraordinary findings such as missing seals etc. are entered.

Sample for Germany

**Checkliste zur Überprüfung von Anlagen
nach § 57b StVZO und §57d StVZO**

Folgende Arbeiten, die nicht auf der Vorderseite des Prüfnachweises aufgeführt sind, wurden durchgeführt.

1 Allgemeine Arbeiten

- ☐ Apparatetyp (AGB Steuergerät / EG Kontrollgerät) und Einbau vorschriftsmäßig
- ☐ Eingangsprüfung durchgeführt (Plombierung, Anfahrtsdiagramm, Zustand)
- ☐ Antriebswellen- bzw. Anschlussleitungsverlegung und Befestigung geprüft
- ☐ Befestigung und Anordnung von Angleich-, Winkel-, Umschaltgetriebe oder Geber geprüft
- ☐ Prüfdiagramm geschrieben, ausgewertet und Stempel ausgefüllt.
- ☐ Elektrischer Anschluss und Absicherung geprüft
- ☐ Gesamtanlage vollständig verplombt
- ☐ Einbauschild angebracht und mit Plombierfolie gesichert
- ☐ Konstantenschild angebracht und mit Plombierfolie gesichert
- ☐ Probefahrt durchgeführt
- ☐ Abregelvorgang geprüft (v-max)

2 Fahrzeuge mit Sondereinrichtungen

- ☐ **Fahrzeuge mit Schaltachse**
 - ☐ Umschaltgetriebe geprüft
 - ☐ Elektronische Umschaltung geprüft
- ☐ **Fahrzeuge zum Transport gefährlicher Güter**
 - ☐ Tachograph und Strombegrenzer vorschriftsmäßig
 - ☐ Eigensicherer Stromkreis geprüft

3 Service Hinweise

- ☐ Verwendete Werkzeuge/Hilfsmittel aus dem Fahrzeug genommen
- ☐ Entstandene Verschmutzungen beseitigt
- ☐ Funktionskontrolle der elektrischen Anlage des Fahrzeuges durchgeführt
- ☐ Blinker, Scheibenwischer, Beleuchtung usw.
- ☐ Fahrer über Apparatebedienung, Original VDO-Kienzle Diagrammscheiben, Auswertung und Aufbewahrung, gesetzliche Bestimmungen informiert.
- ☐ Bedienungsanleitung ausgehändigt (Bei Neu- oder Austauschapparaten)

4 Besonderheiten oder außergewöhnliche Feststellungen, welche bei der Überprüfung gemacht wurden

Fig. 5-3: Test certificate (back)

5.4 Initial check

By carrying out a visual check at the beginning of the test defects and irregularities found in the MTCO 1324 and the tachograph system 1324 can be detected in time.

■ **Ask the driver whether there are any special defects.**

The driver can provide the inspector with information on the functioning of the MTCO 1324 and the tachograph system 1324, such as defects that only occur when driving.

■ **Carry out a visual check on the Electronic Speedometer/ Cluster:**

- **Condition**
- **Type and approval number**
- **Availability of the warning LED.**



Important

If the indicator unit does not feature a warning unit (warning LED) and has not been granted an EC type approval, the indicator unit must be replaced before carrying out the check as prescribed by § 57b StVZO. This does not apply to an MTCO 1324 "Stand alone".

■ **Carry out a visual check on the MTCO 1324:**

- **Condition**
- **Type and approval number**
- **Check that the tray, display and operating elements are working properly**
- **Seal on the test/ programming interface**
- **Installation label.**



Important

The indicator unit must have the same approval number as the MTCO 1324. If not, the indicator unit must be replaced. This does not apply to an MTCO 1324 "Stand alone".

If seals are damaged or missing, the type and position of such seals must be entered on the test certificate under "Special observations".

■ **Carry out a visual check on the tachograph chart used for driving to the workshop:**

- **Recording**
- **Correct EC tachograph chart type.**

5.4.1 Checking the MTCO 1324's basic display



Condition

The tachograph charts can only be inserted or removed when the ignition is on and the vehicle is stationary. And the MTCO 1324 must not display an error message indicating a malfunction.



Important

The tachograph charts used must not be damaged. Curled, wrinkled or torn tachograph charts may cause malfunctions.

When inserting the tachograph charts make sure the tachograph charts are placed under the retaining clip (cf. *Chapter 2.1.2 "Operation"*, from page 2-9).

Preparations

- 1 Turn the ignition on and unlock the tray.
- 2 Insert the labelled tachograph charts for driver 1 and driver 2.
When inserting the tachograph chart(s) make sure the chart(s) is/are placed under the retaining clip.
- 3 Close the tray.

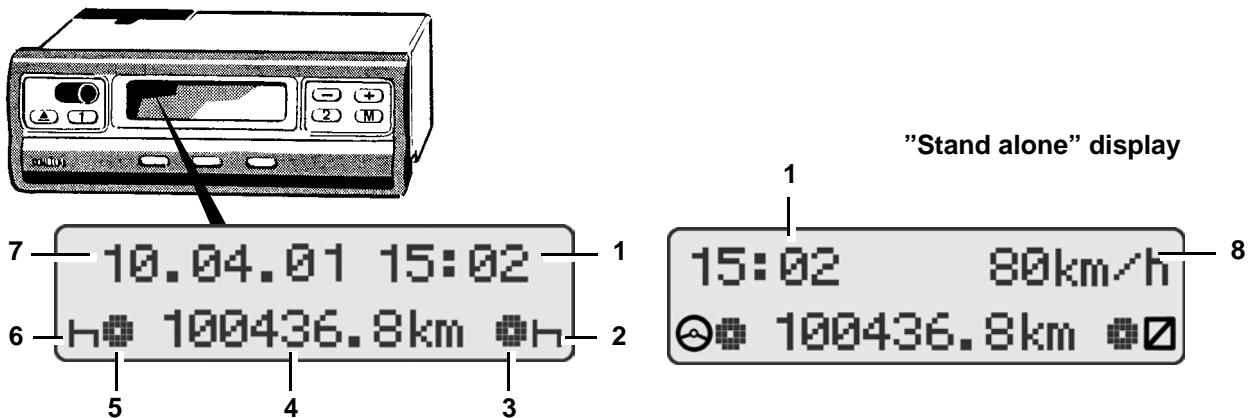


Fig. 5-4: MTCO 1324: Basic display

- | | |
|------------------------------------------|----------------------------------------------|
| 1 Time (system time) | 5 Tachograph chart for driver 1 inserted |
| 2 Time group for driver 2 | 6 Time group for driver 1 |
| 3 Tachograph chart for driver 2 inserted | 7 Date |
| 4 Odometer | 8 Speed display MTCO 1324 "Stand alone" only |

Checking the basic display

When the tray is closed the MTCO 1324 must detect that the tachograph charts are inserted as well as the selected working time groups for driver 1 and driver 2. The basic display shown in the figure above must appear.

5.4.2 Checking system time and date

The display must show the current time and date. If the date or time differ from the reference values, these values must be reprogrammed at the end of the check (cf. Chapter 3.8.4 "Programming the MTCO 1324", from page 3-31).



Important

Time differences of ± 2 minutes can **only be corrected on the MTCO 1324 without NFU** directly (once within 7 days) (see Chapter 2.1.2 "Operation", section "Clock setting (menu 1.)", page 2-14).

5.4.3 Reading the error memory

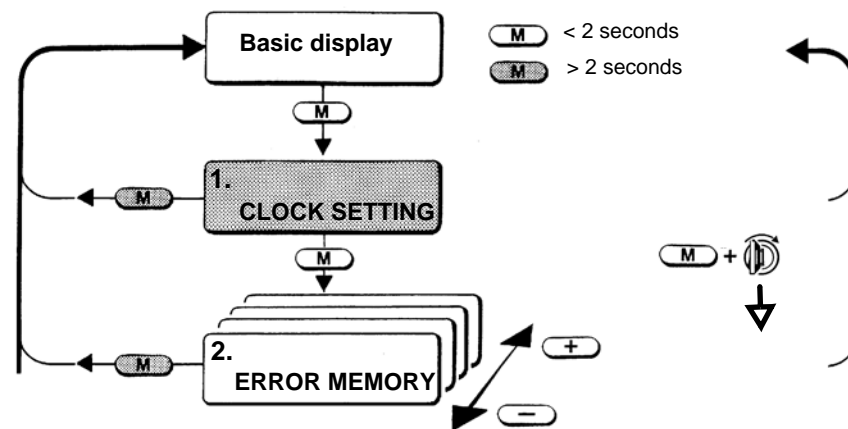


Fig. 5-5: MTCO 1324: "2. Error memory" menu

- 1 **Activate the service mode, if it is not yet active.**
For a detailed description refer to Chapter 2.1.2 "Operation", section "Service mode menu functions", page 2-16.
- 2 **Select the 2. Error memory menu to read out the error memory.**

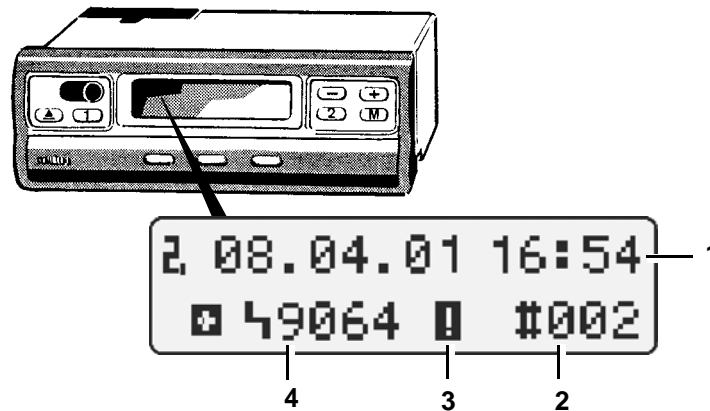


Fig. 5-6: MTCO 1324: Operating error message, e.g. driving without tachograph chart

- | | | | |
|---|-------------------------------------------------|---|-----------------------------|
| 1 | Date, time when the error last occurred | 3 | "Error active" symbol |
| 2 | Number of errors (how often the error occurred) | 4 | Error symbol and error code |

In addition, errors that are still "active" are marked by an !. When the error is corrected the error message "Error active" symbol disappears automatically. The error remains stored in the error memory however.



Important

If an entry in the error memory indicates that a malfunction is still present that cannot be corrected, the MTCO 1324 is defective and must be replaced with a new tachograph.

If the error memory does not contain any entries indicating active malfunctions, the error memory can be deleted at the end of the check (see *Chapter 6.2.3 "System/ tachograph error messages"*, page 6-7).

5.4.4 Checking the seals on the MTCO 1324

Before removal

- On the front of the MTCO 1324 check the condition and existence of the seal plate and the seal cup on the test/ programming interface.

For more detailed information refer to *Chapter 4 "Sealing", Fig. 4-2: "Sealing equipment for and sealing points on the front of the MTCO"*, page 4-4.

Removing the MTCO 1324

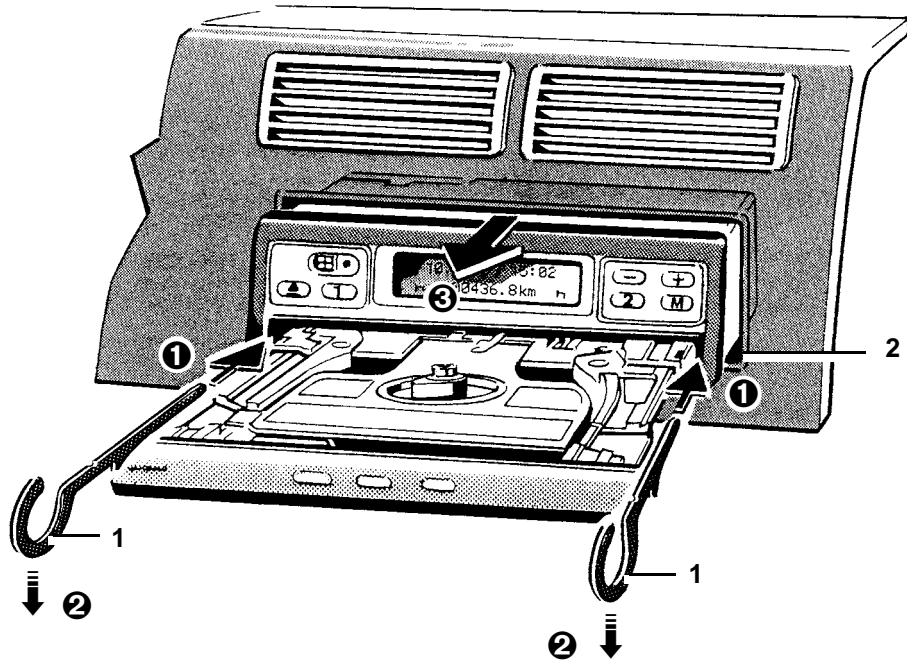


Fig. 5-7: MTCO 1324: Removing the unit from the radio compartment

- 1 Special removal tools 2 Mounting frame

- 1 Insert the special removal tools (1) into the left and right space between the tray and the MTCO 1324's front cover until they will go no further.
- 2 Push the special removal tools (1) down and keep them down.
- 3 Then pull the MTCO 1324 out of the mounting frame or radio compartment.

After removal

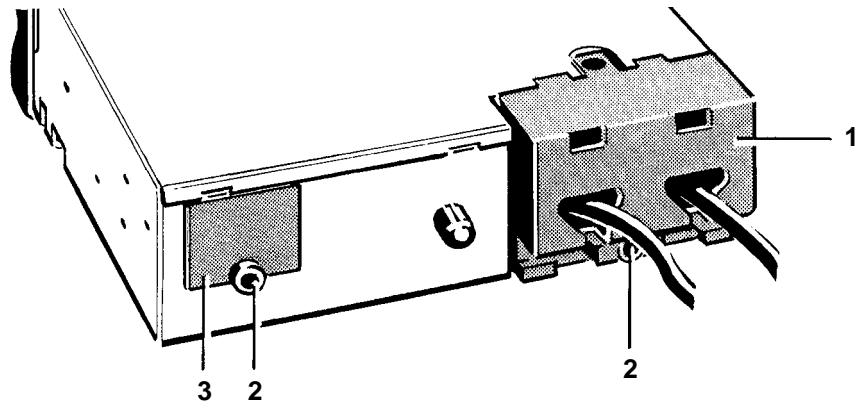


Fig. 5-8: MTCO 1324: Back seals

- | | | | |
|---|----------------------------|---|---------------------|
| 1 | Connector hood *(see note) | 3 | Battery compartment |
| 2 | Seal cap | | |

■ Check the condition and existence of the following seal caps (2):

- **Connector hood (1)**
- **Battery compartment (3).**
From firmware version **04.xx** the battery compartment is no longer available.
The buffer battery is integrated into the circuit board.

! Important

The Federal Office for Motor Traffic in Germany (KBA) no longer requires the back of the tachograph (connector hood) to be sealed*.

Nevertheless, we recommend that you seal the back of the MTCO 1324 for security reasons.

■ Re-install the MTCO 1324 correctly.

Refer to *Chapter 3.6.4 "Installation instructions"*, from page 3-20.

! Important

When the unit is fitted again check the MTCO 1324's error memory for errors (see *Chapter 5.4.3 "Reading the error memory"*, page 5-10).

5.5 Checking the tachograph system

Preparations

When the following preparations have been made

- Preparing the test certificate (*Chapter 5.3*, from *page 5-5*)
- Carrying out the initial check (*Chapter 5.4*, from *page 5-8*)
- Checking the test conditions (*Chapter 5.2*, from *page 5-5*)

and the required values have been entered on the test certificate, the tachograph system must be checked.

Checking inside the vehicle

Unlike older tachograph systems, the tachograph system with MTCO 1324 can be checked inside the vehicle.



Condition

The equipment necessary for checking is the same as for installing and commissioning the tachograph system (cf. *Chapter 3.1 "Necessary equipment"*, page 3-2).

The following service diagnosis system (SDS) must be available:

- For checking the MTCO 1324 an MTC including the following accessories:
 - Interface with software version 6.00
 - Software version 7.xx for BTC
 - Programming cable (1602.78.006.01)
- For checking the tachograph system:
 - Automatic measuring track, including MTC accessories such as light barrier, Start/ Stop reflectors and light barrier cable or
 - Rolling Road Test Computer (ATC) with programming cable.



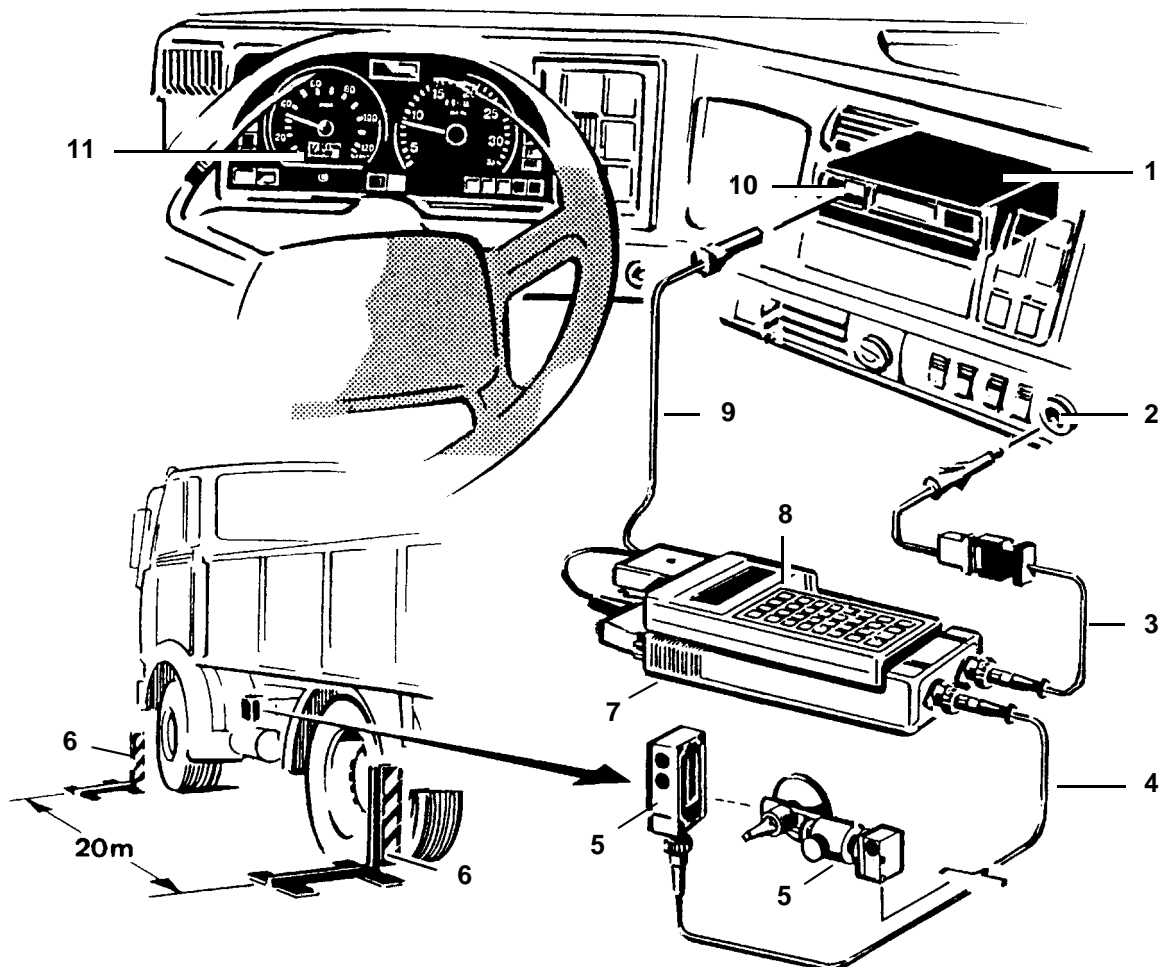
Important

The SDS software versions are displayed when pressing the [–] key on the BTC.

Additional information

You will find detailed information on the diagnosis system in *Chapter 3.1.1 "Service Diagnosis Systems"*, page 3-2 and the order numbers for the various diagnosis systems and their accessories in the appendix in *Section 6, Chapter 2.1 "Service Diagnosis Systems"*, page 2-2.

Section 1: MTCO 1324 EC • Edition 03/2002



1	MTCO 1324	7	MTC interface
2	Cigarette lighter	8	BTC
3	Power cable	9	Test cable
4	Light barrier cable	10	Test and programming interface
5	Light barrier	11	Electronic Speedometer/ Cluster
6	Start/ Stop reflectors		

- Section 1 5-15

- 3 Connect the MTC to the vehicle's electrical system using the power cable (3).
- 4 Attach the light barrier (5) to the vehicle and connect it to the MTC using the light barrier cable (4).
- 5 Check that the measuring track is set up correctly.
Check the position and distance of the Start/ Stop reflectors (6). The real measuring track must have a minimum length of ± 20 metres. For more detailed information and instructions on the correction value *refer to the separate MTC operating instructions*.
- 6 Turn the ignition on and start the engine.

5.5.2 Determining the characteristic coefficient "w" (imp/km)

The values for "w", "k_{old}" and "k" are required for the test certificate and programming and have to be determined and stored. To do this, the following measuring steps must be carried out using the MTC:

- Determine the characteristic coefficient "w" (imp/km)
- Determine and store the tachograph constant "k_{old}"
- Program the tachograph constant "k".

If necessary, refer to the *separate MTC operating instructions* for a detailed description of the measuring steps.



Condition

Make sure that:

- the measuring track is set up correctly
- the MTCO 1324 is ready for operation (displaying the basic display)
- the MTC is connected correctly to:
 - the vehicle's electrical system
 - the test/ programming interface on the MTCO 1324
 - the light barrier attached to the vehicle.

■ Use the MTC or ATC:

- to determine the characteristic coefficient "w" (imp/km)
- to determine and store the tachograph constant "k_{old}".
- Program the new "k" constant.

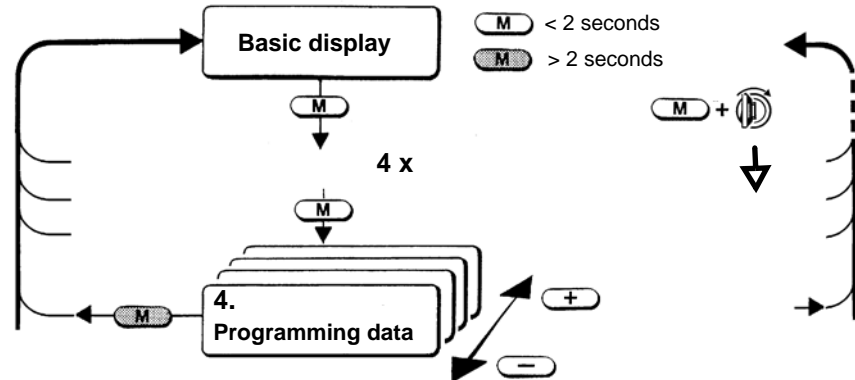


Important

Checking "w_{adjusted}" on tachograph system 1324 is no longer possible or necessary since the constant is programmed 1 : 1 in relation to the measured characteristic coefficient "w".

After "w" and "k" have been measured and programmed their current values are displayed on the MTCO 1324's display.

Calling up the current "w" and "k" values



- 1 **Activate the service mode, if it is not yet active.**

For a detailed description refer to *Chapter 2.1.2 "Operation", section "Service mode menu functions"*, page 2-16.

- 2 **Press the  key four times to switch from the basic display to the "4. Programming data" menu.**

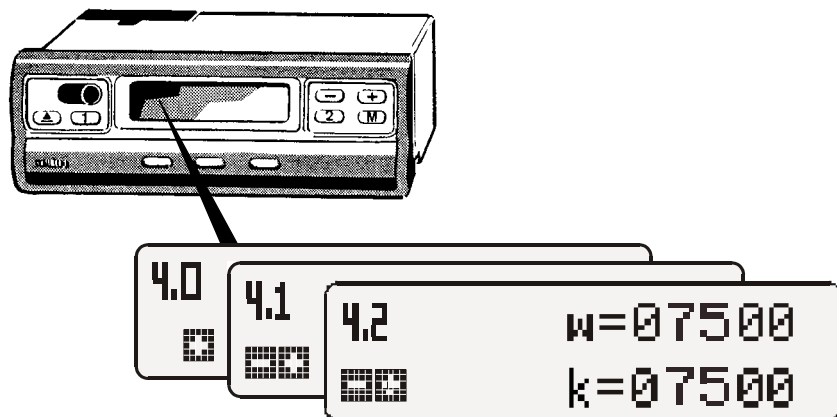


Fig. 5-10: MTCO 1324: Menu 4 "Programming data", displaying "w" and "k"

- **Use the  key to select sub menu 4.2.**

Submenu 4.2 shows the currently stored values for:

- the characteristic coefficient "w" (imp/km) and
- the "k" constant.

Important

If the characteristic coefficient "w" is known, you can also program the "k" constant using the MTC and by selecting "PROGRAMMING" (see *Chapter 3.8.4 "Programming the MTCO 1324"*, from page 3-31).

5.6 Checking the MTCO 1324

When checking an MTCO 1324 the following functions must be checked:

- Auto-diagnosis function
 - Functions of the tray and the tachograph chart turntable
 - Functions of the function and time group keys
 - Functioning of the warning LED on the Electronic Speedometer or Cluster
 - Functioning and time difference of the clock
 - Accuracy of the speed display on the Electronic Speedometer or Cluster. This does not apply to an MTCO 1324 "Stand alone".
 - Accuracy of the MTCO 1324's recording elements
 - Accuracy of the odometer
 - In case of warranty claims, read out and write down the kilometre reading.
- MTCO 1324
"Stand alone"**
- Accuracy of the speed reading on the MTCO 1324 "Stand alone" display.

On detecting a malfunction

If, when checking the unit, the MTCO 1324 or the indicator unit does not perform one of the above functions correctly, use a replacement unit to continue with the test.

5.6.1 Checking the auto-diagnosis function



Important

The auto-diagnosis function need not be checked since the system monitors itself.

MTCO 1324 auto-diagnosis

The MTCO 1324 carries out a constant auto-diagnosis to check that the whole modular tachograph system is functioning correctly.

Malfunctions (electronic/ mechanical) of the MTCO 1324 and of other system components and their connections are recorded automatically every time they occur. And if the tray:

- is closed malfunctions are indicated on the display immediately and, at the same time, the warning LED lights up.
- is open malfunctions are indicated after the tray is closed.

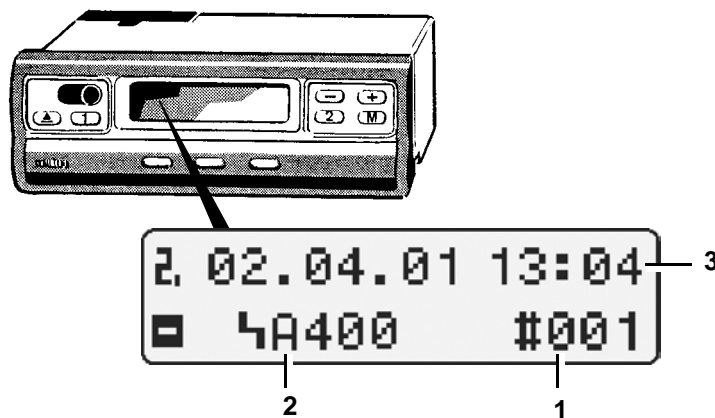


Fig. 5-11: MTCO malfunctions, e.g. display reading in case of a voltage cut

- | | |
|--------------------------------------------------|----------------------------------------------|
| 1 Error number
(how often the error occurred) | 2 Error symbol and error code |
| | 3 Date and time when the error last occurred |

Further error codes

Additional information on error codes and their meaning can be found in *Chapter 6.2 "Representation of error messages"*, from page 6-3.

The following error messages are also recorded as malfunctions on the tachograph chart:

- Recording system drive malfunctions
- Voltage cuts in the tachograph system
- Malfunctions in the KITAS sensor or the sensor cable.

5.6.2 Checking the tachograph chart turntable

Checking the tray



Important

The tray may only open if:

- the vehicle is stationary, i.e. no distance pulses are stored and
- the ignition is turned on.

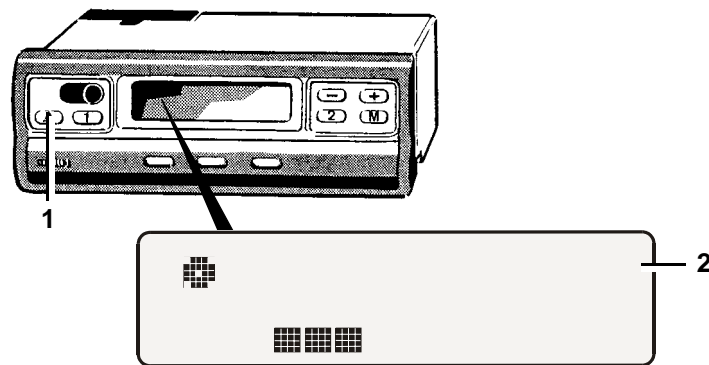



Fig. 5-12: MTCO 1324: Display reading when unlocking the tray

1 Unlock key

2 "Ejecting" display

- 1 To open the tray press the  key (1).
The "Ejecting" symbol and a progress bar must be shown on the display (2).
The tray is unlocked.
- 2 Pull out the tray until it will not go any further.
- 3 Remove the tachograph chart(s).

Checking the mechanical play

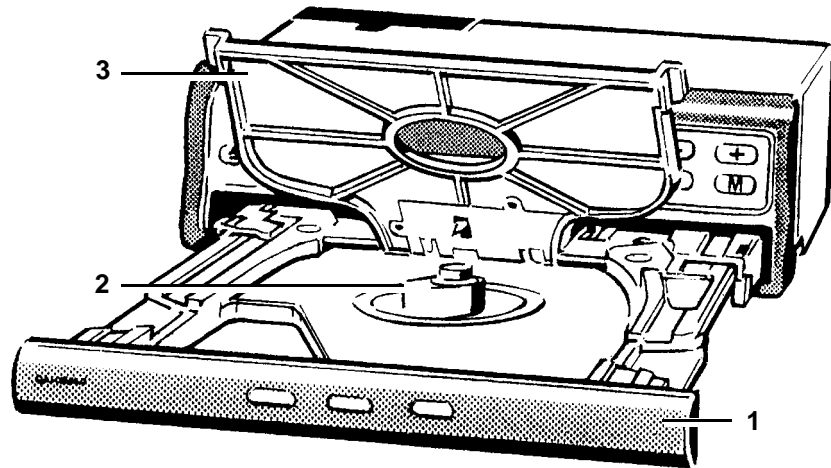


Fig. 5-13: MTCO 1324: Mechanical play of the tray and its components

- | | | | |
|---|----------------------------|---|------------------|
| 1 | Tray | 3 | Separating plate |
| 2 | Tachograph chart turntable | | |

- 1 Lift the separating plate (3) up completely.
- 2 Check the play of the tachograph chart turntable (2), tray (1) and the functioning of the separating plate (3).

5.6.3 Checking the operating keys

All keys on the MTCO 1324 must work correctly.

- Check the mechanical elements and operating function of each key.

Additional information

Descriptions of the operating key functions can be found in *Chapter 2.1 "MTCO 1324 with NFU", section "Tachograph description", page 2-4.*

5.6.4 Checking the indicator unit warning LED

The warning LED on the Electronic Speedometer or Cluster indicates that there is a malfunction in the tachograph system to alert the driver.

When the warning LED lights up this tells the driver that there is a malfunction. The following are differentiated:

- system errors and
- operating errors.



Important

When the warning LED indicates a malfunction a message is also shown on the MTCO 1324's display and the corresponding error code is entered into the error memory.

A description of error codes, their meaning and remedies can be found in *Chapter 6.4 "Error correction measures"*, from page 6-11.



Condition

Before checking the warning LED make sure that:

- the tachograph charts for drivers 1 and 2 are inserted into the MTCO 1324
- the MTCO 1324 tray is closed
- the working times for drivers 1 and 2 are set to other periods of work
- the ignition is turned on
- the display does not show any malfunction messages
- the warning LED on the indicator unit is off.



Important

You can use menu 6 "V PULSE SIMULATION" to simulate driving.

Caution: When executing this function error entries or error messages can be recorded in other electronic components of the vehicle. Cause: "v" pulse emitted while the vehicle is stationary.

- Check the functions of the warning equipment as described in the table below.



Important

If the warning LED lights up, the symbol for "error active" also appears on the MTCO 1324's display.

MTCO 1324 tachograph				Indicator unit
Display reading	Vehicle	Tachograph charts		Warning LED
		Driver 1	Driver 2	
	stationary	inserted	inserted	
	stationary	missing	inserted	
	stationary	missing	missing	
	stationary	inserted	missing	
	stationary/ moving	inserted	missing	

Table 5-2: Warning equipment function check (tachograph system 1324)

- If the warning LED does not perform as shown, either correct the error or replace the unit.

5.6.5 Checking the time difference of the clock

Test condition	The clock must work properly so that the legally prescribed journey and personnel data is recorded correctly.
Permissible tolerance	Regarding the accuracy of the tachograph clock, the following time differences are permitted by law: <ul style="list-style-type: none"> • ± 2 minutes per day or • ± 10 minutes for 7 days.



Condition

Make sure that:

- the MTC and the MTCO 1324 are connected by the test cable
- both tachograph charts are inserted into the MTCO 1324
- the display shows the "basic display".

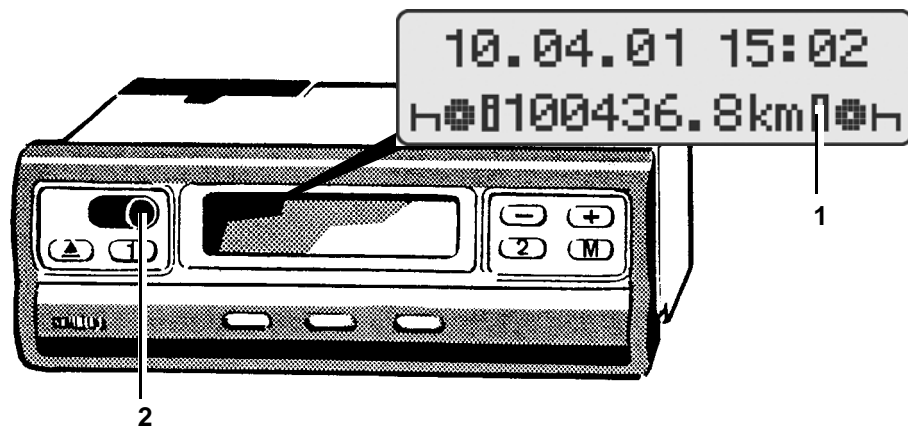


Fig. 5-14: MTCO 1324: Checking the clock

- 1 Display "Basic display" 2 Test/ programming interface

Testing steps

- 1 **Check whether the correct date and the correct time of day are shown on the display (1).**

If the date and/or time are not right, correct the settings using the "PROGRAMMING" program (see *Chapter 3.8.4 "Programming the MTCO 1324"*, from page 3-31).



Important

Please refer to the MTCO operating instructions for a description of the "Clock test" workflow. The only difference is that the test cable and the test sensor are not required. With the MTCO 1324 the "CLOCK TEST" is carried out by connecting the test cable to the test interface.

- 2 On the BTC start the "CLOCK TEST" program to determine the time difference.
- 3 Read the measured value (indicated without "+" and "-" signs) on the BTC's display and enter it on the test certificate in the "+" or "-" fields.
If you believe that the result of the measurement is not correct repeat the measurement. Press [Enter] to start a new measurement.
- 4 Press the Cancel key [C] to terminate the program.



Important

If the measured time difference is within the permissible tolerance range, the difference measured for a period of 24 hours must be entered on the test certificate.

5.6.6 Checking the speed display and recording

Scope of check

The following tolerances (permissible inherent errors) are prescribed by law for:

- the speed display (on the indicator unit and/or MTCO "Stand alone" display)
- speed recording (driver 1 tachograph chart)
- the timed speed recording.

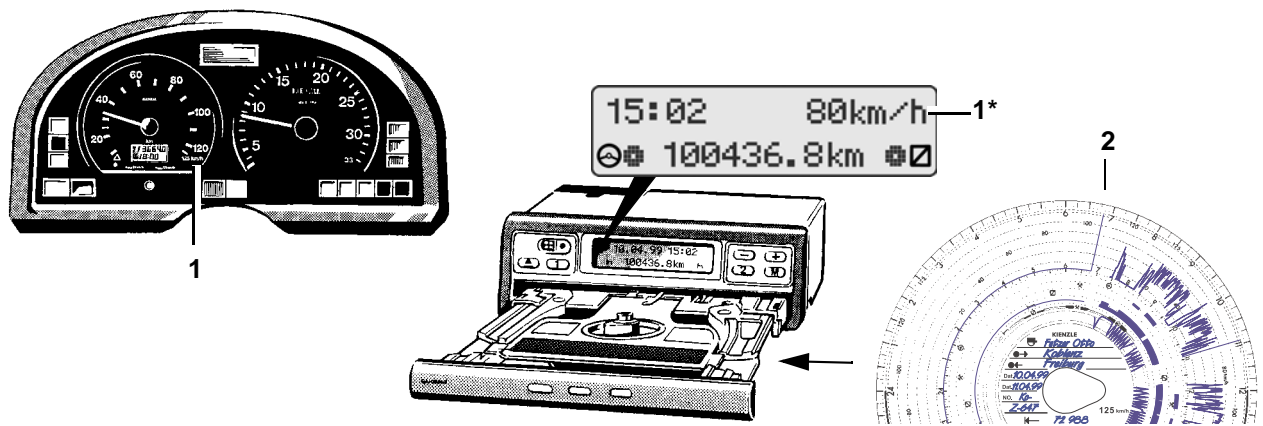


Fig. 5-15: Tachograph system: Scope of speed display and recording check (overview)

- | | |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <p>1 "v" display: e.g. indicator unit/
Electronic Speedometer or on display
(1* MTCO "Stand alone" only)</p> | <p>2 Tachograph chart:</p> <ul style="list-style-type: none"> • "v" recording • Correct recording time |
|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|

Permissible tolerances

The maximum permissible difference between the indicated/ recorded speed and the real speed (reference value) is ± 3 km/h.

Measuring range table

The speed must be correct for the whole measuring range. Therefore, 3 measuring points are defined and checked. The measuring points are stated in the table below:

Final value (km/h)	Measuring points (km/h)		
100	30,	60,	90
125, 140	40,	80,	120
160	60,	100,	140
180	40,	100,	160

Table 5-3: Tachograph speed measuring range table



Important

The indicator unit, MTCO 1324 and the tachograph charts must have the same upper speed limits.

- Check whether the upper speed limits match:
 - on the indicator unit
 - on the MTCO 1324 by selecting the "4. PROGRAMMING DATA" menu and
 - on the tachograph chart inserted into the MTCO 1324.

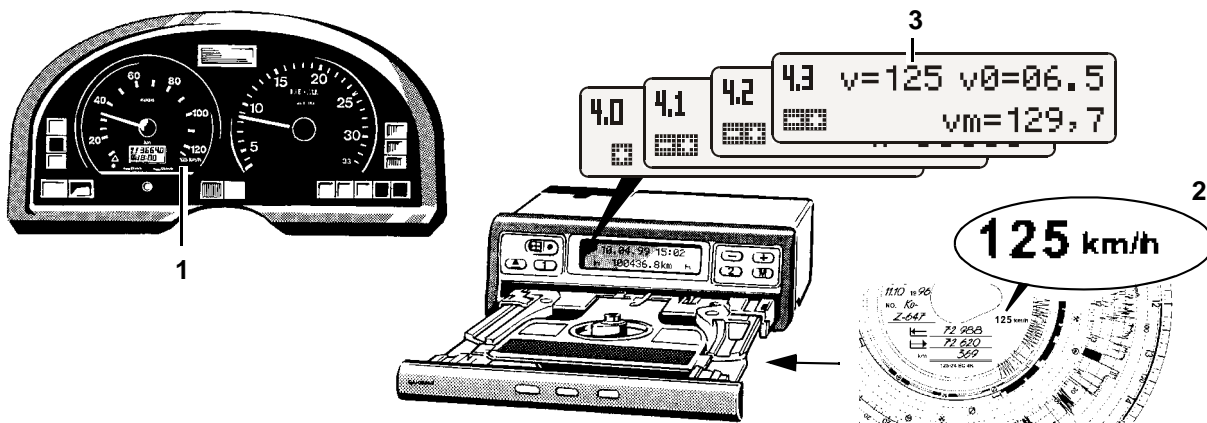


Fig. 5-16: Tachograph system: Overview of upper speed limit information on the individual components

- 1 Indicator unit
- 2 Tachograph chart
- 3 Programmed final value (sub menu)



Condition

Make sure that:

- the MTC and the MTCO 1324 are connected by the test cable
- both tachograph charts are inserted into the MTCO 1324
- the display shows the "basic display".

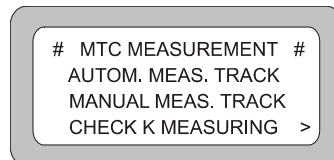


Important

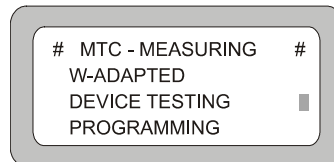
When testing make sure that you do not exceed the measuring points. Therefore, the starting value for the individual measuring points should always be at least 3 km/h lower than the actual measuring point.

The program can be aborted at any time by pressing the **[C]** key.

1 Run the "SPEED TEST" program on the BTC:



Use the DOWN arrow key to move the cursor to the next page of the main menu.



Use the arrow keys to select "DEVICE TESTING" and press **[Enter]** to confirm.

- Use the DOWN arrow key to move the cursor to the next page of the "DEVICE TESTING" sub-menu, select "SPEED TEST" and press **[Enter]** to confirm.
- Enter the starting value for measuring point 1 (e.g. 037 km/h for measuring point 40 km/h) and press **[Enter]** to confirm.
- Press **[Enter]** to confirm the "k" value determined during the previous check of the tachograph system.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches the 1st measuring point exactly. After **1 minute** press **[Enter]** to confirm.

2 Read the measured speed for measuring point 1 on the BTC display and enter it on the test certificate.

- Enter the starting value for measuring point 2 (e.g. 077 km/h for measuring point 80 km/h) and press **[Enter]** to confirm.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches the 2nd measuring point exactly.
- After **1 minute** press **[Enter]** to confirm.

3 Read the measured speed for measuring point 2 on the BTC display and enter it on the test certificate.

- Enter the starting value for measuring point 3 (e.g. 117 km/h for measuring point 120 km/h) and press **[Enter]** to confirm.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches the 3rd measuring point exactly. After **1 minute** press **[Enter]** to confirm.

4 Read the measured speed for measuring point 3 on the BTC display and enter it on the test certificate.

- 5 When the "SPEED TEST" program is terminated open the MTCO tray and remove the tachograph chart.

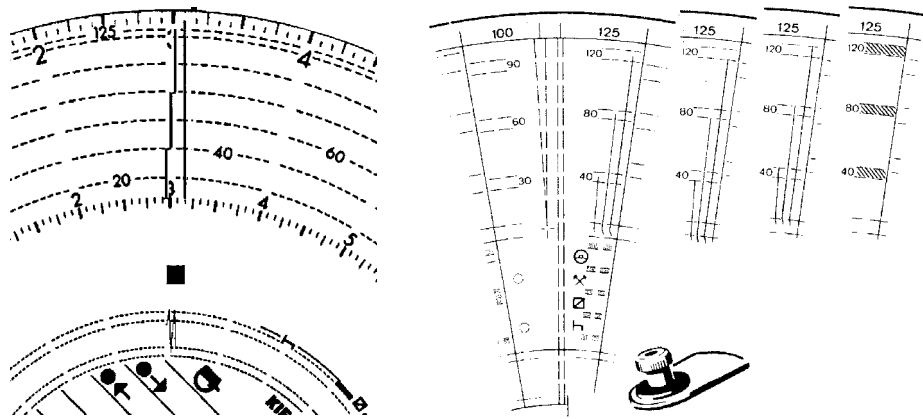


Fig. 5-17: Tachograph chart: Speed recording

- 6 Check the speed recording using the test template.



Important

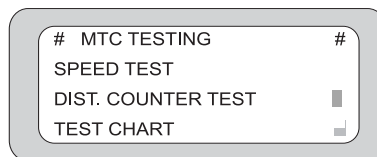
If the speed differs by more than ± 3 km/h, the following components must be replaced:

- When checking the display:
 - indicator unit or
 - MTCO "Stand alone"
- When analysing the recording: MTCO 1324.

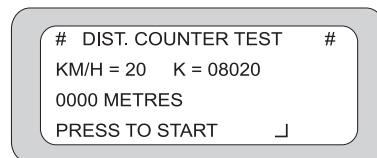
5.6.7 Checking the odometer

Permissible tolerance According to the law, the permissible tolerance for the odometer is ± 10 metres per kilometre.

- 1 Insert the tachograph charts for driver 1 and driver 2 again.
- 2 Close the tray.
- 3 Check the odometer.



Use the arrow keys to select "DIST. COUNTER TEST" and press **[Enter]** to confirm:



The MTCO is driven automatically at a speed of 20 km/h.

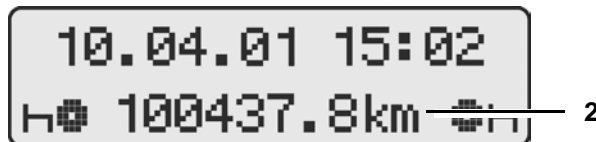
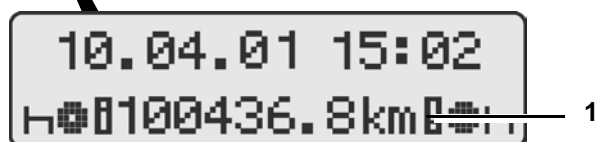
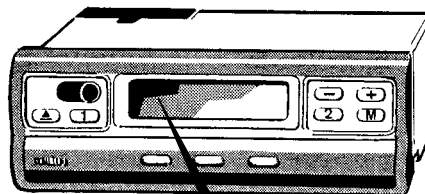


Fig. 5-18: MTCO 1324: Odometer reading, example of odometer check

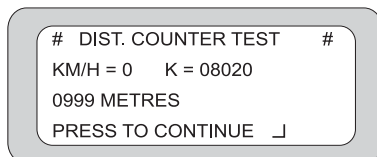
- 1 Initial reading of odometer 2 Final reading of odometer

- 4 Watch the odometer on the MTCO 1324's display and press the **[Enter]** key on the BTC when the odometer advances, select the first decimal place "100436.8", for example.

Now the MTCO 1324 is driven at a speed of 100 km/h automatically. After 950 metres the MTC reduces the speed of the MTCO 1324 automatically to 20 km/h.

- 5 **Watch the odometer and press the BTC [Enter] key at 1000 m precise (in this example, do this at "100437.8").**

The MTCO 1324 is no longer driven. The MTC and the MTCO should remain connected by the test cable.



The display indicates the actual distance travelled.

- 6 **Read the actual distance measured on the BTC display and enter it on the test certificate.**

Not within prescribed tolerances

If, as a result of the check, the actual value of the odometer is not within the prescribed tolerance range of ± 10 m/km, the MTCO 1324 is defective and a replacement tachograph must be used.



Important

When installing a replacement or original equipment tachograph, the odometer reading (kilometre reading (mileage) of the vehicle) of the replaced tachograph must be programmed into the new tachograph.

Additional information on how to program the odometer can be found in *Chapter 3.8.4 "Programming the MTCO 1324"*, from page 3-31.

5.7 Drawing up and analysing the test chart

A test chart must be drawn up for each check according to § 57b StVZO. The test chart proves that the tachograph system has been duly checked according to § 57b StVZO. Carry out the following steps:

- Prepare the test charts
- Draw up the test chart
- Analyse the test chart.

Preparing the test chart(s)

The test chart is part of the test certificate and has to be assigned to the tachograph and the vehicle checked.

1+2 driver tachographs

With 1+2 driver tachographs a test chart must also be drawn up for the driver 2 recordings. The following information must be entered on the second test chart:

- Date of check and
- vehicle registration number.



Important

So that the test can be carried out as prescribed you must make sure when drawing up the test chart that:

- you use new tachograph charts prescribed for the tachograph
- all the required information is entered completely
- two test charts are prepared and drawn up for 1+2 driver tachographs.

Recommendation

The test chart should be stamped and any entries made in the area of the 24:00 hour mark so that the entries are not overwritten by the test chart and test drive data.

- 1 Stamp the new correct test chart(s) with the test stamp.
- 2 Fill in the test chart(s) completely.

5.7.1 Drawing up the test chart

Measuring range

The program sequence (cf. *"Program sequence for drawing up the test chart automatically for 125 km/h tachographs"*) and the following workflow description relate to an MTCO 1324 with:

- final measuring range value for speed of 125 km/h
- constant $k = 7500 \text{ imp/km}$.
-



Important

The measuring points used for drawing up the test chart depend on the MTCO's final measuring range value that you enter into the BTC (see *Table 5-3: "Tachograph speed measuring range table"*, page 5-26).

- 1 **Unlock the tray and open it completely.**
- 2 **Insert new and completely labelled test charts for driver 1 and driver 2 into the MTCO 1324.**
- 3 **Close the tray.**
- 4 **Run the "TEST CHART" program on the BTC.**
The program sequence can be found in the *following Table 5-4*, page 5-33.

Program sequence for drawing up the test chart automatically





	Speed	Duration	Time group setting	
	km/h	seconds	Driver 1	Driver 2
1	0	2		
	Final value	10		
	0	20		
2	0	2		
	40	2		
	80	2		
	120	1		
	Final value	2		
	120	2		
	80	2		
	40	20		
	0			
3	0			
	40	1		
	0	20		
	80	1		
	0	20		
	120	1		
	0			
4	0	20		
	Final value	2		
	120	120		
	80	120		
	40	120		
	0	120		
	0	120		
	0	120		
	0	120		

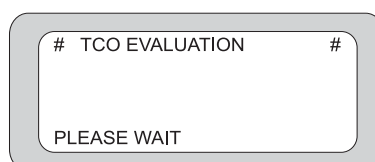
Table 5-4: Program sequence for drawing up the test chart automatically
(Example: final measuring value of 125 km/h)



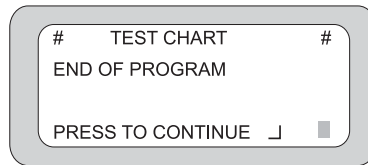
Important

On the MTCO 1324 the working time groups must not be pre-set for drawing up the test chart. All the necessary settings are made by the test unit.

- If all the settings in the BTC are correct, press the [Enter] key to confirm. The program runs automatically to the end.



The MTC checks the type of MTCO connected and starts the correct control program automatically.



You will hear a signal tone.
The test chart has been drawn up.
Press **[Enter]** to continue.

6 Open the tray and remove the test charts.

Automatically drawn up test chart

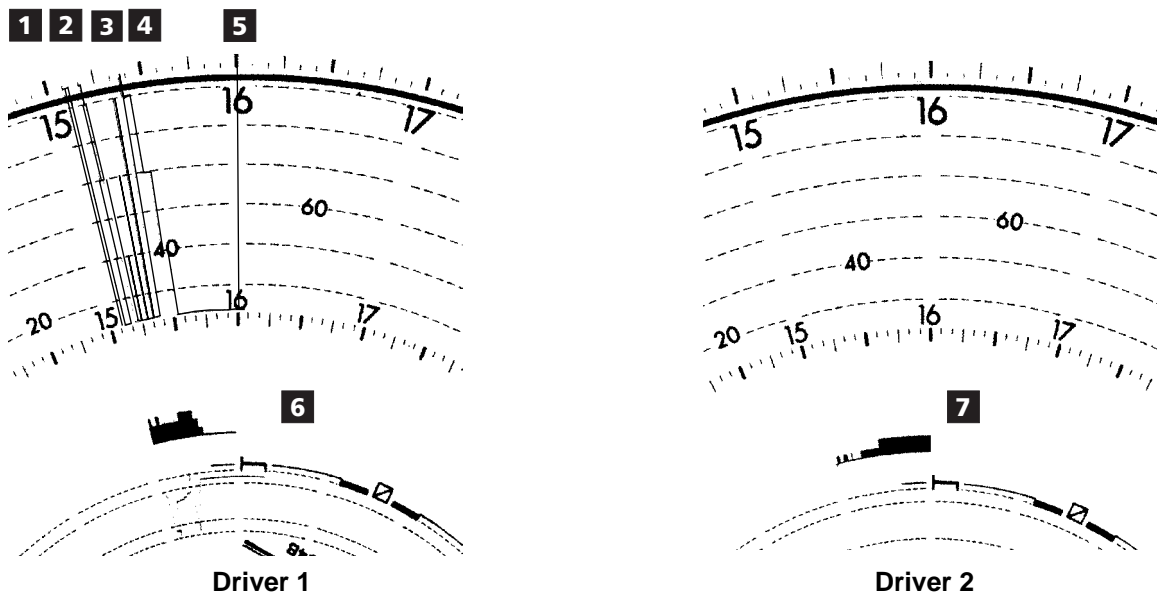


Fig. 5-19: Test chart recordings

- 1 - 4 Straight and perpendicular recording (reference line diagram)
- 5 Ejection mark
- 6 Driver 1 working time recording
- 7 Driver 2 working time recording

5.7.2 Analysing the test chart

■ Analyse the test charts.

Additional information

You will find all the necessary information and instructions on "How to analyse test charts" in *the test template operating instructions*.

5.8 Programming installation data

When the unit has been tested, the necessary installation data must be programmed:

Installation data

- Effective tyre circumference
- Calibration date (test date)
- Any further data such as:
 - Current time of day
 - Current date.

Additional information

The detailed programming workflow is described in *Chapter 3.8.4 "Programming the MTCO 1324"*, from page 3-31.

5.9 Testing using the STC Automatic

You can also use an STC Automatic (STC and BTC) for commissioning and testing an MTCO 1324 tachograph or Electronic Speedometer 1323 outside the vehicle.

The following firmware/ software versions include the extended "Programming" and "Testing" functions:

- Connection cable (order number X12-160-125-103)
- MTCO 1324 tachograph mount (order number X12-160-125-102)
- Upgrade kit for MTCO 1324 (order number 1602-89-902-01) consisting of:
 - Programming cable (**1**, **Fig. 5-19**)
 - Software version **07.xx** for BTC
 - MTCO 1324 programming instructions.



Important

From the MTCO 1324's firmware version 001.07 we recommend that you adapt the "MTCO to Electronic Speedometer" connection cable if it does not match the one shown (**5**, **Fig. 5-20**) (see section *"Recommendations for the test equipment"* on the next page).

Additional information

Additional information on the STC can be found in the separate *"STC 1601.25" operating instructions and supplements*.

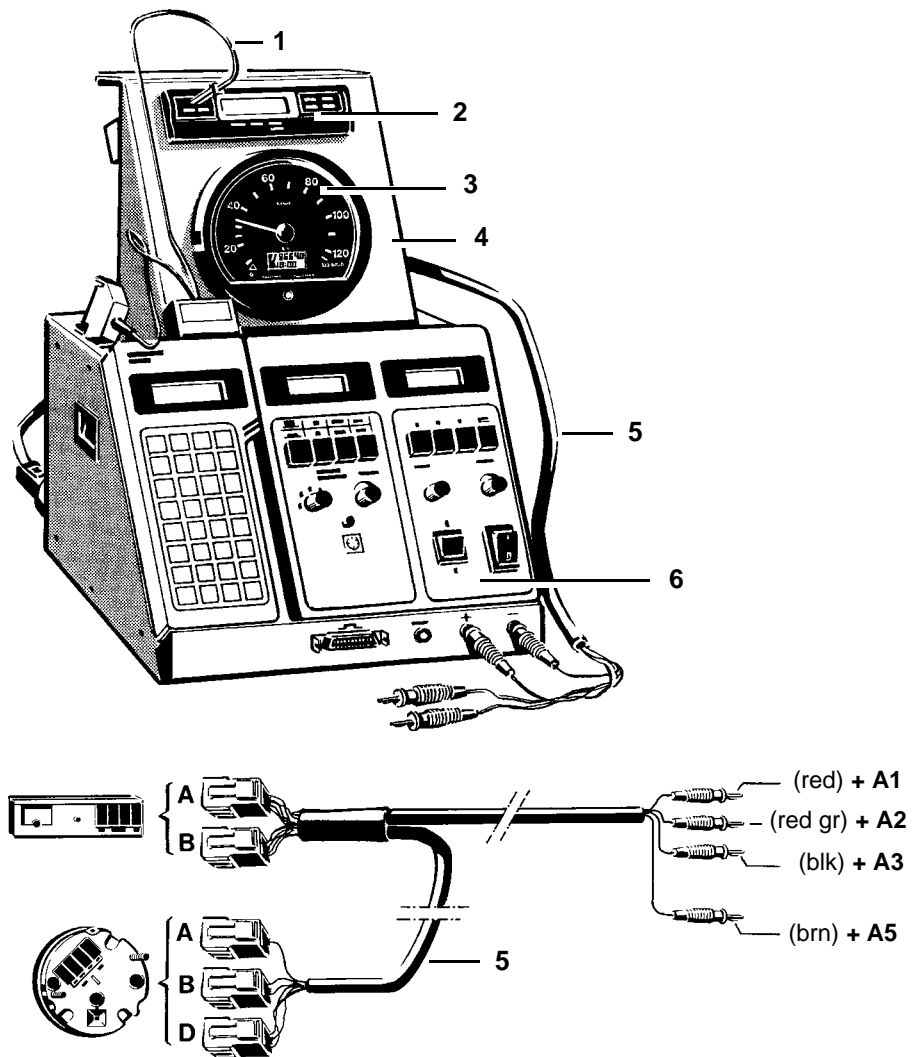


Fig. 5-20: STC Automatic: Connection diagram for MTCO and E-Speedometer

- | | |
|----------------------------------|---------------------------------------|
| 1 Programming cable | 4 MTCO 1324 tachograph mount |
| 2 MTCO 1324 | 5 "MTCO to E-Speedo" connection cable |
| 3 Electronic Speedometer 1323.01 | 6 STC Automatic |

Recommendations for the test equipment

If the "MTCO to E-Speedo" connection cable (5) does not match the cable version shown (two banana plugs A1/A2/A3 and A5), we recommend that you fit a switch (e.g. toggle switch) into the following cables:

Dimming function for display illumination

- "red grey" lead (+ A2) for checking the MTCO 1324's dimming function: If voltage is applied to pin A2, the display illumination gets darker. The dimming function is activated when the vehicle lights are switched on.

Service mode

- "black" lead (+ A3) for activating the service mode: Press the **M** key and, at the same time, turn the ignition on.

5.10 Test drive, sealing and completing the test

5.10.1 Carry out the test drive

When the installation data has been programmed and the analysis of the test charts has proved that the MTCO 1324 is working correctly, the test drive must be carried out with the test charts inserted. The test drive is an integral part of the statutory testing steps.

Test condition

For the test drive the vehicle must be driven on a test track with a minimum length of 1 km.

Recommendation

For road safety reasons we recommend that you check the unit as a co-driver.



Important

It is also possible to carry out the test drive and its related checks on an APS/ATC rolling road test bench (do **not** use a brake test bench).

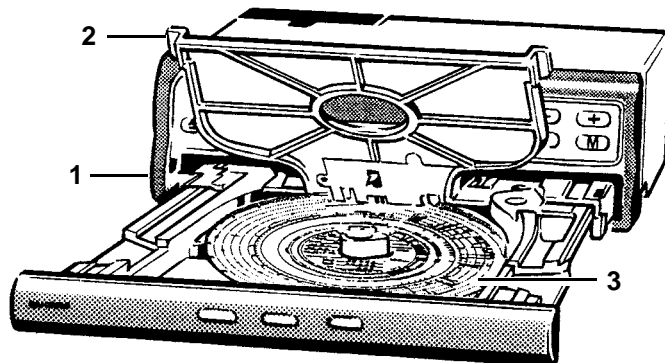


Fig. 5-21: Open MTCO 1324 ready for inserting the test charts

- | | |
|----------------------------|-----------------------|
| 1 MTCO 1324 with open tray | 3 Driver 2 test chart |
| 2 Separating plate | |

- 1 Prepare the vehicle for the test drive:
 - Unlock the tray and open it completely.
 - Insert the driver 2 test chart under the separating plate.
 - Insert the driver 1 test chart on the separating plate.
 - Close the tray.
- 2 Drive along test track with a minimum length of 1 km.

3 As co-driver during the test drive:

- Ensure that the indicator unit display is regular.
- Monitor the reference display on the MTCO display.
- Check any additional functions/ equipment.

4 After the test drive:

- Check the initial position of the pointers on the indicator unit.
- Remove the test charts and analyse the recordings using the test template.

Check the recording time for the ejection mark; track the tachograph chart turntable, if necessary.

The time difference between the ejection mark recording and the clock must not exceed ± 5 minutes.

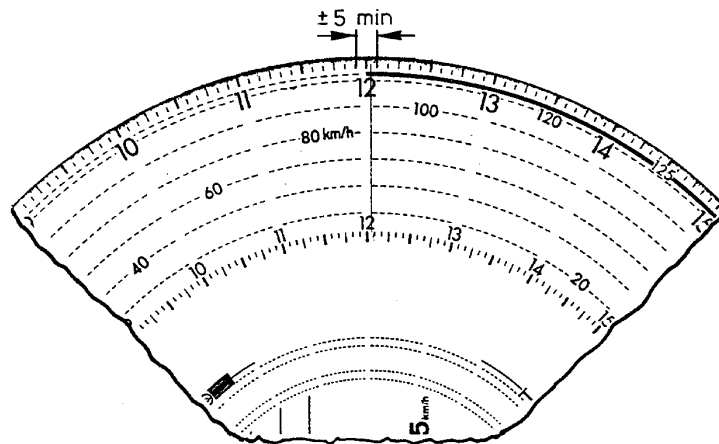


Fig. 5-22: Tachograph chart: Ejection mark

5 Insert the original tachograph charts used for driving to the workshop.



Important

Before handing the vehicle over to the customer, any errors stored in the error memory must be deleted (see *Chapter 3.8.4 "Programming the MTCO 1324", section "Clearing the error memory", page 3-44*).

5.10.2 Sealing

Sealing the test/ programming interface

After the test drive

- Seal the test/ programming interface on the MTCO 1324 and
- check the seal on the KITAS sensor.

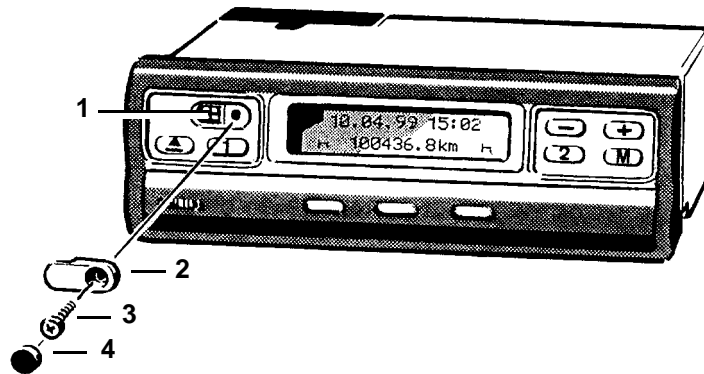


Fig. 5-23: MTCO 1324: Test/ programming interface

- 1 Insert the seal plate (2) into the test/ programming interface (1) and fix it with the screw (3).
- 2 Stamp the seal cap (4) and press it into the seal cup.
- 3 Check the seals on the KITAS sensor on the gearbox; seal the unit correctly if necessary.

Additional information

You will find information on sealing points and how to seal the tachograph system correctly in *Chapter 4.2.1 "MTCO 1324 sealing plan"*, from page 4-3.

5.10.3 Completing the test

To complete the tests for the test certificate:

- Fill in, attach and seal the installation label.
- Attach and seal the "k" label.
- Complete and file the test certificate.



Important

The additional entry on the test certificate relating to EA tachograph systems and the adjusted characteristic coefficient " w_{adjusted} " is no longer necessary.

Completing and attaching the installation label

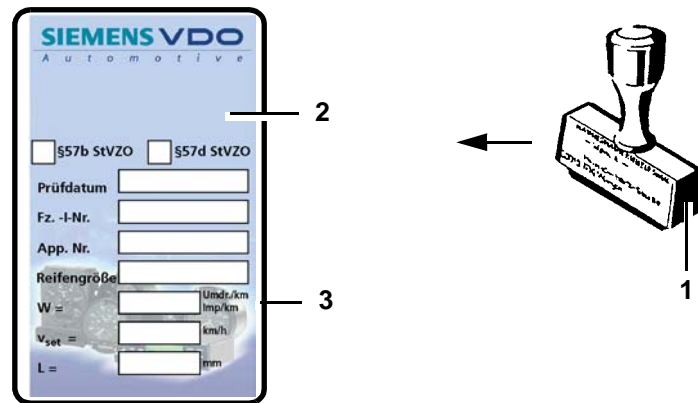


Fig. 5-24: Installation label with company logo and sealing foil

- 1** Company stamp **3** Sealing foil
2 Installation label

! Important

When checking the unit using a rolling road test computer (ATC) / rolling road test bench (ATS), the data is printed on the installation label.

- 1 Fill in the following data on the installation label:**
 - Test date
 - Last eight digits of the vehicle identification number
 - Tachograph number.
 - Size of tires
 - Characteristic coefficient "w" (imp/km)
 - Speed limit value " v_{set} " (if applicable)
 - Effective tyre circumference "L"
- 2 Stamp the installation label with the company stamp.**

If sealing foils with company logo are used, the installation label need not be stamped.
- 3 Stick the completed installation label on the vehicle.**

The position of the installation label depends on the vehicle type and the vehicle manufacturer. Generally, the installation label is attached to the A or B pillar.
- 4 Seal the installation label.**

After the installation label has been attached, use sealing foil to seal it.

Completing and attaching the constant label

Constant labels showing the speed constant "k" imp/km are attached to the tachograph systems.

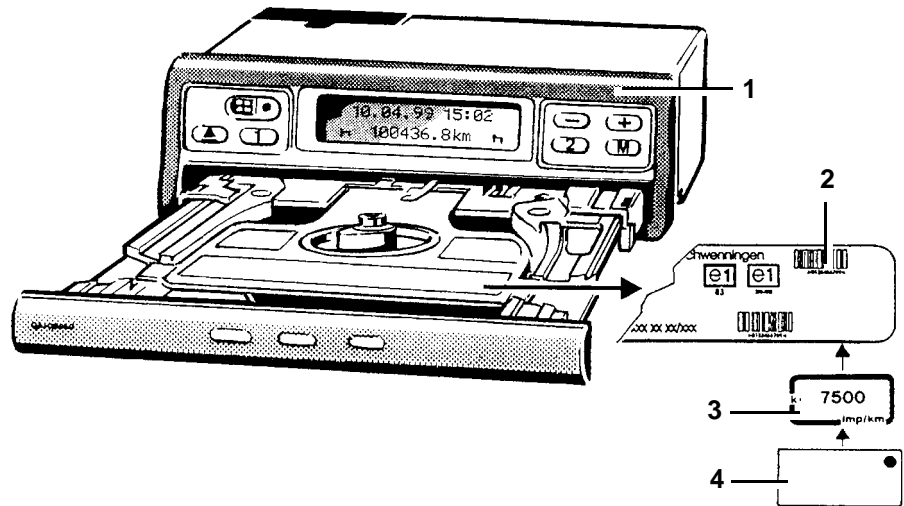


Fig. 5-25: Sealing the constant label

- | | |
|----------------------------|------------------------------|
| 1 MTCO 1324 with open tray | 3 Constant label |
| 2 Type plate | 4 Sealing foil for "k" label |

- 1 Enter the set tachograph constant "k" on the constant label and stick it on the type plate on the separating plate.
- 2 Seal the constant label with sealing foil.

Completing and filing the test certificate

A test chart must be drawn up for each check according to § 57b StVZO. The test certificate and the test chart prove that the check has been carried out correctly and in accordance with § 57b StVZO.

- 1 Check that the test certificate has been completed in full.
- 2 Stamp the test certificate using the company stamp and sign it.
- 3 Attach the test chart(s) to the test certificate and file the test certificate.
- 4 Enter the check on the test record.
- 5 Hand the vehicle over to the customer and inform the driver about any legal provisions or hand out an instruction manual (with new and replacement tachographs).

Chapter 6

Fault analysis

6.1 Error messages

The MTCO 1324 monitors the correct functioning of the system and displays errors/ malfunctions of system components or operating errors.

A message consists of:

- the error symbol on the MTCO 1324's display
- the error entry in the MTCO 1324's error log
- the warning LED lights on the indicator unit.

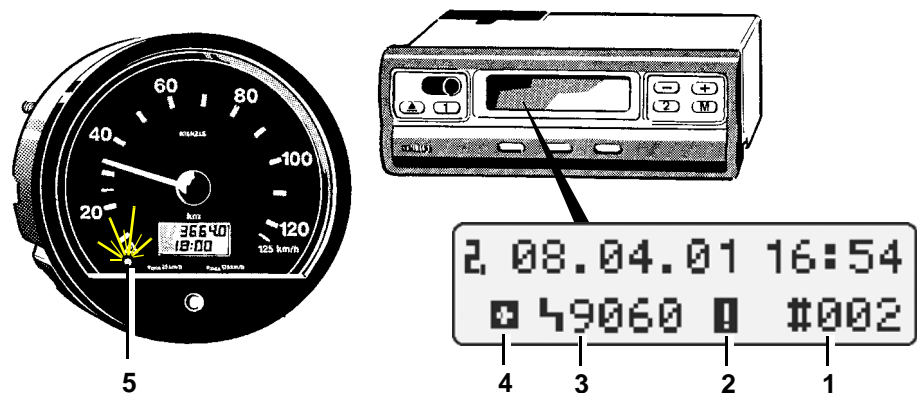


Fig. 6-1: Tachograph system error message, e.g. operating errors

- 1 Error frequency, i.e. how often did the error occur, max. 126 entries
- 2 "Error active" symbol
- 3 Error symbol and error code
- 4 "Further errors stored" symbol
- 5 Warning LED on the indicator unit lights up

Displaying the error memory

The entries in the error memory can be called up for further analysis by selecting the "Error Memory" menu. As well as the types of error the error memory also shows how often the error occurred. Additional information can be found in *Chapter 2.1.2 "Operation", section "Displaying the Error Memory (menu 2.)", page 2-17.*



Important

You can only clear the error memory using an SDS test unit, e.g. MTC/ATC. If the unit displays system or tachograph errors that cannot be corrected or deleted, the MTCO 1324 must be replaced.

6.2 Representation of error messages

Depending on the type of error, the MTCO 1324 displays different messages. The MTCO 1324 distinguishes between:

- messages that relate to a difference between the displayed time (system time) and the time set for the tachograph chart turntable (recording time)
- operating error message
- system error message.

Additional information

A description of the cause of the error, specific features and recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-11.

6.2.1 Message relating to a difference between the recording time and the system time

The time is flashing and the error symbol appears

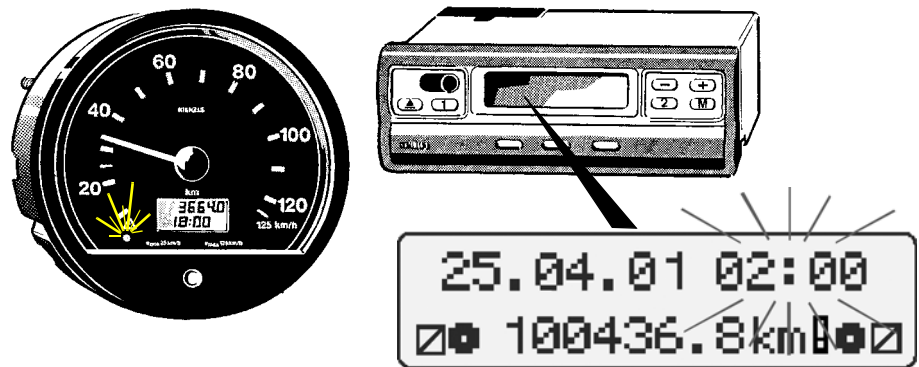


Fig. 6-2: Error message: Difference between the system time and the recording time of the tachograph chart

The MTCO 1324 indicates that:

- either the system time on the display and the tachograph chart's recording time differ.
Code 9053: Track the tachograph chart turntable.
- Or an error occurred when tracking the tachograph chart turntable to match the system time.
Code 9064: Error when tracking the tachograph chart turntable.

Cause

This error occurs if:

- the MTCO 1324 sets the beginning/ end of daylight saving time automatically
- the MTCO 1324's system time was reset (> 2 min) without tracking the tachograph chart turntable or
- after a voltage cut of more than 2 minutes.

Display

The message consists in detail of:

- the error symbol on the MTCO 1324's display
- the flashing system time on the display
- the warning LED lights on the E-Speedometer 1323 or indicator unit
- the entry in the error memory (Code 9064**only**)
- a status output on the CAN bus (tachograph systems with CAN bus **only**).



Important

So that the tachograph chart turntable is set to the current system time automatically:

- the vehicle must be stationary, i.e. no distance pulses are stored
- the ignition must be on
- the tray **without** tachograph charts must be closed.

Measure

■ Track the tachograph chart turntable:

- Turn the ignition on.
- Open the MTCO 1324's tray and remove the tachograph chart(s) if necessary
- Close the tray.

When the tray is closed the MTCO 1324 tracks the tachograph chart turntable automatically and adjusts it to the current system time.

The system time no longer flashes on the display and the error symbol disappears. Insert new tachograph charts, if necessary.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-11 for recommended measures for error correction.

The colon (clock) is not flashing and the error symbol appears

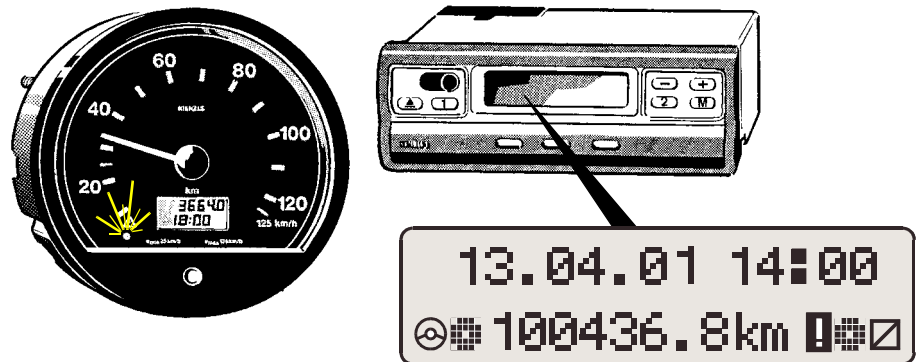


Fig. 6-3: Error message: Tachograph chart turntable drive malfunction

The MTCO 1324 indicates that the tachograph chart turntable drive is faulty and that the tachograph chart turntable is not turning (running control).

Code 9064: Tachograph chart turntable drive error

Cause

This error occurs when there is a malfunction in the MTCO 1324's tachograph chart turntable drive.

Display

The message consists in detail of:

- the error symbol on the MTCO 1324's display
- the non-flashing system time colon on the display
- the warning LED lights on the E-Speedometer 1323 or indicator unit
- the entry in the error memory
- a status output on the CAN bus (tachograph systems with CAN bus **only**).

Measure

- **Check whether the tachograph chart(s) is/are inserted correctly:**
 - Turn the ignition on.
 - Open the MTCO 1324 tray and check the position of the tachograph charts.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-11 for recommended measures for error correction.

6.2.2 Operating error messages

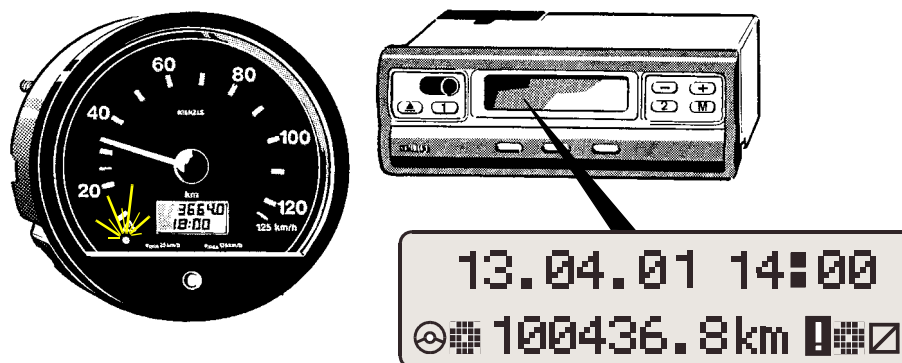


Fig. 6-4: Error message: Sample display for operating error messages

List of operating errors

Display messages	Code	Meaning	Remarks	
13.04.01 14:58 ⊙ 100436.8km ▯ ▯ ▯ ▯	A050	Journey without driver 1 tachograph chart	•	
13.04.01 14:58 ▯ 100436.8km ▯ ▯ ▯ ▯	9051	Driver 1 tachograph chart is missing	•	
13.04.01 14:58 ▯ ▯ 100436.8km ▯ ▯ ▯ ▯	9052	Driver 2 tachograph chart is missing	•	
13.04.01 14:28 ▯ ▯ 100436.8km ▯ ▯ ▯ ▯	9053	The system time was set while the tachograph chart was inserted or the MTCO 1324 has set the beginning/end of daylight saving time automatically		○
13.04.01 14:58 ⊙ ▯ 100436.8km ▯ ▯ ▯ ▯	900F	Key pressed too long (> 3 min.)		○

Table 6-1: Error list: Operating errors

Key

- **No entry** is added to the error memory.
- The error is stored in the error memory.

Code 9051 or Code 9052

The message relating to code 9051 or code 9052 appears as soon as the working time group is switched from rest period "▯" to passive working time "▯", for example, while no tachograph chart is inserted.

6.2.3 System/ tachograph error messages

Malfunctions (electronic/ mechanical) of the MTCO 1324 and of other system components and their connections are:

- automatically displayed whenever they occur or
- when closing the tray, the device indicates that errors have occurred or are about to.

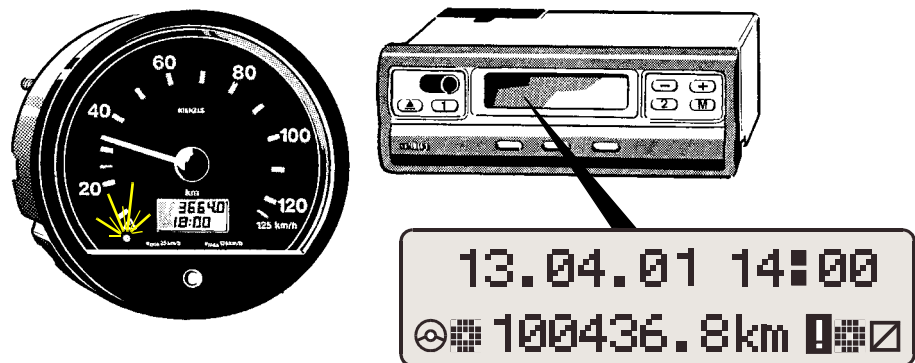


Fig. 6-5: Error message: Sample display of system/ tachograph error message

List of system/ tachograph errors

Display messages	Code	Meaning	Remarks	
	900A	Other errors with CAN transmission		
	900B	Error "CAN bus off"		
	900F	Keypad error: Key[s] jammed		
	9010	LCD error: Display defective or faulty		
	9060	Tray defective, e.g. tray does not open		
	9061	"v" system error	○	
	9062	Multi-stylus system (MFS) defective	○	
	9063	Stylus lifting system (SAS) defective	○	
	9064	Tachograph chart turntable drive faulty/ defective		
	9430	"v" pulse output error (B7)		



Display messages	Code	Meaning	Remarks	
	A00C	Electronic error, clock defective Internal error Operating system error: Program memory error		●
none	A400	Voltage cut	○	
	A411	Communication error between the MTCO 1324 and the indicator unit		
	A423	Sensor communication error	○	
	A822	Sensor key, serial number/ signal error	○	

Table 6-2: Error list: System/ tachograph errors

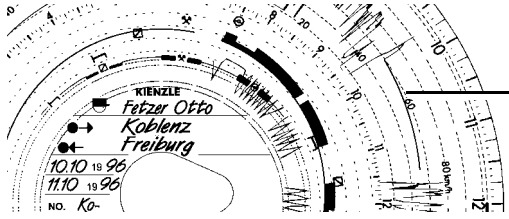
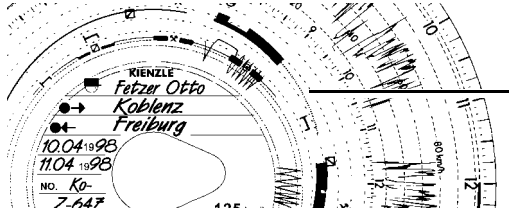
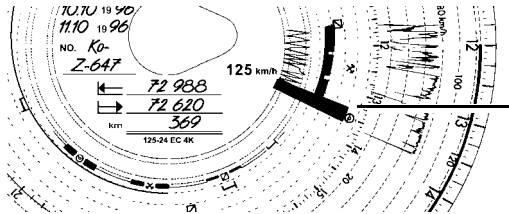
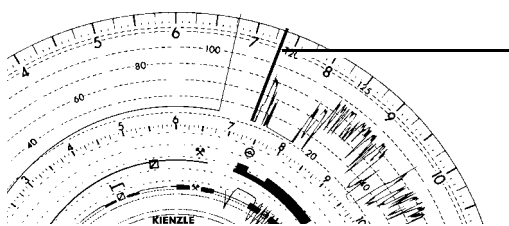
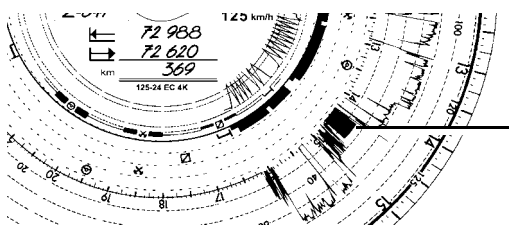
Key

- **No entry** is added to the error memory.
- These errors are also recorded on the tachograph chart (see *Chapter 6.3 "Recording system malfunctions"*, from page 6-9).

Additional information

Recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, page 6-11.

6.3 Recording system malfunctions

Code	Meaning/ Description	
Mechanical defects in the MTCO 1324		
9061	"v" system error, drive defective (1)	
9062	Multi-stylus system (MFS) defective, drive defective (2)	
9063	Stylus lifting system (SAS) defective (3)	
Voltage cut to the MTCO 1324		
A400	If power is restored, the device inscribes a thick trace (4) on the tachograph chart shortly after start off. Prerequisite: No operating error has been recorded, i.e. the driver 1 tachograph chart is inserted and the tray is closed.	
Sensor communication error on the MTCO 1324		
A423	No data signal: <ul style="list-style-type: none"> As soon as the vehicle is stationary this marking (5) is inscribed. When driving "v" is recorded again. 	

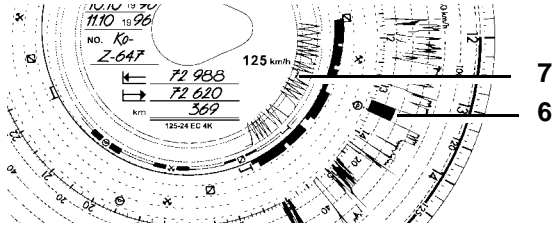
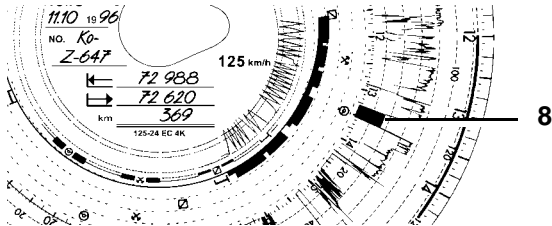
Code	Meaning/ Description	
A423	<p>No data signal and no real time signal:</p> <ul style="list-style-type: none"> This marking (6) is inscribed directly after the error occurred. At regular intervals a radial line (7) is recorded in the area reserved for distance travelled. The period of time set before the error occurred is recorded. <p>These error markings are recorded until the errors are corrected.</p>	 <p>The image shows a tachograph chart with a speed scale from 0 to 125 km/h. A horizontal line at 125 km/h is labeled '125 km/h'. A radial line is drawn from the center to the 125 km/h mark, labeled '7'. A horizontal line is drawn across the chart at the 125 km/h mark, labeled '6'. The chart also shows a date '11.10 19 96', a vehicle number 'NO. K0- Z-647', and a distance travelled '72 988 km' and '72 620 km' with a difference of '369 km'. The text '125-24 EC 4K' is visible at the bottom.</p>
A822	<p>No real time signal:</p> <ul style="list-style-type: none"> This marking (8) is inscribed directly after the error occurred; it is recorded until the error is corrected. The distance travelled is recorded constantly (derived from data signal). The period of time set before the error occurred is recorded. 	 <p>The image shows a tachograph chart similar to the one above, but with a horizontal line at 125 km/h labeled '8'. The chart also shows a date '11.10 19 96', a vehicle number 'NO. K0- Z-647', and a distance travelled '72 988 km' and '72 620 km' with a difference of '369 km'. The text '125-24 EC 4K' is visible at the bottom.</p>

Table 6-3: System malfunctions: Recordings on the tachograph chart

6.4 Error correction measures

The following table lists the recommended measures for error correction.

No error correction possible

If the error cannot be corrected, the MTCO 1324 is defective and must be replaced by an exchange tachograph.



Important

As long as the unit has not been released for repair, pilot units must not be repaired. Please do not try to repair the units. If the MTCO 1324 or the related system component are defective, they must be replaced completely.

Code	Meaning	Remedy (ies)
900A	Other errors with CAN transmission, e.g. no subscriber, no acknowledgement etc. When ignition is switched "on" the error is suppressed for approx. 10 seconds	Check BUS medium and plug and socket connections: Check the voltage supply to the CAN subscribers T. 15, 30, 31 <i>* The MTCO need not be the cause of the error.</i>
900B	Major malfunction on the CAN bus, possible causes: <ul style="list-style-type: none"> BUS medium malfunctions Physical layer malfunctions Log errors 	Check BUS medium and plug and socket connections: <ul style="list-style-type: none"> Voltage supply to the CAN subscribers T. 15, 30, 31 Wiring, connector assignment <i>* The MTCO need not be the cause of the error.</i>
900F	Keypad error: <ul style="list-style-type: none"> Key pressed too long or key[s] jammed 	<ul style="list-style-type: none"> Identify jammed key and try to remove the cause of the jamming. If the error cannot be remedied or repeats itself, replace the MTCO 1324.
9010	LCD error: Display defective or faulty	If the error message repeats itself replace the MTCO 1324.
9051	Driver 1 tachograph chart is missing	Insert the driver 1 tachograph chart or set the working time group to "1".
9052	Driver 2 tachograph chart is missing	Insert the driver 2 tachograph chart or set the working time group to "1".
9053	Difference between the system time and the tachograph chart's recording time > 2 minutes	Track the tachograph chart turntable.
9060	Tray does not open; possible causes: <ul style="list-style-type: none"> Tachograph chart(s) not inserted properly or damaged Jamming or motor does not start. 	Unlock the tray (wait until the chart is ejected): <ul style="list-style-type: none"> Open the tray and check the position of the tachograph chart(s). Insert new tachograph chart(s) if necessary. Check the dimensions of the radio compartment. The housing of the MTCO 1324 may be deformed so that the tray is jamming. Replace the MTCO 1324 if the error repeats itself (cannot be corrected) although the tachograph chart(s) is/are inserted properly and not damaged and the MTCO is fitted correctly.
9061	"V" system error, drive defective	Replace the MTCO 1324.

6 Fault analysis

Code	Meaning	Remedy (ies)
9062	Multi-stylus system (MFS) defective	Replace the MTCO 1324.
9063	Stylus lifting system (SAS) defective, e.g. drive, motor or driver defective.	<ul style="list-style-type: none"> Open the tray and check whether the inserted tachograph charts are damaged. <p>If the error repeats itself (cannot be remedied), replace the MTCO 1324.</p>
9064	Tracking error or tachograph chart turntable drive defective	<ul style="list-style-type: none"> Track the tachograph chart turntable (i.e. open the tray, remove the tachograph chart and close the tray again). <i>The MTCO 1324 tracks the tachograph chart turntable automatically and adjusts it to the current time.</i> <p>Replace the MTCO 1324 if the error repeats itself (cannot be corrected) although the tachograph chart(s) is/are inserted properly and not damaged.</p>
9430	<p>"v" pulse output B7 not working, possible causes:</p> <ul style="list-style-type: none"> MTCO 1324 defective Control unit connected to B7 defective Cable between MTCO and control unit defective 	<ul style="list-style-type: none"> Check the connections and cables between the MTCO 1324 and the control unit: - Short circuit on earth? - Short circuit on +U_B? <p>If the error repeats itself (cannot be remedied), replace the MTCO 1324 or the control unit.</p>
A00C	Internal error, e.g. no communication between the MTCO 1324 and internal components	If the error message repeats itself replace the MTCO 1324.
A050	Journey without tachograph chart, tachograph chart is missing	<ul style="list-style-type: none"> Insert the tachograph chart <p>or</p> <ul style="list-style-type: none"> check whether: <ul style="list-style-type: none"> the tray is closed the working time group for driver 1 is set to "H" while the vehicle is stationary; change the working time group if necessary. <p>If the error cannot be remedied, replace the MTCO 1324.</p>
A400	Voltage cut to MTCO 1324 or MTCO 1324 has detected low voltage	<p>Check the power supply:</p> <ul style="list-style-type: none"> Check the plug connection and cables. A connection in the power supply could also be loose (constant Plus, terminal 30). Check the voltage (T. 30) when starting the vehicle engine (are the voltage values within the specified range?, see <i>Chapter 2.1.4 "Interface specification"</i>, from page 2-23). <p>If the error cannot be remedied, replace the MTCO 1324.</p>

Code	Meaning	Remedy (ies)
A411	Error (disruption) in communication between the MTCO 1324 and the indicator unit	<p>Check the connection between the MTCO and the indicator unit (K-Line):</p> <ul style="list-style-type: none"> • Carry out a continuity check. • Check the plug connections and the connector assignment. • If necessary, replace the indicator unit. <p>If the error cannot be remedied, replace the MTCO 1324.</p>
A423	<p>Error communicating with the KITAS 2170:</p> <ul style="list-style-type: none"> • Communication on line "B4" faulty 	<ul style="list-style-type: none"> • Check recording on the tachograph chart (see <i>Table 6-3</i>, page 6-10 for explanations): <i>Constant or only sporadic recording errors (indicates a loose connection)</i> • Test the KITAS sensor cable for continuity. • Check the plug connections and the connector assignment. • Activate the KITAS sensor. <p>If the error repeats itself (cannot be remedied), replace the defective component.</p>
A822	<p>Error communicating with the KITAS 2170:</p> <ul style="list-style-type: none"> • KITAS sensor not activated • MTCO detects a faulty KITAS serial number/ key • Communication on line "B3" (real time signal) faulty • Unexpected generator reset (voltage drop in generator of > 100 ms) 	<ul style="list-style-type: none"> • Activate the KITAS sensor. • Check recording on the tachograph chart (see <i>Table 6-3</i>, page 6-10 for explanations): <i>Constant or only sporadic recording errors (indicates a loose connection)</i> • Test the KITAS sensor cable for continuity. • Check the plug connections and the connector assignment. • Check the voltage (T. 30) when starting the vehicle engine (are the voltage values within the specified range?). • Check the KITAS sensor. • Check the sensor input on the MTCO 1324. <p>If the error repeats itself (cannot be remedied), replace the defective component.</p>

Table 6-4: Error correction measures

Chapter 7

Maintenance/ minor repairs

7.1 Replacing the MTCO 1324 buffer battery

Depending on load, temperature, humidity etc., the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.



Important

From firmware version **04.xx** the buffer battery is integrated in the circuit board. The battery compartment is no longer necessary. **Only** authorised workshops that have been given authorisation to repair the MTCO 1324 are entitled to replace the buffer battery.

If no voltage is supplied to the unit and if the date and the clock stop, the MTCO 1324 **must** be replaced by a replacement MTCO.

Replacing the buffer battery on units with battery compartment



Important

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Detailed information and instructions on how to program "Date-Time" can be found in *Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time"*, from page 3-39

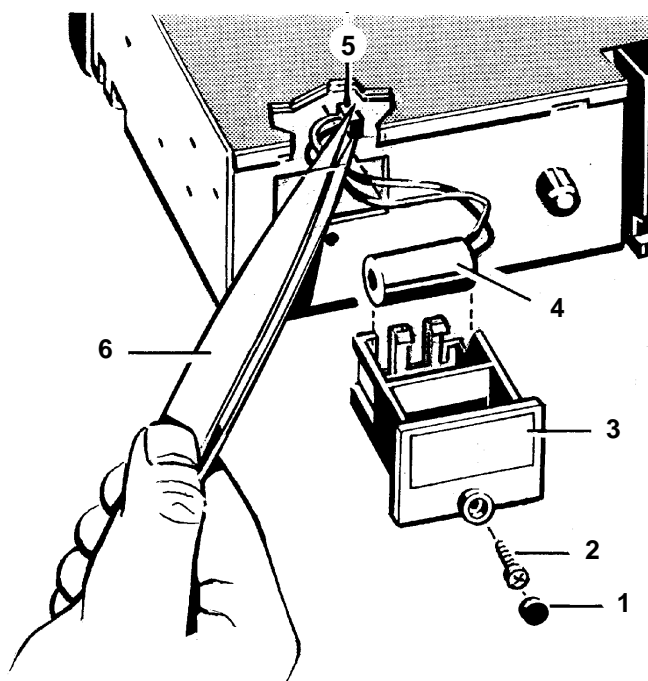


Fig. 7-1: MTCO 1324: Removing the buffer battery

- | | |
|-----------------------|--------------------|
| 1 Seal cap | 4 Battery |
| 2 Torx T9 screwdriver | 5 Connector |
| 3 Battery compartment | 6 Plastic tweezers |

1 Remove the seal cap (1) and unscrew the screw (2) underneath it.

2 Pull out the battery compartment (3).

When opening the battery compartment ensure that the battery lead does not get stuck.

3 Remove the lithium battery (4) from the holder.



Caution

Risk of short circuit!

To avoid system circuit board malfunctions caused by short circuits use plastic tweezers/ insulated tweezers.

4 Using the tweezers (6), carefully remove the connector (5) from its socket on the system circuit board.

5 Put a new lithium battery (4) into the socket.

6 Using the tweezers (6), carefully plug the connector (5) into its socket on the system circuit board.

7 Then slide the battery compartment (3) into the housing until it locks into place and fix it again using the screw (2).

When closing the battery compartment ensure that the battery lead does not get stuck.

8 Stamp the new seal cap (1) and press it into the seal cup.

9 Then slide the MTCO 1324 into the fitting/ radio compartment and adjust the time and date.

10 Finally check that the MTCO 1324 is working properly.

7.2 Minor repairs

Except for the minor repairs described herein, the components of the MTCO 1324 tachograph system must not be repaired.

General repair instructions



Important

The same general repair instructions as for older tachograph systems apply to the MTCO 1324 tachograph and its system components (indicator unit, sensor, cables).

7.2.1 Replacing the MTCO 1324 tray cover

Vehicle specific tray cover

The MTCO 1324 tray cover is vehicle specific. When replacing an MTCO 1324 the tray cover must therefore match the specific vehicle version.

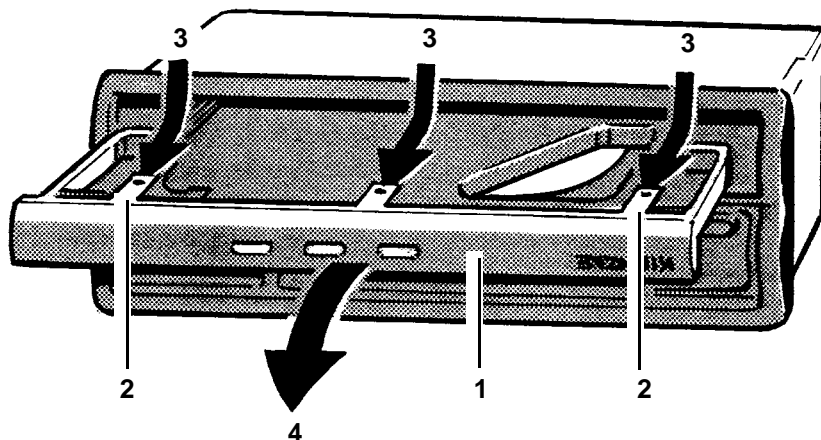


Fig. 7-2: MTCO 1324: Replacing the tray cover

- | | |
|--------------|----------------------------|
| 1 Tray cover | 3 Insert screw driver here |
| 2 Clips (3x) | 4 Direction of removal |

- 1 **Unlock the tray and pull it out approx. 4 cm.**
- 2 **Turn the MTCO 1324 so that the bottom faces up.**
Refer to Fig. 7-2 for positions of tray and MTCO.
- 3 **Slide the screw driver (width 1.5 mm) under the three clips (2) one after the other and lift the clips carefully.**
- 4 **Tilt the tray cover towards you as indicated by the arrow (4).**

Installation is done in reverse order of removal.

7.2.2 Retrofitting the tray stop to fold down tray units

From production no. **96669** the tray security function has been improved on MTCO 1324's with fold down tray.

Recommendation: Retrofit the tray stop

We recommend that you retrofit the tray stop to supplied units with fold down trays that do not feature a tray stop during the period check or when replacing the unit.

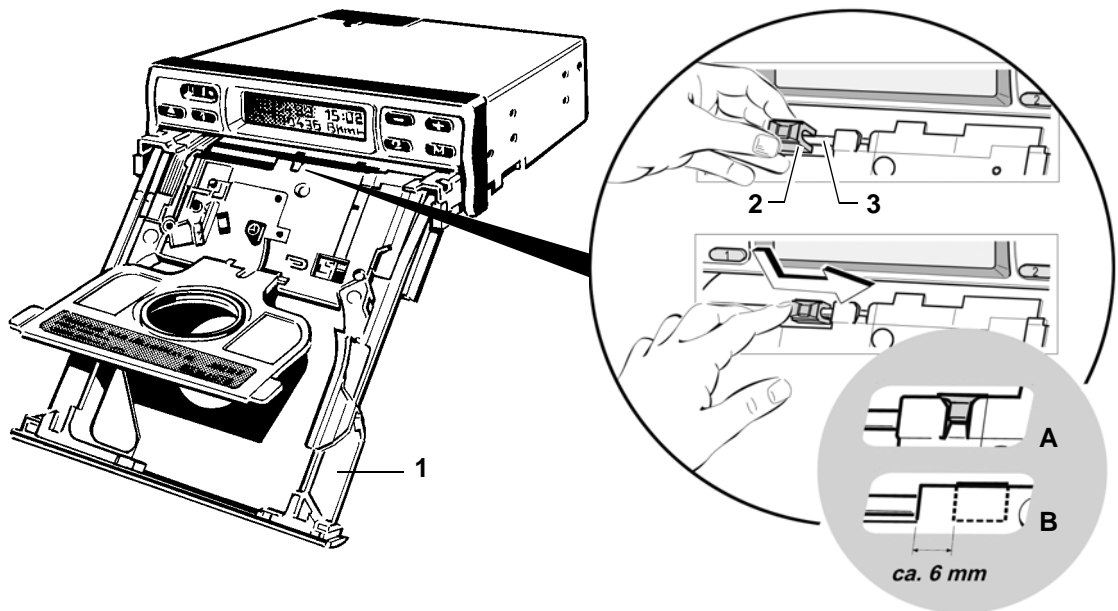


Fig. 7-3: MTCO 1324: Retrofitting the tray stop to unit variants with "fold down tray"

- | | |
|----------------------------|--------------|
| 1 MTCO with fold down tray | 3 Tray shaft |
| 2 Tray stop | |

! Important

On units with a copper spring this must be removed.

The removed copper spring must no longer be used.



- 1 Gently push the tray stop (2) onto the tray shaft (3).
- 2 Then push the tray stop (2) to the right:
 - under the reinforcement recess; variant A or
 - approx. 6 mm under the reinforcement; variant B.

! Important

The tray stop can also be retrofitted when the MTCO 1324 is installed.

7.2.3 Replacing the MTCO 1324 front cover



Condition

A defective or broken front cover can only be replaced if the MTCO 1324 does not have any other defects.

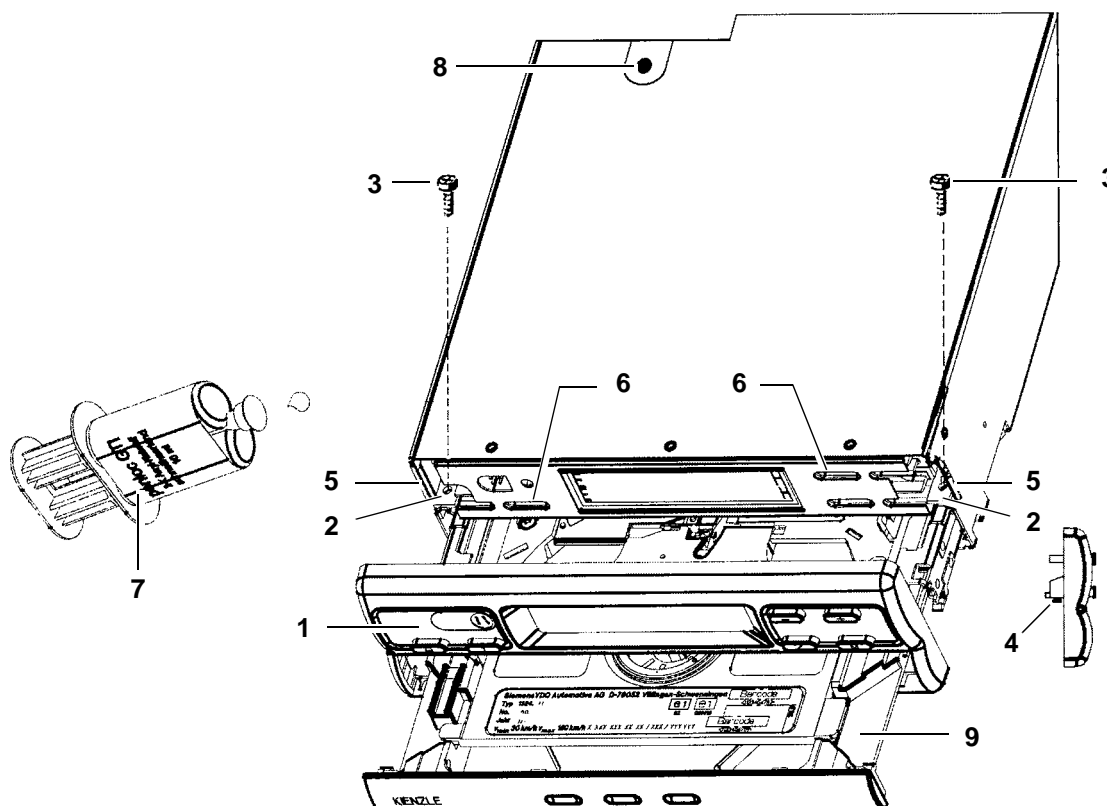


Fig. 7-4: MTCO 1324: Replacing the front cover

- | | |
|-------------------------------------------|--------------------------|
| 1 Front cover | 6 Contact opening (keys) |
| 2 Bore hole (outsert circuit board) | 7 Penloc adhesive |
| 3 Screws (Torx 8) | 8 Housing cover seal |
| 4 Brass lugs (front cover) | 9 Tray (unlocked) |
| 5 Housing areas where adhesive is applied | |



Important

The front of the MTCO 1324 is vehicle specific. When selecting a front cover, therefore, note the tray keys and seal version.

A front cover with seal must be fitted to units that do not have a seal fitted to the outsert circuit board. For all other units use a front cover without seal.



Caution

Only authorised workshops that have been given authorisation to repair the MTCO 1324 are entitled to remove the unit's housing cover seal (8).

So that the MTCO 1324 front cover can be replaced without having to remove the housing cover seal (**8, Fig. 7-4**) snap in and adhesive replacement front covers have been introduced for use by Siemens VDO partners.

An overview of replacement front covers and their order numbers can be found in Section 6 "Appendix" *Table 3-2*, page 3-3.

- 1 **First open the MTCO 1324's tray and pull it out approx. 5 cm.**
- 2 **Then remove the MTCO 1324 from the radio compartment and disconnect the plugs.**
Refer to *Chapter 3.6.3 "Removal instructions"* from page 3-17.
- 3 **Hold the MTCO 1324 down at an angle and carefully remove the broken front cover (1) by pulling it towards you.**



Important

When replacing the front cover make sure that

- no foreign bodies or parts of the front cover get into the unit
- the key contacts on the back of the front cover do not get dirty.

- 4 **Undo the screws (3) completely using a screw driver (Torx 8) and remove any existing front cover parts.**
- 5 **Apply a thin layer of Penloc adhesive (7) to the corresponding housing areas (5).**
- 6 **Slide the new front cover over the open tray (9) so that:**
 - the key contacts go into the existing contact openings (6) and
 - the brass lugs (4) slip over the outsert circuit board.
- 7 **Then firmly press the front cover onto the housing until the brass lugs (4) lock into the bore holes (2) in the outsert circuit board.**
After approx. 4-5 minutes the Penloc adhesive is solid.
- 8 **Install the MTCO 1324 again properly.**
Refer to *Chapter 3.6.4 "Installation instructions"*, from page 3-20.
- 9 **Then delete all active error entries from the error memory.**
Refer to *Chapter 3.8.4 "Programming the MTCO 1324"*, section *"Clearing the error memory"* from page 3-44.
- 10 **Finally check the MTCO according to the legal and country-specific regulations as described in Chapter 5 "Test instructions".**

7.2.4 Replacing the MTCO 1324 type plate

When reprogramming the MTCO 1324's product number (product code), the type plate must be replaced. The product number on the circuit diagram must also be updated.

New type plate

When the MTCO 1324 is reprogrammed label the correct type plate using a typewriter or a permanent black pen (e. g. "Staedler Lymocolor 313").



Important

When labelling the new type plate make sure that:

- all data is correct and entered legibly into the relevant white fields
- the type plate and the MTCO variant match.

Type plates

Type plate	Tachograph variant
	EC Tachograph without RPM Approval e1-83
	EC Tachograph ADR without RPM Approval e1-83
	EC Tachograph with RPM Approval e1-85
	EC Tachograph ADR with RPM Approval e1-85

Table 7-1: MTCO 1324: Overview of type plates

Example

In the following example the "v" measuring range (speed display) of the replacement tachograph is changed from 125 km/h to 140 km/h.

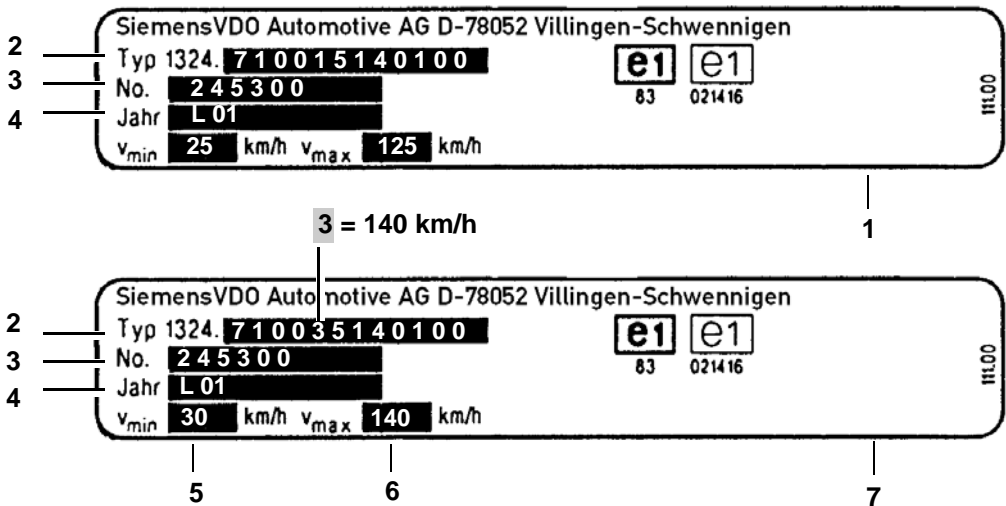


Fig. 7-5: MTCO product number: Labelling new type plate

- | | | | |
|---|---------------------|---|-------------------------------|
| 1 | Original type plate | 5 | "v" measuring range v_{min} |
| 2 | Product number | 6 | "v" measuring range v_{max} |
| 3 | Serial number | 7 | New type plate |
| 4 | Year of manufacture | | |

Measuring range
for speed display
1324-xxxxXxxxxxxx

Measuring range	v_{min} [km/h]	v_{max} [km/h]
2 = 100 km/h	20	100
1 = 125 km/h	25	125
3 = 140 km/h	30	140
4 = -- km/h	--	--
5 = 180 km/h	30	180

Table 7-2: Measuring range table, speed display with v_{min} and v_{max}

- 1 Enter the new product number (2).
- 2 Copy the serial number (3) and the year of manufacture (4).
- 3 Refer to the table and copy the new measuring range speed values for " v_{min} " (5) und " v_{max} " (6).
- 4 Remove the original type plate.
- 5 Stick the new labelled type plate (6) into the space provided on the separating plate.

For the correct position refer to Chapter 2.1.1 "Product description", Fig. 2-1, page 2-4.

Changing circuit diagram data

As the product number has been reprogrammed, the product number and the speed measuring range must be changed on the circuit diagram.

! Important

Any modifications of the product number and the speed measuring range must match the reprogrammed values and the information on the type plate.

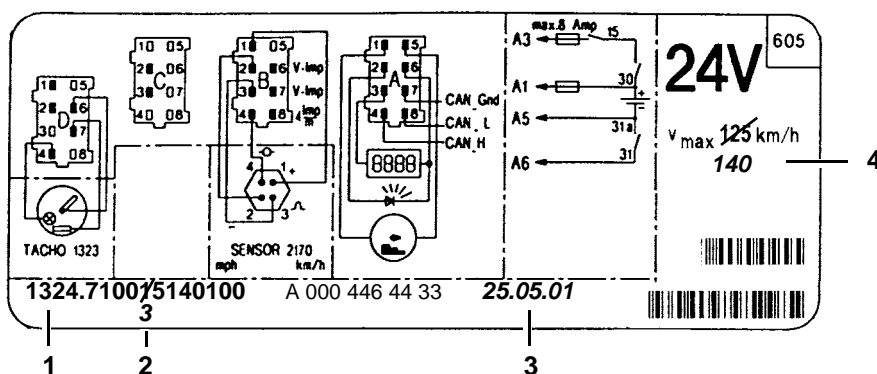


Fig. 7-6: MTCO product number: Changes to the circuit diagram

- | | | | |
|---|-------------------------|---|---------------------------------|
| 1 | Original product number | 3 | Date when modification was made |
| 2 | Modification | 4 | New "v" measuring range |
- 1 Delete the modified digit (2) of the product number (1) and enter the new value underneath.
 - 2 Change the "v" measuring range (4):
 - Delete the old value
 - Enter the new value underneath.
 - 3 Enter the date when the circuit diagram was modified (4).

Chapter 8

Special equipment

8.1 Tachograph system with current limiter (STB)

8.1.1 Vehicle used for the carriage of hazardous goods

Special laws, regulations and standards have to be observed for vehicles used for the carriage of hazardous goods:

EC specific

- ADR Marginal 220000-220990 (220511, 220514 Appendix B in particular)
- EN 50014 provisions
- EN 50020 provisions
- EC Directive 94/9/EC
- EC Directive 94/53/EC
- EC Directive 98/91/EC
- Regulation (EEC) No. 3821/85

Country specific

- GGVS (Regulation on the Carriage of Hazardous Goods by Road)
- VDE provisions, VDE 0170 and 0171 in particular.

GGVS marking

Vehicles used for the carriage of hazardous goods require special approval and must be marked accordingly.

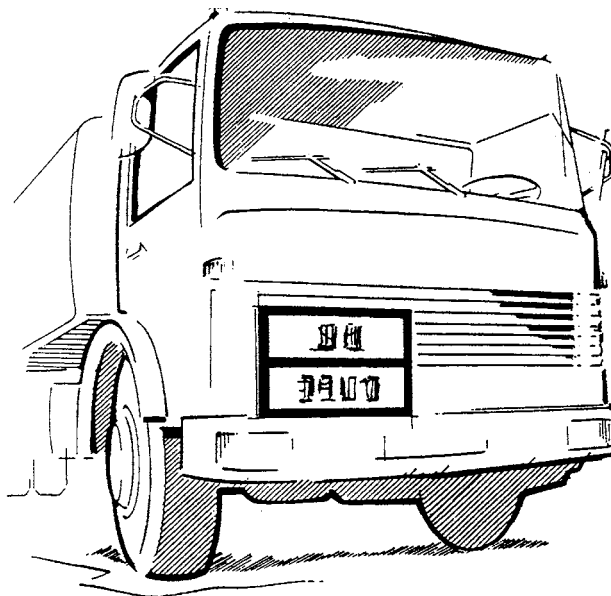


Fig. 8-1: Vehicle with GGVS marking

Intrinsically safe electrical circuit with STB

Vehicles used for the carriage of hazardous good must be equipped with a battery disconnection switch which interrupts all the electrical circuits, except for the EC Tachograph's electrical circuit.

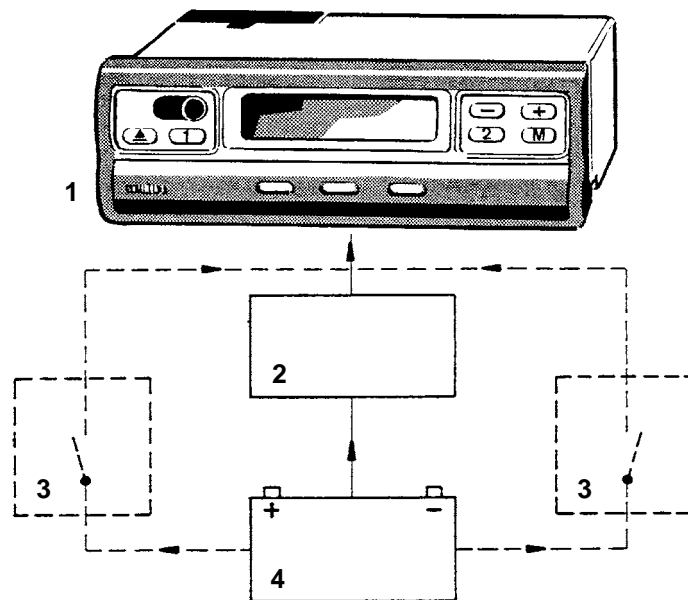


Fig. 8-3: *Intrinsically safe electrical circuit in ADR/ STB tachograph systems (diagram)*

- | | |
|-------------------------|--------------------------------|
| 1 EC Tachograph | 3 Battery disconnection switch |
| 2 Current limiter (STB) | 4 Vehicle battery |

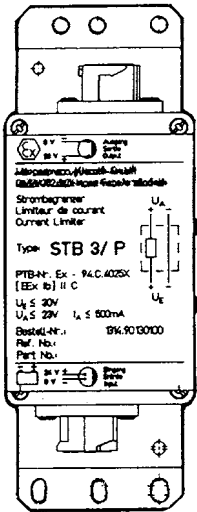
Intrinsically safe electrical circuit requirements

The intrinsically safe electrical circuit in STB tachograph systems must meet the following requirements:

- Constantly live electrical circuits must be intrinsically safe according to EN 50014 and EN 50020.
- Additional units or loads must not be connected to the intrinsically safe electrical circuit.
- The leads used must be protected by a seamless and corrosion-proof sheath.
- When using flat plugs the receptacles must have lugs to avoid severing the cable connections.
- All screw connections must be fixed with tooth lock washers.

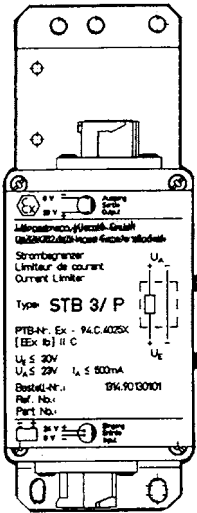
8.1.2 STB product overview

Vehicle-specific STB variants



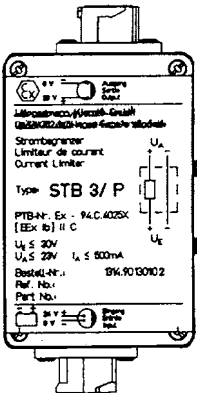
STB type: **STB 3/P**
Operating voltage: 24 V
Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
Type of protection: IP 54
Installed depth: 40.5 mm

Order number: **1314-90130100**



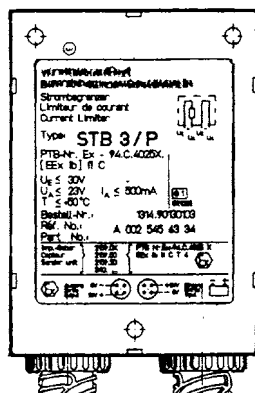
STB type: **STB 3/P**
Operating voltage: 24 V
Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
Type of protection: IP 66
Installed depth: 58 mm

Order number: **1314-90130101**

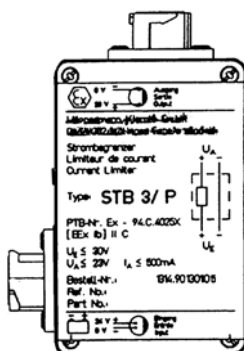


STB type: **STB 3/P**
Operating voltage: 24 V
Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
Type of protection: IP 66
Installed depth: 58 mm

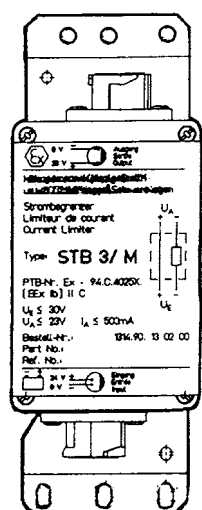
Order number: **1314-90130102**



STB type: **STB 3/P**
 Operating voltage: 24 V
 Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
 Type of protection: IP 66
 Installed depth: 58 mm
 Order number: **1314-9010103**



STB type: **STB 3/P**
 Operating voltage: 24 V
 Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
 Type of protection: IP 66
 Installed depth: 58 mm
 Order number: **1314-90130105**



STB type: **STB 3/M**
 Operating voltage: 24 V
 Short circuit current: $I_{k \max.} \leq 500 \text{ mA}$
 Type of protection: IP 66
 Installed depth: 58 mm
 Order number: **1314-90130200**

8.1.3 STB installation instructions



Important

When fitting a ADR/ STB tachograph system version make sure that:

- the STB is fitted close to the vehicle's battery (e.g. in the battery box) to ensure that the electrical circuit is intrinsically safe
- all tachograph system electrical cables outside the driver's cab are protected by seamless and corrosion-proof sheaths.

Recommendation: Corrugated hose

We recommend that you use a corrugated hose as a corrosion-proof sheath outside the driver's cab (you will find the order number on the microfiche).

Making the intrinsically safe electrical circuit

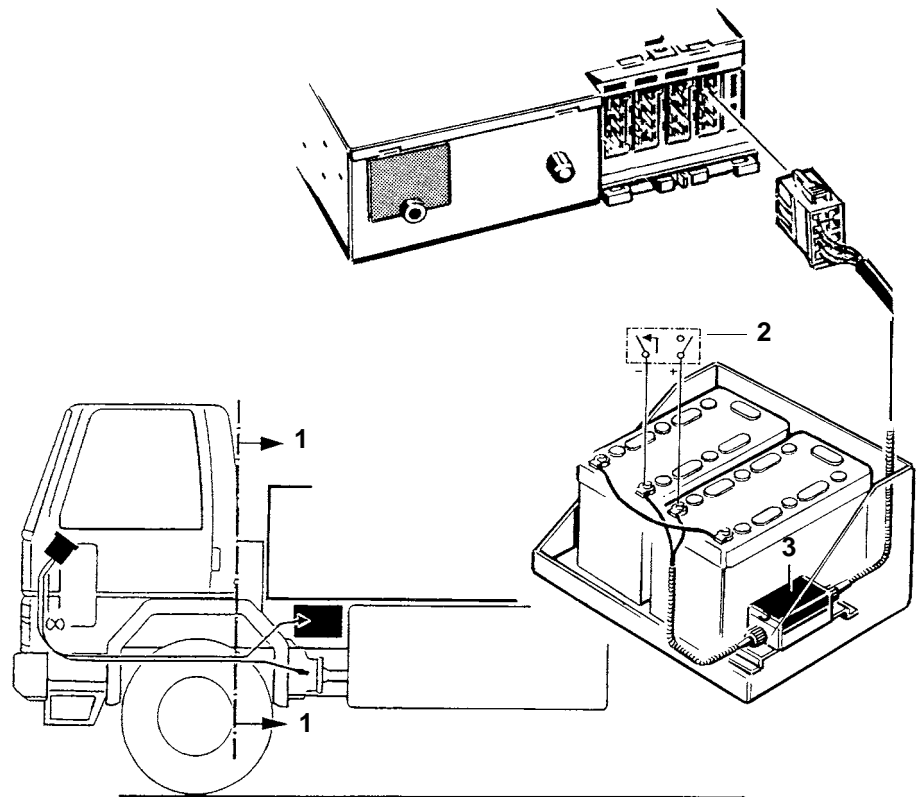


Fig. 8-4: Installing the current limiter in ADR vehicles (diagram)

- | | |
|--------------------------------|-------------------------|
| 1 Hazardous area | 3 Current limiter (STB) |
| 2 Battery disconnection switch | |

STB connection diagram

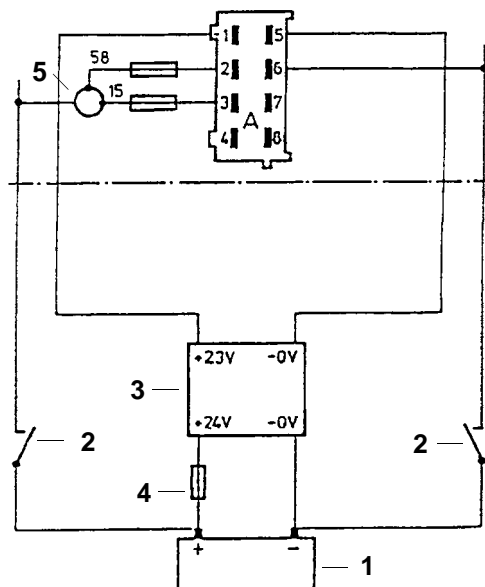


Fig. 8-5: Tachograph system 1324 with STB – connection diagram

- | | |
|--------------------------------|-------------------|
| 1 Vehicle battery | 4 5 AT fuse |
| 2 Battery disconnection switch | 5 Ignition switch |
| 3 Current limiter | |

8.1.4 Checking the STB

The following figure shows how to connect the MTCO and the position of the test units for checking the ADR/ STB tachograph system 1324 version.

Permissible tolerance

All the actual values determined for the intrinsically safe electrical circuit must not exceed the target values stated by more than $\pm 10\%$.



Important

The multimeter must comply with accuracy class 1.5 and have a minimum internal resistance of $30\text{ k}\Omega/\text{V}$.

- 1 Open the battery disconnection switch (2).
- 2 Open the separation point (6), depending on the STB (3) connection type.
- 3 Connect the multimeter as shown and measure the current, resistance and voltage. Observe the measuring range settings on the multimeter.

a. I_0, U_0 are the standby mode target values
 I_B, U_B are the operation mode target values

1	Vehicle battery	6	Tachograph system separation point
2	Battery disconnection switch	7	Multimeter (amperes)
3	Current limiter	8	Multimeter (amperes)
4	1 AT fuse	9	Multimeter (volts)
5	Ignition switch		

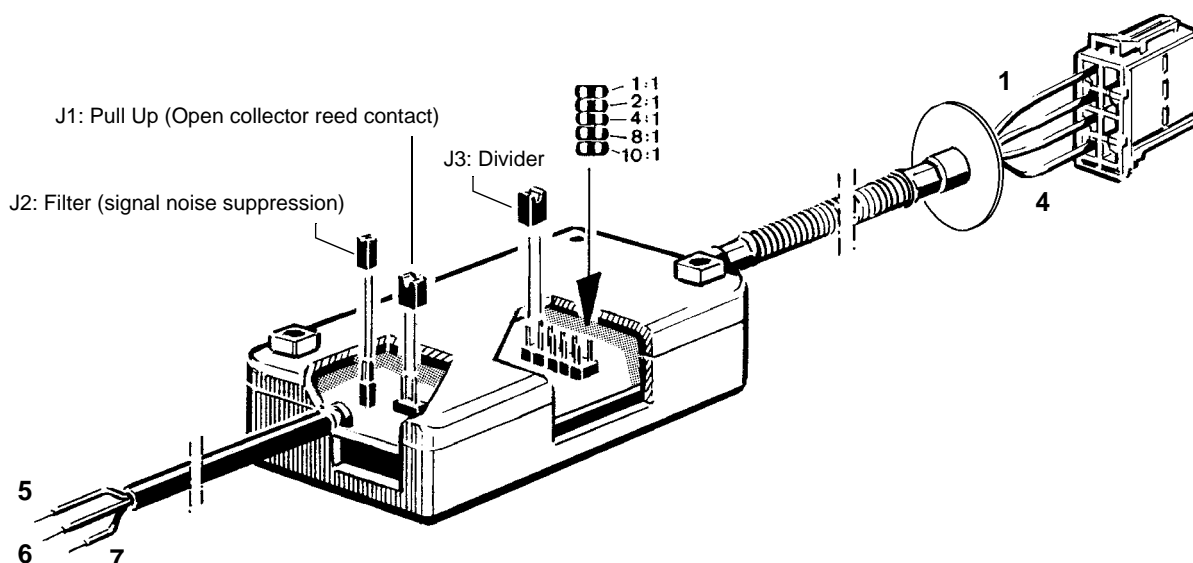
8.2 Pulse shaper X10-415-000-013 (for MTCO 1324)

The pulse shaper can be installed into vehicles with mandatory equipment (vehicle classes M/N1 only) if a KITAS 2170/ 2171 cannot be fitted.

! Important

When the pulse shaper is installed in the vehicle the unit and the MTCO 1324 must be adjusted to each other. As is usual with the KITAS sensor the units are adjusted by selecting the "Activate KITAS" menu item when programming the unit using an MTC/ ATC (see Chapter 3.8.2 "Activating KITAS 2170/ 2171", page 3-28).

Technical data



Pulse shaper X10-415000013

Operating voltage: 8 V

Current consumption: 10 mA

Input voltage: $U_L = <2 \text{ V}$ $U_H > 6 \text{ V}$

Signal shape: sinus./

Output voltage: $U_L = \leq 0.8 \text{ V}$ $U_H \geq 5.2 \text{ V}$

Signal shape:

Pulse outputs: Real time and data signal

Operating temperature: -30 to $+80 \text{ }^\circ\text{C}$

Type of protection (IEC 529): IP 30

Dimensions: L x W x H
100 x 50 x 30 mm

Signal input:

Generator frequency max. 6 kHz

Connector assignment:

1 black	Voltage 8 V
2 brown	Earth
3 blue	"v" signal
4 white	Data signal
5 brown	Earth
6 white	Signal E low sinus. $>300 \text{ mV}$
7 blue	Signal E high sinus. $>2 \text{ V}$
	$>6 \text{ V}$

Factory setting:

- J1: open (Pull Up not active)
- J2: closed (filter active)
- J3: closed on 1 : 1 (divider)

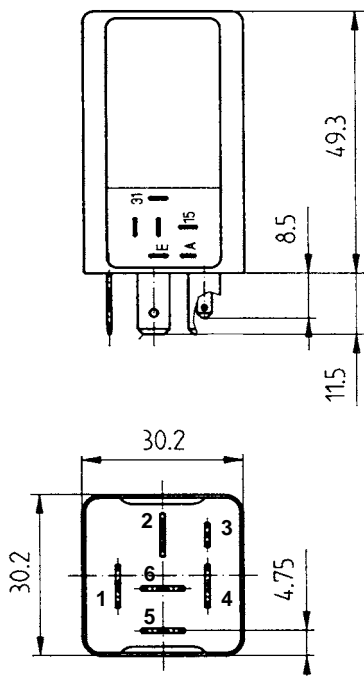
General:

- J1: closed (for Open Collector/Reed contact)
- J2: open (filter not active)

8.3 Pulse memory 2154-xx000000

Using a pulse memory, the tachograph can detect and record transactions of very short duration (e.g. siren, blue flashing light etc.).

Technical data



Pulse memory 2154-xx000000

Operating voltage: 10.5 ... 30 V

Current consumption: $I_0 = 0 \text{ mA}$ $I_B = 12 \text{ mA (30 V)}$

Input voltage: 10 ... 30 V

Output voltage: $U_A > U_B - 3 \text{ V}$

Output current: $I_A < 0.75 \text{ A}$

Dimensions:

L	W	H
31 mm	31 mm	50 mm

EMC:

Intensity IV DIN 40839 T1, T2 / ISO 7637 T2, T3

Strip width DIN 40839 T4: 100 V/m at 80 % AM

Connector assignment:

1 - Input	Earth (terminal 31)
2 - Input	Voltage 10.5 ... 30 V (Terminal 15)
3 - Output	Pulse
4 - Input	Pulse
5 - not used	
6 - not used	

Connection diagram

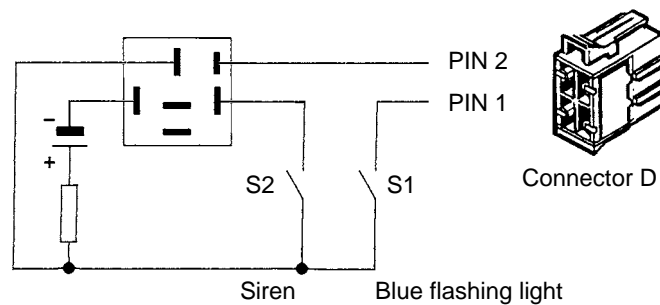


Fig. 8-7: Pulse memory 2154-xx000000 connection diagram

Chapter 9

MTCO 1324 without NFU

9.1 Product description

The dimensions of the Modular Tachograph (MTCO) 1324 without tracked clock (NFU) correspond to the dimensions prescribed for DIN/ ISO 7736 radio compartments. Thus, the MTCO 1324 can be integrated into the dashboard of modern commercial vehicles.



Important

This chapter supplements the "MTCO 1324" manual and describes the MTCO 1324 without NFU which can be identified by the running control (8, Fig. 9-1) on the tray. As the unit is operated in the same way as the MTCO 1324 with NFU, this chapter only details any distinguishing characteristics.

Variants

The MTCO 1324 variants without NFU can be differentiated by their operating voltage, final measuring range value, interfaces, additional equipment etc. and tray type:

- **Rigid tray** and mounting frame for installation into the in-dash radio compartment
- **Fold down tray** and mounting frame for installation into a storage box, e.g. above the sun visor.

Auto-diagnosis function

The MTCO 1324 tachograph carries out a constant auto-diagnosis to check for:

- voltage breaks
- defects in the KITAS sensor and its cable
- communication errors between the MTCO and the indicator unit
- **system errors** and
- **operating errors.**



Important

The auto-diagnosis function is only performed when the ignition is on.

Recording malfunctions

When the MTCO 1324 detects an operating error or a malfunction, it does not distinguish between operating errors, malfunctions or warning messages. Regardless of the cause of the fault, the MTCO always:

- adds an entry to the event or error protocols
- indicates the error/malfunction on MTCO 1324's display
- triggers the warning LED on the indicator unit.

Depending on the error type, the error/malfunction is also recorded on the driver 1 tachograph chart.

Additional information

Detailed information on error messages as well as recommended measures for error correction can be found in *Chapter 9.5 "Error messages"*, from page 9-21 and in *Chapter 6.4 "Error correction measures"*, from page 6-11 respectively.

Tachograph description

Front of MTCO 1324 with rigid tray

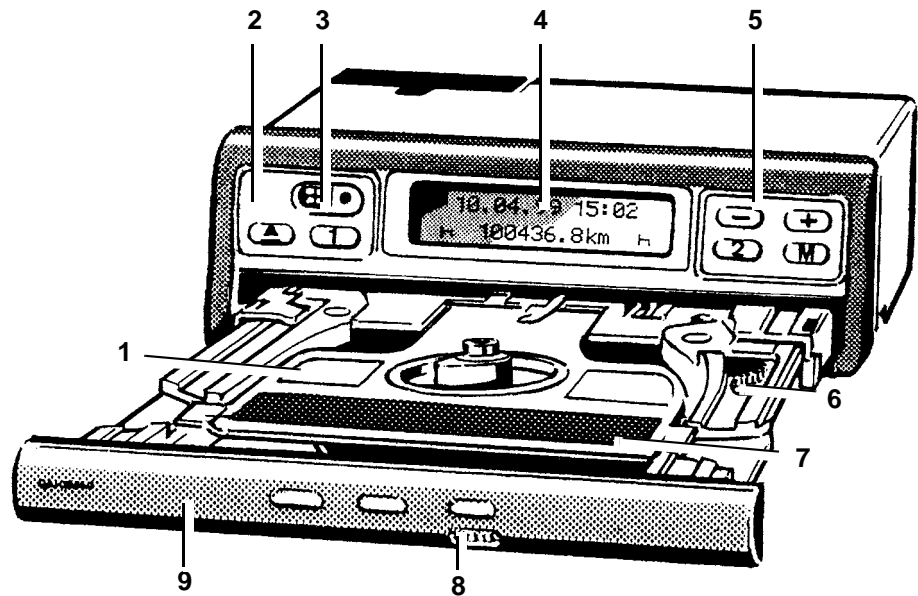


Fig. 9-1: MTCO 1324 w/o NFU: Front of unit with rigid tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Left keypad:
 - Key **1** selects the working time group for driver 1
 - Key **+** unlocks the tachograph chart tray
- 3 Seal plate: protects the test/ programming interface
- 4 Display: illuminated when ignition is on
- 5 Right keypad:
 - Key **2** selects the working time group for driver 2
 - Key **+** selects the next menu item
 - Key **-** selects the previous menu item
 - Key **M** selects the desired menu item
- 6 Setting wheel for tachograph chart turntable clock
- 7 Type plate on the separating plate



- (a) Manufacturer
- (b) Device type
- (c) Serial number
- (d) Speed measuring range
- (e) EC Tachograph approval signs e1-83 or e1-85 with "n" recording
- (f) EMC approval sign
- (g) Third party item number
- 8 Clockwork running control
- 9 Rigid tray/ tachograph chart turntable

Front of MTCO 1324
with fold down tray

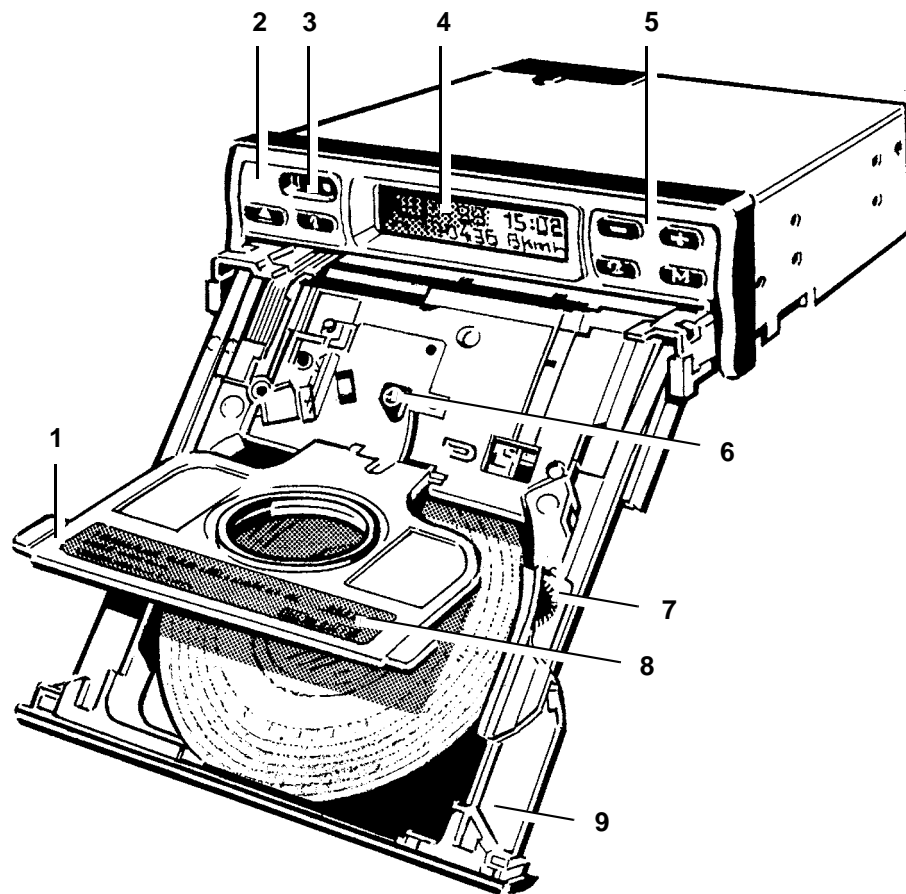








Fig. 9-2: MTCO 1324 w/o NFU: Front of unit with fold down tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Left keypad:
 - Key  selects the working time group for driver 1
 - Key  unlocks the tachograph chart tray
- 3 Seal plate: protects the test/ programming interface
- 4 Display: illuminated when ignition is on
- 5 Right keypad:
 - Key  selects the working time group for driver 2
 - Key  selects the next menu item
 - Key  selects the previous menu item
 - Key  selects the desired menu item
- 6 Time marking for driver 1 tachograph chart
- 7 Setting wheel for tachograph chart turntable clock
- 8 Type plate on the separating plate
- 9 Fold down tray/ tachograph chart turntable

Back of unit

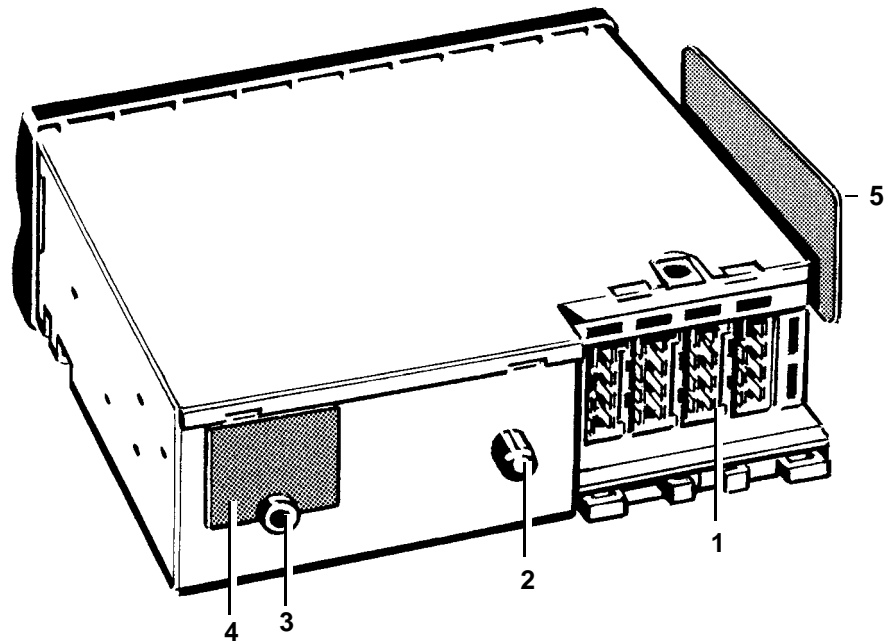


Fig. 9-3: MTCO 1324 w/o NFU: Back of unit

- | | |
|------------------------------------|----------------------------------------------------------------------------|
| 1 Connector sockets A, B, C and D | 4 Battery compartment |
| 2 Fixing screw (radio compartment) | 5 Circuit diagram with voltage indication, serial no., device type (label) |
| 3 Sealing | |



Important

Depending on load, temperature etc., the life of the battery which supplies the clock module (system time) and buffers the "date, time and switchover settings for beginning/ end of daylight saving time" cannot be specified precisely.

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Additional information

Detailed information on how to replace the battery can be found in *Chapter 9.6 "Replacing the buffer battery on the MTCO without NFU"*, page 9-25.

Display



Important

The ignition must be on to display information on the MTCO 1324 display.

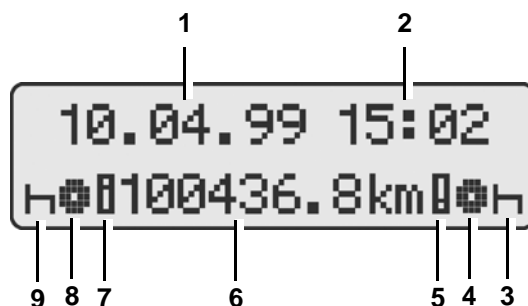
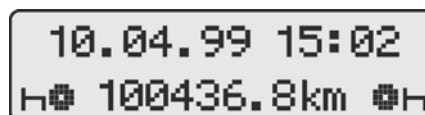


Fig. 9-4: MTCO 1324 w/o NFU: Display (General)

- 1 Date
- 2 System time
- 3 Driver 2 time group symbol
- 4 "Tachograph chart inserted" (driver 2) symbol
- 5 "Error active" symbol
- 6 Total odometer reading
- 7 "Test and programming interface active" symbol
- 8 "Tachograph chart inserted" (driver 1) symbol
- 9 Driver 1 time group symbol

Basic display

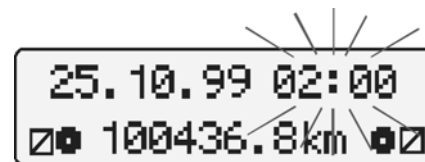
If no messages are stored, the basic display is displayed. Driver 1 and driver 2 tachograph charts are inserted.



Daylight saving time switchover:

Flashing time display

The MTCO 1324 sets the beginning and the end of daylight saving automatically. The flashing time display tells the driver that the tachograph charts must be set to the current time.



Important

Generally, the flashing time display disappears and the error symbol is reset when the tray is closed, regardless of whether the tachograph chart turntable was adjusted to the current time or not.

Ejecting

A progress bar tells the driver how much time has elapsed before the tray is unlocked.



Operating error message

- Driver 1 tachograph chart is missing, left "driver" symbol
- Driver 2 tachograph chart is missing, right "driver" symbol



System or tachograph error messages



Additional information

Detailed information on error messages can be found in *Chapter 9.5 "Error messages"*, from page 9-21.

9.2 Operation

The following paragraph describes the MTCO 1324 operating functions:

- Inserting and removing tachograph charts
- Menu functions.

Additional information

Descriptions on how to set the time groups, driver change etc. can be found in the *separate MTCO 1324 Operating Manual*.

9.2.1 Inserting and removing tachograph charts

The rules governing the use of tachograph charts are the same for all tachograph types and also apply to the MTCO 1324. Detailed information on tachograph charts, the assignment of tachograph charts etc. can be found in *Chapter 2.5 "Tachograph charts", from page 2-52*.



Condition

The tachograph charts can only be inserted and removed if:

- the vehicle is stationary, i.e. no distance pulses are stored and
- the ignition is turned on.

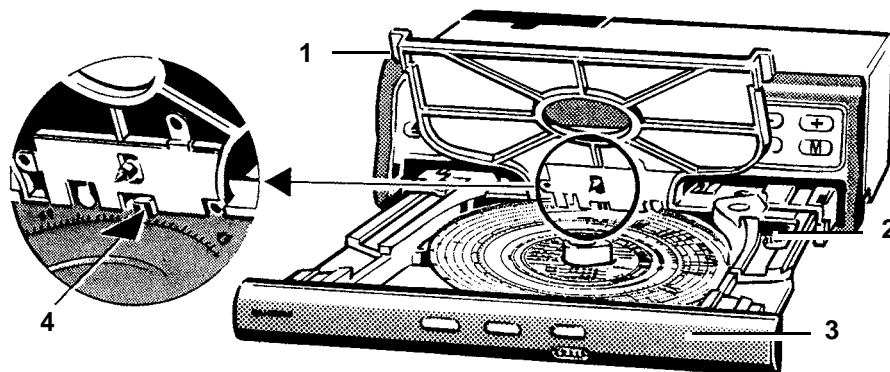


Fig. 9-5: MTCO 1324 w/o NFU: Open with rigid tray

- 1 Separating plate:
 - Tachograph chart for driver 2 is placed under the separating plate
 - Tachograph chart for driver 1 is put onto the separating plate
- 2 Setting wheel for tachograph chart turntable time
- 3 Tray/ tachograph chart turntable
- 4 Driver 2 time marking

Inserting tachograph chart(s)



Important

The tachograph charts used must not be damaged. Curled, wrinkled or torn tachograph charts may cause malfunctions.

When inserting the tachograph chart(s) make sure the chart(s) is/are placed under the retaining clip.

- 1 **Insert the labelled tachograph chart(s) into the open tray, with the labelled side face up.**

The tachograph chart for driver 1 must be placed on the separating plate, the tachograph chart for driver 2 is put under the separating plate. When inserting the tachograph chart make sure you insert the tachograph charts in such a way that the time shown by the clock and the time marking on the chart match. The time marking on the inserted driver 2 tachograph chart must match the time marking **(4)** on the separating plate.

- 2 **If necessary, adjust the tachograph chart(s) to the correct time:**

- **Push the setting wheel in and**
- **turn it until the time scale matches the MTCO 1324 time marking (4).**



Important

When closing the tray of tachograph variants with fold down tray, make sure that the tray is folded up and locked into place after the tachograph chart(s) has/have been inserted.

- 3 **Push the tray into the unit until it locks into place.**

Removing tachograph chart(s)

**Removal after
24 hours at
the latest**

When changing drivers/vehicles, at the end of the daily working period and after 24 hours at the latest the tachograph chart must be removed from the MTCO 1324.

- **Press the Unlock key**



"Ejecting" (represented by the "Tachograph chart inserted" symbol and a progress bar) appears on the display. An ejection mark is recorded on the tachograph chart. After the time needed for inscribing the ejection mark (shown by the progress bar) has elapsed, the tray is unlocked.




Important

Wait until the tray is unlocked.

As long as "Ejecting" is shown on the display, do **not** turn the ignition off.

■ If you have switched the ignition off, follow these steps:

- Switch the ignition on again.
- Press the Unlock key  again and
- wait until the tray is unlocked (chart is ejected).

**MTCO with
rigid tray**

- 1 Pull out the tray until it will not go any further.
Do not fold the tray down.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Push the tray in again until it locks into place.

**MTCO with
fold down tray**

- 1 Pull out the tray to the stop and fold it down, if necessary.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Fold the tray up again until it locks into place.
- 4 Push the tray in again until it locks into place.

9.2.2 Driver and service engineer menu functions

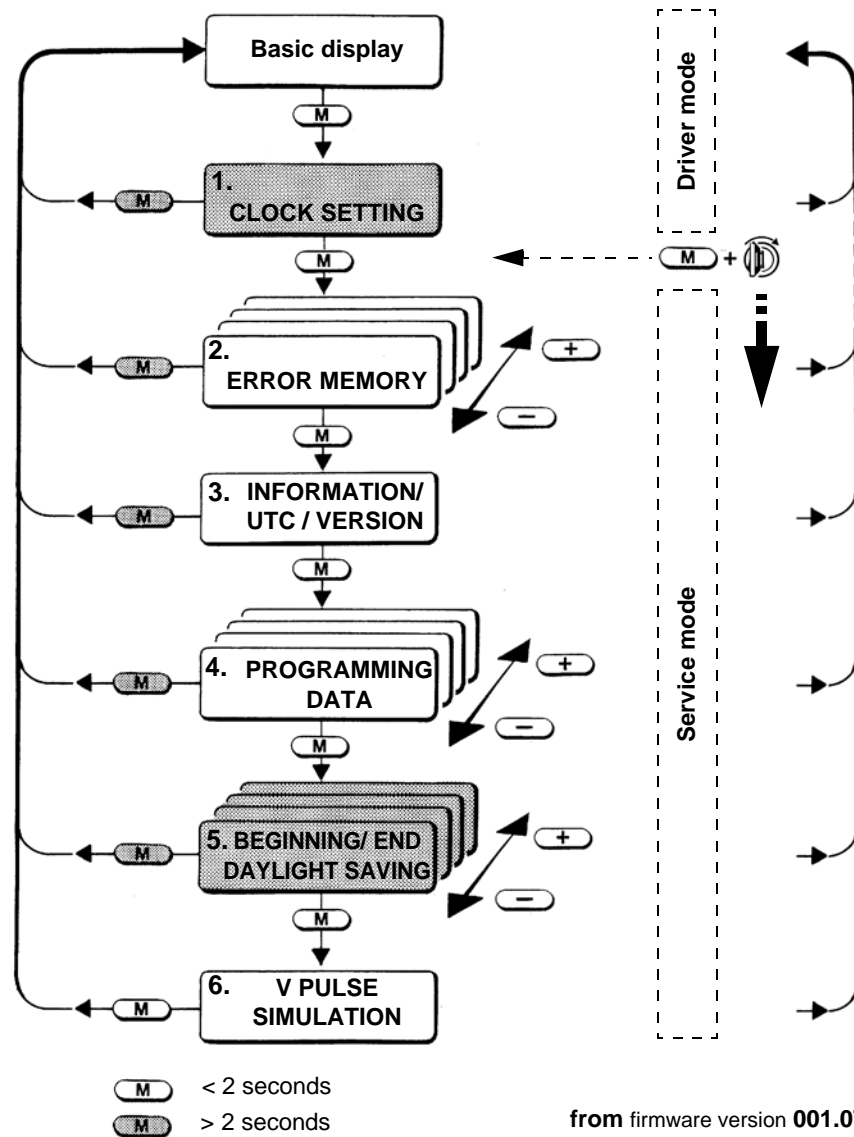


Fig. 9-6: MTCO 1324 w/o NFU: Menu structure overview

Driver functions

The driver can access the following menu functions:

- "1. Clock Setting"

Service functions

The service engineer can access the following menu functions:

- "2. Error Memory"
- "3. Information/ UTC/ Version"
- "4. Programming Data"
- "5. Beginning/ End Daylight Saving Time"
- "6. v Pulse Simulation"



Important

These functions can only be called up if:

- the ignition is on and
- the vehicle is stationary.



If no key is pressed for 20 seconds or no message is displayed, the MTCO 1324 displays the basic display automatically.

Selecting a menu function

From firmware version 001.07

From firmware version **001.07** the driver mode (basic display/ menu 1.) and the service mode (menu 2. to 6.) are accessed differently, i.e. you will have to activate the service mode first to access menus 2. to 6.

1 Activating the service mode:


- Press the  key and keep it pressed; at the same time switch the ignition on. This has to be done within 2 seconds.
- Release the  key when the ignition has been turned on.

If the ignition is switched off and on again, only the "driver mode" is active (access to menus 2. to 6. is blocked).

2 Press the key repeatedly until the desired functions 1 to 6 are displayed.

3 Use the and keys to browse in the sub-menus (forward/ backward) and to make any settings.

Returning to the basic display

- Press the  key for more than 2 seconds.

If no messages are stored, the basic display appears again.

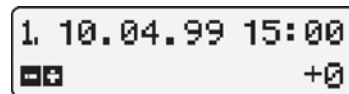
Clock setting (menu 1.)

Within a period of seven days, the MTCO 1324 clock can be reset to correct time differences of ± 2 minutes.

! Important

If the time difference is higher, this can only be corrected using an SDS test unit (cf. Chapter 3.8.4 "Programming the MTCO 1324", from page 3-31).

- 1 Press the **M** key to select the "CLOCK SETTING" menu.



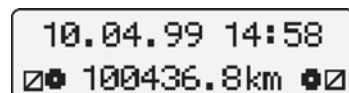
- 2 Use the **+** or **-** key to select the minutes.

The correction value is displayed in the right bottom corner.



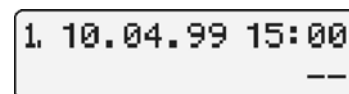
- 3 Press the **M** key to confirm the new clock setting.

The basic display appears and clock setting is blocked for seven days.



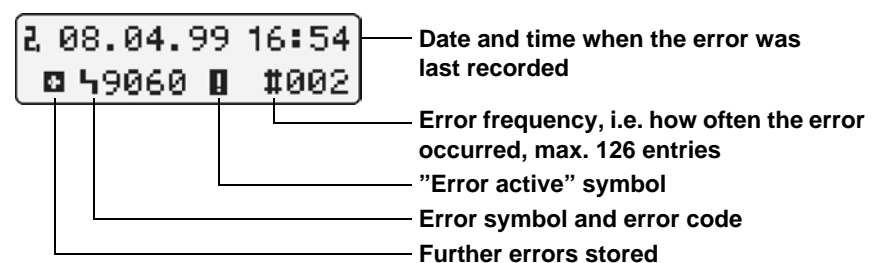
! Important

If menu 1 "Clock Setting" is called up again after the last clock setting and before the end of the 7 day period, this symbol "--" (clock setting blocked!) appears instead of the selected value.




Displaying the Error Memory (menu 2.)


- 1 Press the **M** key to select the "ERROR MEMORY" menu.



- 2 Press the  or  key to call up further error entries.

2. 06.04.99 12:54
 49061 #001

..

2. 02.04.99 13:04
 4A050 #001

Additional information

A detailed description of error messages and recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures", page 6-11.*

Displaying the UTC time and the firmware version (menu 3.)

UTC time and time offset

The MTCO 1324 stores all the time settings as UTC (**Universal Time Coordinated**) time. To display the official time of the country where the vehicle is registered on the MTCO 1324 the so-called time offset must be stored in the MTCO 1324 (additional information on UTC time programming can be found in *Chapter 3.8.4 "Programming the MTCO 1324", from page 3-31.*)

- Press the  key to select the "INFORMATION/ UTC / VERSION" menu.

- MTCO with rigid tray

3. 08.04.99 13:05 — UTC time
 001.07 +02h00 — Time offset
 — Firmware version

- MTCO with fold down tray

3. 08.04.99 13:05 — UTC time
 002.07 +02h00 — Time offset
 — Firmware version

Displaying the programming data (menu 4.)

- 1 Press the **M** key to select the "PROGRAMMING DATA" menu.
- 2 Use the **+** or **-** key to select the programmed data.

4.0 123456789
01234567

Vehicle identification number
(max. 17 digits)

4.1 1324.1111
10010001

MTCO 1324 product code

4.2 w=08010
k=08000

"w" = characteristic coefficient [imp/km]
"k" = device constant [imp/km]

4.3 v=125 v0=06.5
vm=129,7

v = measuring range [km/h]
v0 = minimum measuring range
vm = maximum measuring range

4.4 DI=04000

DI = RPM pulse [imp/ 1000 revs/min]

4.5 n=3300 n0=343
nm=3443

n = measuring range [revs/min]
n0 = minimum measuring range
nm = maximum measuring range

Displaying Beginning/ End Daylight Saving Time (menu 5.)

The switchover settings for the beginning/ end of daylight saving time as defined by the EU member states have been programmed into the MTCO 1324 for a period of five years in advance. This function displays the programmed switchover settings and the corresponding correction values.

Additional information

Detailed information on how to program the beginning/ end of daylight saving can be found in *Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time"*, from page 3-39.

- 1 Press the **M** key to select the "BEGINNING/ END DAYLIGHT SAVING" menu.


5.0 28.03.99
01:00 +01h00

Switchover date

Correction value

Switchover setting in UTC time

- 2 Use the **+** or **-** key to select the desired entries.

5.1 31.10.99
 02:00 +00h00
 ..

5.9 28.10.01
 01:00 +01h00

V Pulse Simulation (menu 6.)

If the vehicle is equipped with a road speed limiter, this function can be used to check the speed limiter's setting range from 75 - 120 km/h.



Important

When executing this function error entries or error messages can be recorded in other electronic components of the vehicle. Cause: "v" pulse emitted while the vehicle is stationary. Refer to the vehicle documentation before executing this function.


- 1 Press the **M** key to select the "V PULSE SIMULATION" menu.

- 2 Simulate "v" pulses using the **+** or **-** key.

The "v" value can be adjusted in 1 km/h steps.

If the pre-set speed of the speed limiter is reached, the engine is limited automatically (at approx. 90 km/h).

- 3

6.
 075.0 km/h
 ..

6.
  085.0 km/h

"v pulse active" symbol

9.3 Overview of variants and type key

9.3.1 Device variants


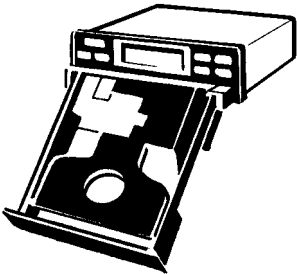
1324 . 1 0 1 0 1 003 00 01									
		1324.1xxx (EC)	2 driver EC Tachograph, 24 V, rigid tray						
		1324.2xxx (EC)	2 driver EC Tachograph, 12 V, rigid tray						
		1324.3xxx (EC)	2 driver EC Tachograph, 24 V, ADR, rigid tray						
		1324.5xxx (EC)	2 driver EC Tachograph, 24 V, fold down tray						

Table 9-1: MTCO 1324 w/o NFU: Device variants

9.3.2 Vehicle-/ manufacturer-specific versions

The MTCO 1324 vehicle-/ manufacturer-specific versions can be differentiated by their display and keypad illumination, front cover etc. as well as vehicle-specific type versions.

1324

.

X

0

1

1

1

003

00

01

	Illumination Display	Dimming	Keys	Cover	SIM	Vehicle type
001	pure green	none	none	IVECO		IVECO
002						reserved
003	pure green	PIN A2 day/ night switchover	none	VDO		BOVA, DAF-BUS, EVO-BUS, NEOPLAN
004	amber	PIN A2 dimming	orange	VDO		MAN
005	pure green	none	none	VDO		DC-Sprinter
006	pure green	none	none	VDO	SIM	NISSAN
007	amber	PIN A2 dimming	orange	VDO	SIM	MAN
008	pure green	none	none	IVECO	SIM	IVECO
009	pure green	none	none	VDO		NISSAN
010	blue		red	VDO		VW
011	green	PIN A2 day/ night switchover	none	VDO		IVEKA
012	pure	PIN A2 dimming	none	VDO	SIM	EVO-BUS, NEOPLAN
013	yellow		none	VDO	SIM	DC-Sprinter
014	yellow	on CAN	none	VDO		DC Actros
015	yellow	on CAN	none	VDO	SIM	DC Actros

Table 9-2: MTCO 1324 w/o NFU: Vehicle-/ manufacturer-specific versions

9.3.3 Type key

Device type	1324	Modular Tachograph
Device variant	1 - 3, 5	see Table 9-1, page 9-17
Interface 1 CAN bus	0	without interface
PIN A: 4, 7, 8	1	CAN with terminal resistance of 120 ohms
	2	CAN without terminal resistance
	3	CAN VW-HW without terminal resistance
Interface 2 K-LINE	0	without interface
PIN D: 4, 6, 7	1	K-LINE used as instrument interface to electronic speedometer
	2	K-LINE (diagnosis interface)*
Additional equipment	0	without additional equipment
	1	RPM recording (without display)*
	2	Additional stylus
	3	RPM recording (without display) and additional stylus*
	4	Half generator frequency on PIN "B6"* (VW only)
	5	Additional stylus and half generator frequency on PIN "B6"* (VW only)
Measuring range	1	125 km/h (standard)
	2	100 km/h
	3	140 km/h
	4	--
	5	180 km/h
	6	--
Veh./ manif. versions	001 - 015	see Table 9-2, page 9-18
Firmware/ Cluster connection	00	without firmware/ Cluster connection
	01	CAN/ Basis ISO/TCO 1 repetition rate 50 ms
	02	CAN/ Basis ISO/TCO 1 repetition rate 10 ms
	03	CAN/ Basis ISO/TCO 1 repetition rate 20 ms
	04	CAN/ VW TCO 1 repetition rate 20 ms
Interface/ customer firmware	00	without customer firmware (customer-specific software)
	01	Electronic Speedometer 1323.01
	02	Standard diagnosis*
<div> <div>1324</div> <div>.</div> <div>1</div> <div>0</div> <div>1</div> <div>0</div> <div>1</div> <div>003</div> <div>00</div> <div>01</div> </div>		

* reserved variant, to be defined upon series production (refer to SI).

Table 9-3: MTCO 1324 w/o NFU: Type key

9.4 Technical data

"v" measuring range	125 km/h (standard)		
Display (LCD)	2 lines, 16 characters per line, illumination controlled by ignition		
Character height	6.3 mm		
Operating voltage	12 V or 24 V (depending on vehicle voltage)		
Current consumption without "n"	at	DC 12 V	DC 24 V
	Standby Operation max.	105 mA 350 mA	40 mA 250 mA
Operating temperature	-25 °C to +70 °C		
Storage temperature	-40 °C to +80 °C		
Adjustment range	"v" 4000 to 25000imp/km		
	"n" 2000 to 62000 imp/ 1000 revs/min		
Inputs	"v" sensor, "n" pulse generator*, additional stylus*		
Outputs	2 x "v" pulses, 1 x 4 imp/m Triggered by external warning LED		
Interfaces	Test and programming interface, K-LINE (instrument interface), CAN interface*		
Accuracy	Speed ± 3 km/h Distance ± 1 % Time (mechanical/ electronic) ± 5 s/day		
EMC	Directive 95/94/EC ISO 7637		
Vibrations	10 to 60 Hz, 0.35 mm 60 to 2000 Hz, 5 g		
Buffer battery	Lithium		
Housing	Galvanised sheet steel		
Weight	1350 g		
Additional and special equipment	ADR, customer-specific display, data bus compliant CAN interface, RPM recording with 3,300 revs/min final measuring range value, additional stylus, "v" final measuring range value: 100, 140, 180 km/h		

* optional

Table 9-4: MTCO 1324 w/o NFU: Technical data

9.5 Error messages

The MTCO 1324 monitors the correct functioning of the system and displays errors/ malfunctions of system components or operating errors.

Display

A message consists of:

- a flashing error message on the MTCO 1324's display
- the error entry in the MTCO 1324's error memory
- the warning LED lights on the indicator unit.

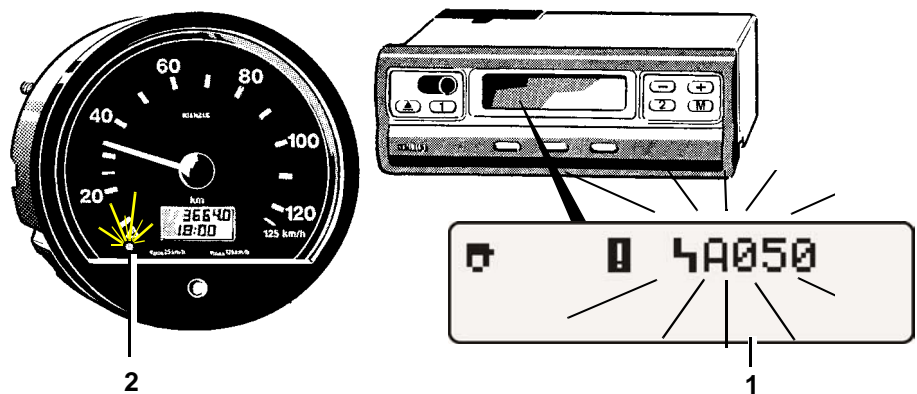


Fig. 9-7: Error messages: Tachograph system 1324 w/o NFU, e.g. operating errors

- 1 Flashing error message on the MTCO 1324's display
- 2 Warning LED on the indicator unit lights up

There are two types of display messages (encoded messages):

- Operating error messages (with operating error symbol)
- System/ tachograph error messages (without operating error symbol).



Important

If errors are still active, the code is displayed together with an ! next to the code.

If system or tachograph errors are displayed with an ! and cannot be corrected, the MTCO must be replaced.

If no ! is displayed together with the error message, the error memory can be cleared at the end of the check.

Displaying the error memory

The entries in the error memory can be called up for further analysis by selecting the "Error Memory" menu. As well as the types of error the error memory also shows how often the error occurred. Additional information can be found in *Chapter 2.1.2 "Operation", section "Displaying the Error Memory (menu 2.)", page 2-17.*

9.5.1 Operating error messages

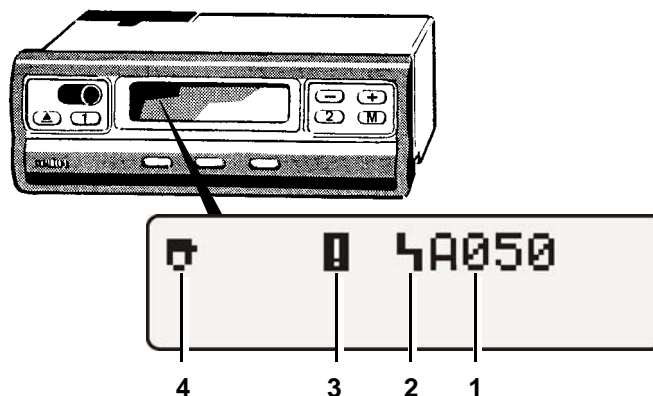


Fig. 9-8: Error message: Example of an operating error in the MTCO w/o NFU

- | | | | |
|---|--------------|---|--------------------------------------------|
| 1 | Code | 3 | "Error active" symbol |
| 2 | Error symbol | 4 | Operating error symbol: |
| | | | - Left display = driver 1 operating error |
| | | | - Right display = driver 2 operating error |

List of operating errors

Code	Meaning	Remarks	
A050	Journey without driver 1 tachograph chart	●	○
9051	Driver 1 tachograph chart is missing	●	○
9052	Driver 2 tachograph chart is missing	●	○
900F	Key pressed too long	●	

Table 9-5: Error list: Operating errors (MTCO 1324 w/o NFU)

Key

- Error message is displayed once.
- After confirming the error the warning LED on the indicator unit is still on. The LED goes off when the error is corrected.

Code 9051 or Code 9052

The message relating to code 9051 or code 9052 appears as soon as the working time group is switched from rest period "H" to break "Z", for example, while no tachograph chart is inserted.

Confirming the operating error message

- Press any key on the MTCO 1324 to confirm the error message.
The error message on the display is deleted and the basic display appears again showing the tachograph chart missing symbol.

9.5.2 System/ tachograph error messages

Malfunctions (electronic/ mechanical) of the MTCO 1324 and of other system components and their connections are:

- automatically displayed whenever they occur or
- when closing the tray, the device indicates that errors have occurred or are about to.

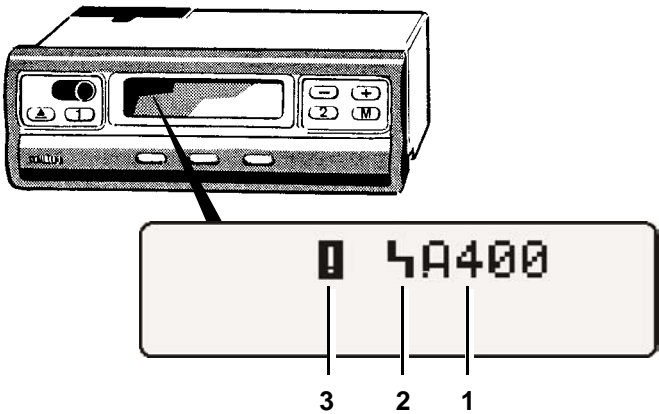


Fig. 9-9: Error message: Example of a system/ tachograph error message (MTCO 1324 w/o NFU)

- 1 Code
2 Error symbol
3 "Error active" symbol

List of system/ tachograph errors

Code	Meaning	Remarks			
900A	Other errors with CAN transmission		○		
900B	Error "CAN bus off"				
900F	Keypad error, key[s] jammed		○		
9010	LCD error: Display defective or faulty	■	○		□
9060	Tray defective, e.g. tray does not open	■	○		□
9061	"v" system error		○	◆	
9062	Multi-stylus system (MFS) defective		○	◆	
9063	Stylus lifting system (SAS) defective		○	◆	
9430	"v" pulse output error (B7)		○		

Code	Meaning	Remarks			
A00C	Electronics error, e.g. FRAM defective/ clock defective Internal error Operating system error: Watchdog overflow Program memory error				
A400	Voltage cut		○	◆	
A411	Communication error between the MTCO 1324 and the indicator unit	■	○		□
A423	Sensor communication error		○	◆	
A822	Sensor key, serial number/ signal error		○	◆	

Table 9-6: Error list: System/ tachograph errors (MTCO 1324 w/o NFU)

Key

- After the current error has occurred for the first time it is displayed every 4 hours.
- After confirming the error the warning LED on the indicator unit is still on. The LED goes off when the error is corrected.
- ◆ These errors are also recorded on the tachograph chart (see *Chapter 6.3 "Recording system malfunctions"*, from page 6-9).
- These errors are displayed only once.

Confirming system/ tachograph error messages

- **Press any key on the MTCO 1324 to confirm the error message.**
The error message on the display is deleted. Depending on whether the error appears sporadically or permanently, the warning LED on the indicator unit reacts as follows:
 - If an error appears only once, the basic display is shown again when you confirm the error and the warning LED goes off.
 - If there is a permanent error, the basic display appears when you confirm the error, but the warning LED lights up until the error is corrected.

Additional information

Recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-11.

9.6 Replacing the buffer battery on the MTCO without NFU

Depending on load, temperature, humidity etc., the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.



Important

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Detailed information and instructions on how to program "Date-Time" can be found in *Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time"*, from page 3-39.

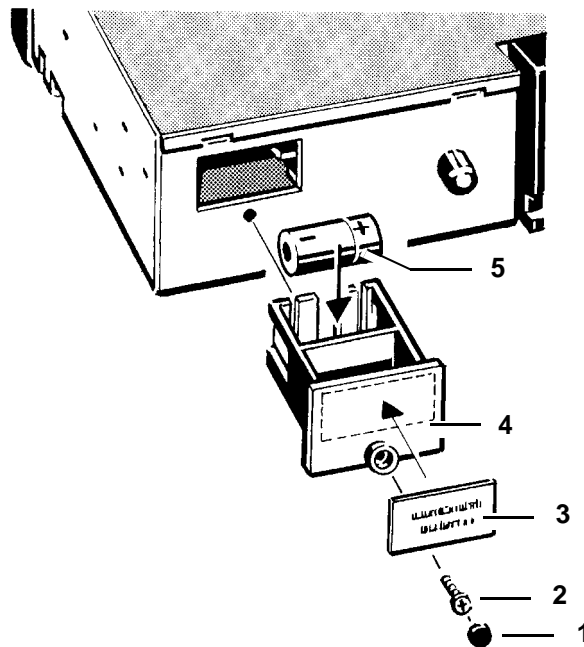


Fig. 9-10: MTCO 1324 w/o NFU: Replacing the buffer battery

- | | |
|-----------------------|-----------------|
| 1 Seal cap | 4 Battery label |
| 2 Torx T9 screwdriver | 5 Battery |
| 3 Battery compartment | |

- 1 Remove the seal cap (1) and unscrew the screw (2) underneath.
- 2 Pull out the battery compartment (4) completely.

- 3 Remove the lithium battery from its socket and press the new battery (5) into the socket.**

Please note the polarity of the battery when doing this.

- 4 Slide the battery compartment (4) into the housing until it locks into place and fix it again using the screw (2).**
- 5 Stamp the new seal cap (1) and press it into the seal cup.**
- 6 Enter the battery installation date on the label (3) and stick it on the battery compartment (4).**
- 7 Then slide the MTCO 1324 into the fitting/ radio compartment and adjust the time and date.**
- 8 Finally check that the MTCO 1324 is working properly.**



Section 2

MTCO 1390 NEC

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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MSU Fleet TA43S2/PTW

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General safety precautions

Kienzle Tachographs and the vehicles into which the tachographs are installed are quality products manufactured to comply with recognised rules of engineering.

The products comply with the quality assurance standards currently in force and are officially authorised for use on public roads.

The products left the factory in a perfectly safe condition.

In order to maintain them in this condition you must carry out your work as an engineer

- in accordance with the descriptions in these instructions,
- correctly and with great accuracy and
- by observing the Health and Safety regulations for safety and accident prevention at work.

Designated use

Kienzle Tachographs may only be used for the purpose for which they have been constructed.

Fitting instructions

There is no need to have access to the safety technology of the vehicles to fit Kienzle Tachographs.

Correct installation will not involve any changes to or affect the structure or driving properties of the vehicle.

- Before installing the tachograph consult the vehicle documentation to find out exactly what sort of vehicle it is and whether it has any special characteristics.
- Refer to the vehicle drawings to identify the position of fuel, hydraulic and compressed air lines and electrical cables.
- Ask the vehicle owner or the driver about any (private) changes to the vehicle which must be taken into consideration when installing the unit.
- During installation and removal, avoid damaging lines and cables and severing line and cable connections.
- Only use original Siemens VDO parts and original Siemens VDO accessories for fitting.
- Only fit undamaged parts to a vehicle.
- When installing the tachograph and its cables, ensure that these parts do not affect or prevent the proper operation of the vehicle and that the parts are not damaged.

General safety precautions

- Do not reduce the cross section of a line; this can lead to the corresponding section of the cable becoming overheated.
- Only solder the new cable connections with soft solder.
- Check all (!) vehicle functions before handing the vehicle back to the customer.

Vehicle hand-over

- Instruct the customer in the operation of the tachograph and give him the relevant operating instructions.

Summary of changes

Date	Chapter/page	Subject, change, measure

Section 2: MTCO 1390 NEC • Edition 03/2002

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Chapter 1

System overview

1.1 General system description

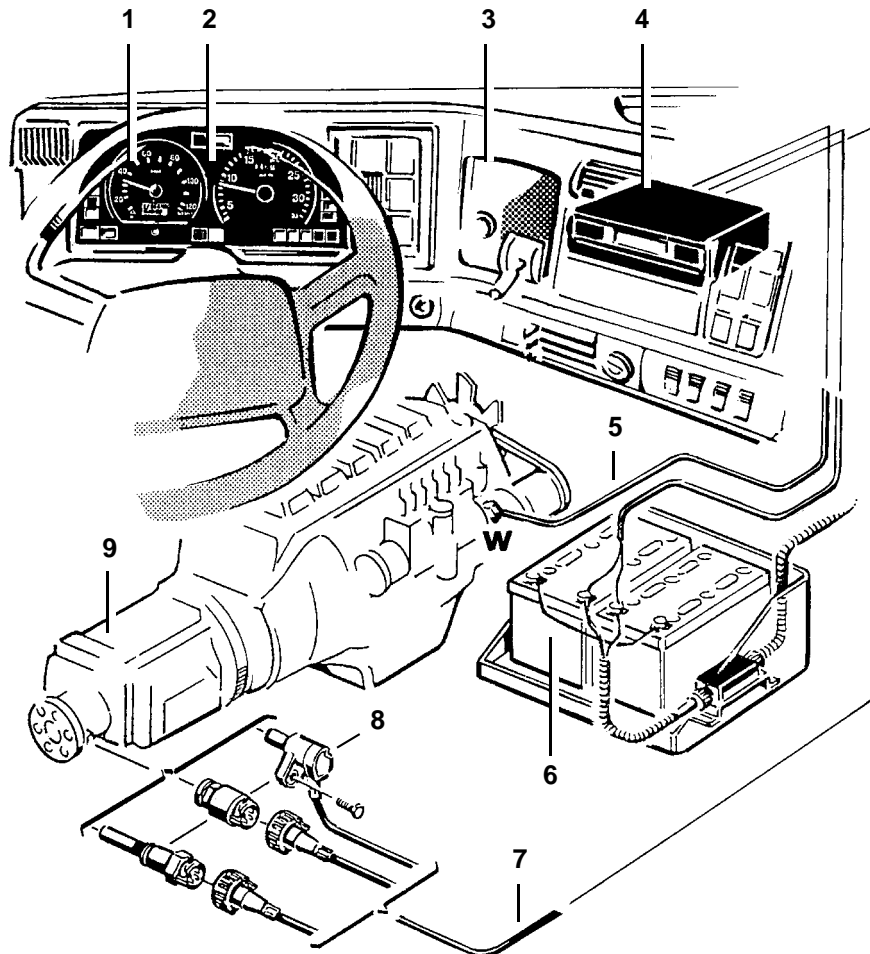


Fig. 1-1: System components of the MTCO 1390 with speed recording (RPM recording optional)

- 1 Electronic Speedometer 1323 or indicator unit (integrated in the Cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 Modular Tachograph MTCO 1390 (installed into the in-dash radio compartment)
- 5 Pulse cable for RPM generator or terminal "W" on vehicle generator (optional)
- 6 Vehicle battery
- 7 Pulse cable/ sensor cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EU Directive 95/54 EMC)
- 8 KITAS 2170/ 2171 sensor or pulse generator 2159/ Eaton generator 4302691
- 9 Gearbox

The "new generation" of tachograph systems has a modular structure and consists of the following individual components:

- Recording unit
- Indicator unit
- Sensor/ pulse generator and sensor/ pulse cable.

The new tachograph system which includes the MTCO 1390 modular tachograph, Electronic Speedometer 1323 or Cluster and the intelligent Kienzle tachograph sensor or pulse generator forms a tamper-proof system unit for quickly and efficiently checking on legally required provisions.

The MTCO 1390 detects operating errors or system malfunctions, indicates these errors to the driver and stores them in the error memory.

In response to market requirements, there are different versions of the MTCO 1390, Electronic Speedometer 1323 and Cluster available.

1.1.1 Recording unit: MTCO 1390

Tamper-proof recording As well as the data relating to speed and distance travelled, the MTCO 1390 records the driving and stopping times of the vehicle; as with existing tachograph models, the recordings are protected against tampering.

The date, time of day, distance travelled, programming data, settings for daylight saving time/ standard time switching and the driving and stopping times of the driver can be displayed on the tachograph's LC display.

The MTCO 1390 "7 day unit" with "driver change recording" (optional) also:

- displays the active driver on the LC display
- records the driving and stopping times of up to three drivers on the tachograph chart.

Auto-diagnosis function The MTCO 1390 tachograph carries out a constant auto-diagnosis to check for:

- voltage breaks
- line disconnections in the sensor/ pulse cables
- system errors and
- operating errors.

1.1.2 Indicator unit: *Electronic Speedometer 1323 or Cluster*

The MTCO 1390 transmits the speed pulse to a separate indicator unit located in such a way that it can be read easily by the driver. The driver can see the current speed and the total distance travelled.



Important

According to provisions currently in force, the recording unit and the indicator unit form a complete system unit and have been granted a single PTB approval number.

The following indicator units can be used:

- Electronic Speedometer 1323 or
- an approved indicator unit integrated into the Cluster.

Electronic Speedometer 1323

The Electronic Speedometer 1323 indicates the speed and the distance travelled as standard. The daily trip recorder and the clock are optional. The warning LED (if available) indicates error messages shown on the MTCO 1390 LC display, e.g. missing tachograph charts, sensor/ generator malfunctions etc.

Cluster

The Clusters are specific to the vehicle. The Cluster indicates, monitors and controls the vehicle functions. An electronic speedometer offering the same functions as the Electronic Speedometer 1323 is integrated into the Cluster. Depending on the vehicle, the MTCO 1390 triggers the electronic speedometer using the K-Line or CAN bus interfaces.

1.1.3 Sensor / generator technology

Sensor

KITAS 2170/ 2171 (Kienzle Tachograph Sensor), the intelligent pulse generator transforms the gearbox revolutions into pulses and transmits these as real-time signals to the MTCO 1390 recording unit together with the data encoded by an integral micro controller.

Sensor cable (DIN 72551 Kfz)

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz.

Generator

The pulse generator converts the gearbox revolutions into double pulses and transmits these to the MTCO 1390 recording unit.

1.1.4 Capability characteristics of the system

Basic characteristics

- Separate indicator and recording units
- Versions for different vehicle voltages (12 V and 24 V)
- NEC Tachograph versions
- MTCO housing dimensions complying with the dimensions for radio compartments specified by DIN/ ISO 7736
- Versions with locked or fold down tray for loading tachograph charts/ the tachograph chart pack (7 day unit)
- Additional mounting sleeve for installing in radio compartment
- Multi-functional two-line LC display, 2 x 16 characters
- 2 key blocks for operating the MTCO 1390
- Read-only Memory for storing required parameters, such as housing variant, "w", "k" etc.
- Automatic switchover to rest period if the vehicle has not been moved for 25 hours
- Battery buffered real time clock with automatic, country-specific daylight saving time/ standard time switchover settings
- Interfaces from the recording unit to the indicator unit:
 - Interface 1: "CAN" type connected to connector A
 - Interface 2: "K-Line" or "K-Diagnosis" connected to connector D (vehicle specific)
- Automatic display of system malfunctions on the LC display: Defects detected in electronic or mechanical components, instruments, interfaces and in the sensor/ generator
- Automatic recording of system malfunctions on the tachograph chart, e.g. line disconnections in the sensor/ pulse cable are indicated in form of a bar inscribed up to approx. 40 km/h (125 km/h measuring range)
- Tachograph chart cycle time:
 - 24 hours for 1 day unit
 - 26 hours for 7 day unit
- Automatic clock tracking (NFU) of the tachograph chart turntable (1 day unit **only**)
- Special interference-free (EMC) KITAS sensor cable with twisted wires
- Special transmission procedure between the KITAS 2170/ 2171 sensor and the MTCO 1390; an armoured tube is no longer necessary.

Options/ Additional equipment

- Vehicle-specific MTCO 1390 front covers
- Vehicle-specific LC display illumination:
 - Colours: yellow, orange, blue and green
 - Dimming using CAN or PIN A2

- Vehicle-specific operating key illumination:
 - Colours: yellow, orange and red
- RPM recording without display:
 - As with existing tachographs, the rotational frequency is controlled using terminal "W" on the vehicle generator or an RPM generator connected to connector C.
 - RPM recording on the:
 - back of the tachograph chart for 1 day units
 - front of the tachograph chart for 7 day units (3 levels)
- Possibility of connecting different "v" pulse generators / sensors such as pulse generator 2159, Eaton generator 4302691, KITAS 2170/ 2171
- Signal input for rear axle shift detection ("+" / "-" active)
- Additional stylus, for recording blue flashing light and emergency siren operations, fuel consumption etc.
- Driver change recording for up to 3 drivers (7 day unit **only**).

1.2 Data transmission within the system

Complying with national regulations

To comply with national regulations the sensor (generator) and the tachograph must be a tamper-proof unit.

The pulse generator 2159 and the MTCO 1390 meet this condition as they control the double pulse signal. The MTCO 1390 thus detects any attempts of fraudulent use, i.e. attempts to tamper with the transmission line between the sensor and the MTCO 1390.

1.2.1 Data transmission between MTCO 1390 and KITAS 2170/ 2171

Tamper-proof unit

The KITAS sensor and the MTCO 1390 meet these requirements:

- The serial number of the sensor is transmitted to and checked by the MTCO 1390
- Data security through DES (Data Encryption Standard)
- The real-time signal is compared with the encoded data signal stored in the MTCO 1390.

The MTCO 1390 thus detects any attempts of fraudulent use, i.e. attempts to tamper with the transmission line between the KITAS sensor and the MTCO 1390.

Data transmission. General.

The KITAS 2170/ 2171 sensor and the MTCO 1390 interchange data at regular intervals by sending the following data:

- Real-time signals and
- data signals.

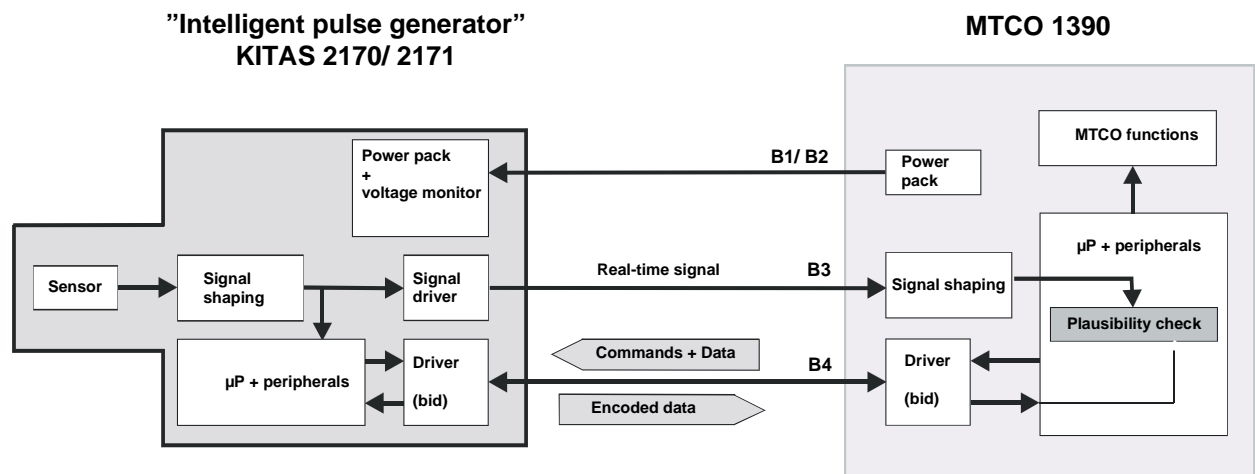


Fig. 1-2: MTCO 1390 - KITAS 2170/ 71 interfaces (diagram)

Real-time signal	<p>The real-time signal sent on cable B3 is proportional to the speed and is required to record the speed and the distance travelled (as with existing tachographs).</p>				
Data signal	<p>The data signal sent on cable B4 is used for communication between the MTCO 1390 and the KITAS sensor. After the MTCO, the master, has sent a data request the sensor returns cumulated encoded data.</p> <p>Basically, the data transmission process can be differentiated as follows:</p> <ul style="list-style-type: none">• Data transmission during initialisation• Data transmission during operation. <p><i>During initialisation</i></p> <p>The serial number of the sensor is pre-programmed into the KITAS sensor at the factory and a so-called master code is stored both in the KITAS sensor and the MTCO 1390.</p> <p>Programming in the vehicle</p> <p>After installation in the vehicle and during the first set up of the system, the KITAS sensor and the MTCO 1390 are adjusted so that these units can communicate with each other. The units are adjusted during programming using an MTC / ATC and by selecting the "ACTIVATE KITAS" menu item (see <i>Chapter 3.8.2 "Activating KITAS 2170/ 2171 (if installed)"</i>, page 3-37).</p> <p><i>During operation</i></p> <p>During operation the MTCO 1390 sends commands and data to the KITAS sensor at regular intervals of approx. 10 seconds.</p> <tr><td>Encoded data record</td><td><p>Based on the command code received, the KITAS sensor compiles an encoded data record and returns it to the MTCO 1390.</p><p>Then the MTCO 1390 compares the data received with the original data record. If the data differs, the system records a transmission error.</p></td></tr> <tr><td>Transmission errors</td><td><p>The MTCO 1390 detects a transmission error:</p><ul style="list-style-type: none">• if no data has been sent within a defined period of time or• if an error occurs during transmission, e.g. wrong acknowledgement byte, wrong checksum etc.<p>If the data is not transmitted correctly within the pre-defined period of time, the sensor is reset, which means that the data lines are set to "Low" for 2 seconds.</p><p>If, after three consecutive attempts, the data transmitted is still faulty, the MTCO 1390 displays an error.</p><p>In addition to the fetch cycles, the sensor pulses (real-time signals) sent by the KITAS 2170/ 2171 sensor are checked for accuracy. If the sensor pulses are not correct, the system records a data error and the MTCO 1390 is set to error mode (see <i>Chapter 6.1 "Error messages"</i>, from page 6-2).</p></td></tr>	Encoded data record	<p>Based on the command code received, the KITAS sensor compiles an encoded data record and returns it to the MTCO 1390.</p> <p>Then the MTCO 1390 compares the data received with the original data record. If the data differs, the system records a transmission error.</p>	Transmission errors	<p>The MTCO 1390 detects a transmission error:</p> <ul style="list-style-type: none">• if no data has been sent within a defined period of time or• if an error occurs during transmission, e.g. wrong acknowledgement byte, wrong checksum etc. <p>If the data is not transmitted correctly within the pre-defined period of time, the sensor is reset, which means that the data lines are set to "Low" for 2 seconds.</p> <p>If, after three consecutive attempts, the data transmitted is still faulty, the MTCO 1390 displays an error.</p> <p>In addition to the fetch cycles, the sensor pulses (real-time signals) sent by the KITAS 2170/ 2171 sensor are checked for accuracy. If the sensor pulses are not correct, the system records a data error and the MTCO 1390 is set to error mode (see <i>Chapter 6.1 "Error messages"</i>, from page 6-2).</p>
Encoded data record	<p>Based on the command code received, the KITAS sensor compiles an encoded data record and returns it to the MTCO 1390.</p> <p>Then the MTCO 1390 compares the data received with the original data record. If the data differs, the system records a transmission error.</p>				
Transmission errors	<p>The MTCO 1390 detects a transmission error:</p> <ul style="list-style-type: none">• if no data has been sent within a defined period of time or• if an error occurs during transmission, e.g. wrong acknowledgement byte, wrong checksum etc. <p>If the data is not transmitted correctly within the pre-defined period of time, the sensor is reset, which means that the data lines are set to "Low" for 2 seconds.</p> <p>If, after three consecutive attempts, the data transmitted is still faulty, the MTCO 1390 displays an error.</p> <p>In addition to the fetch cycles, the sensor pulses (real-time signals) sent by the KITAS 2170/ 2171 sensor are checked for accuracy. If the sensor pulses are not correct, the system records a data error and the MTCO 1390 is set to error mode (see <i>Chapter 6.1 "Error messages"</i>, from page 6-2).</p>				

Data errors

Data errors include:

- Wrong serial number/ transmitted random number and
- faulty real-time signals (pulse errors).
If the pulses are faulty, the MTCO 1390 generates an error bit that is queried later and indicates an error.

These data errors do not interrupt the command sequence stored in the MTCO 1390. As soon as the error is corrected, the MTCO 1390 returns to normal operation mode.

1.2.2 Data transmission between MTCO 1390 and indicator unit

Data transmission. General.

Three types of data are transmitted between the MTCO 1390 and the indicator unit:

- Function signals
- "v" pulses and
- data signals on the instrument interface.

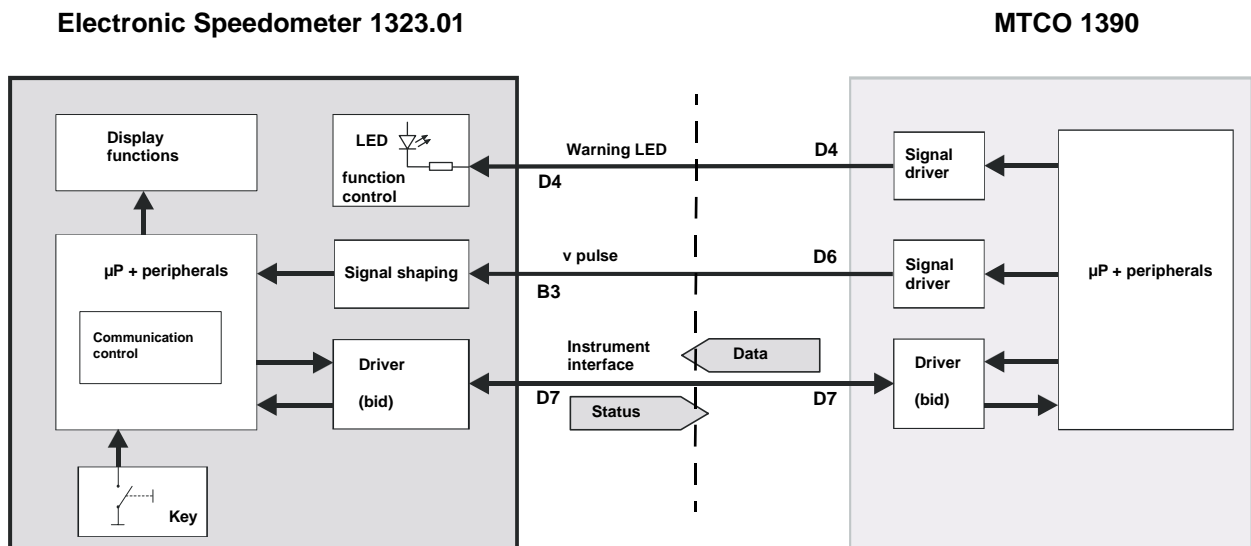


Fig. 1-3: MTCO 1390 - indicator unit interfaces; Example: Electronic Speedometer 1323 (diagram)

Function signal

The MTCO 1390 uses the function signal to trigger the warning LED (if available) on the indicator unit directly. As soon as an entry is added to the event memory, the LED lights up; at the same time, an error message is displayed on the display of the MTCO 1390.

"v" pulse

The MTCO 1390 generates the "v" pulse from the real-time signal sent by the KITAS sensor and the pre-programmed characteristic coefficient (imp/km) "w". The indicator unit converts the pulse, which is proportional to the speed, into a generator signal.

Data signals

The instrument interface (K-Line) is used for the constant data interchange between the MTCO 1390 and the indicator unit. The MTCO 1390, the master, transmits the current status of the odometer, daily trip recorder and the system clock to the indicator unit. The indicator unit sends the reset of the daily trip recorder to the MTCO 1390.

During initialisation, i.e. when the ignition is switched on, the MTCO 1390 sends the stored characteristic coefficient (imp/km) to the indicator unit automatically. To check correct transmission, the MTCO 1390 waits for an acknowledgement to be received within 0.5 seconds. If no acknowledgement is received, the MTCO 1390 generates an error message.

During operation the MTCO 1390 sends the current data to the indicator unit at regular intervals of 0.5 seconds. If the data has been received correctly, the indicator unit returns the current status of the setting key to the MTCO 1390 immediately.

If the data received cannot be interpreted, the indicator unit sends a negative acknowledgement to the MTCO 1390. Then the MTCO 1390 decodes the information received. A corresponding error message is shown on the display. At the same time, an entry is added to the error memory.

1.2.3 MTCO 1390 data transmission using the CAN bus

CAN (Controller Area Network) is a serial bus concept that is used to network various control units. The CAN bus provides high data transmission speed and ensures high data security. Therefore, the Can bus is particularly suitable for real-time applications. It offers the following features:

- Maximum transmission rate 1 Mbit/s
- High reliability if interference from other sources is high
- Open concept.

Data transmission. General.

Data content

When transmitting data on the Can bus no station is addressed, but the data content (e.g. speed display) is identified using a unique identifier. As well as the content identification the identifier also determines the priority level of the message. This is important for bus allocation if several stations want to access the bus.

If the CPU wants to send a message to one or several stations, it forwards the data, its identifier and the transmission request to the CAN controller. The CAN controller then creates and transmits the message. As soon as the CAN

controller has access to the bus ("send message") all the other stations on the CAN network are recipients ("receive message").

Acceptance check

After all the stations have received the message correctly, they carry out an acceptance check ("select") and check the identifier to determine whether the data received is relevant for them or not. If the data is important for the station, the information is processed ("accept"). If not, it is ignored.

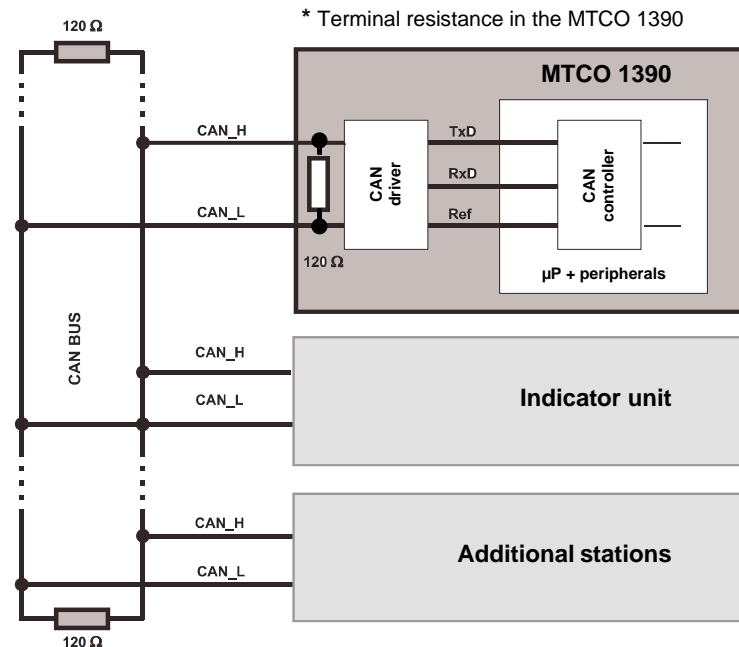


Fig. 1-4: CAN network and MTCO 1390 (diagram)

1.3 System variants

The following variants of the new MTCO 1390 modular tachograph system are available:

- MTCO - K-Line and Electronic Speedometer 1323 or Cluster
- MTCO - CAN-bus and Cluster.



Important

The "MTCO - CAN bus and Cluster" system variant can be expanded to include the K-Line interface as a diagnosis interface.

1.3.1 MTCO - K-Line and Electronic Speedometer or Cluster

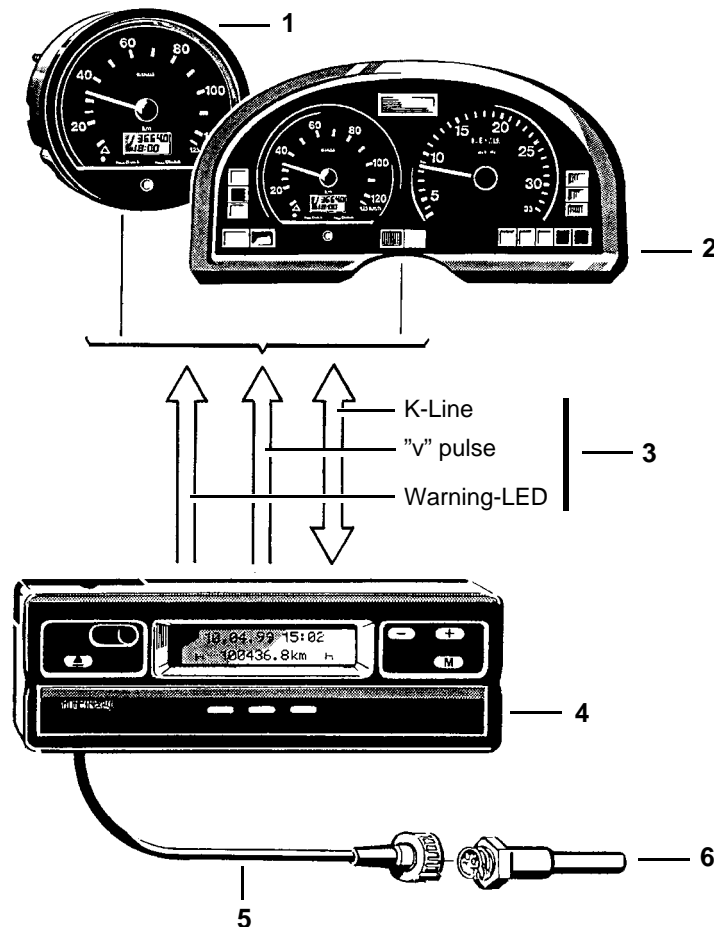


Fig. 1-5: System variant: MTCO - K-Line and Electronic Speedometer/ Cluster

- | | | | |
|---|--------------------------------|---|------------------------------------------------------------------------------|
| 1 | Electronic Speedometer 1323.01 | 4 | MTCO 1390 |
| 2 | Cluster | 5 | Pulse/ sensor cable |
| 3 | Interfaces | 6 | KITAS 2170/ 2171 sensor/
pulse generator 2159/
Eaton generator 4302691 |

K-Line

K-Line is a standard asynchronous serial interface with a specific physical structure. It is used for interchanging digital data and is available as:

- Instrument interface between the MTCO 1390 and the Electronic Speedometer 1323
- Diagnosis interface, e.g. vehicle diagnosis systems and suitable diagnosis test devices or
- K-Diagnosis for reading out the MTCO 1390 error memory.

1.3.2 MTCO - CAN bus and Cluster

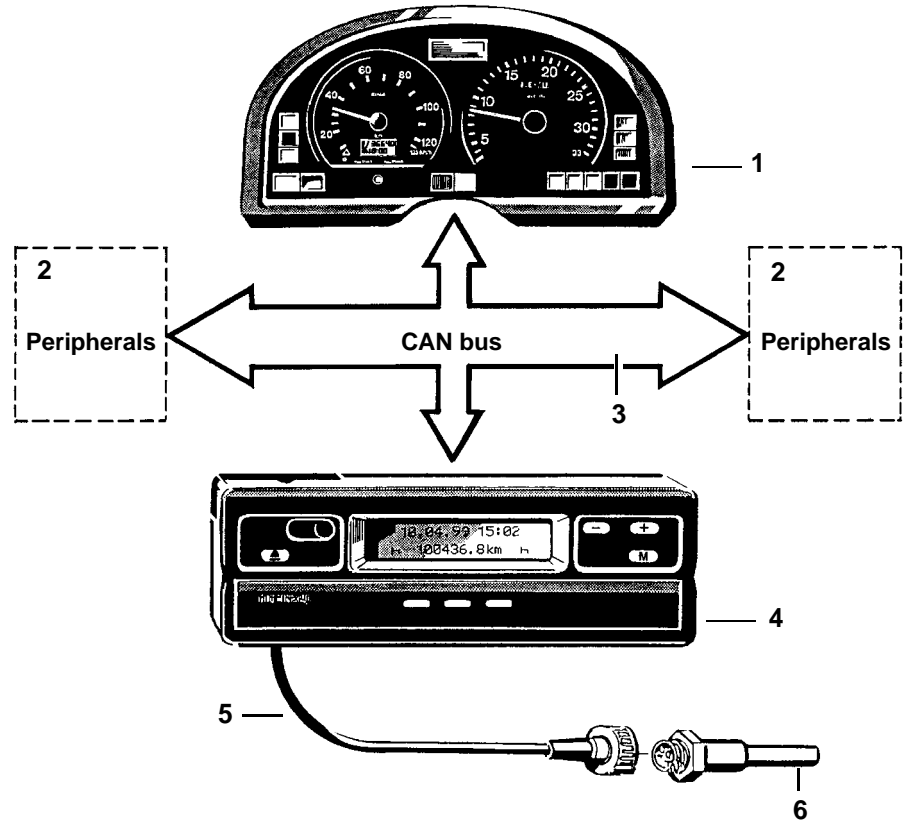


Fig. 1-6: System variant: MTCO - CAN bus and Cluster

- | | |
|-------------------------------|--------------------------------------------------------------------------------|
| 1 Cluster | 4 MTCO 1390 |
| 2 Further vehicle instruments | 5 Pulse/ sensor cable |
| 3 CAN bus (serial interface) | 6 KITAS 2170/ 2171 sensor/
pulse generator 2159/
Eaton generator 4302691 |

CAN bus

CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus provides high data transmission speed and ensures high data security. Therefore, it is particularly suitable for real-time applications.

Chapter 2

Product description/ description of functions

2.1 MTCO 1390

2.1.1 Product description

The dimensions of the Modular Tachograph (MTCO) 1390 correspond to the dimensions prescribed for DIN/ ISO 7736 radio compartments. Thus, the MTCO 1390 can be integrated into the dashboard of modern commercial vehicles. Depending on the type of vehicle, the unit features a customised front cover and customised instruments. The MTCO 1390 records the journey and the crew data on a tachograph chart.

The tachograph's speed and RPM (optional) are adjusted and programmed using an MTC/ ATC:

Setting ranges

- Speed: 4000 - 25000 imp/km, measuring range 180 kmh
4000 - 43000 imp/km, measuring range 125 kmh
- RPM: 2000 - 64000 imp/1000 revs/min.

Variants

The MTCO 1390 variants can be differentiated by their operating voltage, final measuring range value, interfaces, additional equipment etc. and tray type:

- Locked tray and mounting frame for installation into the in-dash radio compartment
- Fold down tray and mounting frame for installation into a storage box, e.g. above the sun visor.

When used for retrofitting, the MTCO 1390 is expanded to include a mounting console if the vehicle does not have a radio compartment/ storage box.

Tachograph chart(s)

The rules governing the use of tachograph charts are the same for all tachograph types and also apply to the MTCO 1390. Detailed information on tachograph charts, the assignment of tachograph charts etc. can be found in *Chapter 2.5 "Tachograph charts"*, from page 2-42. Also refer to the *separate MTCO 1390 Operating Manual* for specific information on tachograph charts that can be used in combination with the MTCO 1390.

Display and recording malfunctions

Auto-diagnosis function The MTCO 1390 tachograph carries out a constant auto-diagnosis to check for:

- voltage breaks
- defects in the KITAS sensor/ pulse generator and its cable
- communication errors between the MTCO 1390 and the indicator unit
- system errors and
- operating errors.



Important

The auto-diagnosis function is only carried out when the ignition is on.

When the MTCO 1390 detects an operating error or a malfunction, it does not distinguish between operating errors, malfunctions or warning messages. Regardless of the cause of the fault, the MTCO 1390 always:

- adds an entry to the event or error protocols
- indicates the error/malfunction on the display
- triggers the warning LED on the indicator unit (if available).

Depending on the error type, the error/malfunction is also recorded on the tachograph chart/ tachograph chart pack.

Displaying events and malfunctions

Thus, system errors are indicated to the driver by the warning LED on the indicator unit (if available) and on the MTCO 1390 display.

Recording system malfunctions

As prescribed by law, the unit also records system malfunctions on the tachograph chart automatically. For example:

- A line disconnection in the sensor/ pulse cable by a bar inscribed up to approx. 40 km/h (125 km/h measuring range)
- Voltage breaks shortly after start off by a thick trace up to "v_{max}".

Additional information

Detailed information on error messages/ recordings as well as recommended measures for error correction can be found in *Chapter 6 "Fault analysis"*.

Tachograph description (1 day unit)

Front of
MTCO 1390.1/ 3
(1 day unit)

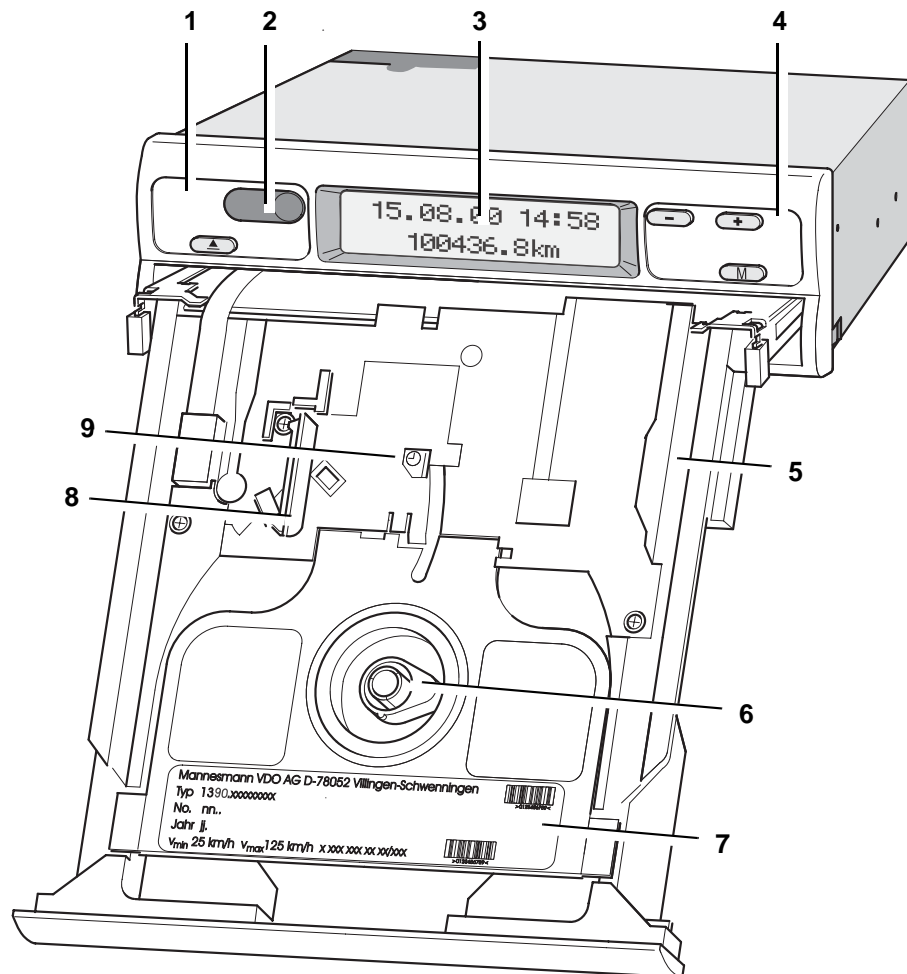






Fig. 2-1: MTCO 1390.1/3: Front of unit (1 day unit)

- 1 Left keypad:
 - Key  unlocks the tachograph chart tray
- 2 Seal plate: protects the test/ programming interface
- 3 Display: illuminated when ignition is on
- 4 Right keypad:
 - Key  selects the next menu item
 - Key  selects the previous menu item
 - Key  selects the desired menu item
- 5 Tray (example: fold down version)
- 6 Tachograph chart turntable
- 7 Type plate
- 8 Tachograph chart retaining clip
- 9 Time marking for tachograph chart

Tachograph description (7 day unit)

Front of
MTCO 1390.2/ 4
(7 day unit)

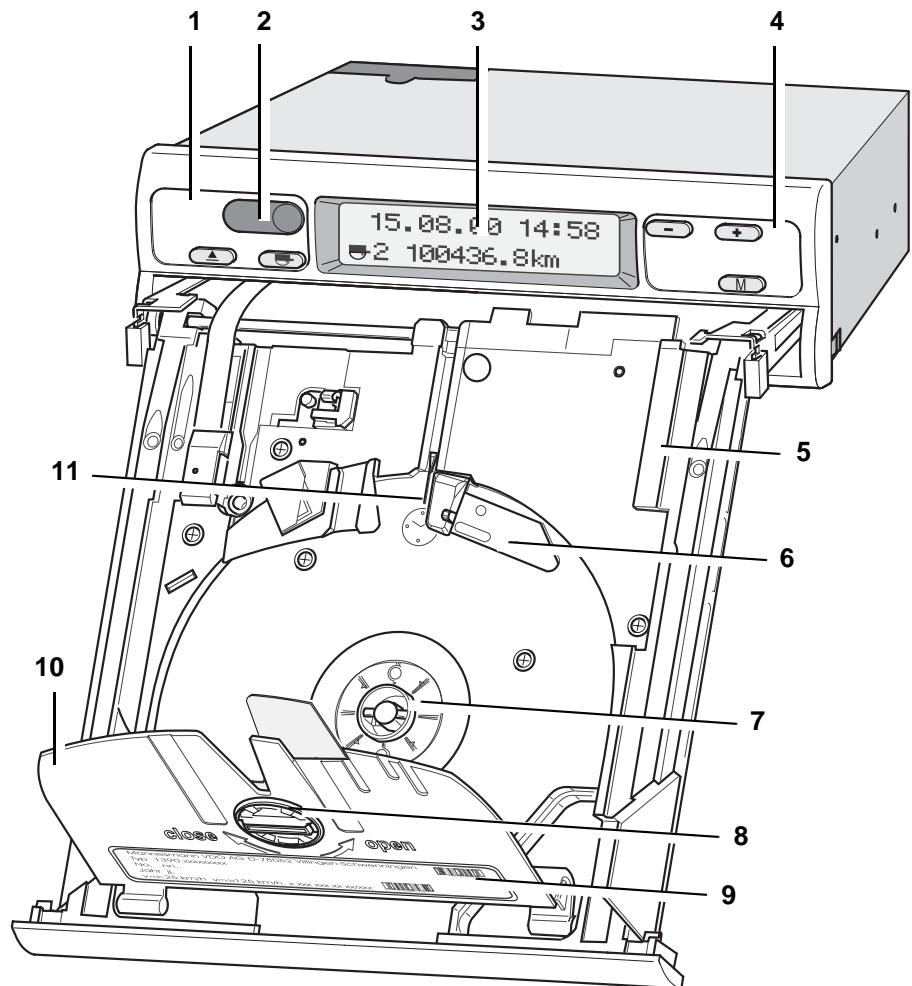







Fig. 2-2: MTCO 1390.2/4: Front of unit (7 day unit)

- 1 Left keypad:
 - Key  selects the active driver (driver change recording optional)
 - Key  unlocks the tachograph chart tray
- 2 Seal plate: protects the test/ programming interface
- 3 Display: illuminated when ignition is on
- 4 Right keypad:
 - Key  selects the next menu item
 - Key  selects the previous menu item
 - Key  selects the desired menu item
- 5 Tray (example: fold down version)
- 6 Cutting blade: Separates the completed tachograph chart from the pack
- 7 Tachograph chart turntable (7 day pack)
- 8 Tensioning ring and tensioning mechanism for tachograph chart pack
- 9 Type plate affixed to the cover plate
- 10 Cover plate
- 11 Time marking for tachograph chart

Back of unit with battery compartment MTCO 1390

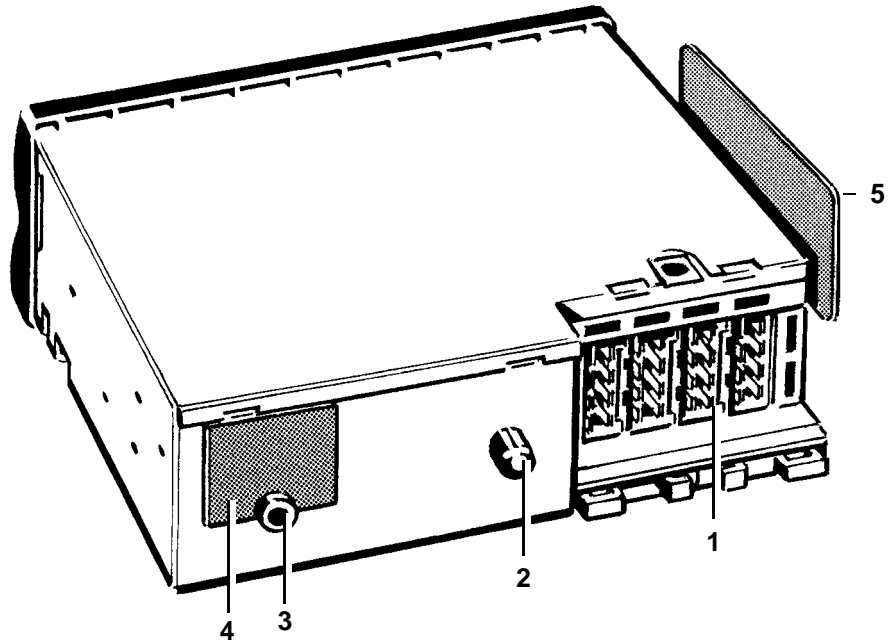


Fig. 2-3: MTCO 1390: Back of unit

- | | |
|------------------------------------|----------------------------------------------------------------------------|
| 1 Connector sockets A, B, C and D | 4 Battery compartment |
| 2 Fixing screw (radio compartment) | 5 Circuit diagram with voltage indication, serial no., device type (label) |
| 3 Seal | |



Important

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Additional information

Detailed information on how to replace the battery can be found in *Chapter 7.1 "Replacing the MTCO 1390 buffer battery"*, page 7-2.

Type plate



Fig. 2-4: MTCO 1390: Type plate (general)

- | | |
|-------------------|-----------------------------|
| (a) Manufacturer | (d) Speed measuring range |
| (b) Device type | (e) Approval sign |
| (c) Serial number | (f) Third party item number |

**Back of unit without
battery compartment
MTCO 1390 from
serial no. 450.000**

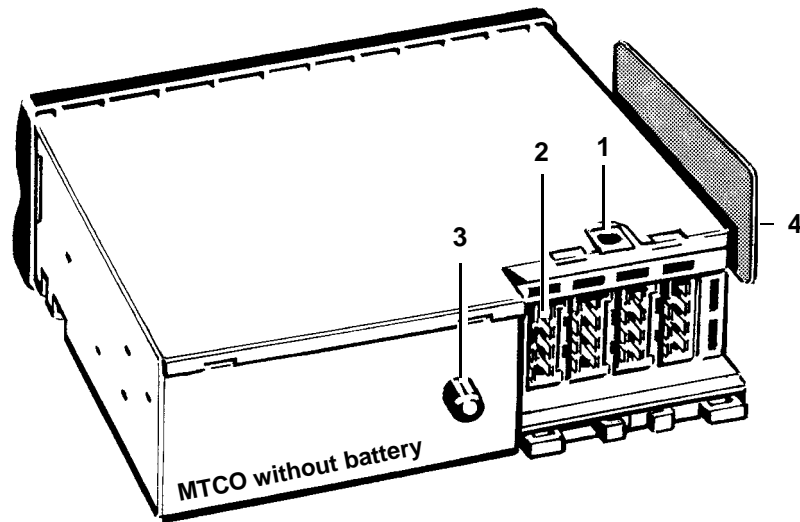


Fig. 2-5: MTCO 1390: Back of unit

- | | |
|-----------------------------------|----------------------------------------------------------------------------|
| 1 Housing cover seal | 3 Fixing screw (radio compartment) |
| 2 Connector sockets A, B, C and D | 4 Circuit diagram with voltage indication, serial no., device type (label) |



Caution

Only authorised workshops that have been given authorisation to repair the MTCO 1390 are entitled to remove the unit's housing cover seal (1).

If the housing cover seal is removed by unauthorised persons, the guarantee will be invalid.



Important

As load, temperature etc. vary, the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.

MTCO 1390 without battery compartment

From serial no. 450.000/ year 01, the buffer battery is integrated in the circuit board. The battery compartment is no longer necessary.

If no voltage is supplied to the unit and if the date and the clock stop, the MTCO 1390 **must** be replaced by a replacement tachograph.

Only authorised workshops that have been given authorisation to repair the MTCO 1390 are entitled to replace the battery.

Display



Important

The ignition must be on to display information on the MTCO 1390 display.

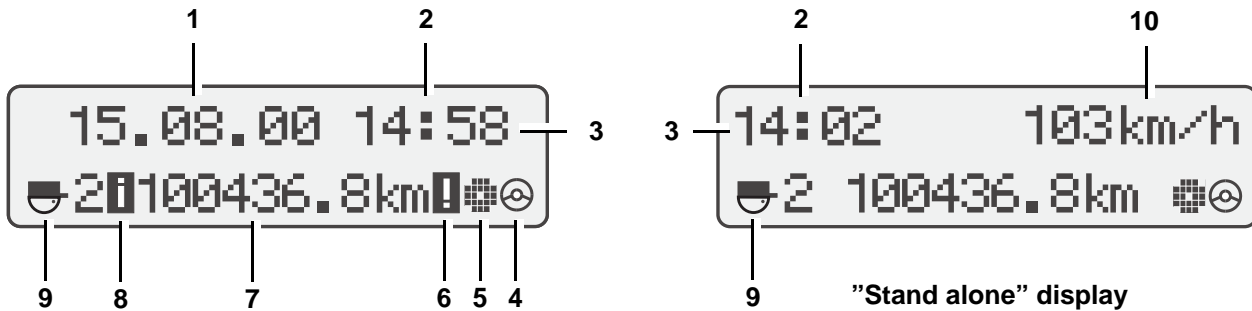
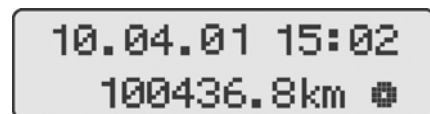


Fig. 2-6: MTCO 1390: Display(General)

- 1 Date
- 2 Tachograph chart turntable running control (colon)
(flashes when driven correctly)
- 3 System time
- 4 "Journey time" symbol (displayed automatically when driving)
- 5 "Tachograph chart inserted" symbol
- 6 "Error active" symbol
- 7 Total odometer reading
- 8 "Test and programming interface active" symbol; **only** when transmitting data using the MTC
- 9 "Driver change recording" symbol (optional, 7 day units **only**)
- 10 Digital speed display (MTCO 1390 "Stand alone"**only**)

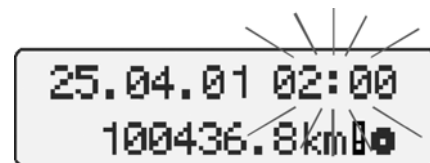
Basic display: If no messages are stored, the basic display is displayed.



Daylight saving time switchover:

Flashing time display

The MTCO 1390 sets the beginning and the end of daylight saving automatically. The flashing time display tells the driver that the tachograph chart turntable must be set to the current system time.



Important

The display normally stops flashing:

- **1 day unit:** when "tachograph chart tracking" is complete (i.e. open the tray, remove the tachograph chart and close the tray again; the tachograph chart turntable is set to the current system time automatically).
- **7 day unit:** when the tray is closed again, regardless of whether the tachograph chart turntable is set to the current time or not.

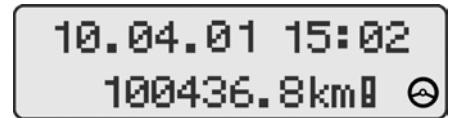
Ejecting

A progress bar tells the driver how much time has elapsed before the tray is unlocked.

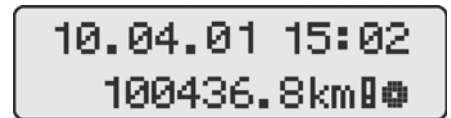


Operating error messages

e.g. driving without tachograph chart:
"Tachograph chart is missing" symbol



System or tachograph error messages



Additional information

You will find detailed information on error messages and recommended measures for error correction in *Chapter 6 "Fault analysis"*.

2.1.2 Operation

The following paragraph describes the MTCO 1390 operating functions:

- Inserting and removing the tachograph chart (1 day unit/ 7 day unit)
- Menu functions (driver and service modes).

Additional information

The driver change recording etc. is described in the *separate MTCO 1390 Operating Manual*.

Inserting and removing tachograph charts

The rules governing the use of tachograph charts are the same for all tachograph types and also apply to the MTCO 1390. Detailed information on tachograph charts, the assignment of tachograph charts etc. can be found in *Chapter 2.5 "Tachograph charts"*, from page 2-42.



Condition

The tachograph charts can only be inserted and removed if:

- the vehicle is stationary, i.e. no distance pulses are stored
- the ignition is switched on.



Important

The tachograph charts used must not be damaged. Curled, wrinkled or torn tachograph charts may cause malfunctions.

Inserting the tachograph chart (1 day unit)

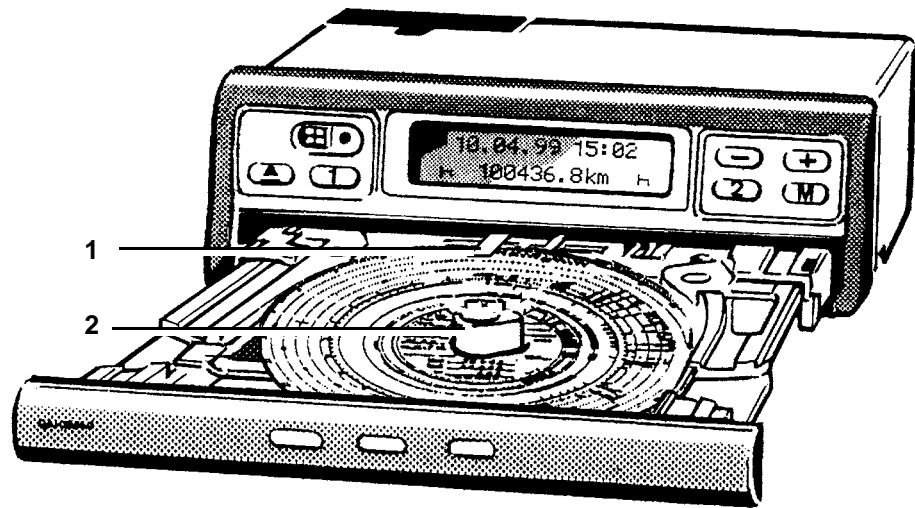


Fig. 2-7: MTCO 1390: Open with tachograph chart

- 1 Retaining clip
- 2 Tachograph chart turntable



Important

When inserting the tachograph chart make sure the chart is placed under the retaining clip.

- 1 **Insert the labelled tachograph chart into the open tray, with the labelled side face up.**

When inserting the tachograph chart make sure you insert the tachograph chart in such a way that the time shown by the clock and the time marking on the chart match.

If not, remove the tachograph chart and track the tachograph chart turntable:

- **Push the tray without tachograph chart into the unit until it locks into place.** The MTCO 1390 adjusts the tachograph chart turntable to the current time automatically.
- **Open the tray again and insert a new tachograph chart, if necessary.**



Important

When inserting the tray of tachograph variants with fold down tray make sure that the tray is folded up and locked into place after the tachograph chart is inserted.

- 2 **Push the tray into the unit until it locks into place.**

Removing the tachograph chart(s) (1 day unit)

Removal after 24 hours at the latest

At the end of the daily working period and after 24 hours at the latest the tachograph chart must be removed from the MTCO 1390.

- Press the Unlock key .



"Ejecting" (represented by the symbol for "Tachograph chart inserted" and a progress bar) appears on the display. An ejection mark is recorded on the tachograph chart. After the time needed for inscribing the ejection mark (shown by the progress bar) has elapsed, the tray is unlocked.




Important

Wait until the tray is unlocked.

As long as "Ejecting" is shown on the display, do **not** turn the ignition off.

- If you have switched the ignition off, follow these steps:

- Switch the ignition on again.
- Press the Unlock key  again and
- wait until the tray is unlocked (chart is ejected).

MTCO with locked tray

- 1 Pull out the tray to the stop.
Do not fold the tray down.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Push the tray in again until it locks into place.

MTCO with fold down tray

- 1 Pull out the tray to the stop and fold it down, if necessary.
- 2 Remove the tachograph chart(s) from the tray.
- 3 Fold the tray up again until it locks into place.
- 4 Push the tray in again until it locks into place.

Inserting/ removing the tachograph chart pack (7 day unit)



Important

When inserting the tachograph chart make sure the chart is placed under the cutting blade. When inserting the tachograph chart pack make sure you insert it in such a way that the time shown by the clock and the time marking on the chart match.

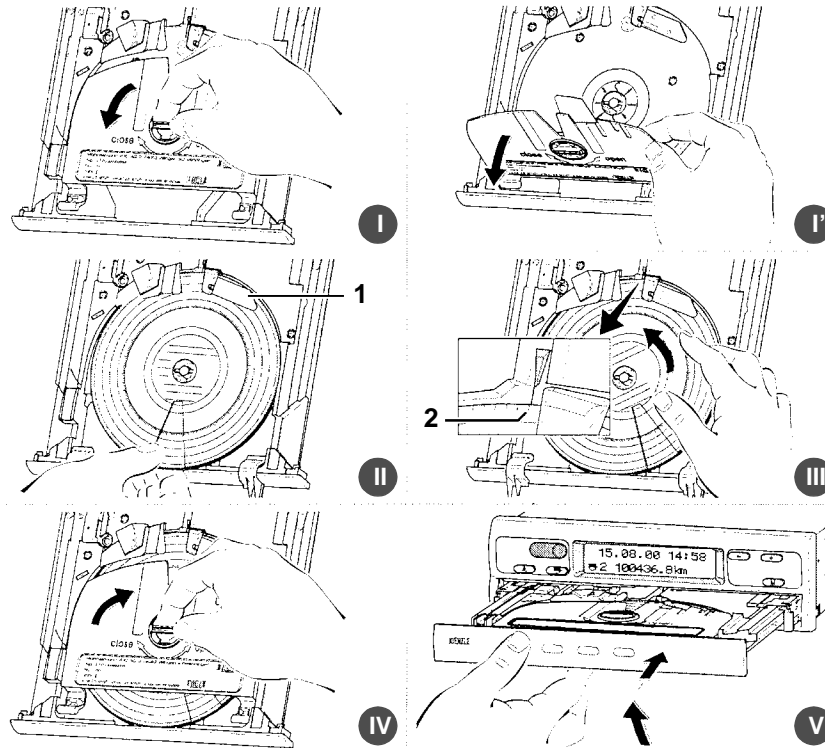


Fig. 2-8: MTCO 1390: Open unit, tachograph chart pack can be inserted (7 day unit)

- **Unlock the tray and open it completely.**
- 1 **Unlock the tensioning ring by turning it anti-clockwise and open the cover plate completely.**
- 2 **Insert the labelled tachograph chart pack, with the labelled side face up, under the cutting blade (1).**
- 3 **Then turn the tachograph chart pack until the recording time and the time marking (2) on the tray match.**
- 4 **Lift the cover plate back and lock the tensioning ring by turning it clockwise.**



Important

When inserting the tray of tachograph variants with fold down tray make sure that the tray is folded up and locked into place after the tachograph chart pack is inserted.

- 5 **Push the tray in until it locks into place.**

The tachograph chart pack is removed in reverse order of insertion after the tray is opened.

MTCO 1390 menu functions

There are two categories of functions and, depending on the user, different menu functions can be called up:

- Driver mode
- Service mode (for service engineers).

! Important

The separate menu functions can only be called up if:

- the vehicle is stationary, i.e. no distance pulses are stored
- the ignition is turned on.

When driving the basic display appears automatically.

Driver mode menu functions

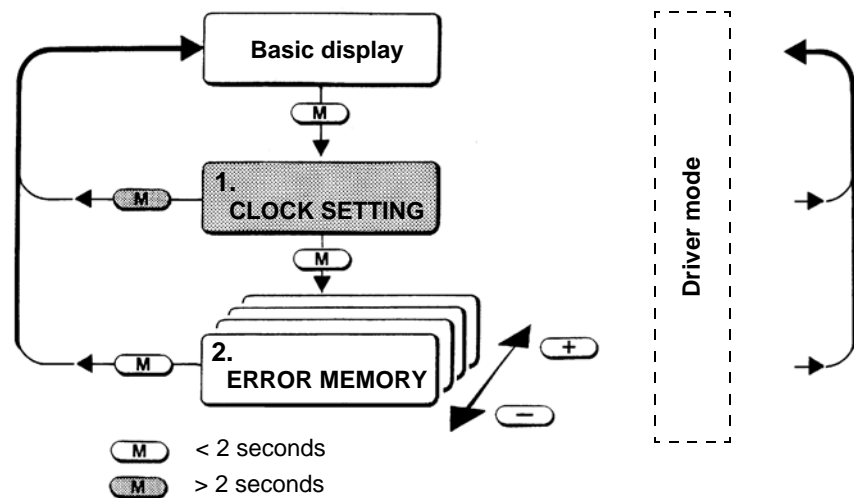


Fig. 2-9: MTCO 1390: Overview of menu structure (driver mode)

Driver functions

The driver can access the following menu functions:

- "1. Clock Setting"
- "2. Error Memory" download.

! Important

The driver can call up the "2. Error Memory" menu function.

The driver can only see the active errors.

Clock setting (menu 1.)



Important

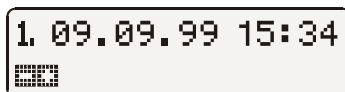
The date will be corrected automatically when setting the clock back or forward (0.00 hours).

When re-setting the clock:

- the time offset displayed (menu 3 "Information/ UTC / Version") is modified
- the programmed UTC time is not affected.

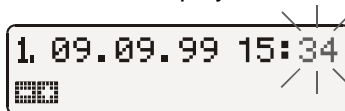
Setting the clock

- 1 Press the **M** key to select the "CLOCK SETTING" menu.



Changing the minutes

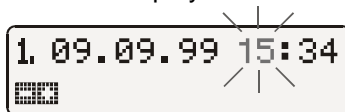
- 2 Use the **+** or **-** key to activate clock setting.
The minute display flashes.



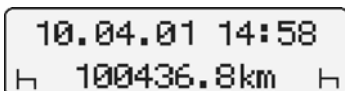
- 3 Use the **+** or **-** key to select the minutes.
- 4 Press the **M** key:
 - for more than 2 seconds to confirm the minutes setting or
 - briefly to set the hours.

Changing the hours

- 5 Use the **+** or **-** key to select the hours.
The hour display flashes.



- 6 Press the **M** key (for more than 2 seconds) to confirm the new clock setting.
The basic display appears once more.




Important

Tracking the tachograph chart turntable:

- 1 day unit: Start automatic tracking.
- 7 day unit: Adjusting the tachograph chart pack to match the time marking.


Tracking the tachograph chart turntable (1 day unit)

- 1 **Press the Unlock key** .
Wait until the tray is unlocked.
- 2 **Pull out the tray to the stop.**
- 3 **Remove the tachograph chart from the tray.**
- 4 **Close the tray.**
When the tray is closed the MTCO 1390 tracks the tachograph chart turntable automatically and adjusts it to the current system time.

The system time no longer flashes on the display and the error symbol disappears. Insert a new tachograph chart, if necessary.

Additional information A description of error messages and measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-14.

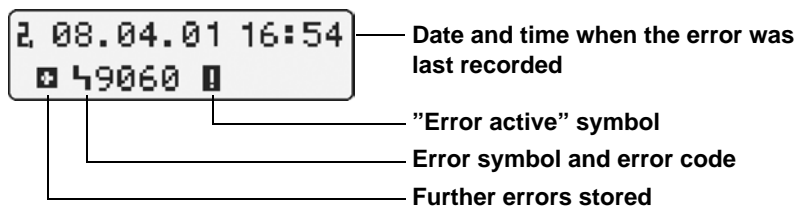
Tracking the tachograph chart pack (7 day unit)

- 1 **Press the Unlock key** .
Wait until the tray is unlocked.
- 2 **Pull out the tray to the stop.**
- 3 **Unlock the tensioning ring by turning it anti-clockwise.**
- 4 **Open the cover plate completely.**
- 5 **Turn the tachograph chart pack until the recording time and the time marking on the tray match.**
- 6 **Lift the cover plate back and lock the tensioning ring by turning it clockwise.**
- 7 **Close the tray.**
When the tray is closed the time display no longer flashes on the display and the error symbol disappears.

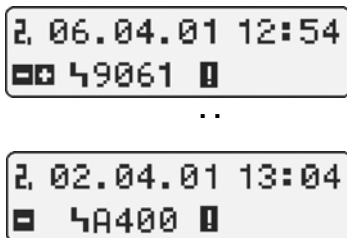
Additional information A description of error messages and measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-14.

Displaying the Error Memory (menu 2.)

- 1 Press the **M** key to select the "ERROR MEMORY" menu.



- 2 Press the **+** or **-** key to display further error entries.



Important

When calling up the "ERROR MEMORY" function in driver mode the number of active errors is not displayed.

Additional information

A detailed description of error messages and recommended measures for error correction can be found in *Chapter 6 "Fault analysis"*.

Service mode menu functions

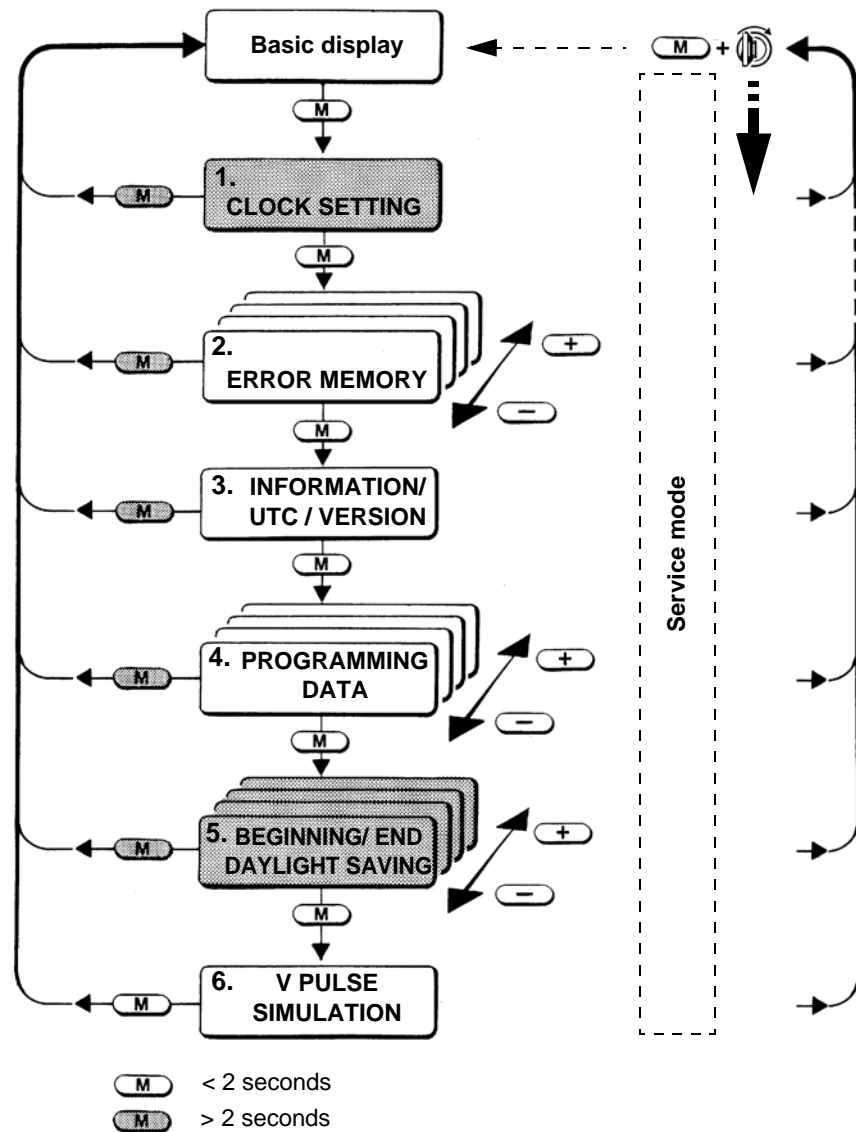


Fig. 2-10: MTCO 1390: Overview of menu structure (service mode)

Service functions

The service engineer can access the following menu functions:

- "2. Error Memory"
- "3. Information/ UTC/ Version"
- "4. Programming Data"
- "5. Beginning/ End Daylight Saving Time"
- "6. v Pulse Simulation"



Important



These functions can only be called up if:

- the ignition is on and
- the vehicle is stationary.

If no key is pressed for 20 seconds or no message is displayed, the MTCO 1390 displays the basic display automatically.

Selecting a menu function

1 Activating the service mode:


- Press the  key and keep it pressed; at the same time switch the ignition on. This has to be done within 2 seconds.
- Release the  key when the ignition is on.

If the ignition is switched off and on again, only the "driver mode" is active.

2 Press the key repeatedly until the desired functions 1 to 6 are displayed.

3 Use the and keys to browse in the sub-menus (forward/ backward) and to make any settings.

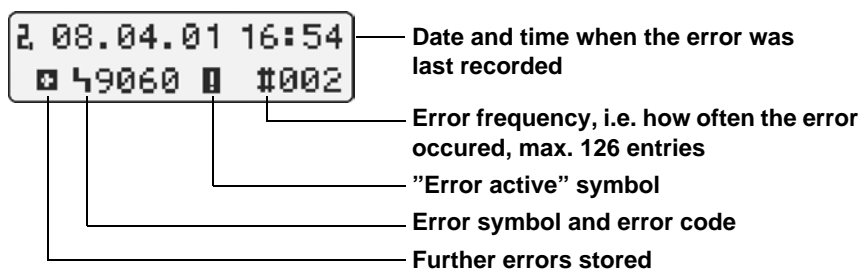
Returning to the basic display

- Press the  key for more than 2 seconds.

If no messages are stored, the basic display appears again.

Displaying the Error Memory (menu 2.)

- 1 Press the  key to select the "ERROR MEMORY" menu.



2.06.04.01 12:54
49061 #001

□ □

```
2. 02.04.01 13:04
  4A400      #001
```

Displaying the UTC time and the firmware version (menu 3.)

The MTCO 1390 stores all the time settings as UTC (**Universal Time Coordinated**) time. To display the official time of the country where the vehicle is registered on the MTCO 1390 the so-called time offset must be stored in the MTCO 1390.

3. 08.04.01 13:05
003.03A +02h00

Time offset

- **Firmware version**

Detailed information on how to program UTC time can be found in *Chapter 3.8.4 "Programming the MTCO 1390", section "Adjusting date and time"*, from page 3-51.

Displaying the programming data (menu 4.)

- 1 Press the **M** key to select the "PROGRAMMING DATA" menu.
- 2 Use the **+** or **-** key to select the programmed data.

4.0 123456789
01234567

Vehicle identification number
(max. 17 digits)

4.1 1324.1111
10010001

MTCO 1390 product code

4.2 w=08010
k=08000

"w" = characteristic coefficient [imp/km]
"k" = device constant [imp/km]

4.3 v=125 v0=06.5
vm=129,7

v = measuring range [km/h]
v0 = minimum measuring range
vm = maximum measuring range

4.4 DI=04000

DI = RPM pulse [imp/ 1000 revs/min]

1 day unit

4.5 n=3300 n0=343
nm=3443

n = measuring range [revs/min]
n0 = minimum measuring range
nm = maximum measuring range

7 day unit

4.5 n1=0900
n2=1400

n1 = bottom limit value [revs/min]
n2 = final limit value [revs/min]

These define the "n" ranges:

- Range 1 = 0 to 899 [revs/min]
- Range 2 = **900** to 1,399 [revs/min]
- Range 3 = over **1,400** [revs/min]

Displaying Beginning/ End Daylight Saving Time (menu 5.)



Important

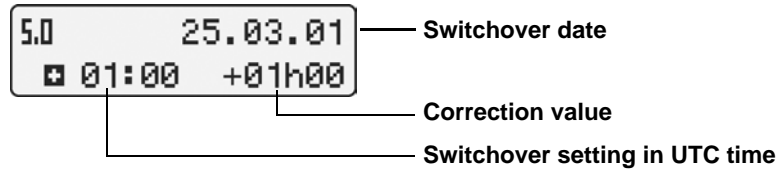
At the factory the switchover settings for the beginning/ end of daylight saving time are not stored into the MTCO 1390.

These can be programmed on request. This function displays the programmed switchover settings and the corresponding correction values.

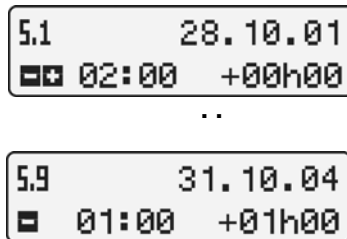
Additional information

Detailed information on how to program the beginning/ end of daylight saving can be found in *Chapter 3.8.4 "Programming the MTCO 1390", section "Adjusting date and time"*, from page 3-51.

- 1 Press the **M** key to select the "BEGINNING/ END DAYLIGHT SAVING" menu.



- 2 Use the **+** or **-** key to select the desired entries.



V Pulse Simulation (menu 6.)

If the vehicle is equipped with a road speed limiter, this function can be used to check the speed limiter's setting range from 75 - 120 km/h.

! Important

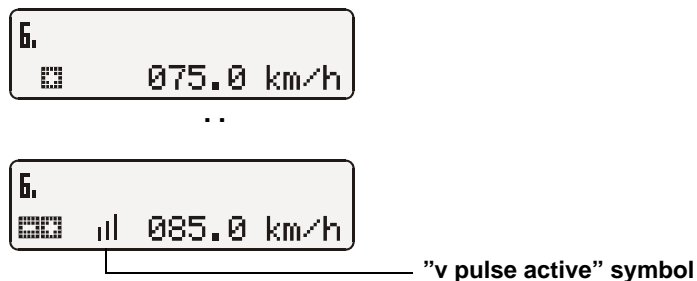
When executing this function error entries or error messages can be recorded in other electronic components of the vehicle.
Cause: "v" pulse emitted while the vehicle is stationary.
Refer to the vehicle documentation before executing this function.

- 1 Press the **M** key to select the "V PULSE SIMULATION" menu.

- 2 Simulate "v" pulses using the **+** or **-** key.

The "v" value can be adjusted in 1 km/h steps.

If the pre-set speed of the speed limiter is reached, the engine is limited automatically (at approx. 90 km/h).



2.1.3 Interfaces

Overview of interfaces

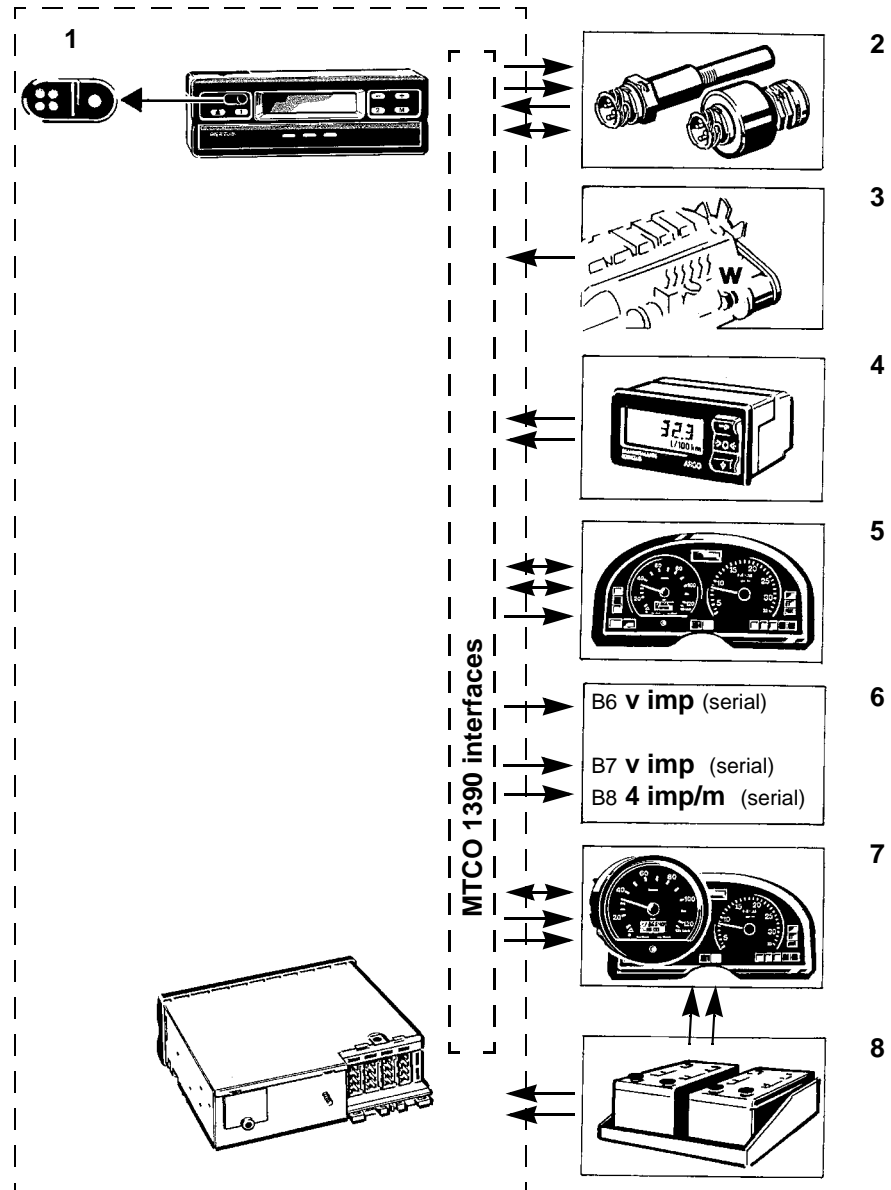


Fig. 2-11: MTCO 1390: Overview of interfaces (all interfaces connected, not possible in real-time operation)

- 1 Test and programming interface
- 2 Speed sensor or speed pulse generator
- 3 RPM generator (optional); pulse generator 2155/ 2159 or terminal "W"
- 4 Additional stylus (optional); e.g. EDM
- 5 CAN bus for Cluster
- 6 Outputs (e.g. "v" pulse, 4 imp/m)
- 7 K-Line for Electronic Speedometer/ Cluster (as instrument interface)
- 8 Vehicle supply voltage (vehicle battery)

CAN interface

CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus has a high data transmission speed. Therefore, it is particularly suitable for real-time applications.

An identifying address which identifies the message content (e.g. engine speed) is assigned to the data transmitted on the CAN bus. A station connected to the CAN bus interprets the address to find out whether the data is relevant or not. If so, the data is processed; otherwise the message is ignored.

K-LINE interface

K-Line is a standard asynchronous serial interface with a specific physical structure for exchanging digital information. It is used to facilitate the control, diagnosis checking and set up of vehicles and systems. It serves as:

an instrument interface

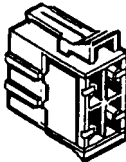
- Instrument interface between the MTCO 1390 and the Electronic Speedometer 1323 for:
 - Function Control LED signal (if available)
Direct control of the warning LED on the indicator unit. When the MTCO 1390 detects a system event (error/ malfunction), it sends a signal directly to the warning LED so that it lights up.
 - "v" pulse
The Electronic speedometer 1323 interprets these pulses sent by the MTCO 1390 as its "v" generator signals.
 - K-LINE data cable
The MTCO 1390 and the Electronic Speedometer 1323 use this line for constant data exchange. The MTCO (master) constantly transmits the current status of the odometer, the daily trip recorder and the system clock to the Electronic Speedometer 1323.
The Electronic Speedometer (slave) sends the reset of the daily trip recorder to the MTCO 1390.

Diagnosis interface

- Diagnosis interface, e.g. vehicle diagnosis systems and suitable diagnosis test devices.

2.1.4 Interface specification

Connector A

Connector contact	Parameters	Values			[Unit]	Connector A
		min.	typ.	max.		(natural white)
						
Remarks						

A1 O						T. 30 constant voltage (relating to A5)
Battery +	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current		30		mA	"v" standby
				350	mA	Total "v" current
			40		mA	"v + n" standby
				380	mA	Total "v + n" current
	12 V					
	Voltage	10.8	12	15	V	
				16		Short term (max. 1 h)
	Current		50		mA	"v" standby
				400	mA	Total "v" current
			70		mA	"v + n" standby
				500	mA	Total "v + n" current
	Fuse			8	A	

Standby definition: no RPM, work status on break time and ignition off

A2 I						T. 58d (relating to A6, signal input)
Illumination	Voltage			32	V	
	PWM frequency	150			Hz	24 V / direct current level
		50				12 V / direct current level

A3 O						T. 15 (relating to A6)
Battery + ignition	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current		70		mA	"v" display on
				500	mA	Total "v" current
			80		mA	"v + n" standby
				600	mA	Total "v + n" current
	12 V					
	Voltage	10.8	12	15	V	
				16		Short term (max. 1 h)
	Current		50		mA	"v" display on
				450	mA	Total "v" current
			70		mA	"v + n" standby
				470	mA	Total "v + n" current
	Fuse			8	A	

Total current is defined including tray discharge.

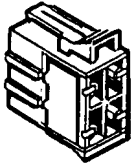
Connector contact	Parameters	Values			[Unit]	Connector A (natural white) 
		min.	typ.	max.		
A4 O						(relating to A7)
CAN_H						Technical description according to ISO/WD 16844
A5 O						T. 31a (relating to A1)
Battery -						
A6 O						T. 31 (relating to A2, A3)
GND						
A7 O						(optional)
CAN_GND						Galvanised / capacitive connection
A8 O						(relating to A7)
CAN_L						Technical description according to ISO/WD 16844

Table 2-1: Interfaces: Connector A (current and CAN bus connection)

Connector B

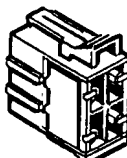
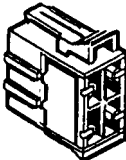
Connector contact	Parameters		Values			[Unit]	Connector B km/h MPH (yellow)	
			min.	typ.	max.		Remarks	
B1 O								

Table 2-2: Interfaces: Connector B "km/h MPH"

Connector C

Connector contact							Connector C rev/min RPM	
			Values				(red)	
	Parameters	min.	typ.	max.	[Unit]		Remarks	
C2 O								
GND							T. 31, minus internal bridge with A6	
C3 I								
							"n" signal input (relating to C2)	
T. W	Voltage	Low High	3.5		2.0 40	V	Alternating current generator	
	Current				15	mA		
	Frequency				4	kHz		
	Pulse length		125			ms		
	RPM constant		2000		64000	imp/1000 revs/min		

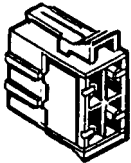


Table 2-3: Interfaces: Connector C "revs/min RPM" (optional)

Connector D

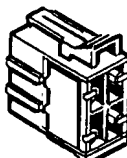
Connector contact	Parameters		Values			[Unit]	Remarks
			min.	typ.	max.		
			Connector D ZuE (brown) 				
D1 I Additional stylus 1 (relating to A6)							
Status input 1	Voltage	Low High	8		2 32	V	
D2 I Additional stylus 2 (relating to A6)							
Status input 2	Voltage	Low High	8		2 32	V	
D4 O Instrument interface (relating to A6)							
General warning signal	Voltage	Low High		1.5		V	I = 5 mA
	Current			20		mA	Lower current limit (open collector)
D5 I (relating to A6)							
Rear axle shift	Voltage	Low High	8		2 32	V V	For shift see product key
	Voltage	Low High	8		2 32	V V	
	Voltage	Low High	8		2 32	V V	
D6 O Instrument interface (see definition of B7)							
"v" pulse							
D7 I/O Instrument interface/ K-LINE (relating to A6)							
Data transmission							Technical description according to ISO 14230 Part 1

Table 2-4: Interfaces: Connector D ZuE, especially input / output stages (optional)

2.1.5 Overview of variants

MTCO 1390 device types


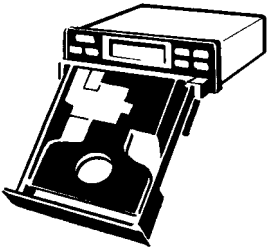
		1390	.	4	04	00	1	3	0	0	002
		↓									
		Device types									
	1390.1xxx	1 day NEC Tachograph, locked tray with NFU									
	1390.2xxx	7 day NEC Tachograph, locked tray without NFU									
	1390.3xxx	1 day NEC tachograph, fold down tray with NFU									
	1390.4xxx	7 day NEC tachograph, fold down tray without NFU									

Table 2-5: MTCO 1390: Overview of device types

MTCO 1390 measuring range, voltage, "v" sensor/ generator

		1390	.	4	04	00	1	3	0	0	002
		↓									
	Measuring range	Voltage		"v" sensor/ generator							
01	125 km/h	12 V		KITAS 2170/2171							
02	125 km/h	12 V		Pulse generator 2159							
03	125 km/h	12 V		Eaton generator 4302691							
04	125 km/h	24 V		KITAS 2170/2171							
05	125 km/h	24 V		Pulse generator 2159							
06	125 km/h	24 V		Eaton generator 4302691							
11	180 km/h	12 V		KITAS 2170/2171							
12	180 km/h	12 V		Pulse generator 2159							
13	180 km/h	12 V		Eaton generator 4302691							
14	180 km/h	24 V		KITAS 2170/2171							
15	180 km/h	24 V		Pulse generator 2159							
16	180 km/h	24 V		Eaton generator 4302691							

Table 2-6: MTCO 1390: Measuring range, voltage, "v" sensor/ generator overview

MTCO 1390 Additional equipment

1390	.	4	04	00	1	3	0	0	002
------	---	---	----	----	---	---	---	---	-----

Additional equipment	
00	none
01	RPM recording (1 day unit)
02	RPM recording (7 day unit)
03	Additional stylus
04	Driver change recording (7 day unit)
08	"Stand-alone", digital "v" display
09	Shift axle adjustment, i 0 1.383 : 1, Plus control
10	Shift axle adjustment, i 0 1.383 : 1, Minus control
11	"Stand-alone", additional stylus and digital "v" display
12	"Stand-alone", additional stylus and digital "v" display, RPM recording (1 day unit)
13	"Stand-alone", digital "v" display, driver change recording, RPM recording (7 day unit)
14	"Stand-alone", digital "v" display, additional stylus, driver change recording (7 day unit)
29	Driver change recording, shift axle adjustment i = 1.383 : 1, Plus control (7 day unit)

Table 2-7: MTCO 1390: Additional equipment overview

MTCO 1390 vehicle-/ manufacturer-specific versions

The MTCO 1390 vehicle-/ manufacturer-specific versions can be differentiated by their display and keypad illumination, front cover etc. as well as vehicle-/ customer-specific optional extras.

1390	.	4	04	00	1	3	0	0	002
------	---	---	----	----	---	---	---	---	-----

	Illumination			Cover lettering	Optional extras
	Display	Keys	Dimming		
001	blue	none	using Rheostat	KIENZLE	
002	yellow	none	on CAN	KIENZLE	
003	green	none	on CAN	KIENZLE	
004	yellow	yellow	on CAN	none	Fitted mounting bracket (1390.81.702.xx), extended error handling on CAN for checking speed, output shaft value 6.0
005	green	none	PIN A2, 100% day/ 30% night switchover	KIENZLE	

Table 2-8: MTCO 1390: Overview of vehicle-/ manufacturer-specific versions

2.1.6 Type key

Device type	1390	Modular Tachograph											
Device variant	1 - 4	see Table 2-5, page 2-29											
Measuring range/ voltage/ sensor or pulse generator	01 - 16	see Table 2-6, page 2-29											
Additional equipment	00 - 29	see Table 2-7, page 2-30											
Interface 1 CAN bus	0	without interface											
	1	CAN with terminal resistance of 120 ohms											
	2	CAN without terminal resistance											
	3	CAN VW-HW without terminal resistance											
Firmware/ Cluster connection CAN	0	without firmware/ Cluster connection											
	1	CAN/ Basis ISO/TCO 1 repetition rate 50 ms											
	2	CAN/ Basis ISO/TCO 1 repetition rate 10 ms											
	3	CAN/ Basis ISO/TCO 1 repetition rate 20 ms											
Interface 2 K-LINE	0	without interface											
	1	Instrument interface (electronic speedometer)											
	2	Diagnosis interface											
Interface/ customer firmware K-Line	0	without customer firmware											
	1	Electronic Speedometer 1323.01											
	2	Standard diagnosis											
Vehicle-/ manufacturer- specific version		see Table 2-8, page 2-30											
<table><tr><td>1390</td><td>.</td><td>4</td><td>04</td><td>00</td><td>1</td><td>3</td><td>0</td><td>0</td><td>002</td></tr></table>				1390	.	4	04	00	1	3	0	0	002
1390	.	4	04	00	1	3	0	0	002				

Table 2-9: MTCO 1390: Type key

2.1.7 Technical data

"v" measuring range	125 km/h (standard)		
Display (LCD)	2 lines, 16 chars. per line, illumination controlled by ignition		
Character height	6.3 mm		
Operating voltage	12 V or 24 V (depending on vehicle voltage)		
Current consumption	at	DC 12 V	DC 24 V
	Standby Operation max.	50 mA 500 mA	30 mA 380 mA
External fusing	Connectors "A1, A3"	8 A	8 A
Operating temperature	-25 °C to +70 °C		
Storage temperature	-40 °C to +80 °C		
Adjustment range	"v" 4000 to 43000 imp/km; max. 1.5 kHz		
	"v" 4000 to 25000 imp/km; max. 1.5 kHz ("v" > 125 km/h)		
	"n" 2000 to 64000 imp/ 1000 revs/min; max. 4 kHz		
Inputs	"v" sensor, "n" pulse generator*, additional stylus*, rear axle shift* (i = 1.383:1)		
Outputs	2 x "v" pulses, 1 x 4 imp/m Triggered by external warning LED		
Interfaces	Test and programming interface, K-LINE (instrument interface), CAN interface*		
Accuracy	Speed ± 3 km/h Distance ± 1 % Clock (electronic) ± 5 sec/day Recording ± 2 min/day		
EMC	Directive 95/94/EC ISO 7637 e1 021416		
Noise	5 to 150 Hz, $0.02 \text{ g}^2/\text{Hz} = 1.7 \text{ g RMS}$		
Buffer battery	Lithium		
Housing	Galvanised sheet steel		
Weight	1,350 g		
Additional and special equipment	Customised front cover and display illumination, keypad, data bus CAN interface, RPM recording with upper measuring range limit of 3,300 revs/min, additional stylus, driver change recording, digital speed display and cut off, "v" final measuring range value: 100, 180 km/h		

* optional

Table 2-10: MTCO 1390: Technical data

2.2 Electronic Speedometer 1323

The Electronic Speedometer 1323 has the form of a standard tachograph and a diameter of Ø 140 mm. It is available with different front covers: round Ø 150 mm, rectangular KTCO/ FTCO design. Further vehicle-/ manufacturer-specific versions are possible.

Basic functions

Basic functions of the Electronic-Speedometer displaying:

- speed (analogue)
- odometer reading and time (digital).

2.2.1 Product description

Electronic Speedometer 1323 (KTCO design, round)

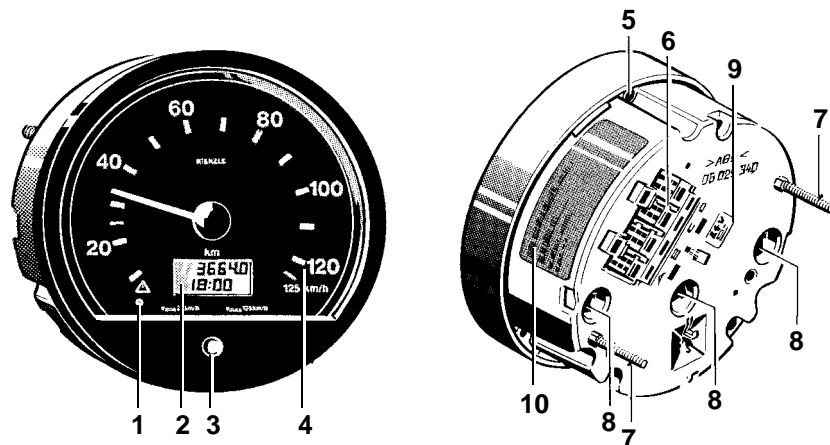


Fig. 2-12: Electronic Speedometer 1323: Front and back (KTCO design, round)

- 1 Warning LED:
The LED lights up when an error or malfunction is detected in one of the system components. At the same time, a message (code) is shown on the MTCO 1390 display.
- 2 Odometer/ clock display:
7-digit display of total odometer reading; the last digit indicates 100 m.
Either the time of day or the distance travelled per day (optional) are displayed in the bottom line.
- 3 Setting key for switching between clock/ daily trip recorder (optional)
- 4 Speed dial
- 5 Sealing point
- 6 Connector sockets A, B, C and D
- 7 Fixing screws
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Voltage label
- 10 Type plate

Electronic Speedometer 1323 (KTCO design, rectangular)

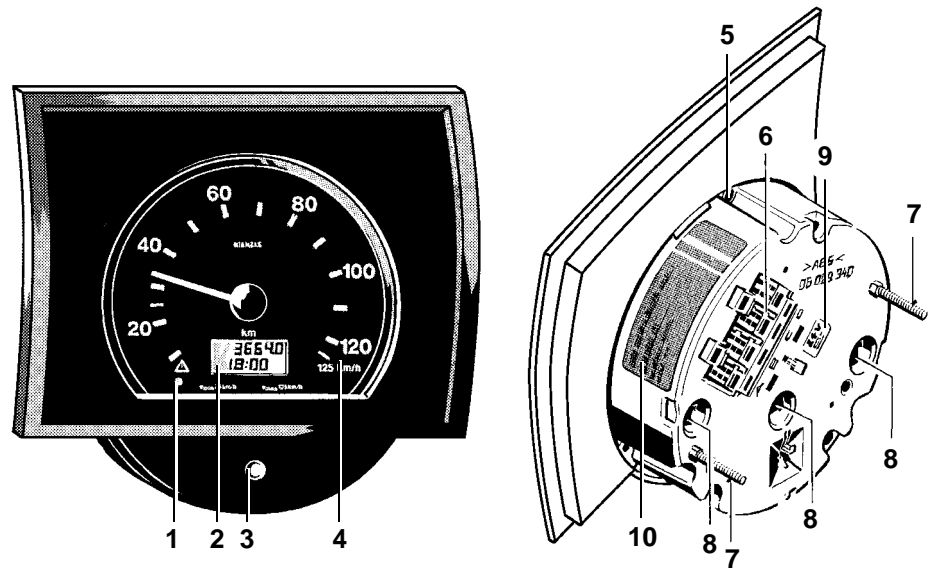


Fig. 2-13: Electronic Speedometer 1323: Front and back (KTCO design, rectangular)

- 1 Warning LED:
The LED lights up when an error or malfunction is detected in one of the system components. At the same time, a message (code) is shown on the MTCO 1390 display.
- 2 Odometer/ clock display:
7-digit display of total odometer reading; the last digit indicates 100 m.
Either the time of day or the distance travelled per day (optional) are displayed in the bottom line.
- 3 Setting key for switching between clock/ daily trip recorder (optional)
- 4 Speed dial
- 5 Sealing point
- 6 Connector sockets A, B, C and D
- 7 Fixing screws
- 8 Illumination (incandescent lamps 24 V/ 1.2 W; 12 V/ 1.2 W)
- 9 Voltage label
- 10 Type plate

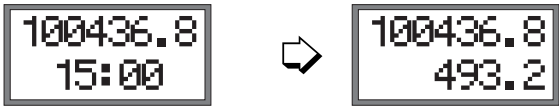
Operation

The Electronic Speedometer 1323.01 features the following operating functions:

- Setting the display to clock or daily trip recorder
- Resetting the daily trip recorder to zero.

When the ignition is on, the Electronic Speedometer 1323.01 is ready for operation. The display indicates the total odometer reading and the clock or the daily trip recorder.

Setting the display to clock or daily trip recorder



- Press the setting key (3, Fig. 2-8) briefly.
In the bottom line of the display either the "clock" or the "daily trip recorder" are displayed.



Resetting the daily trip recorder to zero



- Press the setting key for more than 2 seconds when the "daily trip recorder" is displayed.
The daily trip recorder is reset to "0".

2.2.2 Overview of variants

Electronic Speedometer 1323

	Device type 1323.01 only in combination with the MTCO 1390 (examples)	
	1323.01 01000001 03	125 km/h, 12 V, daily trip recorder + clock, with round front cover in KTCO design
	1323.01 01001159 23	125 km/h, 24 V, daily trip recorder + clock, with rectangular KTCO design front cover

Please contact your Siemens VDO partner for up-to-date information on the Electronic Speedometer 1323 device variants available.

Table 2-11:Electronic Speedometer 1323: Examples of variants

Table 2-12:Electronic Speedometer 1323: Type key

2.2.4 Technical data

Electronic Speedometer				1323.01	1323.02
Measuring range	125 km/h (standard)			●	●
Display	7-digit, 4-digit (optional)			●	●
Character height	5 mm			●	●
Operating voltage	12 V or 24 V (depending on vehicle voltage)			●	●
Current consumption	at	12 V	24 V	●	●
	Standby operation max.	3 mA 55 mA	6 mA 58 mA		
Operating temperature	-25 °C to +70 °C			●	●
Storage temperature	-40 °C to +85 °C			●	●
Pulse range	4000 to 25000 imp/km			●	●
Inputs	"v" pulse, warning LED			●	--
	Inductive sensor			--	●
Outputs	None			●	--
	2 x "v" pulse, 1 x 4 imp/m, driving-stopping signal			--	●
Interface	K-LINE (instrument interface)			●	--
Accuracy	Speed display within the legally required tolerance of ± 3 km/h			●	●
EMC	Directive 95/94/EC ISO 7637			●	●
Housing	Acrylonitrile-butadiene-styrene (ABS)			●	●
Weight	470 g			●	●
Optional extras	Daily trip recorder, clock display, vehicle-specific design of front frame and display, "v" upper limit of measuring range: 100, 140, 180 km/h			●	●
	Daily trip recorder, clock display, vehicle-specific design of front frame and display, "v" upper limit of measuring range: 80 km/h			--	●

Table 2-13: Electronic Speedometer 1323: Technical data

2.3 Cluster

2.3.1 Product description

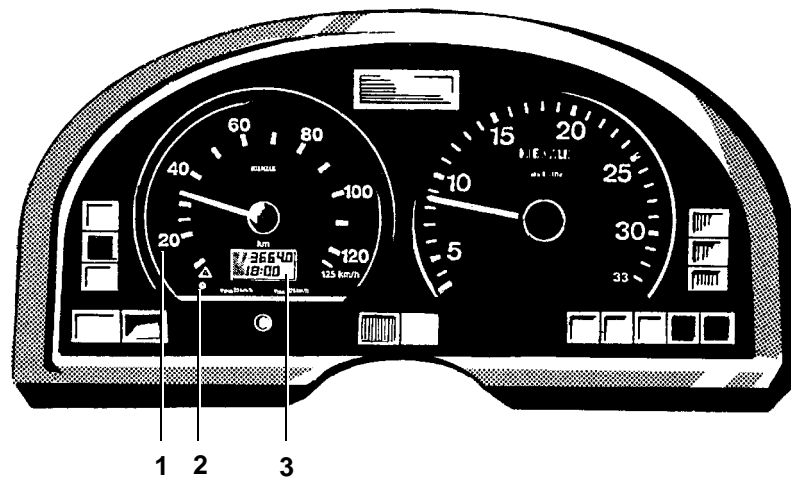


Fig. 2-14: Cluster: Front (standard)

- 1 Speed dial
- 2 Warning LED with warning triangle
- 3 Display showing odometer and clock/ daily trip recorder

Indicator elements

Clusters feature the following indicator elements:

- Speedometer dial (km/h or mph)
- Odometer
- RPM dial
- Time
- Fuel gauge
- Temperature gauge and
- further warning indicators.


Operating elements

The operating elements on the Cluster (e.g. Reset key for resetting the daily trip recorder) are specific to the vehicle.

2.3.2 Overview of variants

As with the Electronic Speedometer 1323 clusters are available as system and "Stand alone" versions for 12 V or 24 V.


System versions

	System units for MTCO 1390 K-Line	
	1551-6000xx	km/h, left-hand drive
	1551-6000xx	km/h, right-hand drive
	1551-6000xx	mph, left-hand drive
	1551-6000xx	mph, right-hand drive

Please contact your Siemens VDO partner for up-to-date information on the available device variants.

Table 2-14:Cluster: Device variants for MTCO K-Line system variants

"Stand-alone" version

	"Stand alone" units	
	1551-6010xx	km/h, left-hand drive
	1551-6010xx	km/h, right-hand drive

Please contact your Siemens VDO partner for up-to-date information on the device variants available.

Table 2-15:Cluster: "Stand alone" device variants

2.4 Speed sensor/ generator

2.4.1 KITAS 1270/ 2171

Sensor cable acc. to DIN 72551 Kfz

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz. Main differences between the new sensor cable and existing pulse cables:

- The cable can only be used up to 50 V direct voltage; existing cables can be used up to 230 V alternating voltage.
- The cables are twisted 15 revolutions per metre which means that the sensor cable complies with EC Directive 95/54 EMC.

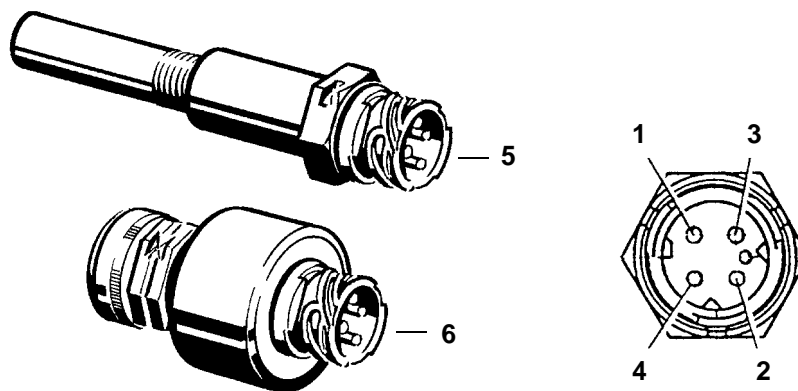


Fig. 2-15: Sensors: KITAS 2170/ 2171

- | | | | |
|---|--------------------------|---|-------------------|
| 1 | Sensor supply (+ U_E) | 4 | Data signal I/O |
| 2 | Sensor supply (- U_0) | 5 | Integrated sensor |
| 3 | "V" real time signal | 6 | Standard sensor |

Additional information

You will find detailed information on KITAS 2170/ 2171 in *Section 4 "Sensors and pulse generators", Chapter 1 "Kienzle sensors"*.

2.4.2 Kienzle pulse generator 2159

The pulse generator converts the gearbox revolutions into double pulses and transmits these to the MTCO 1390 recording unit.

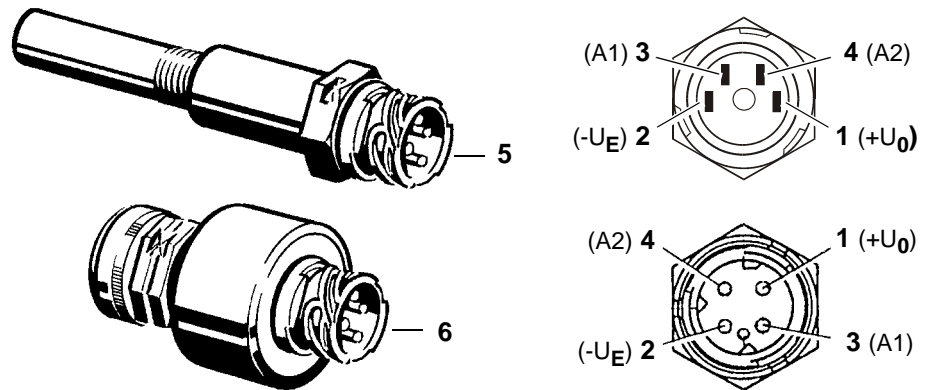


Fig. 2-16: Generator: Kienzle pulse generator 2159

- | | |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| 1 Generator supply (+ U_E) | 4 A2 output signal (inverted, ) |
| 2 Generator supply (- U_0) | 5 Integrated generator |
| 3 A1 output signal () | 6 Standard generator |

Additional information

Detailed information on pulse generator 2159 can be found in *Section 4 "Sensors and pulse generators", Chapter 2.1 "Pulse generator 2159"*, from page 2-2.

2.4.3 Eaton generator 4302691

The pulse generator converts the gearbox revolutions into double pulses and transmits these to the MTCO 1390 recording unit.

Fitting information

Descriptions on how to fit and connect the Eaton generator 4302691 pulse cable can be found in *Section 4 "Sensors and pulse generators", Chapter 3 "Eaton generator"*.

Additional information

Please refer to the manufacturer's documentation (Eaton) for detailed information on the Eaton generator 4302691.

2.5 Tachograph charts

The following tachograph charts can be used in combination with the MTCO 1390:

- 1 day tachograph charts and
- 7 day tachograph chart pack.

2.5.1 1 day tachograph chart

Front of tachograph chart

Front of 1 day chart

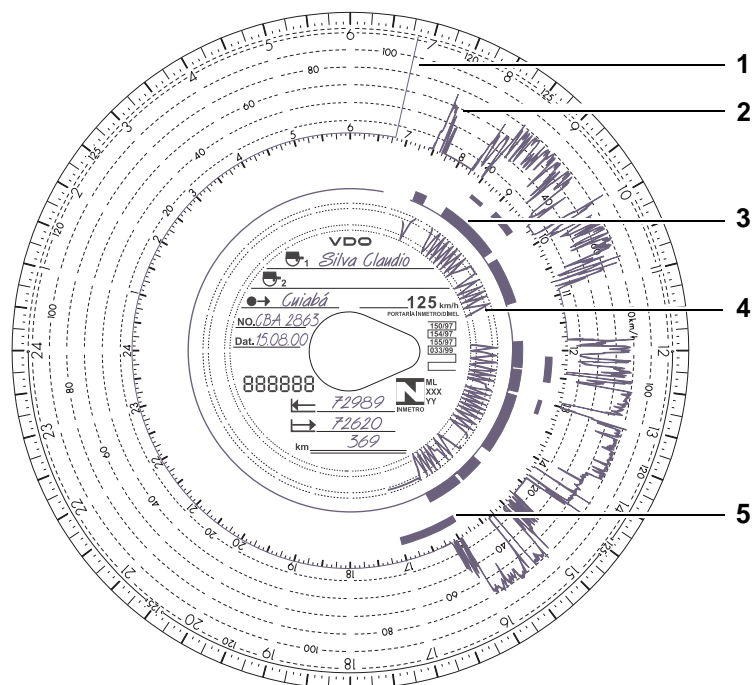
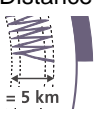
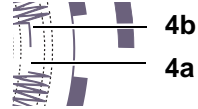


Fig. 2-17: Recordings on the tachograph chart: Front of 1 day chart

- 1 Ejection mark:
Each time the tray is opened the MTCO 1390 records this on the tachograph chart.
- 2 Speed recording [km/h]
- 3 Driving and stopping times
- 4 Distance recording (distance travelled)


A distance of 5 km corresponds to one trace drawn up and one down.
- 5 Additional recordings (optional, e.g. blue flashing light, siren etc.)

Interrupted distance recording



Upper speed limit 180 km/h



Specific recording features

When the vehicle is standing and the ignition is off, the distance recording is (4a) interrupted.

Units with "additional recording" option record the distance travelled continuously (4b) if at least one input (D1 and/ or D2) is triggered.

An MTCO 1390 with an upper speed limit of 180 km/h records the additional recordings in the area of (5a).

Back of tachograph chart

An MTCO 1390 (1 day unit) with RPM recording option records the revolution frequency on the back of the tachograph chart.

Back of 1 day chart

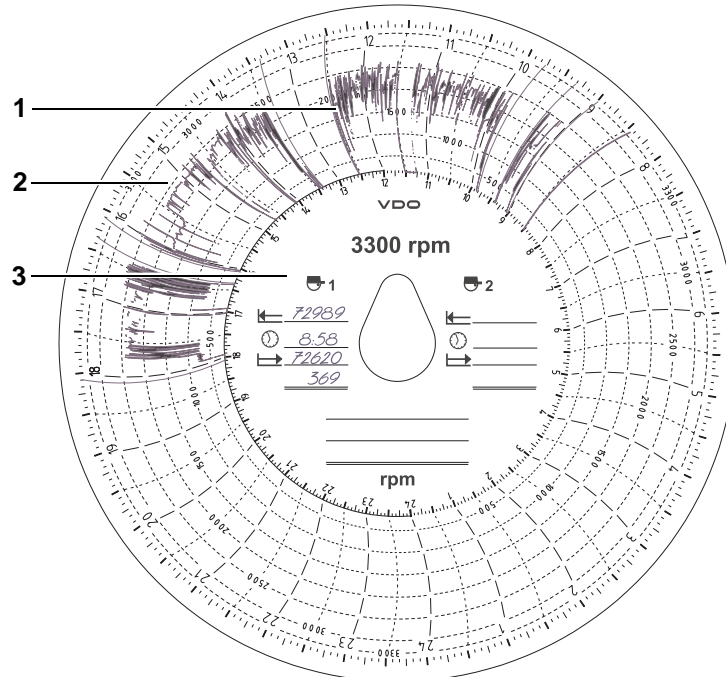


Fig. 2-18: Tachograph chart recordings: Back of 1 day chart

- | | | | |
|---|----------------------------------|---|-------------|
| 1 | Markings when ignition is on/off | 3 | Inner field |
| 2 | RPM recording | | |

2.5.2 7 day tachograph chart pack

Front of tachograph chart

Front of 7 day chart

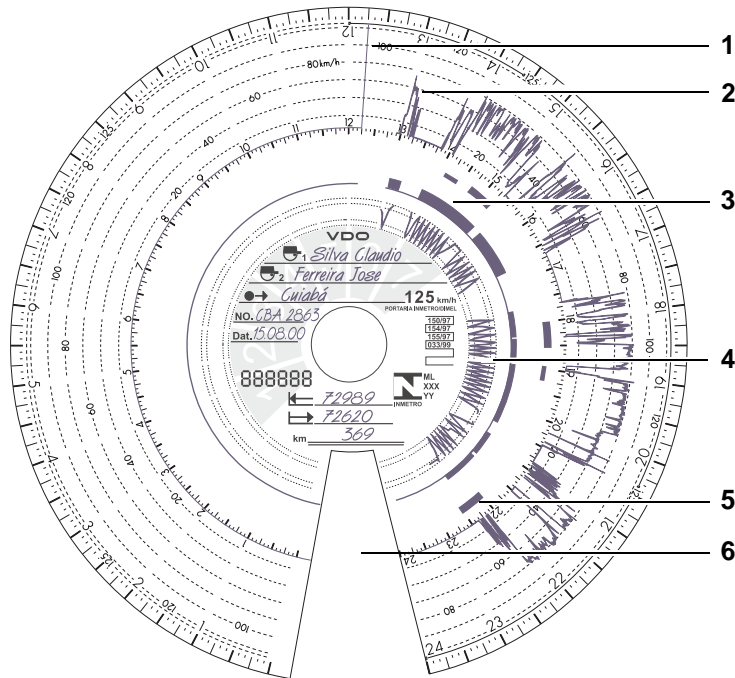
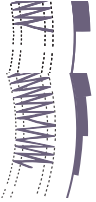


Fig. 2-19: Tachograph chart recordings: Front of 7 day chart


- 1 Ejection mark: Each time the tray is opened the MTCO 1390 records this on the tachograph chart.
- 2 Speed recording [km/h]
- 3 Driving and stopping times



Driving time
Stopping time

1 Driver
3
2 Stopping time

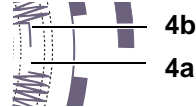
Units with driver change recording option record driving times of up to 3 drivers.
- 4 Distance recording (distance travelled)



A distance of 5 km corresponds to one trace drawn up and one down.
- 5 Additional recordings:
 - Optional, e.g. blue flashing light, siren etc. or
 - alternatively three RPM ranges
- 6 Cutting between 24:00 and 00:00 hours:
Continuous recording of the next day on the next tachograph chart (in the 7 day pack).

Specific recording features

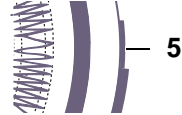
Interrupted distance recording



When the vehicle is standing and the ignition is off, the distance recording is (4a) interrupted.

Units with "additional recording" option record the distance travelled continuously (4b) if at least one input (D1 and/ or D2) is triggered.

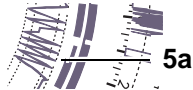
RPM range



Alternatively, the additional recording option also enables the following RPM ranges to be recorded:

- Range 1: 0 - 899 [min⁻¹]
- Range 2: 900 - 1,399 [min⁻¹]
- Range 3: over 1,400 [min⁻¹]

Upper speed limit 180 km/h



An MTCO 1390 with an upper speed limit of 180 km/h records the additional recordings in the area of (5a).

2.5.3 Handling tachograph charts



Important

When using tachograph charts, the following rules must be observed:

- **Basically**, only those tachograph charts/ tachograph chart packs that have been approved for the tachograph can be used. *Table 2-16* and *Table 2-17* page 2-46 show an overview of the tachograph charts for the MTCO 1390.
- According to the law **recordings** on the tachograph chart are "technical recordings" and protected by the criminal code; this means that they **must not be tampered with in any way**.

Handling

Tachograph charts have to be protected against:

- Contamination
- Damage
- Direct sunlight.
- Humidity

Storage

Obligation to carry tachograph charts

The driver must be able to produce the tachograph charts (record sheets) whenever requested by an authorised inspecting office to do so:

- for the current week and
- in any case for the last day of the previous week on which he drove.

Length of storage

Tachograph charts must be kept for at least 1 year.

2.5.4 Assignment of tachograph charts



Important

Generally, only tachograph charts fulfilling the following conditions can be used:

- the **final measuring range value** corresponds to that of the tachograph and
- the MTCO 1390 approval sign, if prescribed by law, corresponds to the information on the tachograph chart.

The correct tachograph chart for the MTCO 1390

1 day unit

Combi chart	Tachograph chart for electronic analysis
125-24	125-24/2
125-3300-24	125-3300-24/2
180-24	----

 Tachograph chart for device version with RPM recording, e.g. MTCO **13900.302010**

Table 2-16: Tachograph charts for the MTCO 1390 (1 day unit)

7 day unit

Combi chart	Tachograph chart for electronic analysis
125-7-24	125-7-24/2
125-8-24	125-8-24/2
180-7-24	----

 Tachograph chart for device version with RPM recording

Table 2-17: Tachograph charts for the MTCO 1390 (7 day unit)



Important

Only use tachograph charts/ tachograph chart packs with national approval signs that comply with legal regulations.

Chapter 3

Installation instructions

3.1 Necessary equipment

3.1.1 Service Diagnosis Systems

The following service diagnosis systems can be used for setting the parameters for and checking the MTCO 1390 tachograph system:

- MTC (checking/ parameter setting inside the vehicle)
- ATC (checking/ parameter setting inside the vehicle)
- STC (checking/ parameter setting outside the vehicle).

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1 "Test equipment and service diagnosis systems"* as well as in the separate *"MTC 1602.04" operating instructions and supplements*.

Upgrade kit for MTCO 1390

An upgrade kit can be used for retrofitting the above service diagnosis systems for use in combination with the MTCO 1390 tachograph system.

Interface firmware version 06.00

The upgrade kit for the MTCO 1390 is based on the interface firmware version 06.00. Interfaces with older firmware versions must be updated to version 06.00 (see circular dated 14.08.1997).

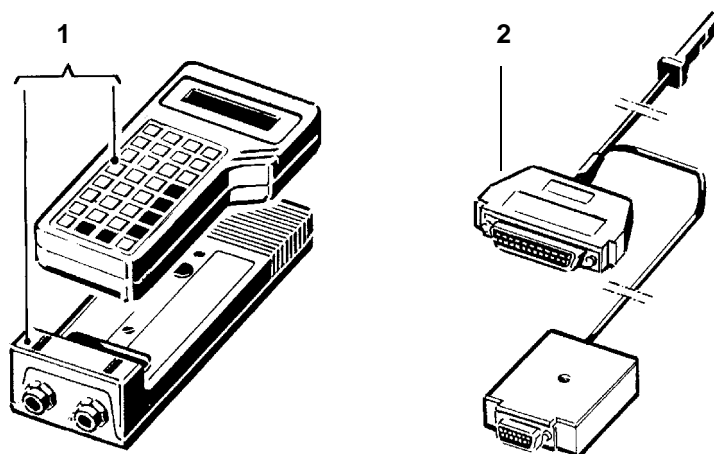


Fig. 3-1: MTC/ ATC service diagnosis systems and upgrade kit for MTCO 1390

- 1 MTC or ATC consisting of interface and BTC
- 2 Upgrade kit for MTCO 1390

The MTCO 1390 upgrade kit includes:

- a programming cable
- BTC software version **07.xx**
- MTCO 1390 programming instructions.

Additional information

The order numbers for the various diagnosis systems and accessories can be found in the appendix Section 6.

3.1.2 Special tools/ sealing tools

Special tools

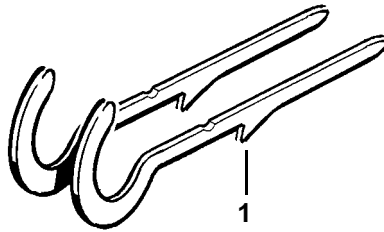


Fig. 3-2: Special tools for MTCO 1390

- 1 Special tools for removing the MTCO 1390



Important

To disassemble dashboard components vehicle specific tools may be required.

Sealing tools

Original Siemens VDO tools and sealing equipment must be used for sealing (if prescribed by law).



Important

The prescribed and required/ necessary seals for operating the tachograph system 1390 according to the law are subject to national laws and regulations.

Check the legal regulations prevailing in your country to find out whether the test and programming interface on the MTCO 1390 must be sealed.

Nevertheless, we recommend that you seal the tachograph system 1390 for security reasons.

Additional information

A complete overview of the necessary sealing tools can be found in *Section 6, Chapter 2.2 "Special tools"*, from page 2-5.

3.2 Installation workflow overview

3.2.1 Check list

			Chap./ page
1	Determine the installation site/ installation position	Tachograph system 1390	<ul style="list-style-type: none"> Determine (when retrofitting) 3-6
2	Running cables and making connections	MTCO 1390 and Electronic Speedometer 1323 Sensor/ generator	<ul style="list-style-type: none"> Determine the connector allocation and wiring diagram Run Running the sensor/ pulse cable 3-8 3-23
3	Installing the sensor/ generator	KITAS 2170/ 2171, pulse generator 2159 or Eaton generator type 4302691	<ul style="list-style-type: none"> Install Seal 3-23
4	Installing the tachograph	MTCO 1390	<ul style="list-style-type: none"> Connect the unit using the connectors Seal the back of the unit Install 3-24
5	Installing the Electronic Speedometer	Electronic Speedometer 1323	<ul style="list-style-type: none"> Connect the unit using the connectors Install 3-30
6	Commissioning the tachograph system	MTCO 1390 and sensor/ generator Characteristic coefficient (imp/km) MTCO 1390	<ul style="list-style-type: none"> Adjust the units to each other Determine "w" [imp/km] Program installation data 3-33 3-38 3-39

Table 3-1: Installation check list

3.2.2 Installation site requirements

The tachograph system must be fitted to the vehicle in such a way that:

- the driver has a clear view of the speedometer, odometer and clock from his seat.
- all components including the transmission elements are protected against accidental damage.

3.3 Overview of installation site/ position

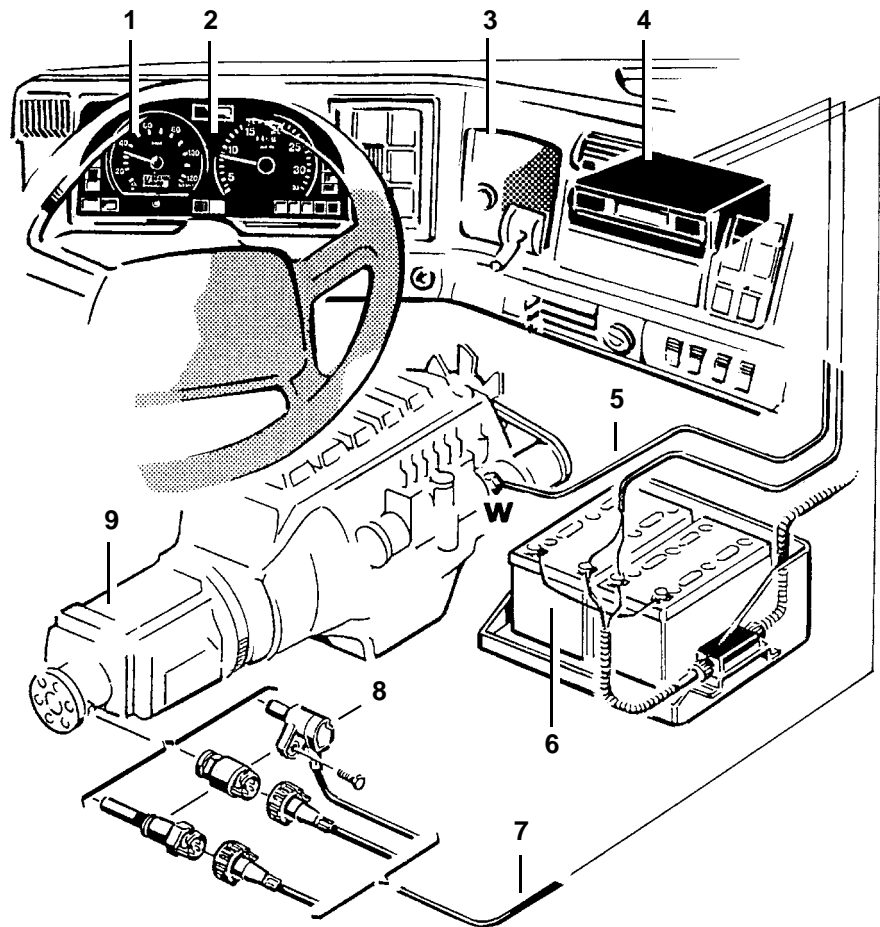


Fig. 3-3: MTCO 1390: Tachograph system installation overview

- 1 Electronic Speedometer 1323.01 or indicator unit (integrated in the Cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 Modular Tachograph MTCO 1390 (installed into the in-dash radio compartment)
- 5 Pulse cable for RPM generator or terminal "W" on vehicle generator (optional)
- 6 Vehicle battery
- 7 Sensor/ pulse cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EC Directive 95/54 EMC)
- 8 Sensor KITAS 2170/ 2171/ pulse generator 2159/ Eaton generator (type 4302691)
- 9 Gearbox



Important

Refer to the current ordering documents for complete order numbers and spare part types.

3.4 Installation criteria for retrofitting

Older tachograph systems

When retrofitting an MTCO 1390 into older tachograph systems first check:

- possible installation sites in the cab and
- any legal provisions.

Regardless of the tachograph system fitted to the vehicle, the following components must be installed:

- Electronic Speedometer 1323
- KITAS 2170/ 2171 sensor, pulse generator 2159/
Eaton generator 4302691
- sensor/ pulse cable and
- data cable (K-Line) from the MTCO 1390 to the Electronic Speedometer 1323.



Important

When installing an MTCO 1390 tachograph system for the first time, the installation position, sensor/ generator type etc. have already been defined by the vehicle manufacturer.

3.4.1 Adjusting the MTCO system to existing tachograph systems

KITAS sensor/ generator

- Determine the type of pulse generator installed and its length:
 - Is the sensor/ generator screwed onto or into the gearbox output?
 - If it is screwed into the gearbox output, how long must it be?

Electronic Speedometer installation site

- Determine the sensor/ generator type that can be fitted.
 - Which tachograph (design) is installed?
 - Where must the Electronic Speedometer 1323 be fitted?
(form, dimensions etc.)

MTCO 1390 installation site

- Determine the installation site for the MTCO 1390.



Important

We recommend that you use the existing tachograph's installation site for fitting the Electronic Speedometer 1323. If this is not possible, make sure that the Electronic Speedometer is positioned in such a way that the driver can see it directly.

The MTCO 1390 has been designed for installation in the DIN ISO 7736 radio compartment. The installation site must:

- provide easy access to the unit for easy operation (inserting/ removing tachograph charts)
- be positioned in such a way that the driver can see and operate the unit directly
- ensure optimum legibility (non dazzling); please note the display angle
- ensure that there is enough room between the unit and any in-dash ventilation/ heating vents
- provide quick and easy access to the unit for service operations.

3.4.2 Adjusting the MTCO "Stand alone" to existing tachograph systems

What is special about the MTCO "Stand alone" is the speed display on the LCD display.



KITAS sensor/ pulse generator

- Determine the type of pulse generator installed and its length:
 - Is the sensor/ generator screwed onto or into the gearbox output?
 - If it is screwed into the gearbox output, how long must it be?



Important

The MTCO "Stand alone" can only be triggered by a KITAS 2170/ 2171, pulse generator 2159, Eaton generator 4302691 or a special adapter approved for it.

MTCO 1390 "Stand alone" installation site

- Only position the MTCO 1390 "Stand alone" in the driver's direct field of vision.



Important

Do not remove an existing in-dash indicator instrument from the vehicle. This can either be triggered together with the MTCO "Stand alone" or by the "v" pulse B6 output.

3.5 Running cables and making connections

Connection cables are necessary:

- for connecting the MTCO 1390 to the vehicle battery
- for connecting the recording unit to the indicator unit
- for transmitting data/ pulses (e.g. "v"/ "n" pulses, electronically triggered special equipment etc.).

3.5.1 Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired "side effects" such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

3.5.2 Making connection cables



Important

Electrical connection leads must have a cross section of 0.75 mm².

All "positive" wires must be protected with:

- 8 A with an operating voltage of 12 V
- 5 A with an operating voltage of 24 V.

Depending on the conditions in the vehicle, you must make your own connection cables or adapt the cables contained in the accessory kit.

Example: MTCO 1390 connection cables

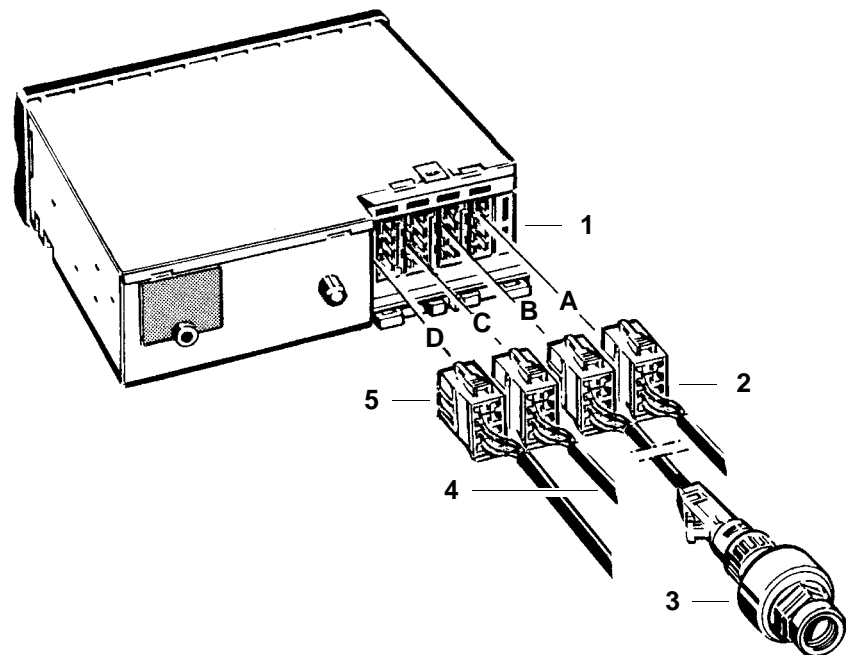


Fig. 3-4: MTCO 1390: Connection cable overview

- | | | | |
|---|--------------------------------------------------|---|-----------------------------------------------------------|
| 1 | MTCO 1390 connector sockets | 3 | Sensor/ generator with connection cable |
| 2 | Connector with connection cable (voltage supply) | 4 | Connector with connection cable for "n" generator/ signal |
| 5 | Connection cable to Electronic Speedometer 1323 | | |

Making connection cables

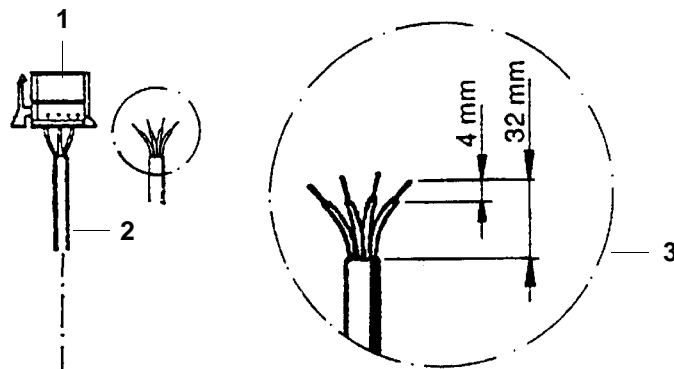


Fig. 3-5: *Making connection cables (example)*

- | | | | |
|---|----------------------------------------|---|------------------------------|
| 1 | Connector | 3 | Cable sheathing (bared ends) |
| 2 | Connection cable connectors A, B, C, D | | |

- 1 Cut the connection cable to the required length.
- 2 Strip the insulation on the lead ends as shown in the figure.
- 3 Crimp the cable shoes onto the lead ends and insert them into the connector socket until they lock into place.

Disengaging the mini-timer connector

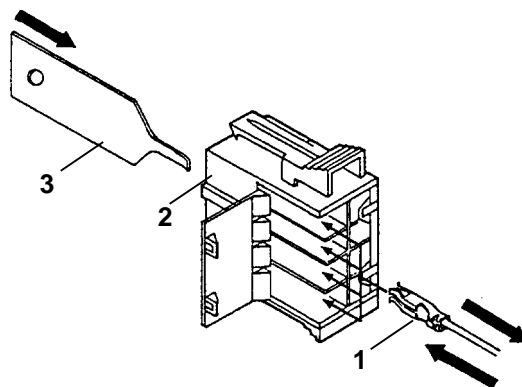


Fig. 3-6: *Disengaging the mini-timer connector*

- | | | | |
|---|------------------------|---|------------------|
| 1 | Cable shoe (with lead) | 3 | Disengaging tool |
| 2 | AMP connector socket | | |

- 1 Insert the disengaging tool (3) into the correct connector socket.
- 2 Pull the lead out of the AMP connector socket (2).

3.5.3 K-Line connection diagram (with KITAS 2170/ 2171)

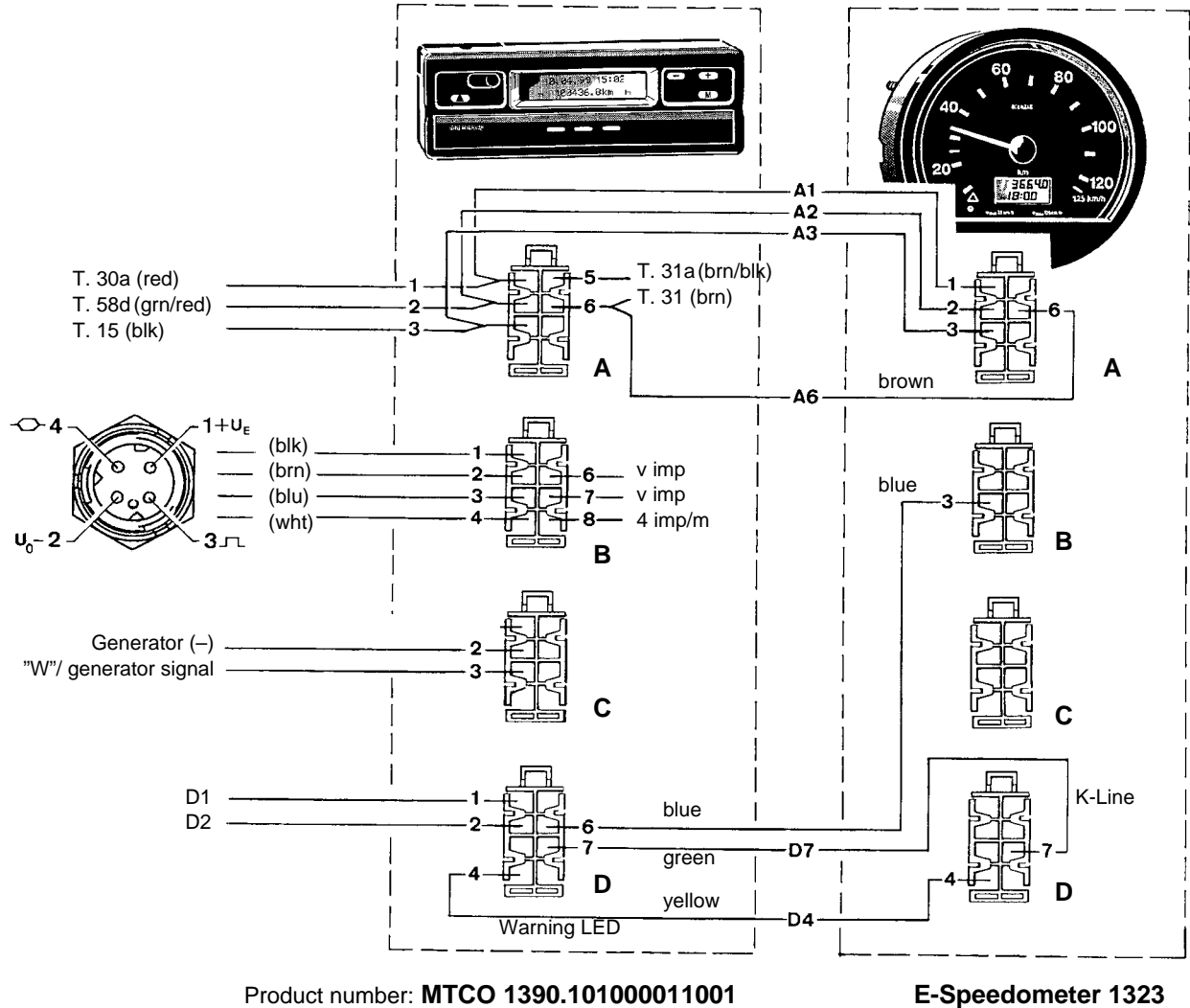
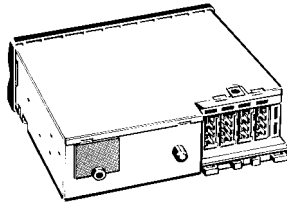


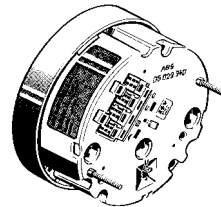
Fig. 3-7: Tachograph system 1390:
K-Line and KITAS 2170/ 2171 connection diagram

3 Installation instructions



MTCO 1390

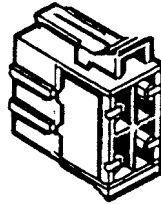
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T. 15 (blk)	Ignition
A 4	not used	
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7	not used	
A 8	not used	



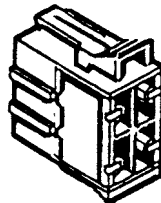
Electronic Speedometer 1323

A 1 -	MTCO - A 1	Constant voltage (red)
A 2 -	MTCO - A 2	Illumination (grn red)
A 3 -	MTCO - A 3	Ignition (blk)
A 4	not used	
A 5	not used	
A 6 -	MTCO - A 6	Earth (brn)
A 7	not used	
A 8	not used	

Connector A white



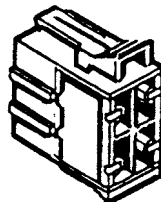
Connector B yellow



B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	Real-time signal
B 4 -		(wht)	Data signal I/O
B 5	not used		
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

B 1	not used	
B 2	not used	
B 3 -	MTCO - D6	"v" pulse
B 4	not used	
B 5	not used	
B 6	not used	
B 7	not used	
B 8	not used	

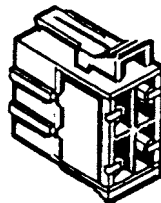
Connector C red



C 1 -	not used	
C 2 -	(-)	"n" pulse generator supply
C 3 -		"n" generator signal, terminal "W"
C 4	not used	
C 5 -		"n" generator signal (inductive)
C 6	not used	
C 7	not used	
C 8	not used	

A 1	not used	
A 2	not used	
A 3	not used	
A 4	not used	
A 5	not used	
A 6	not used	
A 7	not used	
A 8	not used	

Connector D brown

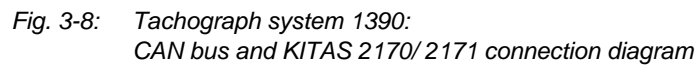


D 1 -		Additional stylus
D 2 -		Additional stylus
D 3	not used	
D 4 -		External warning LED
D 5	not used	
D 6 -	E-Speedo B3	"v" pulse
D 7 -		K-Line (instrument interface)
D 8	not used	

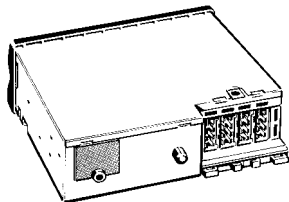
D 1	not used	
D 2	not used	
D 3	not used	
D 4 -	MTCO - D4	External warning LED
D 5	not used	
D 6	not used	
D 7 -	MTCO - D7	K-Line (instrument interface)
D 8	not used	

Table 3-2: MTCO 1390: K-Line connector assignment with Electronic Speedometer 1323 and KITAS 2170/ 2171

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MTCO 1390

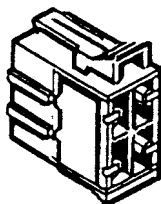
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T.15 (blk)	Ignition
A 4 -		CAN_H
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7 -		CAN_GND
A 8 -		CAN_L

B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	Real-time signal
B 4 -		(wht)	Data signal I/O
B 5			not used
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

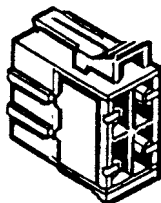
C 1			not used
C 2 -	(optional)		"n" pulse generator supply
C 3 -	(optional)		"n" generator signal, terminal "V"
C 4			not used
C 5			not used
C 6			not used
C 7			not used
C 8			not used

D 1 -			Additional stylus (optional)
D 2 -			Additional stylus (optional)
D 3			not used
D 4			not used
D 5			not used
D 6			not used
D 7 -			K Diagnosis
D 8			not used

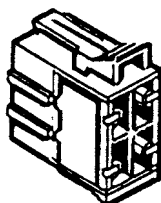
Connector A white



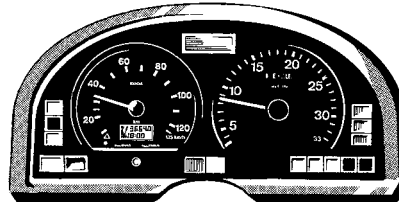
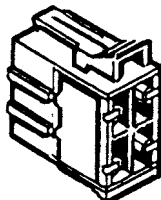
Connector B yellow



Connector C red



Connector D brown



Cluster

T. 30	Constant voltage
T. 58d	Illumination
T. 15	Ignition
T. 31	Earth
	CAN_H
	CAN_L
	CAN_GND
	Warning LED

Table 3-3: MTCO 1390:
CAN bus connector assignment with Cluster and KITAS 2170/ 2171

3.5.5 K-Line connection diagram (with pulse generator 2159)

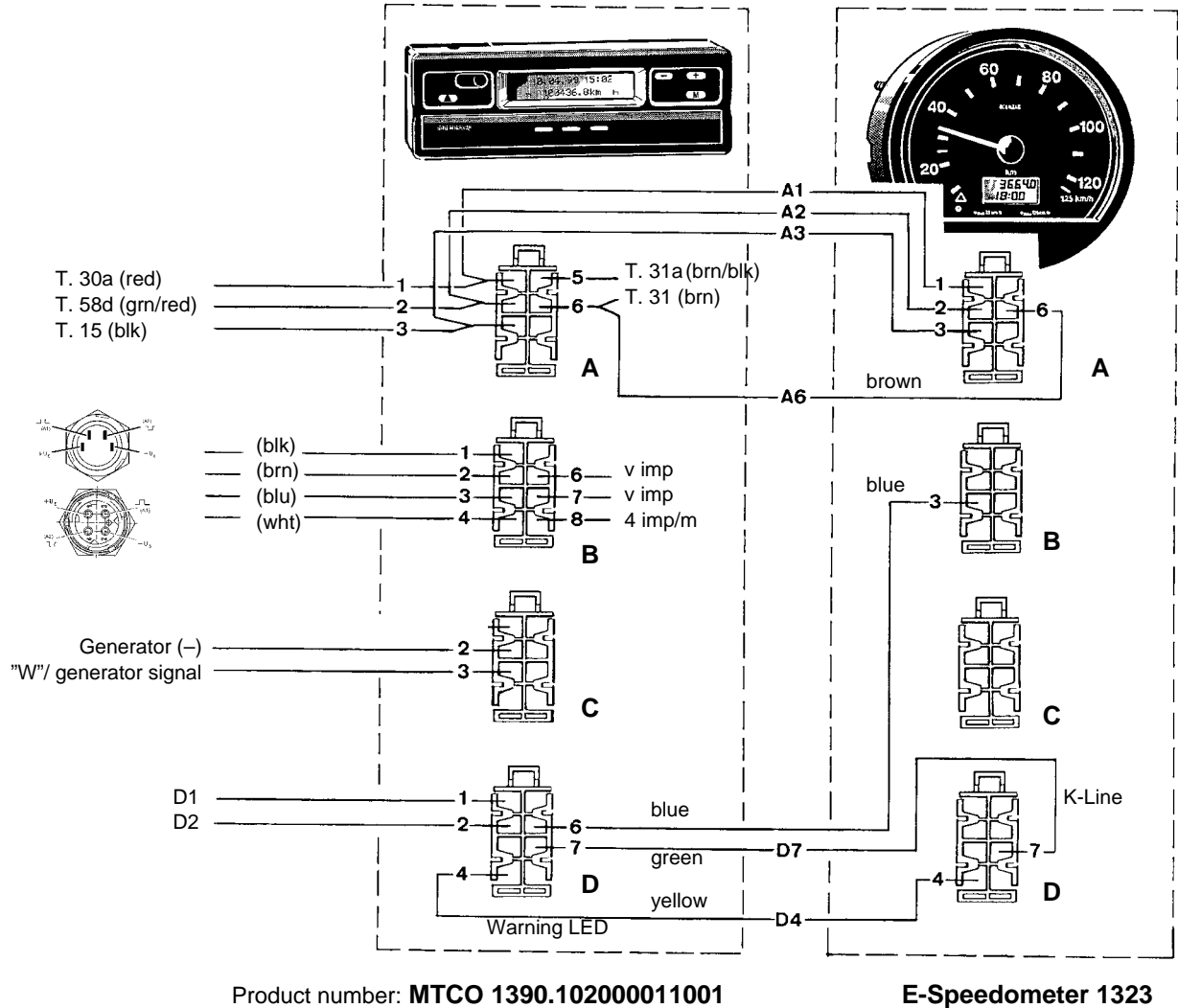
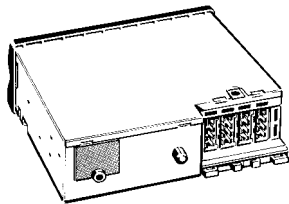


Fig. 3-9: Tachograph system 1390:
K-Line and pulse generator 2159 connection diagram

3 Installation instructions



MTCO 1390

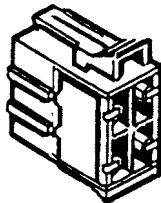
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T. 15 (blk)	Ignition
A 4	not used	
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7	not used	
A 8	not used	

B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	A1 output signal
B 4 -		(wht)	A2 output signal (inverted)
B 5	not used		
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

C 1 -	not used	
C 2 -	(-)	"n" pulse generator supply
C 3 -		"n" generator signal, terminal "W"
C 4	not used	
C 5 -		"n" generator signal (inductive)
C 6	not used	
C 7	not used	
C 8	not used	

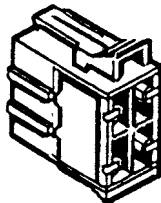
D 1 -		Additional stylus
D 2 -		Additional stylus
D 3	not used	
D 4 -		External warning LED
D 5	not used	
D 6 -		E-Speedo. B3 "v" pulse
D 7 -		K-Line (instrument interface)
D 8	not used	

Connector A white



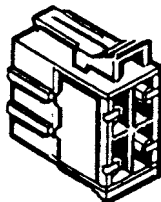
A 1 -	MTCO - A 1	Constant voltage (red)
A 2 -	MTCO - A 2	Illumination (grn red)
A 3 -	MTCO - A 3	Ignition (blk)
A 4	not used	
A 5	not used	
A 6 -	MTCO - A 6	Earth (brn)
A 7	not used	
A 8	not used	

Connector B yellow



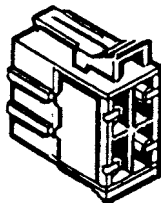
B 1	not used	
B 2	not used	
B 3 -	MTCO - D6	"v" pulse
B 4	not used	
B 5	not used	
B 6	not used	
B 7	not used	
B 8	not used	

Connector C red

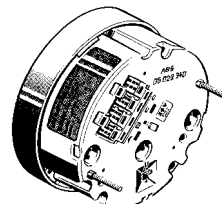


A 1	not used	
A 2	not used	
A 3	not used	
A 4	not used	
A 5	not used	
A 6	not used	
A 7	not used	
A 8	not used	

Connector D brown



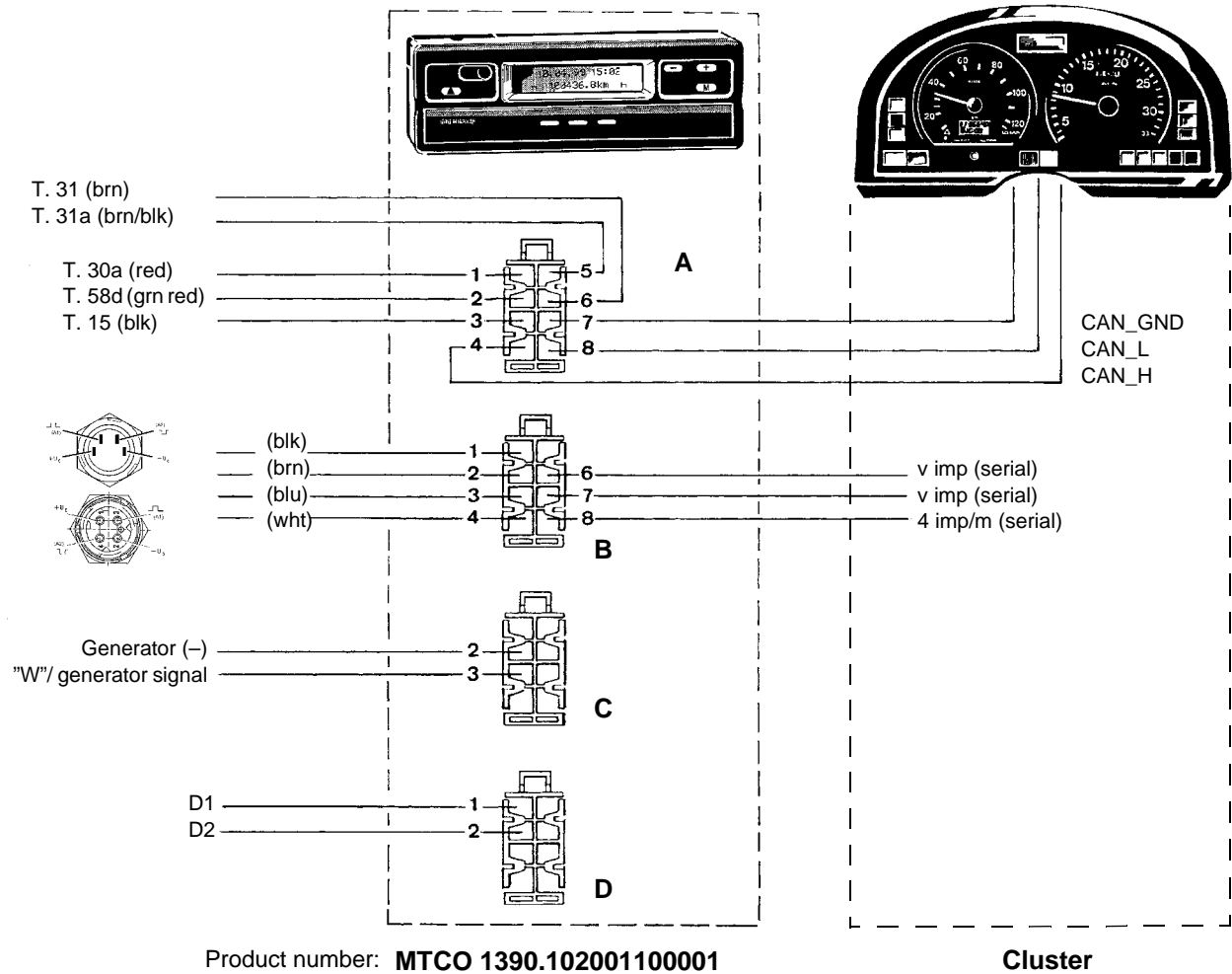
D 1	not used	
D 2	not used	
D 3	not used	
D 4 -	MTCO - D4	External warning LED
D 5	not used	
D 6	not used	
D 7 -	MTCO - D7	K-Line (instrument interface)
D 8	not used	



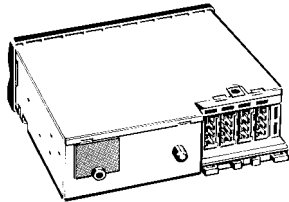
Electronic Speedometer 1323

Table 3-4: MTCO 1390: K-Line connector assignment with Electronic Speedometer 1323 and pulse generator 2159

3.5.6 CAN bus connection diagram (with pulse generator 2159)



3 Installation instructions



MTCO 1390

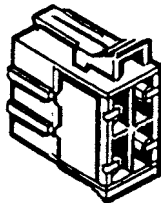
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T. 15 (blk)	Ignition
A 4 -	CAN_H	
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7 -	CAN_GND	
A 8 -	CAN_L	

B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	A1 output signal
B 4 -		(wht)	A2 output signal (inverted)
B 5			not used
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

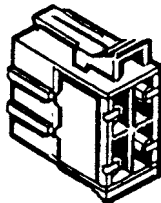
C 1			not used
C 2 -	(optional)		"n" pulse generator supply
C 3 -	(optional)		"n" generator signal, terminal "W"
C 4			not used
C 5			not used
C 6			not used
C 7			not used
C 8			not used

D 1 -			Additional stylus (optional)
D 2 -			Additional stylus (optional)
D 3			not used
D 4			not used
D 5			not used
D 6			not used
D 7 -			K Diagnosis
D 8			not used

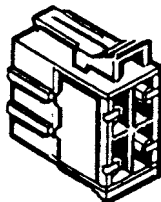
Connector A white



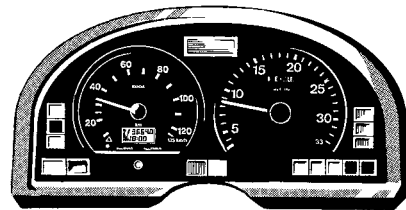
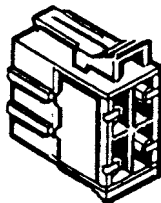
Connector B yellow



Connector C red



Connector D brown



Cluster

T. 30	Constant voltage
T. 58d	Illumination
T. 15	Ignition
T. 31	Earth
	CAN_H
	CAN_L
	CAN_GND
	Warning LED

Table 3-5: MTCO 1390:
CAN bus connector assignment with Cluster and pulse generator 2159

3.5.7 K-Line connection diagram (with Eaton generator 4302691)

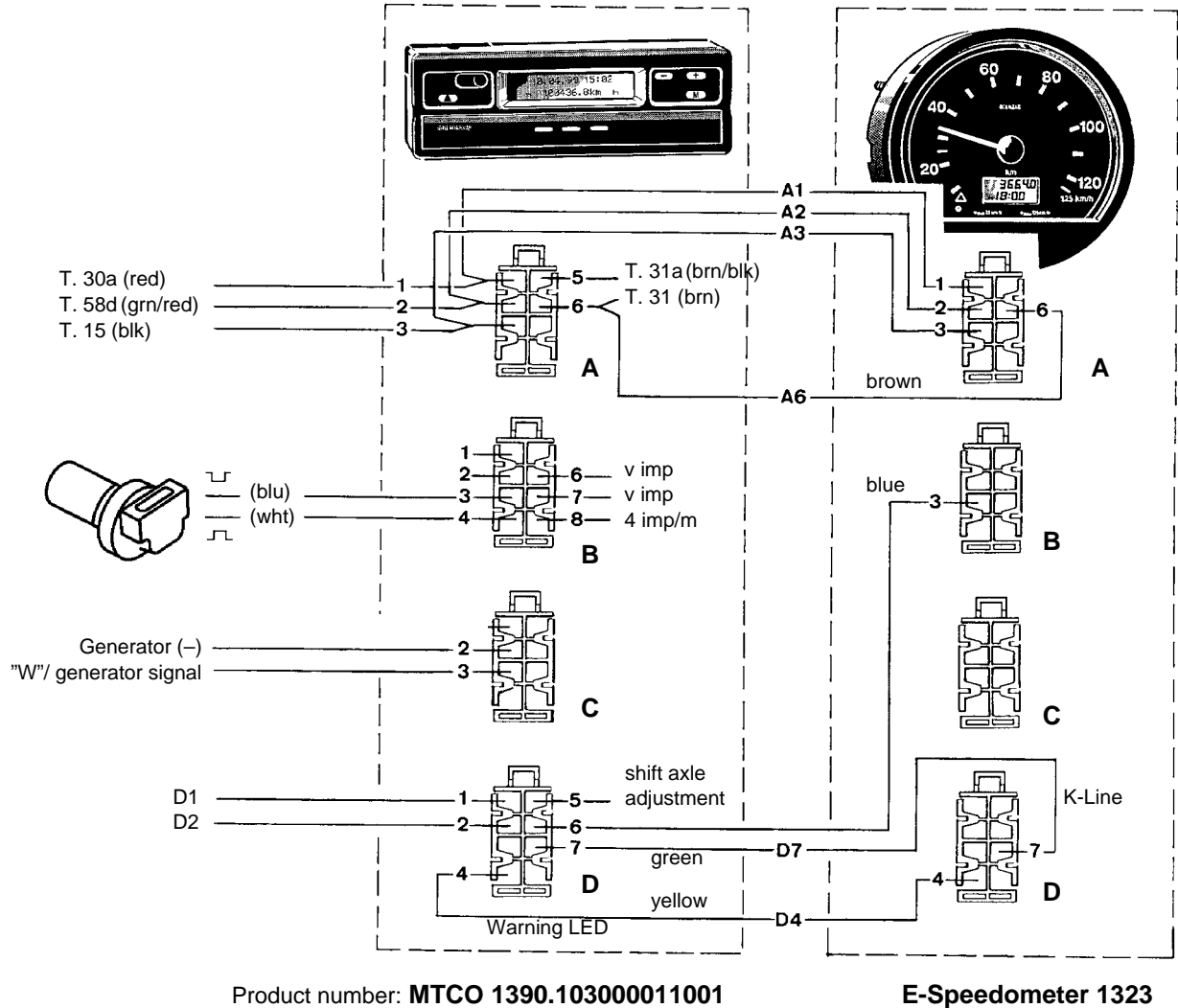
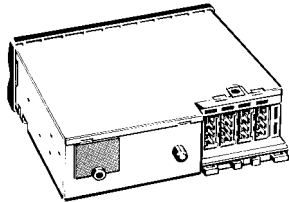


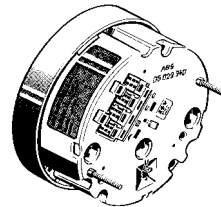
Fig. 3-11: Tachograph system 1390:
K-Line and Eaton generator 4302691 connection diagram

3 Installation instructions



MTCO 1390

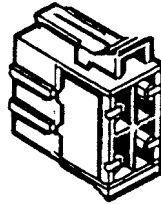
A 1 -	T. 30a (red)	Constant voltage
A 2 -	T.58d(grn/red)	Illumination
A 3 -	T. 15 (blk)	Ignition
A 4	not used	
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7	not used	
A 8	not used	



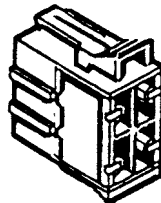
Electronic Speedometer 1323

A 1 -	MTCO - A 1	Constant voltage (red)
A 2 -	MTCO - A 2	Illumination (grn red)
A 3 -	MTCO - A 3	Ignition (blk)
A 4	not used	
A 5	not used	
A 6 -	MTCO - A 6	Earth (brn)
A 7	not used	
A 8	not used	

Connector A white



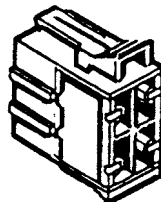
Connector B yellow



B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	A1 output signal
B 4 -		(wht)	A2 output signal (inverted)
B 5	not used		
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

B 1	not used	
B 2	not used	
B 3 -	MTCO - D6	"v" pulse
B 4	not used	
B 5	not used	
B 6	not used	
B 7	not used	
B 8	not used	

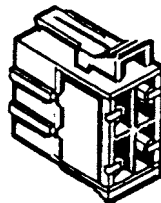
Connector C red



C 1 -	not used	
C 2 -	(-)	"n" pulse generator supply
C 3 -		"n" generator signal, terminal "W"
C 4	not used	
C 5 -		"n" generator signal (inductive)
C 6	not used	
C 7	not used	
C 8	not used	

A 1	not used	
A 2	not used	
A 3	not used	
A 4	not used	
A 5	not used	
A 6	not used	
A 7	not used	
A 8	not used	

Connector D brown



D 1 -		Additional stylus
D 2 -		Additional stylus
D 3	not used	
D 4 -		External warning LED
D 5 -		Shift axle adjustment
D 6 -	E-Speedo B3	"v" pulse
D 7 -		K-Line (instrument interface)
D 8	not used	

D 1	not used	
D 2	not used	
D 3	not used	
D 4 -	MTCO - D4	External warning LED
D 5	not used	
D 6	not used	
D 7 -	MTCO - D7	K-Line (instrument interface)
D 8	not used	

Table 3-6: MTCO 1390: K-Line connector assignment with Electronic Speedometer 1323 and Eaton generator 4302691

3.5.8 CAN bus connection diagram (with Eaton generator 4302691)

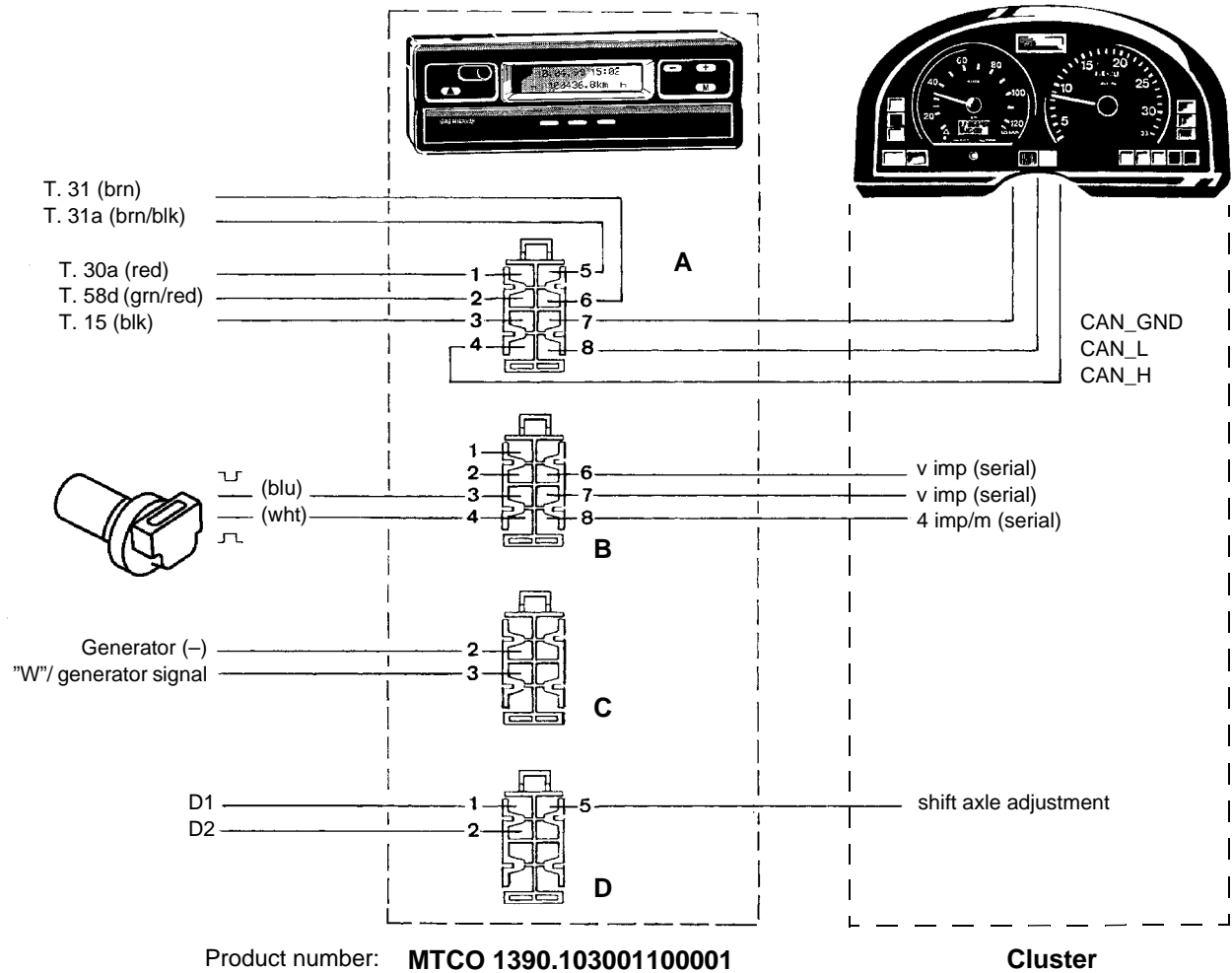
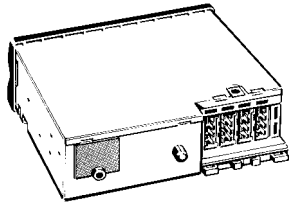


Fig. 3-12: Tachograph system 1390:
CAN bus and Eaton generator 4302691 connection diagram



MTCO 1390

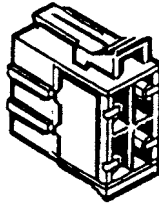
- A 1 - T. 30a (red) Constant voltage
- A 2 - T. 58d (grn/red) Illumination
- A 3 - T. 15 (blk) Ignition
- A 4 - CAN_H**
- A 5 - T. 31a (brn/blk) Minus (negative?)
- A 6 - T. 31 (brn) Earth
- A 7 - CAN_GND**
- A 8 - CAN_L**

- B 1 - + (blk) "v" sensor supply
- B 2 - - (brn) "v" sensor supply
- B 3 - (blu) A1 output signal
- B 4 - (wht) A2 output signal (inverted)
- B 5 - not used
- B 6 - "v" pulse output
- B 7 - "v" pulse output
- B 8 - 4 imp/m signal output

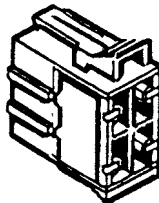
- C 1 - not used
- C 2 - (optional) "n" pulse generator supply
- C 3 - (optional) "n" generator signal, terminal "W"
- C 4 - not used
- C 5 - not used
- C 6 - not used
- C 7 - not used
- C 8 - not used

- D 1 - Additional stylus (optional)
- D 2 - Additional stylus (optional)
- D 3 - not used
- D 4 - not used
- D 5 - Shift axle adjustment
- D 6 - not used
- D 7 - K Diagnosis
- D 8 - not used

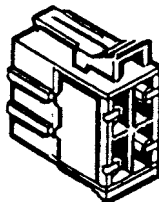
Connector A white



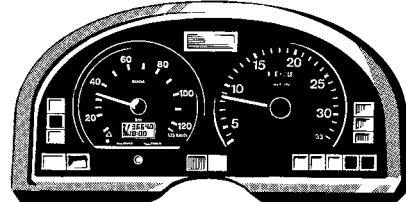
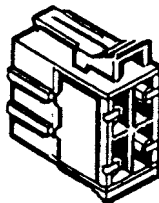
Connector B yellow



Connector C red



Connector D brown



Cluster

- T. 30 Constant voltage
- T. 58d Illumination
- T. 15 Ignition
- T. 31 Earth
- CAN_H
- CAN_L
- CAN_GND
- Warning LED

Table 3-7: MTCO 1390:
CAN bus connector assignment with Cluster and Eaton generator 4302691

3.5.9 Running connection and sensor cables

Connection cables



Condition

Before running connection cables the following information must be available:

- Components of the tachograph system
- Special conditions for running the cables in the vehicle such as exhaust, shift axle, tiltable cab...



Important

When running and connecting connection cables make sure that the connection cables are:

- fixed at short intervals (approx. every 500 mm) and in such a way that they do not vibrate
- not exposed to tensile, compressive or shearing forces
- protected with rubber grommets when run through sheet metal or plastic.

Sensor/ pulse cable



Important

When running and connecting the sensor/ pulse cable make sure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cab
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

3.5.10 Installing the sensor/ pulse generator

Additional information

More detailed information and instructions on making connection cables and installing the KITAS sensor and pulse generator can be found in the relevant chapters in *Section 4 "Sensors and pulse generators"*.

3.6 Installing/ removing the MTCO 1390

3.6.1 Fitting dimensions and permissible fitting position

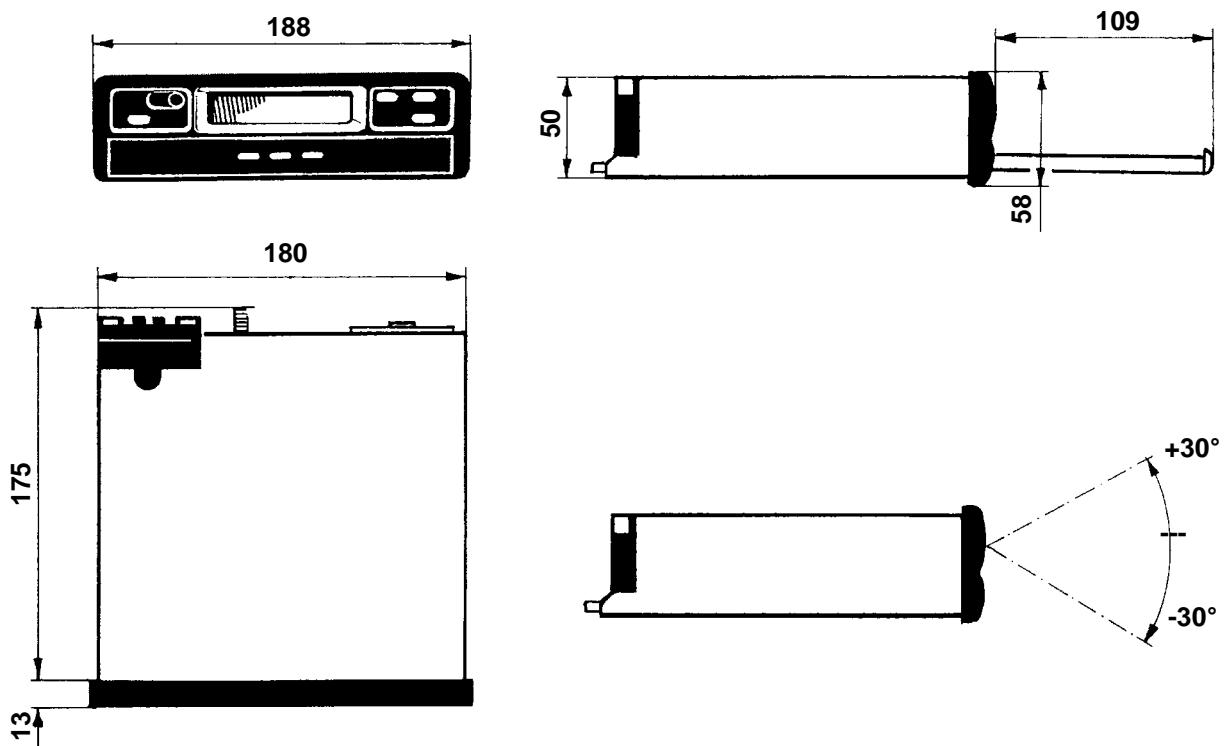


Fig. 3-13: MTCO 1390: Housing dimensions



Important

Dimensions complying with DIN/ ISO 7736 radio compartment.
The fitting position depends on the legibility of the display.
The optimum fitting position is $\pm 30^\circ$.

3.6.2 Installation accessories

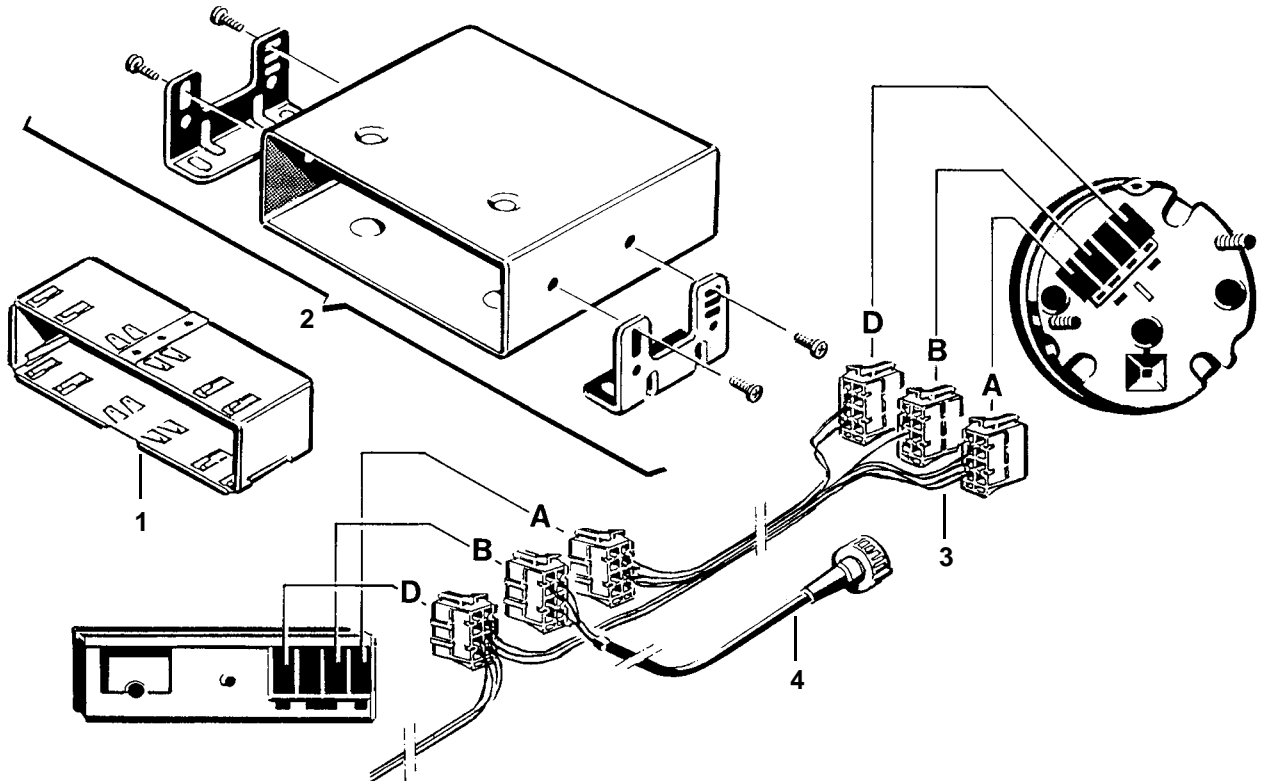


Fig. 3-14: MTCO 1390: Installation accessories

- | | |
|--------------------|----------------------------------|
| 1 Mounting frame | 3 E-Speedometer connection cable |
| 2 Mounting console | 4 Sensor/ pulse cable |

3.6.3 Installation instructions

The installation site for the MTCO 1390 depends on the vehicle. Observe the instructions contained in the vehicle's service manual when fitting the unit.

Before fitting the unit



Important

Before installing the components into the driver's cab, run all necessary connection cables. When installing the MTCO 1390 into the radio compartment, the connection cables must be shortened so that they can be connected and removed safely.

Installing the mounting frame into the radio compartment

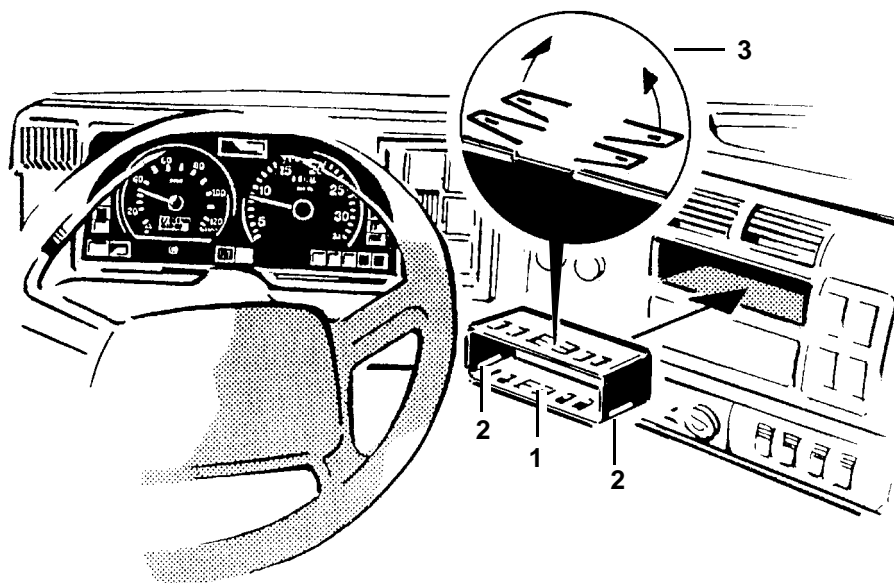


Fig. 3-15: MTCO 1390: Mounting frame for radio compartment

- | | | | |
|---|----------------|---|-------------------------|
| 1 | Mounting frame | 3 | Tabs for securing frame |
| 2 | Catch springs | | |

- 1 Slide in the mounting frame (1).**
Make sure that the catch springs (2) are at the bottom.
- 2 Bend the tabs (3) up using a screw driver to secure the frame in the dashboard.**
The mounting frame must sit firmly in the radio compartment.

Connecting and sealing the MTCO 1390

- 1 Plug connectors A, B, C (optional) and D into the MTCO 1390's sockets on the back.**
For connector assignments and connections refer to the "Tachograph system wiring diagrams", Fig. 3-7 to Fig. 3-12, from page 3-11.
- 2 Put the seal hood on and seal it.**

Installing the MTCO 1390

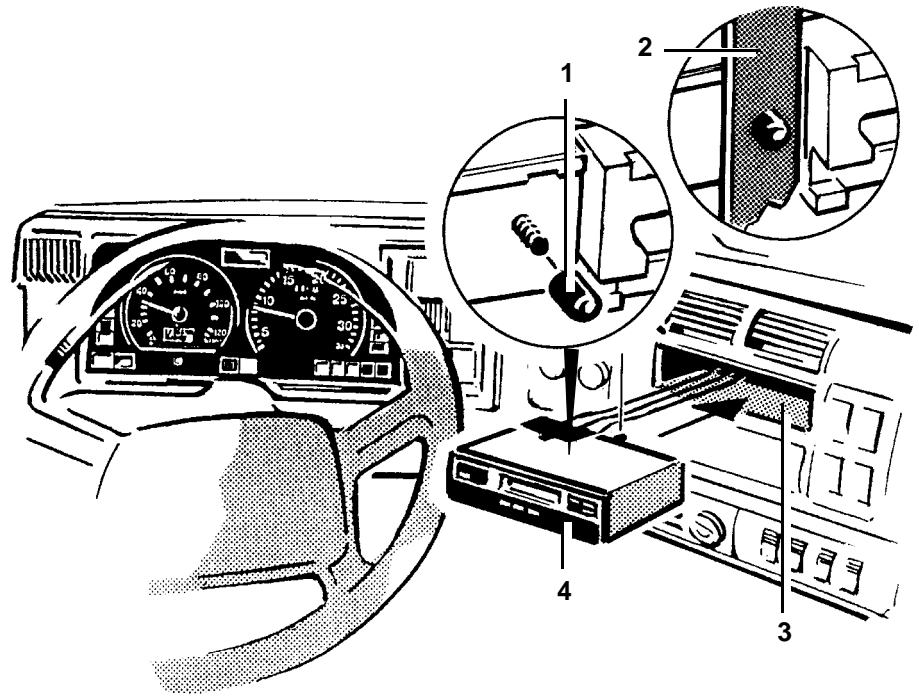


Fig. 3-16: MTCO 1390: Installing into the radio compartment

- | | | | |
|---|--------------------------------------|---|-------------------|
| 1 | Fixing cap | 3 | Radio compartment |
| 2 | Holding bracket in radio compartment | 4 | MTCO 1390 |

- 1 Press the fixing cap (1) onto the screw on the back of the MTCO 1390 (4).
- 2 Slide the MTCO 1390 (4) into the mounting frame (3) until the unit locks into place and the front cover is flush with the dashboard.
Generally, there is a holding bracket (2) with a drilled hole on the radio compartment's back panel. When sliding the MTCO 1390 into the radio compartment, the fixing cap (1) fits into this hole and holds the unit in place.

3.6.4 Removal instructions

The steps for removing the MTCO 1390 depend on the vehicle. Observe the instructions contained in the vehicle's service manual when removing the unit.

Before removal



Important

Before removing the MTCO 1390 you will have to determine the following:

- Current odometer reading of the vehicle
- The following additional details in case of warranty claims:
 - Installation date
 - Kilometre reading (mileage) of the MTCO 1390.

■ **Determine the vehicle's current total odometer reading and write it down:**

- Refer to the display reading on the tachograph.
- When the display is defective ask the vehicle owner.

■ **In case of warranty claims use an MTC to determine the installation date by selecting the "INSTALLATION DATA" program.**

The "INSTALLATION DATA" program description can be found in *Chapter 3.8.4 "Programming the MTCO 1390"* from page 3-39.

Removal

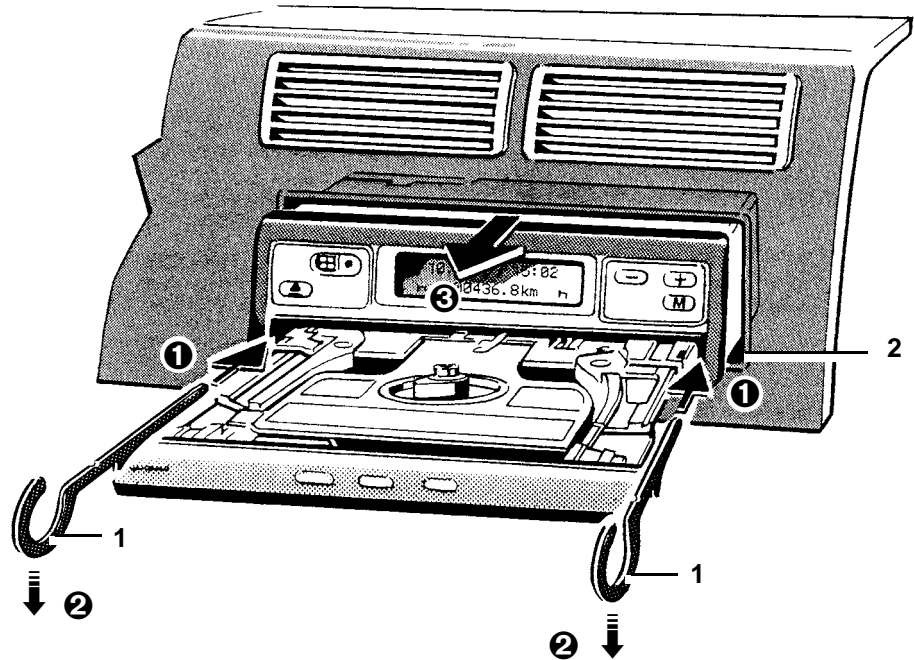


Fig. 3-17: Removing the MTCO 1390

- 1 Special removal tools 2 Mounting frame

- 1 Insert the special removal tools (1) into the left and right space between the tray and the MTCO 1390's front cover until they will go no further.
- 2 Push the special removal tools (1) down and keep them down.
- 3 Then pull the MTCO 1390 out of the mounting frame or radio compartment.

3.7 Removing/ installing the Electronic Speedometer 1323

3.7.1 Electronic Speedometer fitting dimensions

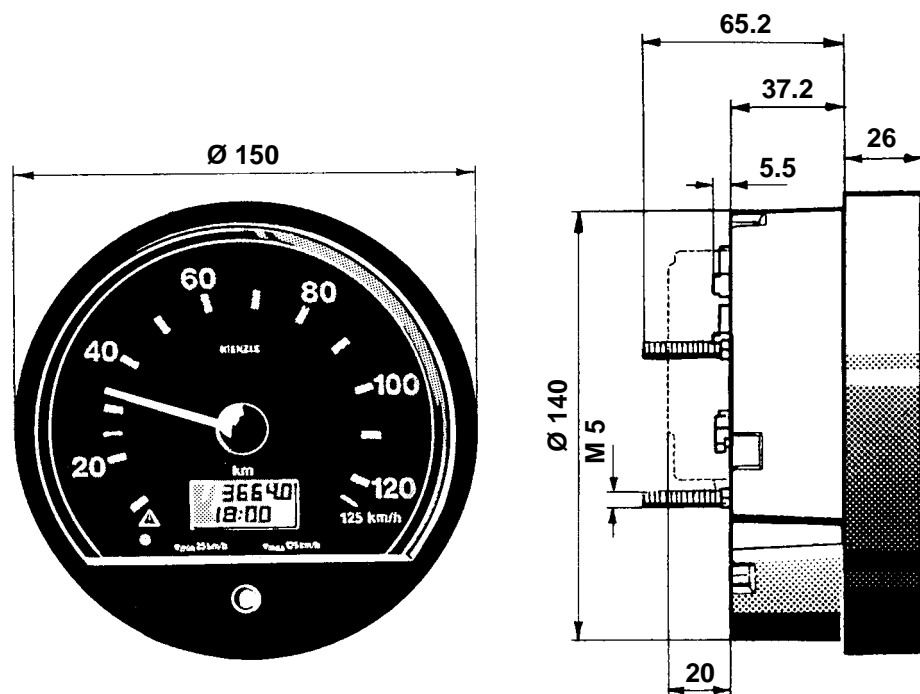


Fig. 3-18: Electronic Speedometer 1323: Housing dimensions



Important

Vehicle-/manufacturer-specific versions with different housing dimensions and designs are possible.

3.7.2 Electronic Speedometer installation accessories

When installing the Electronic Speedometer into the vehicle's dashboard, use the following tools which are the same as for older tachographs:

- Mounting brackets
- Collars or profile brackets.

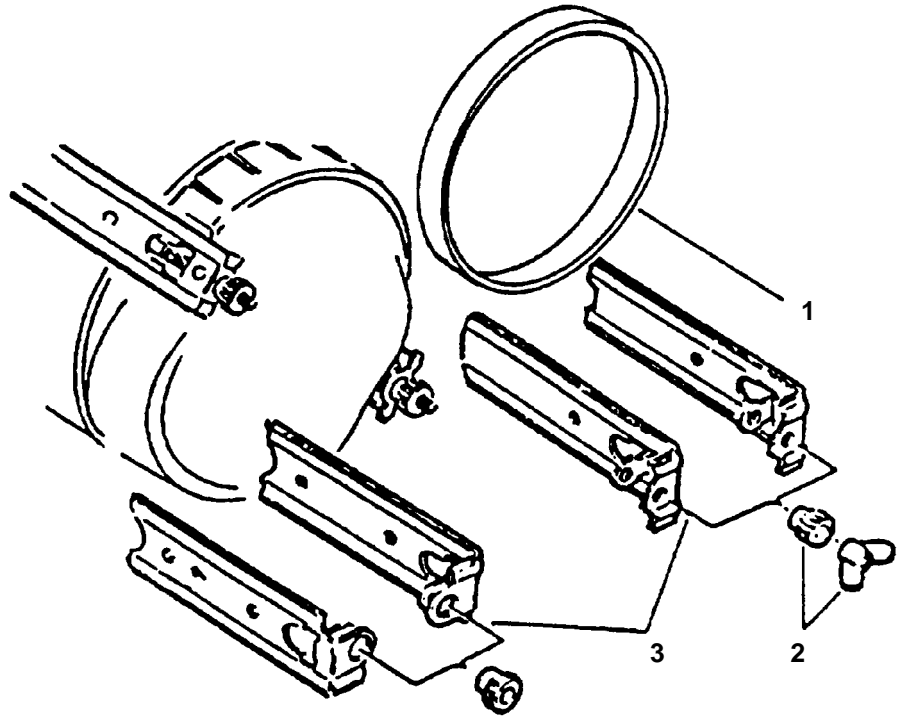


Fig. 3-19: Electronic Speedometer 1323: Installation accessories

- | | |
|-------------------------|---------------------|
| 1 Collar | 3 Mounting brackets |
| 2 Knurled nut/ wing nut | |



Important

Only tighten the mounting bracket's knurled nut manually, maximum torque 0.5 Nm.

Installation

If collars are used to adapt the unit to the dashboard, only fit these with the correct mounting brackets.

Removal

When using profiles for fixing the Electronic Speedometer 1323 must not be pulled out. Just press firmly on the back to remove it.

3.7.3 Instructions for installing/ removing the Electronic Speedometer



Important

The steps for installing the Electronic Speedometer 1323 depend on the vehicle. Observe the instructions contained in the vehicle's service manual when fitting the unit.

Installation instructions

Follow these two steps to install the unit:

- Install the Electronic Speedometer 1323 into the dashboard
- Replace the dashboard/ components.

Installing the Electronic Speedometer 1323 into the dashboard

- 1 **Connect the Electronic Speedometer using the connectors.**
- 2 **Put the seal hood on and seal it correctly.**
According to the law, the connectors on the Electronic Speedometer need not be sealed (see Chapter 4.2.2 "Sealing plan for the Electronic Speedometer 1323", page 4-5).
- 3 **Mount the Electronic Speedometer into the dashboard.**

Mounting dashboard/ components again

- **Before fixing the dashboard check:**
 - that all connectors, switches etc. are fitted correctly
 - the position of the wiring harness.

The wiring harness must not exert pressure on the back of the Electronic Speedometer.



Important

Check whether all units and switches on the dashboard function correctly when the dashboard is fixed.

Removal instructions

The Electronic Speedometer is removed by undoing the brackets on the back first and then removing the unit.



Important

Refer to the vehicle' service instructions for a detailed description on how to remove the dashboard and its components.

3.8 Commissioning the tachograph system

When commissioning the unit all the modular components of the MTCO 1390 tachograph system are adjusted to each other. This ensures that the tachograph system 1390 forms a unit that is ready for operation.

The commissioning completes the initialisation of the individual components which have already been pre-set at the factory (see *Chapter 1.2 "Data transmission within the system"*, from page 1-7. It is carried out when programming the system using an MTC/ ATC.

The following service diagnosis systems are used to set the parameters for and program the MTCO 1390 inside the vehicle:

- MTC 1602.04, including the following accessories:
 - Interface with software version 6.00
 - BTC software version 07.xx
 - Programming cable (1602-78-170-00)
 - Diagnosis cable (1602-78-171-00)
- Automatic measuring track, including MTC accessories such as light barrier, Start/ Stop reflectors and light barrier cable or
- Rolling Road Test Computer (ATC) with programming cable.

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1.3 "Mobile Test Computer (MTC)"* from page 1-8 as well as in the separate "MTC 1602.04" operating instructions and supplements.

Commissioning workflow overview



Important

When the tachograph system is fitted to the vehicle and all electrical connections are made, the vehicle must be made roadworthy again so that it can be moved safely.

- 1 **Prepare programming.**
- 2 **Activate KITAS 2170/ 2171 (MTCO 1390 with KITAS sensor only).**
The pulse generator 2159/ Eaton generator 4302691 are initialised automatically when programming the tachograph system 1390.
- 3 **Determine the wheel circumference and the vehicle's characteristic coefficient "w" (imp/km).**
- 4 **Set the parameters for the MTCO 1390:**
 - **Enter/ set the determined vehicle and installation data**
 - **Set the date and the clock.**

MTC 1602.04 menu structure

MTC MEASUREMENT

- └─ AUTOM. MEAS. TRACK
- └─ MANUAL MEAS. TRACK
- └─ CHECK K MEASURING
- └─ W-ADAPTED
- └─ DEVICE TESTING

PROGRAMMING

MTCO installation data

- └─ v constant
- └─ n constant
- └─ Wheel circumference
- └─ Distance counter
- └─ VIN (vehicle identification number)
- └─ Configuration
- └─ CAN configuration
- └─ Product code
- └─ Drive shaft PPR
- └─ Initial installation
- └─ Calibration date
- └─ Seal number
- └─ Maximum speed
- └─ RPM recording
- └─ Rear axle

Date - Time

- └─ Programming TCO
 - Prog-Time Zone
 - Prog-System time
- └─ Programming BTC
 - Time zone
 - Change-over times 01/ 05.

Activate KITAS

Manufacturing data

Distance covered

Erase error memory

- └─ DFK MEAS. (see MTC programming instructions)

3.8.1 Preparing programming

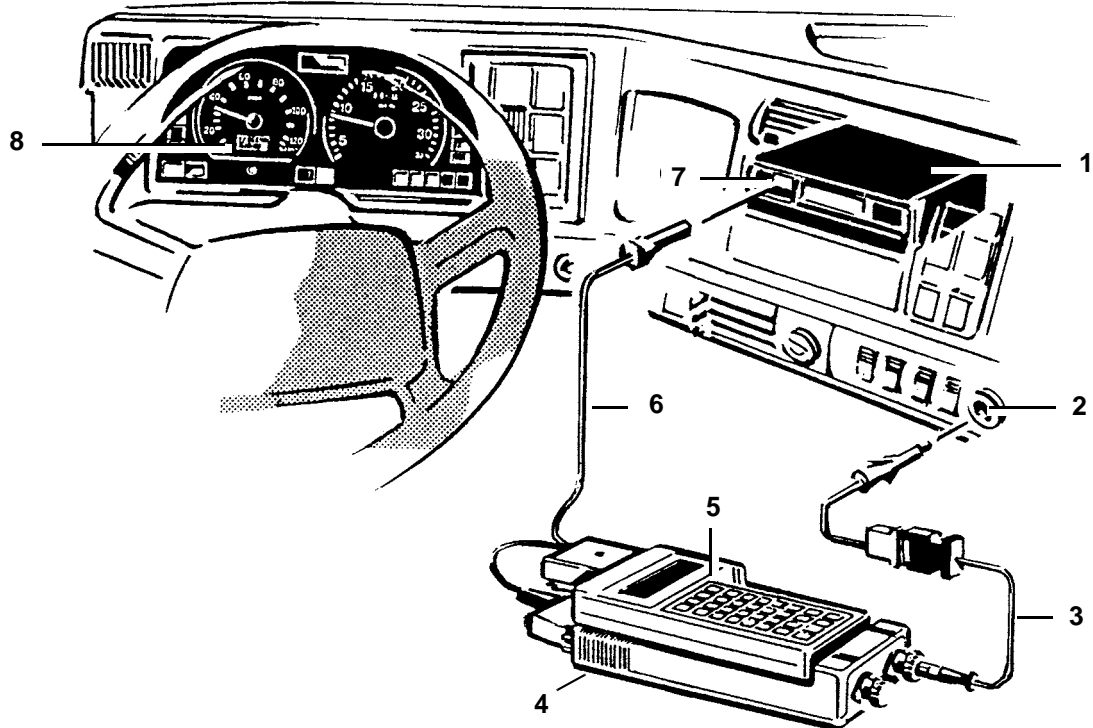


Fig. 3-20: MTCO 1390: MTC connection overview

- | | |
|---------------------|-----------------------------------|
| 1 MTCO 1390 | 5 BTC |
| 2 Cigarette lighter | 6 Test cable |
| 3 Power cable | 7 Test and programming interface |
| 4 MTC interface | 8 Electronic Speedometer/ Cluster |



Condition

The tachograph charts can only be inserted or removed when the ignition is on and the vehicle is stationary. And the MTCO 1390 must not display an error message indicating a malfunction.

- 1 Turn the ignition on.**
The basic display appears. If not, all errors/ malfunctions in the MTCO 1390 must be corrected until no message is shown on the display (see *Chapter 6.4 "Error correction measures"*, from page 6-14).
- 2 Unlock the tray.**
- 3 Insert the tachograph chart(s) into the MTCO 1390.**
For a description on how to insert and remove the tachograph charts please refer to *Chapter 2.1.2 "Operation"*, from page 2-9.
- 4 Close the tray.**

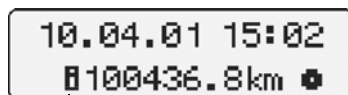
5 Access the programming interface (7) on the MTCO 1390:

- Remove the seal cap.
- Undo the screw and remove the seal plate.

6 Connect the MTC to the MTCO's programming interface (7) using the test cable (6).

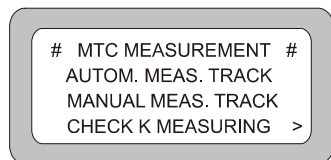
7 Connect the MTC to the vehicle's electrical system using the power cable (3).
When the MTC is connected to the vehicle's electrical system, the program starts automatically and the main menu is displayed. The program uses the programming cable to detect that an MTCO 1390 is connected.

As well as the "basic display" the "test and programming interface active" symbol appears on the MTCO 1390's display (during data transmission **only**).



"Test and programming interface active"

8 Start programming.



Use the DOWN arrow key to move the cursor to the next page of the main menu.

3.8.2 Activating KITAS 2170/ 2171 (if installed)

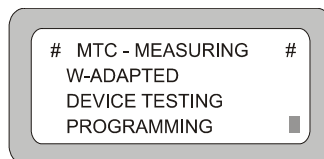


Important

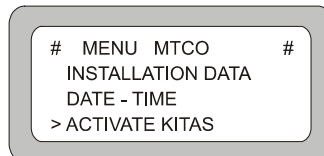
"Activate sensor/ generator" is **only** used to activate the KITAS sensor (MTCO 1390 with KITAS sensor).

The pulse generator 2159/ Eaton generator 4302691 are initialised automatically when programming the 1390 tachograph system.

When both components are installed into the vehicle, the KITAS sensor and the MTCO 1390 must be adjusted to each other. The units are adjusted by selecting the "ACTIVATE KITAS" menu item when programming the unit using an MTC/ ATC.



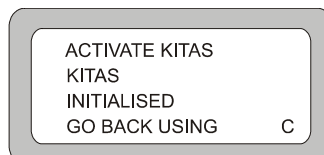
Select "PROGRAMMING" and press **[Enter]** to confirm.



Select the "ACTIVATE KITAS" menu and press **[Enter]** to confirm.



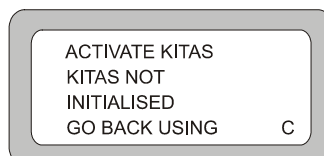
Initialisation can take up to 30 seconds.



Press **[C]** to return to #MENU MTCO#.

Error message

When the sensor cannot be initialised an error message is displayed:



KITAS cannot be initialised or KITAS is not connected.

Press **[C]** to return to #MENU MTCO#.

3.8.3 Determining the vehicle's wheel circumference and characteristic coefficient "w" (imp/km)

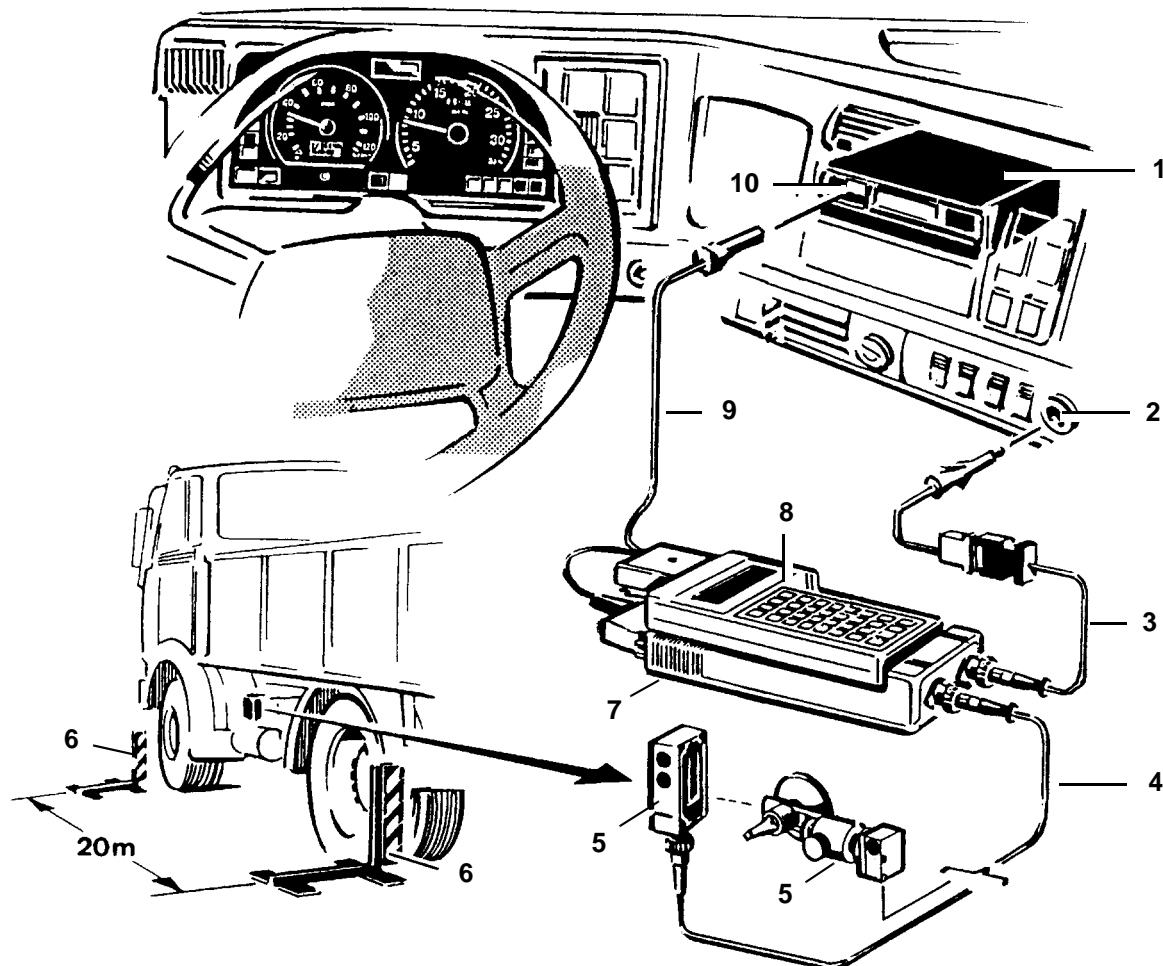


Fig. 3-21: MTCO 1390: MTC connection overview with automatic measuring track

- | | |
|-----------------------|-----------------------------------|
| 1 MTCO 1390 | 6 Start/ Stop reflectors |
| 2 Cigarette lighter | 7 MTC interface |
| 3 Power cable | 8 BTC |
| 4 Light barrier cable | 9 Test cable |
| 5 Light barrier | 10 Test and programming interface |
- 1 Attach the light barrier (5) to the vehicle and connect it to the MTC using the light barrier cable (4).
 - 2 Check that the measuring track is set up correctly.

Additional information

A detailed description of the measurement workflow and instructions on how to determine the wheel circumference and the vehicle's characteristic coefficient "w" (imp/km) can be found in *Chapter 5.5.2 "Determining the characteristic coefficient "w" (imp/km)"*, page 5-15.

3.8.4 Programming the MTCO 1390

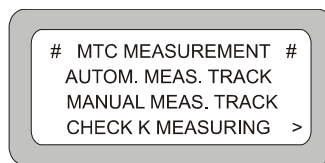


Condition

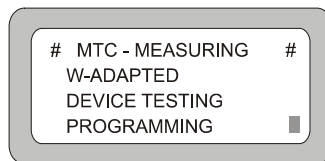
Make sure that:

- the MTC and the MTCO 1390 are connected by the test cable
- the tachograph chart/ pack is inserted into the MTCO 1390
- the "basic display" is shown on the MTCO 1390.

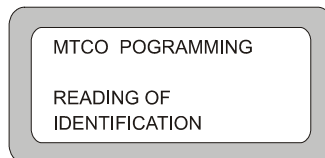
■ Start programming.



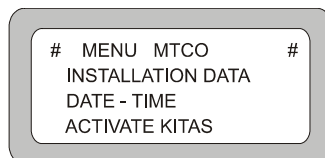
Use the DOWN arrow key to move the cursor to the next page of the main menu.



Select "PROGRAMMING" and press [Enter] to confirm.



When "Programming" is selected this mask is displayed for approx. 2 seconds.



The "INSTALLATION DATA" menu is already selected. If not, select it and press [Enter] to confirm.

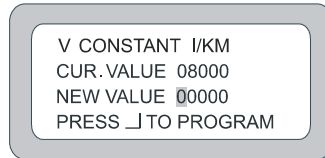
MTCO 1390 installation data

■ Program the installation data:

Summary

- | | |
|---------------------------------------|-------------------------|
| 1 v constant | 8 Product code |
| 2 n constant | 9 Drive shaft PPR |
| 3 Wheel circumference | 10 Initial installation |
| 4 Distance counter | 11 Calibration date |
| 5 VIN (vehicle identification number) | 12 Seal number |
| 6 Configuration | 13 Maximum speed |
| 7 CAN configuration | 14 RPM recording |
| | 15 Rear axles |

1 Program the v constant.



"MTCO INSTALLATION" menu

The "V CONSTANT" menu is already selected. If not, select it and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (03200-25000 imp/km).

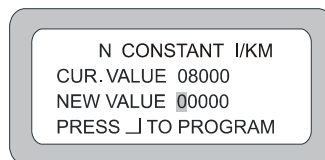
Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to
#MTCO INSTALLATION#.

2 Program the n constant.

"MTCO INSTALLATION" menu



Select the "N CONSTANT" menu and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (02000-62000 imp/km).

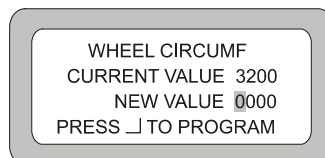
Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to
#MTCO INSTALLATION#.

3 Program the wheel circumference.

"MTCO INSTALLATION" menu



Select the "WHEEL CIRCUMF." menu and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the decimal in the entry field
- Enter figures (1000-7200 mm).

Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to
#MTCO INSTALLATION#.

4 Program the distance counter.



Important

From firmware version 001.07 the threshold is 1000 km. This means that:

- if the odometer reading is 0 - 999 km any value can be programmed
- if the odometer reading is 1000 - 899999 km the value that can be programmed **must** be equivalent to or higher than the previous odometer reading
- if the odometer reading is 900,000 km or higher the odometer reading cannot be modified.

"MTCO INSTALLATION" menu

```

DISTANCE COUNTER
ACT      0000025 KM
NEW      0000000 KM
PROGRAM VIA  →
    
```

Select the "DISTANCE COUNTER" menu and press **[Enter]** to confirm.

Enter the odometer reading:

- Select the decimal in the entry field
- Enter figures (up to 7 digits).

Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

5 Program VIN.

```

# MTCO INSTALLATION #
ODOMETER
> VIN
CONFIGURATION
    
```

"MTCO INSTALLATION" menu

Select the "VIN" menu and press **[Enter]** to confirm.

```

VIN
RE-ENTER F1
123456789ABCDEFGH
PRESS → TO PROGRAM
    
```

Press **[F1]** to enter a new vehicle identification number. For the vehicle identification number enter letters and figures (up to 17 digits).

Press **[Enter]** to confirm your entry.

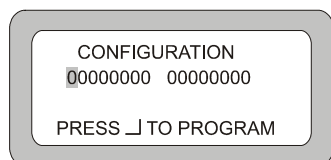
If programming has been successful the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

6 Query the configuration.

Use this menu item to program a special device variant in situ.

"MTCO INSTALLATION" menu



```
CONFIGURATION
00000000 00000000
PRESS ↓ TO PROGRAM
```

Select the "CONFIGURATION" menu and press **[Enter]** to confirm.

Display the configuration:

Press **[C]** to return to #MTCO INSTALLATION#.



Caution

Please note when replacing units

When replacing units featuring:

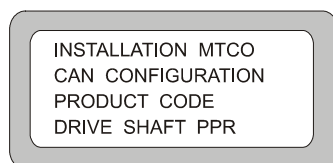
- the same firmware version the configuration must be checked. If necessary, the values stored in the removed unit have to be programmed into the new one.
- a higher firmware version the factory configuration must be accepted.

7 Set the CAN priority by selecting CAN configuration.



Important

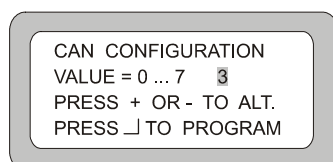
The CAN configuration is a vehicle and manufacturer specific configuration. Please note the manufacturer's instructions when setting the CAN configuration. Currently, priorities 0 to 7 can be selected.



```
INSTALLATION MTCO
CAN CONFIGURATION
PRODUCT CODE
DRIVE SHAFT PPR
```

"MTCO INSTALLATION " menu

Select the "CAN CONFIGURATION" menu and press **[Enter]** to confirm.

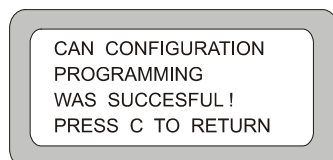


```
CAN CONFIGURATION
VALUE = 0 ... 7  3
PRESS + OR - TO ALT.
PRESS ↓ TO PROGRAM
```

If necessary, select a new value:

-Press **[Enter]** to confirm
a value from 0 to 7.

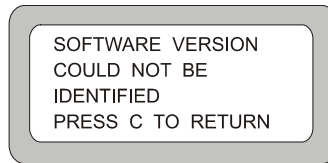
If programming has been **successful** the following message is displayed:



```
CAN CONFIGURATION
PROGRAMMING
WAS SUCCESSFUL!
PRESS C TO RETURN
```

Press **[C]** to return to #MTCO INSTALLATION#.

If programming has not been **successful** the following error message is displayed:



Press **[C]** to return to
#MTCO INSTALLATION#.

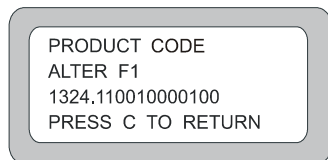
8 Set variants by selecting the product code.

! Important

The 8th to 16th digit of the product code is used to store variants in the MTCO 1390.

Please refer to the product key for the corresponding values
(see *Table 3-8*; page 3-44 and *Table 3-9*; page 3-45).

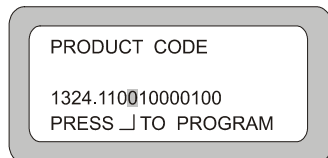
"TCO INSTALLATION" menu



Select the "PRODUCT CODE" menu and
press **[Enter]** to confirm.

Change the product code.
Press **[F1]** to confirm.

Press **[C]** to return to
#MTCO INSTALLATION#.



Enter a new value:
- Select the decimals 8 - 16 in the entry field
- Enter a numerical value.

Press **[Enter]** to confirm.
If programming has been successful the new
product key is displayed.

If the values entered were not correct
#WRONG ENTRY# is displayed.

Press **[C]** to return to
#PRODUCT CODE F1 CHANGE#.

! Important

A new type plate must be affixed when modifying the product code (see
Chapter 7.2.2 "Replacing the MTCO 1390 type plate", page 7-5).

MTCO 1390 product code

Device variant	1	1 day unit, locked tray, with tracked clock
	2	7 day unit, locked tray, without tracked clock
	3	1 day unit, fold down tray, with tracked clock
	4	7 day unit, fold down tray, without tracked clock
Measuring range, voltage, sensor/ pulse generator	01	125 km/h, 12 V, KITAS 2170/ 2171
	02	125 km/h, 12 V, pulse generator 2159
	03	125 km/h, 12 V, Eaton generator type 4302691
	04	125 km/h, 24 V, KITAS 2170/ 2171
	05	125 km/h, 24 V, pulse generator 2159
	06	125 km/h, 24 V, Eaton generator type 4302691
	11	180 km/h, 12 V, KITAS 2170/ 2171
	12	180 km/h, 12 V, pulse generator 2159
	13	180 km/h, 12 V, Eaton generator type 4302691
	14	180 km/h, 24 V, KITAS 2170/ 2171
	15	180 km/h, 24 V, pulse generator 2159
	16	180 km/h, 24 V, Eaton generator type 4302691
Additional equipment		
Hardware interface 1		
Firmware/ Cluster connection CAN		
Hardware interface 2		
Interface/ customer firmware K-Line		
Display and keypad illumination		
<div> <div>1390</div> <div>.</div> <div>4</div> <div>04</div> <div>00</div> <div>1</div> <div>3</div> <div>0</div> <div>0</div> <div>002</div> </div>		

Table 3-8: MTCO 1390: Product code (part 1)

MTCO 1390 product code

Additional equipment										00	without additional equipment
										01	RPM recording (1 day unit)
										02	RPM recording (7 day unit)
										03	Additional stylus
										04	Driver change recording (7 day unit)
										08	Digital "v" display (Stand alone)
										09	Shift axle adjustment i = 1.383:1, Plus control
										10	Shift axle adjustment i = 1.383:1, Minus control
										11	Additional stylus, digital "v" display (Stand alone)
										12	RPM recording, additional stylus and digital "v" display (Stand alone, 1 day unit)
										13	RPM recording, driver change recording, digital "v" display (Stand alone, 7 day unit)
										14	Additional stylus, driver change recording, digital "v" display (Stand alone, 7 day unit)
										29	Driver change recording (7 day unit), shift axle adjustment i = 1.383:1, Plus control
Hardware interface 1										0	without interface
										1	CAN 120 ohms
										2	CAN without resistance
										3	CAN VW-HW switching
Firmware/ Cluster connection											
CAN										0	without firmware/ Cluster connection
										1	CAN/ Basis ISO/TCO 1 repetition rate 50 ms
										2	CAN/ Basis ISO/TCO 1 repetition rate 10 ms
										3	CAN/ Basis ISO/TCO 1 repetition rate 20 ms
Hardware interface 2										0	without interface
										1	K-Line (Electronic Speedometer)
										2	K-Line (diagnosis)
Interface/ customer firmware											
K-Line										0	without customer firmware
										1	Electronic Speedometer 1323
										2	Standard diagnosis*
Display and key illumination										001	blue, none, dimming controlled by Rheostat
										002	yellow, none, without dimming 50% day
										003	green, none, without dimming 50% day
										004	yellow, yellow, with dimming on CAN
										005	green, none, with dimming 100% day/ 40% night
										006	yellow, none, with dimming 30% day/ 5% night
1390	.	4	04	00	1	3	0	0	002		

Table 3-9: MTCO 1390: Product code (part 2)

9 Program the drive shaft PPR.



Important

There are specific vehicle types where a gearbox specific factor has to be set.

If a value (imp/revs) is programmed into the MTCO, the same value must be set when using a replacement tachograph. If this value can no longer be read out, contact the vehicle manufacturer to find out which value has to be set.

INSTALLATION MTCO
VIN
CONFIGURATION
> DRIVE SHAFT PPR

DRIVE SHAFT PPR
CURRENT VALUE 15.544
NEW VALUE 00.000
PRESS <input type="button" value="↵"/> TO PROGRAM

"MTCO INSTALLATION" menu

Select the "DRIVE SHAFT PPR" menu and press **[Enter]** to confirm.

If necessary, enter a new value:

- Select the entry field before/ after the decimal point,
- Enter a value for each decimal (0-64.255 imp/revs).

The MTCO sends this value (imp/revs) to the CAN bus; depending on the vehicle type, the value is needed to control the retarder (this does not affect the MTCO).

Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

10 Program the commissioning date.



Important

When the unit is installed the current date which is the commissioning date has to be programmed into the MTCO 1390. If the target value on the BTC display does not match the current date, update the date first using the BTC service program (see the separate "MTC 1602.04" operating instructions, "Setting the operating system").



Caution

The commissioning date can only be programmed once into the MTCO 1390.

"MTCO INSTALLATION" menu

INITIAL INSTALLATION
CURRENT 00.00.00
VALUE 03.07.98
PRESS <input type="button" value="↵"/> TO PROGRAM

INITIAL INSTALLATION
CURRENT 03.07.98

Select the "INITIAL INSTALLATION" menu and press **[Enter]** to confirm.

Press **[Enter]** to confirm.

If programming has been successful the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

When selecting "INITIAL INSTALLATION" again, the current date is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

11 Program the calibration date.

! Important

After commissioning and each periodic check the current date, i.e. the calibration date, must be programmed into the MTCO 1390.

If the target value on the BTC display does not match the current date, update the date first using the BTC service program (see the separate "MTC 1602.04" operating instructions section, "Setting the operating system").

MTCO INSTALLATION
INITIAL INSTALLAT.
CALIBRATION DATE
> SEAL NUMBER

"MTCO INSTALLATION" menu

Select "CALIBRATION DATE" and press **[Enter]** to confirm.

CALIBRATION DATE
CURRENT 00.00.00
VALUE 03.07.98
PRESS **[]** TO PROGRAM

If necessary, enter the target date or press **[Enter]** to confirm the displayed date.

If programming has been successful the "CURRENT" field shows the current date.

Press **[C]** to return to #MTCO INSTALLATION#.

12 Program the seal number.

! Important

After commissioning or an inspection in accordance with §57b the workshop's seal number must be programmed into the MTCO 1390.

"MTCO INSTALLATION" menu

Select the "SEAL NUMBER" menu and press **[Enter]** to confirm.

SEAL NUMBER
RE - ENTER F1
D 1234567
GO BACK USING C

If necessary, enter a new value (up to 8 digits) or press **[Enter]** to confirm the value displayed.

SEAL NUMBER

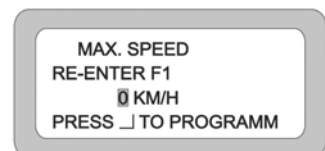
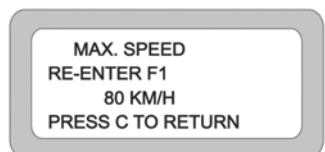
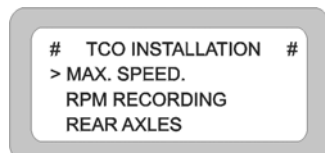
D 1234567
GO BACK USING C

If programming has been successful the new seal number is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

13 Program the maximum speed (warning speed).

"TCO INSTALLATION" menu



Select the "INITIAL INSTALLATION" menu and press **[Enter]** to confirm.

Select "MAX SPEED" and press **[Enter]** to confirm.

Press **[F1]** to enter the new warning speed.

Enter the new value:

- Select the decimal in the entry field
- Enter figures (000 - 200).

Press **[Enter]** to confirm.

If programming has been successful the current value is displayed in the "KM/H" field.

Press **[C]** to return to #TCO INSTALLATION#.

14 Program RPM recording.

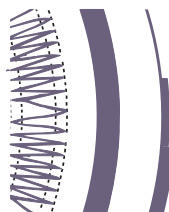
On 7 day units the RPM ranges are recorded on the front of the tachograph chart.

RPM range limit values set at the factory

At the factory the following value limits are programmed into the MTCO 1390;

- Lower limit: 900 [min⁻¹]
- Upper limit: 1,400 [min⁻¹]

The programmed value limits correspond to the following RPM ranges:



Range 1: 0 - 899 [min⁻¹]

Range 2: **900** - 1,399 [min⁻¹]

Range 3: over **1,400** [min⁻¹]



Important

When entering value limits for RPM recording the upper value limit must be higher than the lower value limit.


```
# TCO INSTALLATION #
MAX. SPEED.
> RPM RECORDING
REAR AXLES
```

"TCO INSTALLATION" menu

Select "RPM RECORDING" and press **[Enter]** to confirm.

```
# RPM RECORDING #
> LOW LIMIT      0900
HIGH LIMIT      1400
PRESS C TO RETURN
```

Select the "LOWER LIMIT" menu and press **[Enter]** to confirm.



Caution

If the LOWER LIMIT to be entered is higher than the programmed UPPER LIMIT, a higher value must be set for the UPPER LIMIT.

```
# RPM RECORDING #
> LOW LIMIT      0900
PRESS _ TO PROGRAMM
PRESS C TO RETURN
```

Enter the new value:

- Select the decimal in the entry field
- Enter figures (0200 -3200).

Press **[Enter]** to confirm.

If programming has been successful the current value is displayed in the "LOWER LIMIT" field.

Press **[C]** to return to #RPM RECORDING#.

```
# RPM RECORDING #
> LOW LIMIT      1200
HIGH LIMIT      1400
PRESS C TO RETURN
```

Select the "UPPER LIMIT" menu and press **[Enter]** to confirm.

```
# RPM RECORDING #
> HIGH LIMIT     3000
PRESS _ TO PROGRAMM
PRESS C TO RETURN
```

Enter the new value:

- Select the decimal in the entry field
- Enter figures (0201 - 3300).

Press **[Enter]** to confirm.

If programming has been successful the current value is displayed in the "UPPER LIMIT" field.

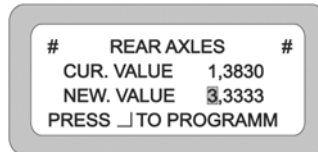
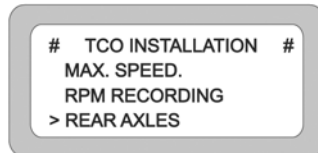
Press **[C]** to return to #RPM RECORDING#.

```
# RPM RECORDING #
LOW LIMIT      1200
> HIGH LIMIT     3000
PRESS C TO RETURN
```

Press **[C]** to return to #TCO INSTALLATION#.

15 Program the rear axle (switchover value).

"TCO INSTALLATION" menu



Select the "INITIAL INSTALLATION" menu and press **[Enter]** to confirm.

Select the "REAR AXLES" menu and press **[Enter]** to confirm.

Enter the new value:

- Select the decimal in the entry field
- Enter figures (0.0000 - 6.5535).

Press **[Enter]** to confirm.

If programming has been successful, the new value is displayed.

Press **[C]** to return to #MTCO INSTALLATION#.

16 Press **[C]** to terminate programming.

Adjusting date and time

- **Program the date and time (MTCO):**
 - **Prog-Time Zone**
 - **Prog-System time**
- **Enter the date and time (BTC):**
 - **Time zone**
 - **Switchover settings 01/ 05.**

Local time

The "DATE - TIME" menu item is used to adjust the local time to UTC time. To display the official time of the country where the tachograph system is installed or the vehicle is registered, the following parameters must be stored in the MTCO 1390:

- The time zone offset and
- the switchover setting for the beginning and end of daylight saving time.








Important

Program the time zones by entering values with opposite signs.

At the factory the MTCO 1390's clock is set to the local time at the time of manufacture. Deviations can be detected when checking the MTCO 1390 and be corrected when programming the MTCO 1390.

Checking date and time (MTCO)

- **Check the system time (MTCO).**
 - Press the  key to select menu 1 "CLOCK SETTING".
- **Check the time zones (MTCO).**
 - Press the  key to select menu 3 "INFORMATION UTC/ VERSION".
- **Check the switchover setting (MTCO).**
 - Press the  key to select menu 5 "BEGINNING/ END DAYLIGHT SAVING".
 - Use the  or  key to select the desired entries.

Additional information

Detailed information and instructions on how to select the menu functions can be found in *Chapter 2.1.2 "Operation", section "MTCO 1390 menu functions"*, from page 2-13.

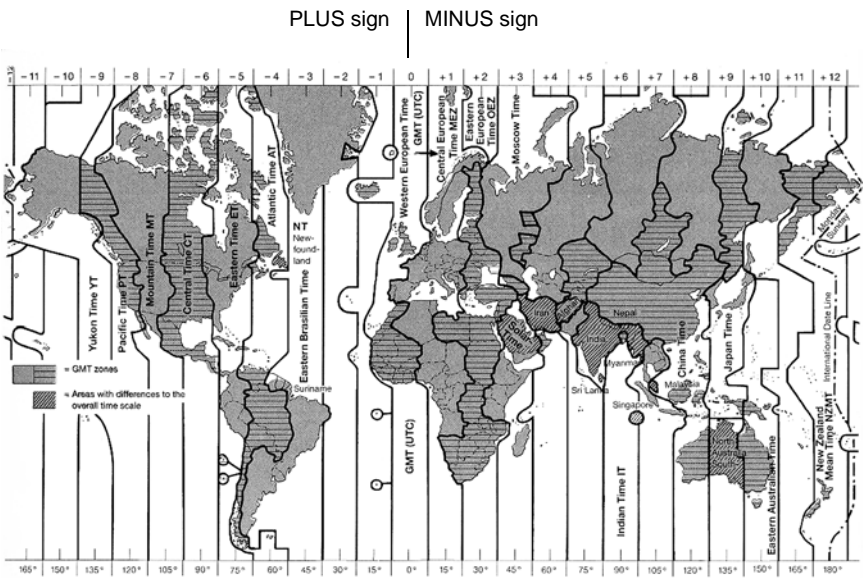


Fig. 3-22: The 24 international time zones

Entry for beginning and end of daylight saving time

!

Important

At the factory no switchover settings are stored into the test unit.

Offset years	Beginning of daylight saving time	Offset	End of daylight saving time	Offset
2001	25th March 2:00	+1 hour	28th October 2:00	0 hour
2002	31st March 2:00	+1 hour	27th October 2:00	0 hour
2003	28th March 2:00	+1 hour	26th October 2:00	0 hour
2004	28th March 2:00	+1 hour	31st October 2:00	0 hour
2005	27th March 2:00	+1 hour	30th October 2:00	0 hour

Table 3-10: Beginning and end of daylight saving time in EU member states from 2001 to 2005

These switchover settings are stored in the MTCO 1390 during programming.

!

Important

When programming switchover settings you have to distinguish between countries in the northern and southern hemispheres (the beginning/ end of daylight saving time is different). If necessary, you can change the stored switchover setting using the "ENTRY" sub menu and add new settings continuously.

Northern hemisphere

"Select "N" for northern hemisphere using the "+" or "-" key (BTC)

Winter	Beginning	Summer	End	Winter
Jan Feb March	April May June July Aug Sept	Oct Nov Dec		
Summer ends	Winter	Summer begins		

Southern hemisphere

"Select "S" for southern hemisphere using the "+" or "-" key (BTC)

Time zone offset

Formula	EU member states	Entry value
Local time = UTC time ±Time zone offset If you take Germany as an example this means: Local time = UTC time +1 hour for time zone offset UTC time = local time - 1 hour for time zone offset In this example, the time zone offset "- 1:00 hour" must be set in the test unit. IMPORTANT: The time zone offset corresponds to the time zone value (see table) with the opposite sign.	Austria	- 1:00 hour
	Belgium	- 1:00 hour
	Germany	- 1:00 hour
	Denmark	- 1:00 hour
	Spain	- 1:00 hour
	France	- 1:00 hour
	United Kingdom	0:00 hour
	Greece	- 2:00 hours
	Italy	- 1:00 hour
	Ireland	0:00 hour
	Luxembourg	- 1:00 hour
	The Netherlands	- 1:00 hour
	Portugal	0:00 hour
	Sweden	- 1:00 hour
	Finland	- 2:00 hours

1 Set the Prog-Time zone (MTCO).

#DATE-TIME#

Press **[Enter]** to select the menu.

#PROGRAMMING TCO#

Press **[Enter]** to select the menu.

PROG - TIME ZONE
TCO : -01:00 h
F1 CHANGE TIME ZONE
PRESS _J_ TO CONTINUE

If you do not want to change the time zone set in the BTC, press **[Enter]** to continue; otherwise press **[F1]**.



Important

The set time zone offset corresponds to the time zone where the MTCO 1390 was installed. Generally, you have to accept this value.

The time zone offsets stored in the MTCO and in the test unit can differ if the MTCO was installed in a country that belongs to another time zone, for example.

Program the time zones by entering values with opposite signs.

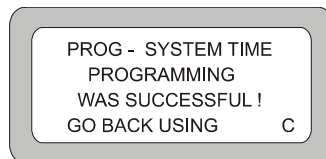
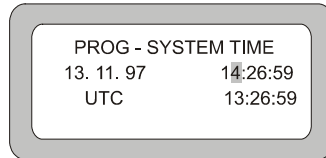
PROG - TIME ZONE
CHANGE USING + ODER -
-01:00 h
PRESS _J_ TO CONTINUE

To change the MTCO's time zone:

Select the corresponding time zone offset (+11:00 hours ... - 12:00 hours).

Press **[Enter]** to confirm.

2 Set the Prog-System time.



If the time setting is correct:

- Press **[Enter]** to confirm
- or press **[F1]** to update the clock.

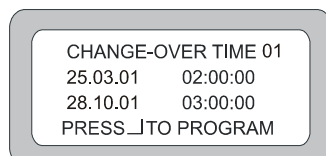
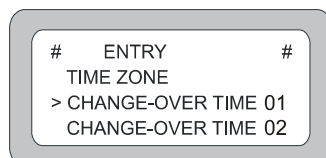
Select the fields and/ or decimals, enter figures, then press **[Enter]** to confirm "PROGRAMMING".

Press **[C]** to return to #DATE-TIME#.

3 Change the switchover settings for beginning and end of daylight saving time.

#DATE-TIME#

#PROGRAMMING BTC#



Press **[Enter]** to select the menu.

Press **[Enter]** to select the menu.

Select "CHANGE-OVER TIME 01", for example, and press **[Enter]** to confirm.

The display shows:

- *Beginning of daylight saving*
- *End of daylight saving*

To change the switchover settings: Select the fields and/ or decimals, enter figures, then press **[Enter]** to confirm the new values.

Press **[C]** to return to #ENTRY#.

Programming Date-Time (BTC)

Use this menu item to transmit the values stored in the test unit such as time zone offset and switchover settings to the MTCO 1390.



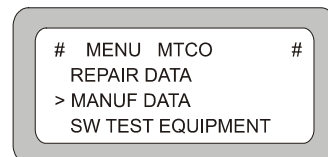
Important

Any values modified using this menu item are only stored in the test unit and must be programmed into the MTCO 1390 using the "PROGRAMMING BTC" menu.

Additional information

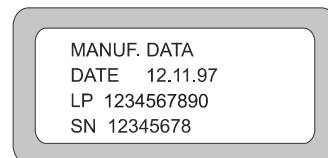
Detailed information on the "time zone offset" and "switchover settings for beginning/ end of daylight saving time" can be found in the separate "MTCO Programming instructions".

Displaying manufacturing data



"MENU MTCO" menu

Select the "MANUF DATA" menu and press **[Enter]** to confirm.



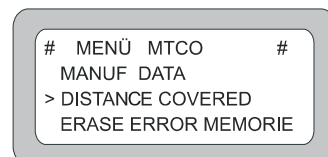
The following information is displayed:

- Date = test date
- LP = PCB number
- SN = serial number.

Press **[C]** to return to #MENU MTCO#.

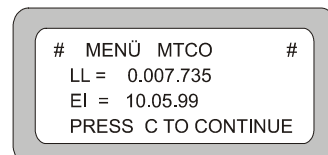
Displaying the distance covered

Inside the MTCO 1390 there is an internal counter which shows the tachograph's kilometre reading (mileage). No matter how often the odometer has been corrected, this counter always shows the actual distance covered (total of all kilometres driven and transmitted to the tachograph).



"MENU MTCO" menu

Select "DISTANCE COVERED" and press **[Enter]** to confirm.



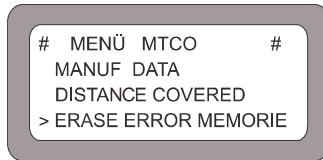
The following information is displayed: The MTCO's actual kilometre reading (mileage):

- LL = kilometre reading
- EI = commissioning data.

Press **[C]** to return to #MENU MTCO#.

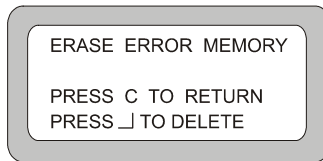
Clearing the error memory

Select this menu item to clear the error memory.



"MENU MTCO" menu

Select the "ERASE ERROR MEMORY" menu and press **[Enter]** to confirm.



Press **[Enter]** to clear the error memory
or

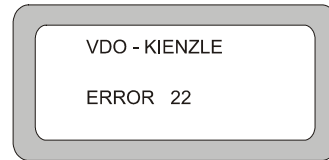
press **[C]** to return to #MENU MTCO#.

When the memory has been deleted successfully

"ERROR MEMORY CLEARED" appears in the display field.

Press **[C]** to return to #MENU MTCO#.

Error correction



If an error occurs during programming, the MTCO 1390 displays a coded error message.

System errors

Code	Cause	Remedy
01	Cannot open file	Reset the test unit: Press the [F12] , [+] , [-] , [F12] keys one after the other
02	Cannot read file	
03	Cannot write to file	
04	Cannot open file	
05	Cannot modify the test unit's time setting	
06	Cannot read the test unit's time setting	
07	Cannot close file	
08	Cannot load mask.	

Transmission errors

Code	Cause	Remedy
20	Checksum error	Restart the program.
21	Negative response from test unit	Repeat programming.
22	Interface interrupted	Plug in the MTCO's programming cable again and repeat programming.
23	Unknown unit connected	Check if the connected tachograph is wrong.

Sensor errors

Code	Cause	Remedy
33	Generator does not respond	Check the v sensor cable, check the sensor and replace it, if necessary
34	Generator serial number is missing	



Important

If an error cannot be corrected with the listed measures, contact your nearest Siemens VDO partner.

Chapter 4

Sealing

4.1 General sealing provisions (if applicable)

All removable mechanical and electrical connections of the tachograph systems 1390 as well as all setting and adjustment elements on the tachograph must be sealed.



Important

When checking the unit the tested part can be sealed after each testing step.

Sealing

When sealing make sure that:

- the seal is put on correctly
- the sealing pliers are set correctly
- only the assigned mark is used
- the locking wire is as short as possible when sealing bayonet connections
- the locking wire does not cause any short circuits.

Effective sealing

Sealing must be done in such a way that the parts protected with seal caps, locking wire and two-hole seals cannot be removed or put out of operation without ruining or visibly damaging them.

4.2 Sealing equipment and sealing plans



Important

The prescribed/ required seals for operating a tachograph system according to the law are subject to national laws and regulations.

Check the legal regulations prevailing in your country to find out whether the test and programming interface on the MTCO 1390 must be sealed.

Nevertheless, we recommend that you seal the tachograph system 1390 for security reasons.

Siemens VDO original tools and sealing equipment must be used for sealing.

4.2.1 MTCO 1390 sealing plan

Sealing points on the tachograph system 1390

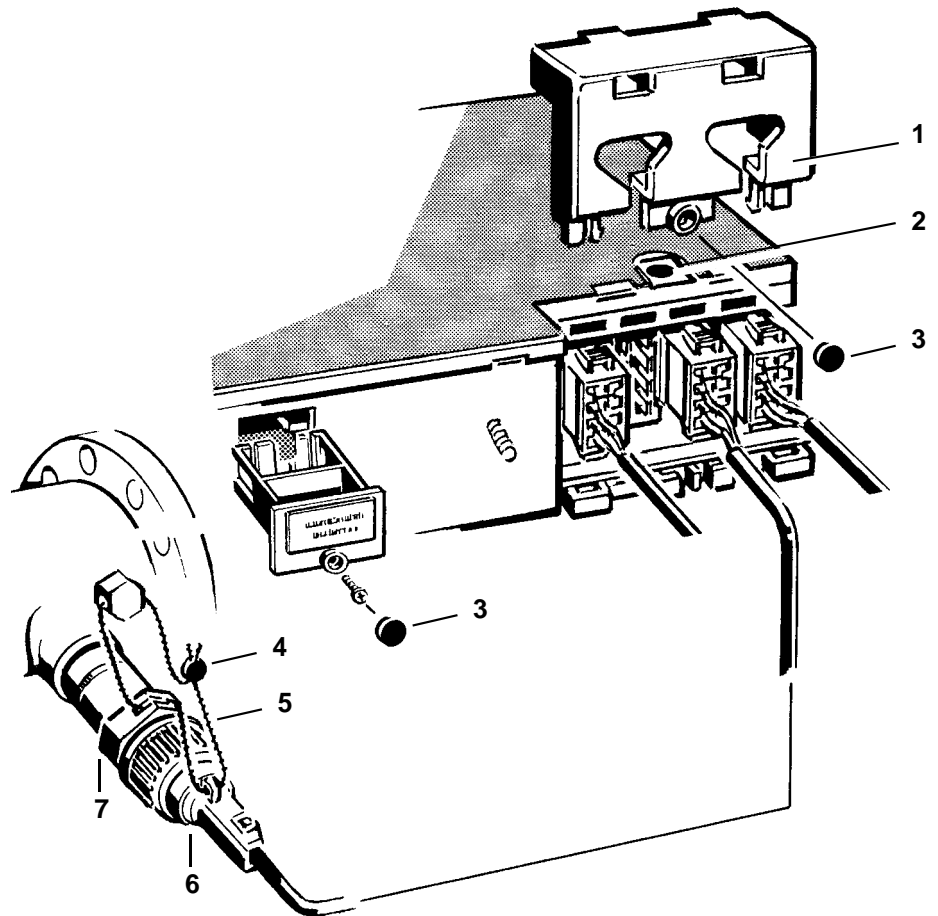


Fig. 4-1: Sealing equipment for and sealing points on the tachograph system 1390

- | | |
|--------------------------------|----------------------------------------------------------------------------|
| 1 Connector hood | 5 Locking wire |
| 2 MTCO 1390 housing cover seal | 6 Sensor/ pulse cable (connector) |
| 3 Seal cap (red) | 7 KITAS 2170/ 2171 sensor or pulse generator 2159/ Eaton generator 4302691 |
| 4 Two-hole seal | |

Sealing points on the front of the tachograph

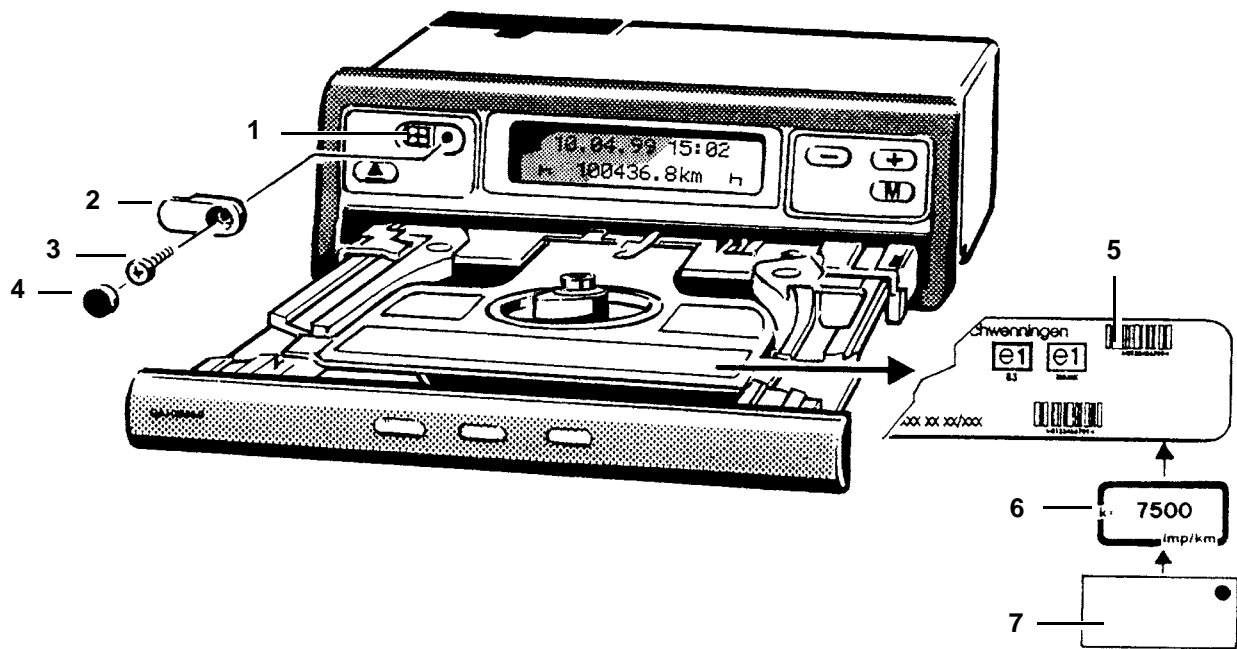


Fig. 4-2: Sealing equipment and sealing points on the front of the tachograph (MTCO 1390)

- 1

Test/ programming interface
- 2

Seal plate
- 3

Screw
- 4

Seal cap (red)
- 5

Type plate
- 6

"k" label
- 7

Sealing foil

Sealing point	before/after step	Sealing equipment
KITAS sensor, sensor cable gearbox side	after checking the tachograph system	Two-hole seal, locking wire
Connections/ plug and socket connections Back of tachograph	after checking the tachograph and before the test drive	Seal hood and seal cap
Programming interface	after the test drive	Seal plate and seal cap
"k" label	at the end of the test	Sealing foil
Installation label	at the end of the test	Sealing foil

Table 4-1: Tachograph system 1390: Sealing steps

4.2.2 Sealing plan for the Electronic Speedometer 1323

! Important

We recommend that you seal the back of the Electronic Speedometer 1323 for security reasons.

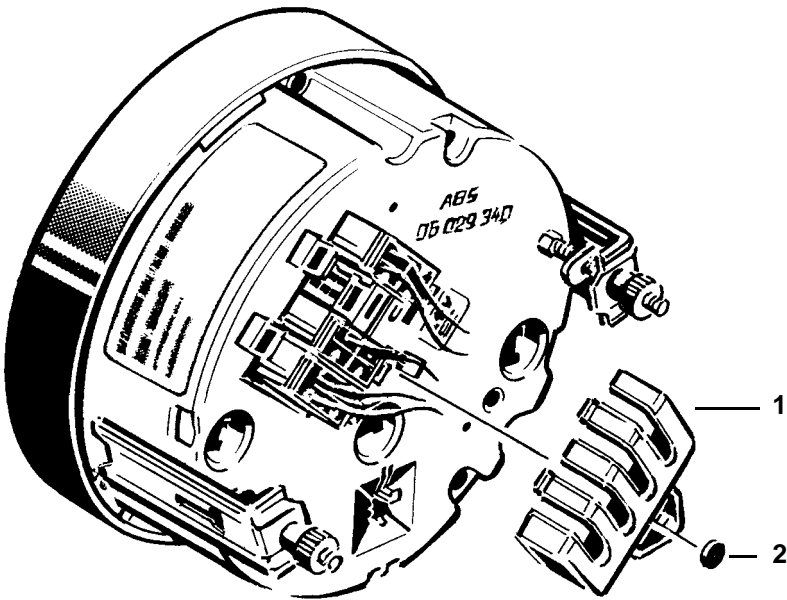


Fig. 4-3: Sealing equipment for and sealing points on the Electronic Speedometer 1323

- 1 Sealed connector hood
- 2 Seal cap

Sealing point	before/after step	Sealing equipment
Connections/ plug and socket connections Back of Electronic Speedometer	after checking the Electronic Speedometer	Sealed connector hood and seal cap

Table 4-2: Electronic Speedometer 1323: Sealing steps

Chapter 5

Test instructions

5.1 Overview of test workflow

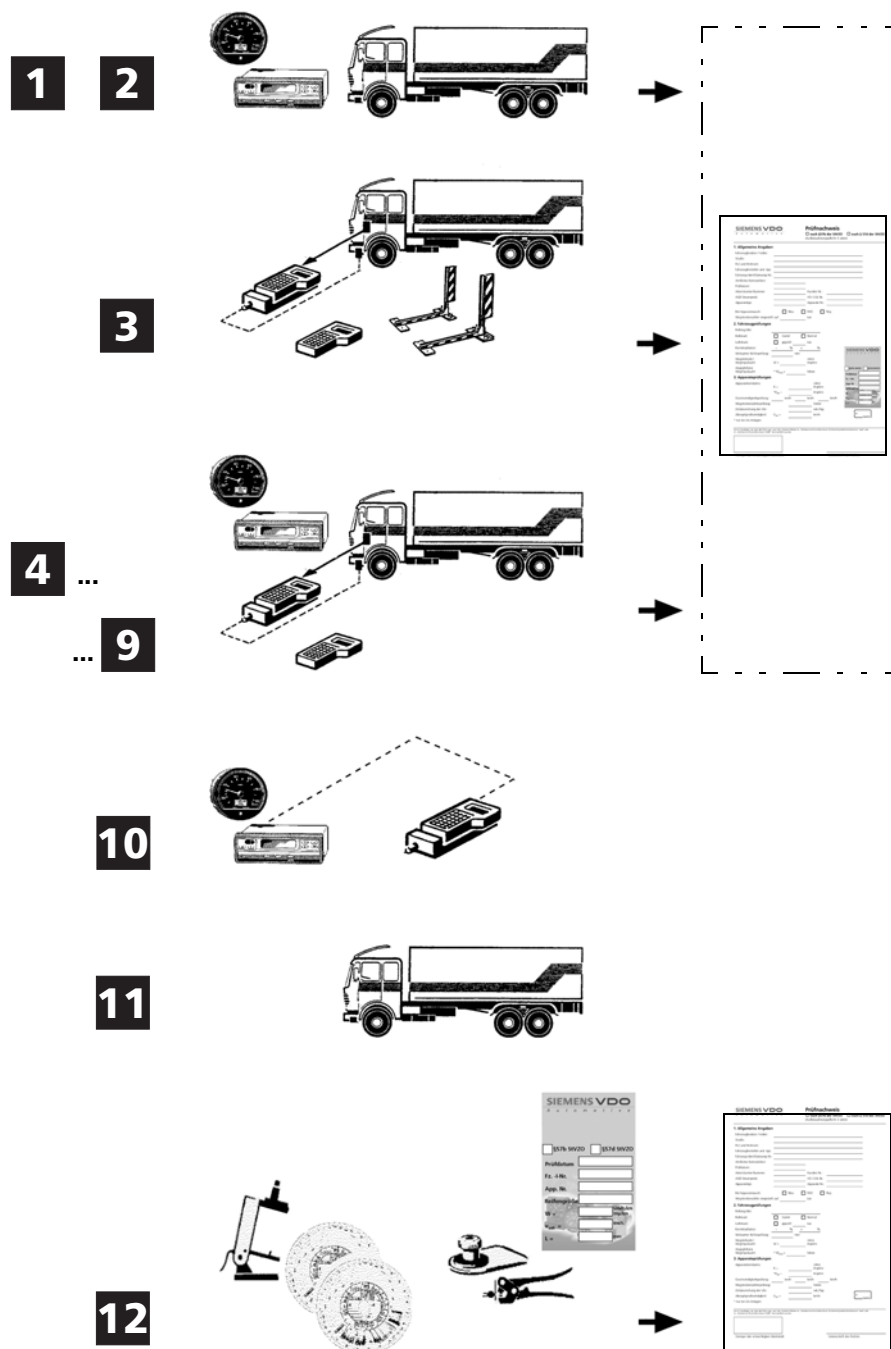


Fig. 5-1: Overview of test workflow

				Chap./page
1	Prepare the test certificate as prescribed by law	Vehicle data	<ul style="list-style-type: none">Determine (vehicle owner, vehicle manufacturer, registration number...)Enter on the test certificate	5-5
2	Carry out the initial check	E-Speedometer 1323.01/ Cluster	<ul style="list-style-type: none">Make a visual checkCheck the multi-function display	5-8
		MTCO 1390	<ul style="list-style-type: none">Make a visual checkCheck the displayCheck system time and dateRead out the error codeRemove the MTCOCheck the sealsInstall the MTCORemove the installation label	5-9
3	Check the tachograph system	Vehicle	<ul style="list-style-type: none">Check the test conditionsDetermine the effective tyre circumference	5-13
		Characteristic coefficient (imp/km)	<ul style="list-style-type: none">Determine "w" using the "AUTOM. MEAS. TRACK" programDetermine the "k_{old}" constant using the "CHECK K MEASURING" programProgram the "k" constant	5-14
Tachographs manufactured not more than one year ago need not be checked for permissible inherent errors (steps 4 to 8). We recommend that you draw up a test chart to prove that the recordings comply with legal stipulations (step 9).				
4	Check the tray, tachograph chart turntable, operating keys and display	MTCO 1390	<ul style="list-style-type: none">Unlock and open the trayInsert the tachograph chartsSet the correct recording timeClose the trayCheck the driver change keyCheck the ejection mark	5-17
5	Check the warning equipment	MTCO 1390	<ul style="list-style-type: none">Check the display	5-22
		E-Speedometer 1323/ Cluster	<ul style="list-style-type: none">Check the warning LED (if available)	
6	Check the clock	MTCO 1390	<ul style="list-style-type: none">Determine the time difference using the "CLOCK TEST" programEnter the value on the test certificate	5-24
7	Check the speed display	E-Speedometer 1323/ Cluster	<ul style="list-style-type: none">Determine the measuring rangeCarry out a "SPEED TEST"	5-25
	Check speed recording	MTCO 1390	<ul style="list-style-type: none">Enter the value on the test certificate	
8	Check the odometer	MTCO 1390	<ul style="list-style-type: none">Check the odometer using the "DIST. COUNTER TEST" programEnter the value on the test certificate	5-29

9	Draw up the test charts	MTCO 1390	<ul style="list-style-type: none"> • Prepare the tachograph charts • Draw up the test charts using the "TEST CHART" program • Analyse the test charts 	5-31
10	Program the MTCO 1390	MTCO 1390	<ul style="list-style-type: none"> • Program installation data • Check date and time, program again, if necessary 	5-34
11	Test drive	MTCO 1390	<ul style="list-style-type: none"> • Insert the test charts • Set the recording time 	5-36
		Tachograph system	<ul style="list-style-type: none"> • Drive along the test track (minimum length 1 km): <ul style="list-style-type: none"> – Check the steady display on the Electronic Speedometer / Cluster – Monitor the units' LC displays – Check additional functions • Complete the test drive: <ul style="list-style-type: none"> – Check the initial position of the pointers – Analyse the test drive recordings 	5-36
12	Complete the test	Tachograph	<ul style="list-style-type: none"> • Seal the test and programming interface • Complete the test certificate • Fill in/ print the test certificate and installation label • Stick the installation label into the driver's cab 	5-38
		Test certificate	<ul style="list-style-type: none"> • File the test certificate and test charts 	5-40

Table 5-1: Test workflow check list



Important

The following instructions only describe how to check tachograph systems with MTCO 1390.

Generally, the same provisions as for older tachographs apply when checking tachograph systems with MTCO 1390.

5.2 *Obligation to check the unit and test conditions*

Obligation to check

In the various countries the provisions for installing and the obligation to check tachographs are different. If you do not have the provisions in force for your country available, please contact the authority responsible in your country.

The device manufacturers or their approved workshops are responsible for carrying out the tests. When the units are fitted to new vehicles these checks have to be carried out by vehicle manufacturers that have been given authorisation for testing.

Testing conditions

A check should only be carried out if the following conditions are met:

- the vehicle must be in a roadworthy condition
- the size of the tyres fitted to the vehicle must comply with the specifications on the vehicle certificate
- the tyre pressure must comply with the vehicle manufacturer's specifications
- the vehicle owner's order and the vehicle certificate should be available.

Recommendation: Work sheet:

We recommend that you complete a work sheet for each check.



Important

Vehicle defects relating to roadworthiness or the tyre size fitted are reasons for not carrying out the check. Discuss any defects with the vehicle keeper before the check.


5.3 *Preparing the test certificate*

Before the check enter the vehicle data from the vehicle certificate on the test certificate to ensure that the MTCO 1390 (tachograph system) and the vehicle can be easily identified during the test.

**Test certificate
(front)**

During the test the person carrying out the check must enter all the legally prescribed data on the form (front).

Sample for Germany



Prüfnachweis

☐ nach §57b der StVZO ☐ nach § 57d der StVZO
 (Aufbewahrungspflicht 3 Jahre)

1. Allgemeine Angaben

Fahrzeugbesitzer / Halter: _____
 Straße: _____
 PLZ und Wohnort: _____
 Fahrzeughersteller und -typ: _____
 Fahrzeug Identifizierungs Nr.: _____
 Amtliches Kennzeichen: _____
 Prüfdatum: _____
 Arbeitskarten Nummer: _____ Kunden Nr.: _____
 AGB Steuergerät: _____ HD / Lfd. Nr. _____
 Apparatetyp: _____ Apparat Nr.: _____

Bei Apparatetausch: ☐ Neu ☐ RAS ☐ Rep.
 Wegstreckenzähler eingestellt auf: _____ km

2. Fahrzeugprüfungen

Reifengröße: _____
 Reifenart: ☐ Gürtel ☐ Normal
 Luftdruck: ☐ geprüft _____ bar
 Korrekturfaktor: - % + %
 Wirksamer Reifenumfang: _____ mm
 Wegdrehzahl / Wegimpulszahl: W = _____ U/km Imp/km
 Angeglichene Wegimpulszahl: * W_{ang} = _____ Meter

3. Apparatprüfungen

Apparatkonstante: K = _____ U/km Imp/km
 * K_{alt} = _____ Imp/km
 Geschwindigkeitsprüfung: _____ km/h _____ km/h _____ km/h
 Wegstreckenzählerprüfung: _____ Meter
 Zeitabweichung der Uhr: _____ sek./Tag
 Abregelgeschwindigkeit: V_{set} = _____ km/h
 * nur bei EA-Anlagen

SIEMENS VDO
Automotive

☐ §57b StVZO ☐ §57d StVZO
 Prüfdatum: _____
 Fz. -I-Nr.: _____
 App. Nr.: _____
 Reifengröße: _____
 W = _____ U/km Imp/km
 V_{set} = _____ km/h
 L = _____ mm
 K = _____ Imp/km

Stempel der ermächtigten Werkstatt

 Unterschrift des Prüfers

Hiermit bestätigen wir, dass alle Prüfungen nach den Arbeitsrichtlinien im „Technischen Produkthandbuch EG Kontrollgeräte/Fahrtschreiber“ und / oder im „Technischen Produkthandbuch AGBII“ durchgeführt wurden.

Fig. 5-2: Test certificate (front)

**Test certificate
(back)**

A check list printed on the back of the form summarises all the necessary work steps for checking the tachograph and includes a field where any extraordinary findings such as missing seals etc. are entered.

Sample for Germany

**Checkliste zur Überprüfung von Anlagen
nach § 57b StVZO und §57d StVZO**

Folgende Arbeiten, die nicht auf der Vorderseite des Prüfnachweises aufgeführt sind, wurden durchgeführt.

1 Allgemeine Arbeiten

- ☐ Apparatetyp (AGB Steuergerät / EG Kontrollgerät) und Einbau vorschriftsmäßig
- ☐ Eingangsprüfung durchgeführt (Plombierung, Anfahrtsdiagramm, Zustand)
- ☐ Antriebswellen- bzw. Anschlussleitungsverlegung und Befestigung geprüft
- ☐ Befestigung und Anordnung von Angleich-, Winkel-, Umschaltgetriebe oder Geber geprüft
- ☐ Prüfdiagramm geschrieben, ausgewertet und Stempel ausgefüllt.
- ☐ Elektrischer Anschluss und Absicherung geprüft
- ☐ Gesamtanlage vollständig verplombt
- ☐ Einbauschild angebracht und mit Plombierfolie gesichert
- ☐ Konstantenschild angebracht und mit Plombierfolie gesichert
- ☐ Probefahrt durchgeführt
- ☐ Abregelvorgang geprüft (v-max)

2 Fahrzeuge mit Sondereinrichtungen

- ☐ **Fahrzeuge mit Schaltachse**
 - ☐ Umschaltgetriebe geprüft
 - ☐ Elektronische Umschaltung geprüft
- ☐ **Fahrzeuge zum Transport gefährlicher Güter**
 - ☐ Tachograph und Strombegrenzer vorschriftsmäßig
 - ☐ Eigensicherer Stromkreis geprüft

3 Service Hinweise

- ☐ Verwendete Werkzeuge/Hilfsmittel aus dem Fahrzeug genommen
- ☐ Entstandene Verschmutzungen beseitigt
- ☐ Funktionskontrolle der elektrischen Anlage des Fahrzeuges durchgeführt
- ☐ Blinker, Scheibenwischer, Beleuchtung usw.
- ☐ Fahrer über Apparatebedienung, Original VDO-Kienzle Diagrammscheiben, Auswertung und Aufbewahrung, gesetzliche Bestimmungen informiert.
- ☐ Bedienungsanleitung ausgehändigt (Bei Neu- oder Austauschapparaten)

4 Besonderheiten oder außergewöhnliche Feststellungen, welche bei der Überprüfung gemacht wurden

Fig. 5-3: Test certificate (back)

5.4 Initial check

By carrying out a visual check at the beginning of the test defects and irregularities found in the MTCO 1390 and the tachograph system 1390 can be detected in time.

■ **Ask the driver whether there are any special defects.**

The driver can provide the inspector with information on the functioning of the MTCO 1390 and the tachograph system, such as defects that only occur when driving.

■ **Carry out a visual check on the Electronic Speedometer/ Cluster:**

- Condition
- Type and approval number
- Existence of the warning LED.

■ **Carry out a visual check on the MTCO 1390:**

- Condition
- Type and approval number
- Check that the tray, display and operating elements are working properly
- Seal on the test/ programming interface
- Installation label.



Important

If seals are damaged or missing, the type and position of such seals must be entered on the test certificate under "Special observations".

■ **Carry out a visual check on the tachograph chart used for driving to the workshop:**

- Recording
- Correct tachograph chart type.

5.4.1 Checking the MTCO 1390's basic display



Condition

The tachograph chart(s) can only be inserted or removed when the ignition is on and the vehicle is stationary. And the MTCO 1390 must not display an error message indicating a malfunction.



Important

The tachograph charts used must not be damaged. Curled, wrinkled or torn tachograph charts may cause malfunctions.

When inserting the tachograph chart/ tachograph chart pack make sure the tachograph chart/ tachograph chart pack is placed under the retaining clip (cf. *Chapter 2.1.2 "Operation"*, from page 2-9).

Preparations

- 1 Turn the ignition on and unlock the tray.
- 2 Insert the labelled tachograph charts.
When inserting the tachograph chart(s) make sure the chart(s) is/are placed under the retaining clip.
- 3 Close the tray.

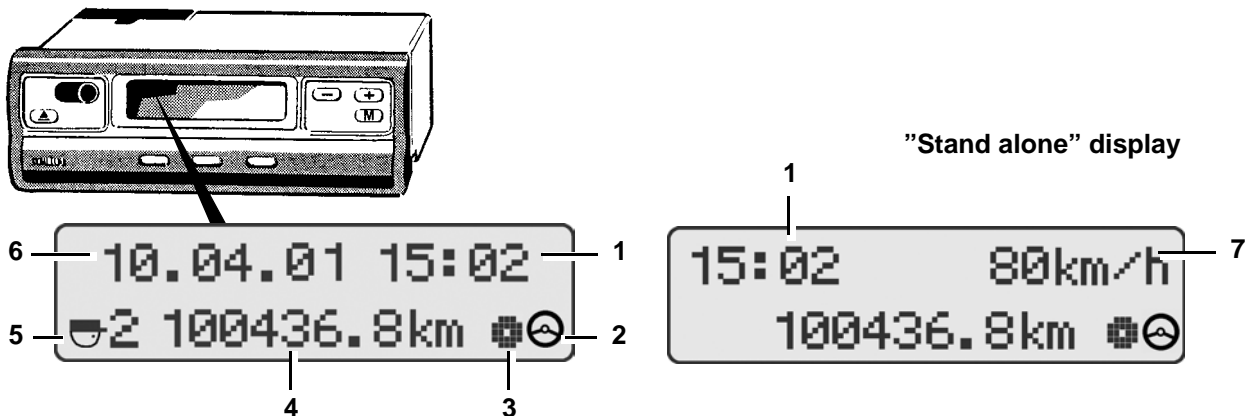


Fig. 5-4: MTCO 1390: Basic display

- | | |
|-----------------------------|---------------------------------------------------------------------------|
| 1 Time (system time) | 5 Driver change recording (driver 2)
7 day unit (optional) only |
| 2 Journey time | 6 Date |
| 3 Tachograph chart inserted | 7 Speed display MTCO 1390 "Stand
alone" only |
| 4 Odometer | |

Checking the basic display

When the tray is closed the MTCO 1390 must detect that the tachograph chart/ tachograph chart pack is inserted. The tachograph chart symbol (3) shown in the figure above must appear.

5.4.2 Checking system time and date

The display must show the current time and date. If the date or time differ from the reference values, these values must be reprogrammed at the end of the check (cf. Chapter 3.8.4 "Programming the MTCO 1390", from page 3-39).

5.4.3 Reading the error memory

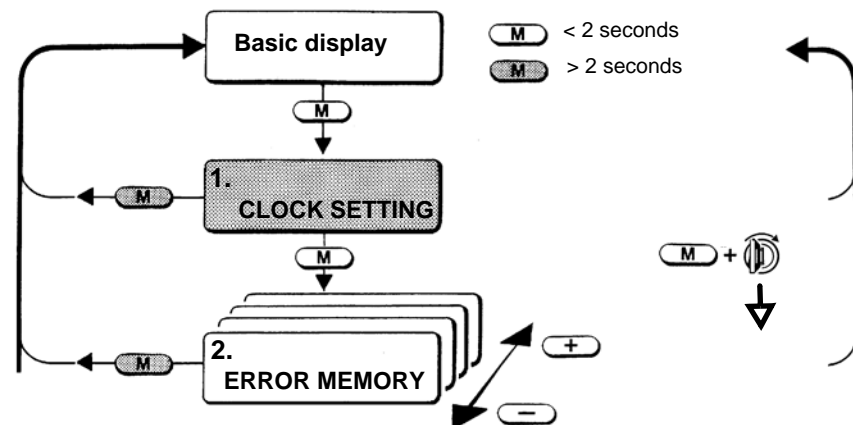


Fig. 5-5: MTCO 1390: "2. Error Memory" menu

- 1 **Activate the service mode, if it is not yet active.**
For a detailed description refer to Chapter 2.1.2 "Operation", section "Service mode menu functions", page 2-17.
- 2 **Select the 2. Error Memory menu to read out the error memory.**

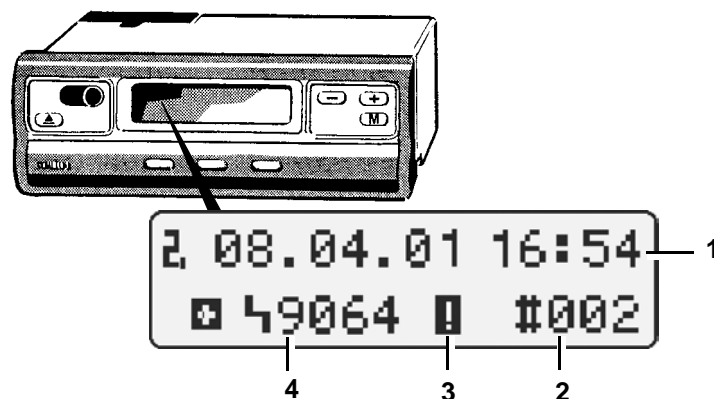


Fig. 5-6: MTCO 1390: Operating error message, e.g. driving without tachograph chart

- | | |
|------------------------------------------------------|-------------------------------|
| 1 Date, time when the error last occurred | 3 "Error active" symbol |
| 2 Number of errors
(how often the error occurred) | 4 Error symbol and error code |

In addition, errors that are still "active" are marked by an !. When the error is corrected the "Error active" error message symbol disappears automatically. The error remains stored in the error memory however.



Important

If an entry in the error memory indicates that a malfunction is still present that cannot be corrected, the MTCO 1390 is defective and must be replaced with a new tachograph.

If the error memory does not contain any entries indicating active malfunctions, the error memory can be deleted at the end of the check (see *Chapter 6.2.4 "System/ tachograph error messages"*, page 6-10).

5.4.4 Checking the seals on the MTCO 1390

Before removal

- On the front of the MTCO 1390 check the condition and existence of the seal plate and the seal cap on the test/ programming interface.

For more detailed information refer to *Chapter 4 "Sealing"*, Fig. 4-2: "Sealing equipment and sealing points on the front of the tachograph (MTCO 1390)", page 4-4.

Removing the MTCO 1390

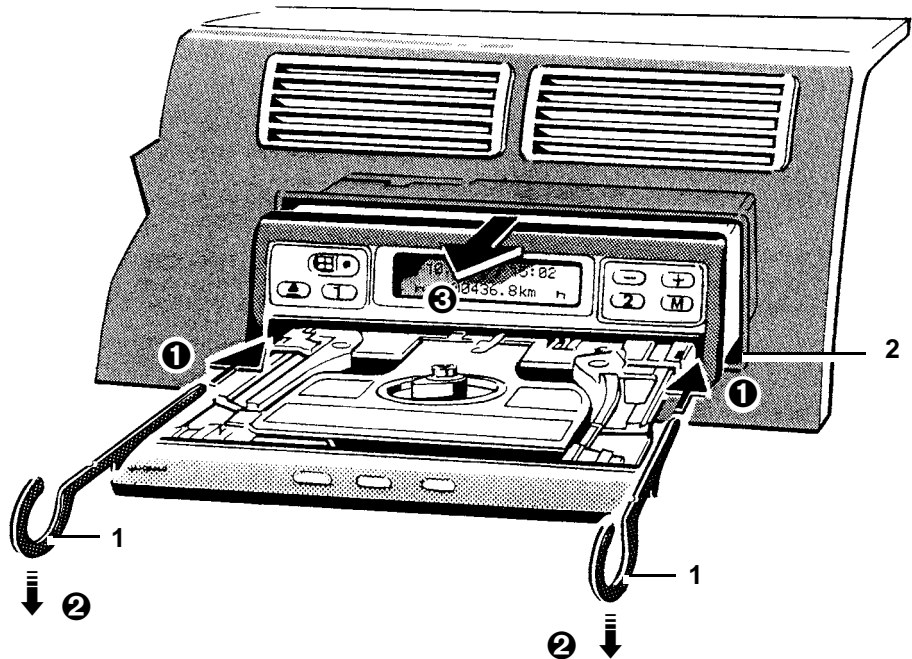


Fig. 5-7: MTCO 1390: Removing the unit from the radio compartment

1 Special removal tools

2 Mounting frame

- 1 Insert the special removal tools (1) into the left and right space between the tray and the MTCO 1390's front cover until they will go no further.
- 2 Push the special removal tools (1) down and keep them down.
- 3 Then pull the MTCO 1390 out of the mounting frame or radio compartment.

After removal

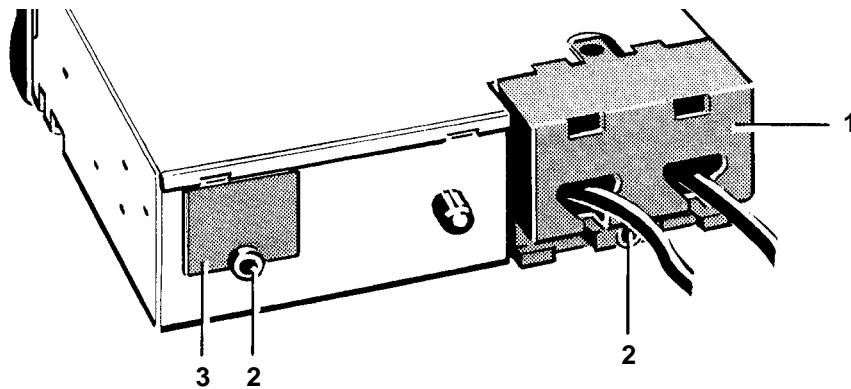


Fig. 5-8: MTCO 1390: Back seals

- | | |
|------------------------------|-----------------------|
| 1 Connector hood *(see note) | 3 Battery compartment |
| 2 Seal cap | |

■ **Check the condition and existence of the following seal caps (2):**

- **Connector hood (1)**
- **Battery compartment (3)** (if available).



Important

We recommend that you seal the back of the MTCO 1390 for security reasons.

■ **Re-install the MTCO 1390 correctly.**

Refer to *Chapter 3.6.3 "Installation instructions"*, from page 3-25.



Important

When the unit is fitted again check the MTCO 1390's error memory for errors (see *Chapter 5.4.3 "Reading the error memory"*, page 5-10).

5.5 Checking the tachograph system

Preparations

When the following preparations have been made:

- Preparing the test certificate (*Chapter 5.3*, from *page 5-5*)
- Carrying out the initial check (*Chapter 5.4*, from *page 5-8*)
- Checking the test conditions (*Chapter 5.2*, from *page 5-5*)

and the required values have been entered on the test certificate, the tachograph system must be checked.

Checking inside the vehicle

Unlike older tachograph systems, the tachograph system with MTCO 1390 can be checked inside the vehicle.



Condition

The equipment necessary for checking is the same as for installing and commissioning the tachograph system (cf. *Chapter 3.1 "Necessary equipment"*, page 3-2).

The following service diagnosis system (SDS) must be available:

- For checking the MTCO 1390 an MTC including the following accessories:
 - Interface with software version 6.00
 - Software version 7.xx for BTC
 - Programming cable (1602-78-006-01).
- For checking the tachograph system:
 - Automatic measuring track, including MTC accessories such as light barrier, Start/ Stop reflectors and light barrier cable or
 - Rolling Road Test Computer (ATC) with programming cable.

Additional information

You will find detailed information on the diagnosis system in *Chapter 3.1.1 "Service Diagnosis Systems"*, page 3-2 and the order numbers for the various diagnosis systems and their accessories in the appendix in *Section 6, Chapter 2.1 "Service Diagnosis Systems"*, page 2-2.

5.5.1 Measuring set up for measuring the characteristic coefficient

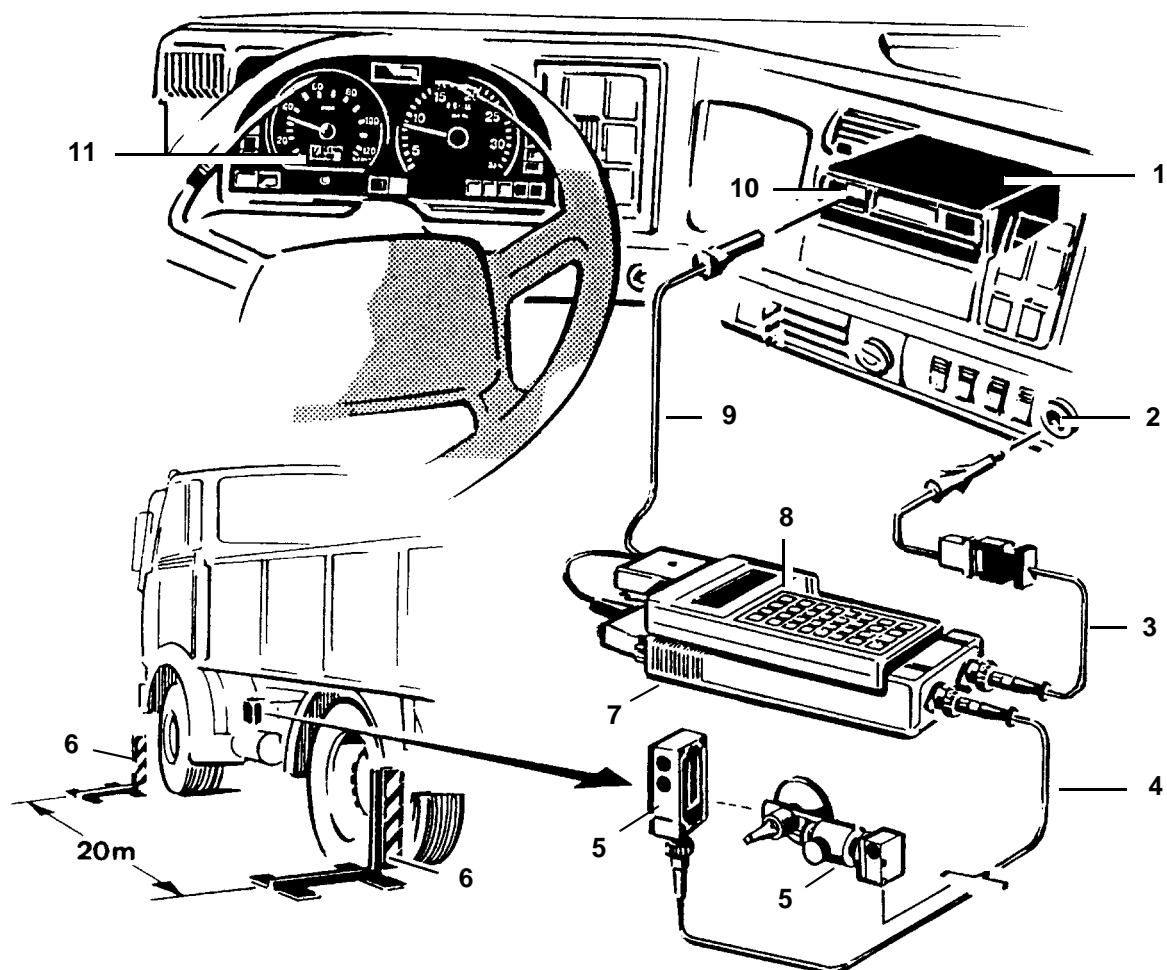


Fig. 5-9: MTCO 1390:
MTC connection overview with automatic measuring track and light barrier

- | | |
|--------------------------|------------------------------------|
| 1 MTCO 1390 | 7 MTC interface |
| 2 Cigarette lighter | 8 BTC |
| 3 Power cable | 9 Test cable |
| 4 Light barrier cable | 10 Test and programming interface |
| 5 Light barrier | 11 Electronic Speedometer/ Cluster |
| 6 Start/ Stop reflectors | |

- 1 Access the programming interface (10) on the MTCO 1390:
 - Remove the seal cap.
 - Undo the screw and remove the seal plate.
- 2 Connect the MTC to the MTCO programming interface (10) using the test cable (9).

- 3 Connect the MTC to the vehicle's electrical system using the power cable (3).
- 4 Attach the light barrier (5) to the vehicle and connect it to the MTC using the light barrier cable (4).
- 5 Check that the measuring track is set up properly.
Check the position and distance of the Start/ Stop reflectors (6). The real measuring track must have a minimum length of ± 20 metres. For more detailed information on the correction value *refer to the MTC operating instructions*.
- 6 Turn the ignition on and start the engine.

5.5.2 Determining the characteristic coefficient "w" (imp/km)

The values for "w", "k_{old}" and "k" are required for the test certificate and programming and have to be determined and stored. To do this, the following measuring steps must be carried out using the MTC:

- Determine the characteristic coefficient "w" (imp/km)
- Determine and store the tachograph constant "k_{old}"
- Program the tachograph constant "k".

If necessary, refer to the *separate MTC operating instructions* for a detailed description of the measuring steps.



Condition

Make sure that:

- the measuring track is set up correctly
- the MTCO is ready for operation (displaying the basic display)
- the MTC is connected correctly to:
 - the vehicle's electrical system
 - the test/ programming interface on the tachograph
 - the light barrier attached to the vehicle.

■ Use the MTC or ATC:

- to determine the characteristic coefficient "w" (imp/km)
- to determine and store the tachograph constant "k_{old}".
- Program the new "k" constant.

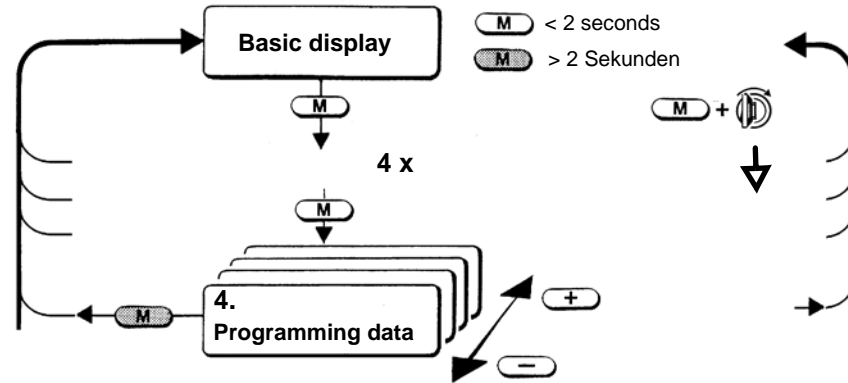


Important

Checking "w_{adjusted}" on an MTCO tachograph system is no longer possible or necessary since the constant is programmed 1 : 1 in relation to the measured characteristic coefficient "w".

After "w" and "k" have been measured and programmed their current values are displayed on the MTCO 1390's display.

Calling up the current "w" and "k" values



- 1 **Activate the service mode, if it is not yet active.**
For a detailed description refer to *Chapter 2.1.2 "Operation", section "Service mode menu functions"*, page 2-17.
- 2 **Press the key four times to switch from the basic display to the "4. Programming data" menu.**

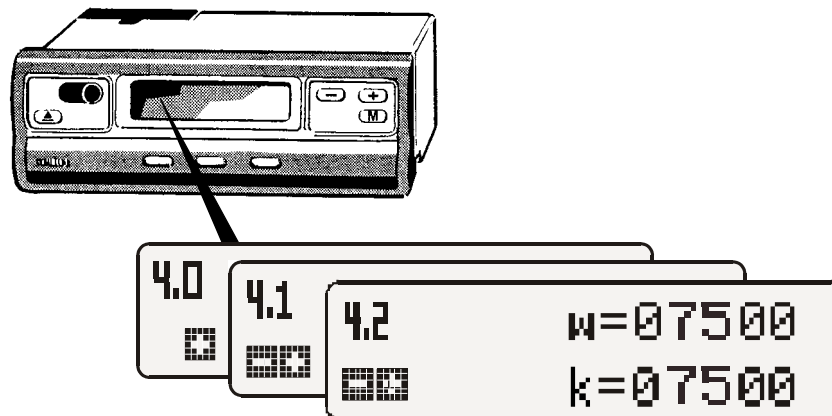


Fig. 5-10: MTCO 1390: Menu 4 "Programming data", displaying "w" and "k"

- **Use the key to select the sub-menu 4.2.**
Sub-menu 4.2 shows the currently stored values for:
 - the characteristic coefficient "w" (imp/km) and
 - the "k" constant.



Important

If the characteristic coefficient "w" is known, you can also program the "k" constant using the MTC and by selecting "PROGRAMMING" (see *Chapter 3.8.4 "Programming the MTCO 1390"*, from page 3-39).

5.6 Checking the MTCO 1390

When checking an MTCO 1390 the following functions must be checked:

- Auto-diagnosis function
- Functions of the tray and the tachograph chart turntable
- Key functions
- Functioning of the warning LED (if available) on the Electronic Speedometer or Cluster
- Functioning and time difference of the clock
- Accuracy of the speed display on the Electronic Speedometer or Cluster. This does not apply to an MTCO 1390 "Stand alone".
- Accuracy of the MTCO 1390's recording elements
- Accuracy of the odometer
- In case of warranty claims, read out and write down the kilometre reading.
- Accuracy of the speed reading on the MTCO 1390 "Stand alone" display.

MTCO 1390 "Stand alone"



Important

New tachographs manufactured not more than one year ago need not be checked for inherent errors. It is recommended that you draw up a test chart to prove that the MTCO 1390 is working correctly.

In case of a malfunction

If, when checking the unit, the MTCO 1390 or the indicator unit does not perform one of the above functions correctly, use a replacement unit to continue with the test.

5.6.1 Checking the auto-diagnosis function



Important

The auto-diagnosis function need not be checked since the system monitors itself.

MTCO 1390 auto-diagnosis

The MTCO 1390 carries out a constant auto-diagnosis to check that the whole modular tachograph system is functioning correctly.

Malfunctions (electronic/ mechanical) of the MTCO 1390 and of other system components and their connections are recorded automatically every time they occur. And if the tray:

- is closed malfunctions are indicated on the display immediately and, at the same time, the warning LED (if available) lights up.
- is open malfunctions are indicated after the tray is closed.

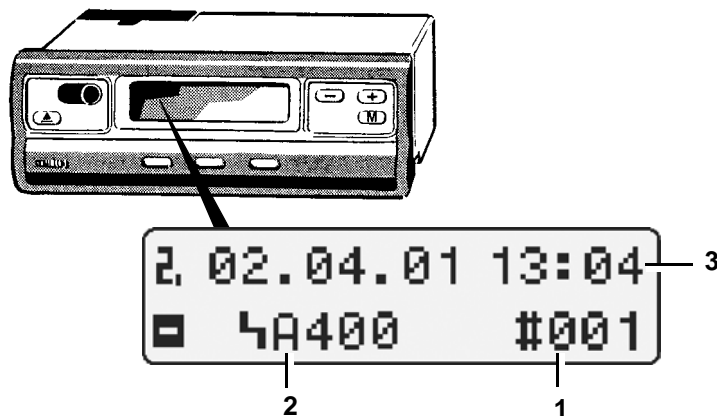


Fig. 5-11: MTCO malfunctions, e.g. display reading in case of a voltage cut

- | | |
|----------------------------------------------------------|-----------------------------------------------------|
| <p>1 Error number
(how often the error occurred)</p> | <p>2 Error symbol and error code</p> |
| | <p>3 Date and time when the error last occurred</p> |

Further error codes

Additional information on error codes and their meaning can be found in *Chapter 6.2 "Representation of error messages"*, from page 6-3.

The following error messages are also recorded as malfunctions on the tachograph chart:

- Recording system drive malfunctions
- Voltage cuts in the tachograph system
- KITAS sensor/ generator malfunctions or
- sensor/ pulse cable defects.

5.6.2 Checking the tachograph chart turntable

Checking the tray



Important

The tray may only open if:

- the vehicle is stationary, i.e. no distance pulses are stored and
- the ignition is switched on.

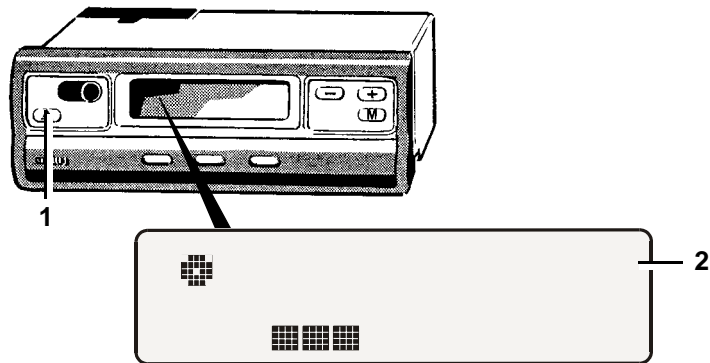


Fig. 5-12: MTCO 1390: Display reading when unlocking the tray

1 Unlock key "▲"

2 "Ejecting" display

- 1 To open the tray press the ▲ key.
The symbol for "Ejecting" and a progress bar must be shown on the display.
The tray is unlocked.
- 2 Pull out the tray until it will not go any further.
- 3 Remove the tachograph chart(s).

Checking the mechanical play (1 day unit)

MTCO 1390.1/3
(1 day unit)

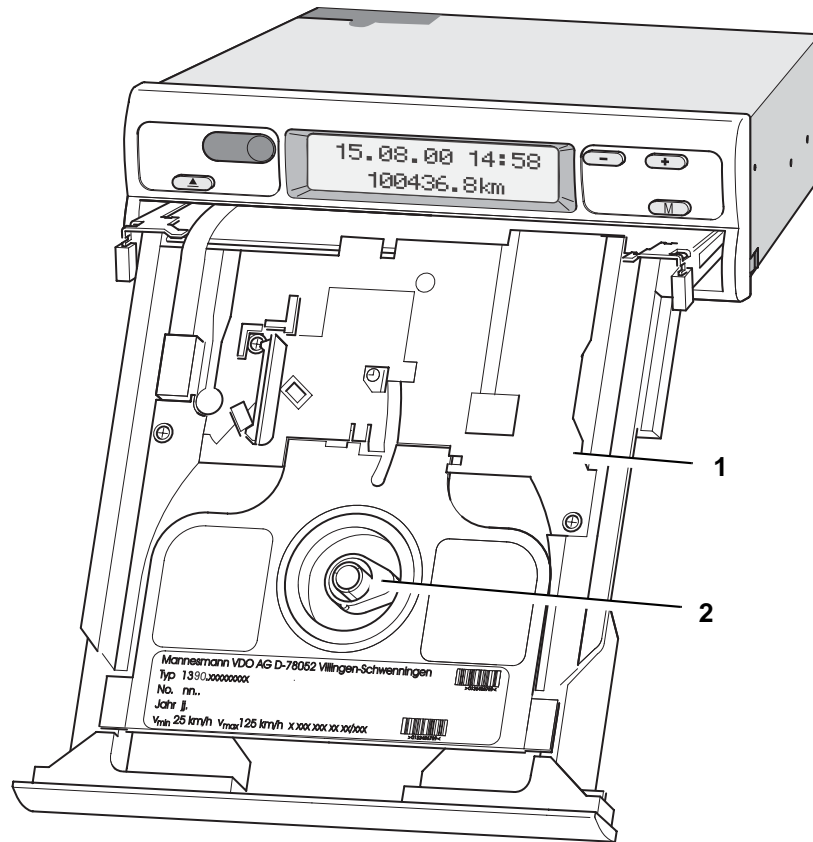


Fig. 5-13: MTCO 1390: Mechanical play of the tray (1 day unit)

1 Tray

2 Tachograph chart turntable

- Check the play of the tray (1) and the tachograph chart turntable (2).

Checking the mechanical play (7 day unit)

MTCO 1390.2/4
(7 day unit)

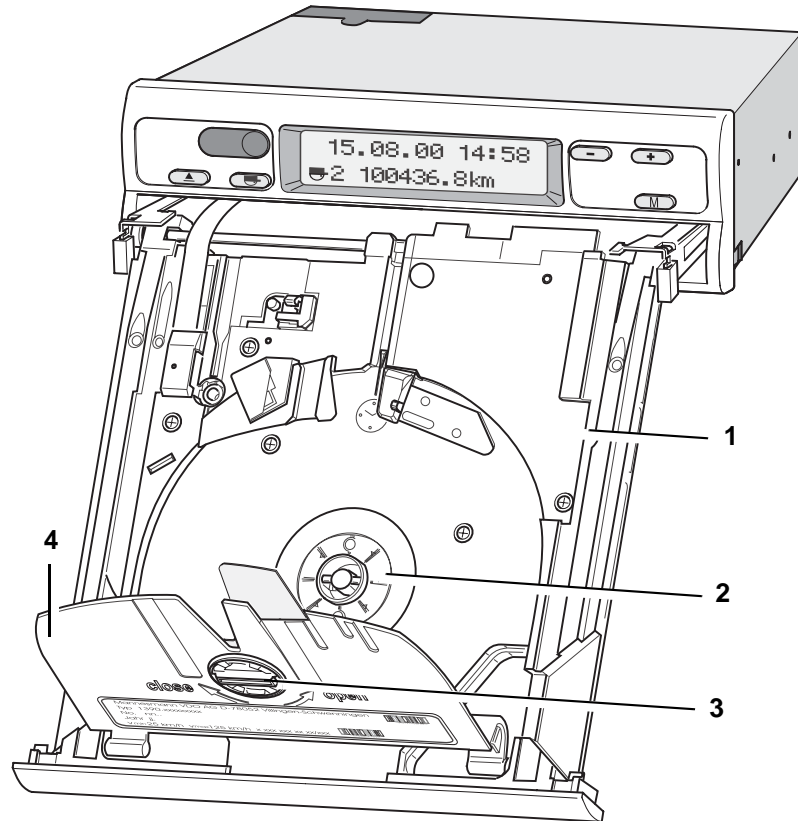


Fig. 5-14: MTCO 1390: Mechanical play of the tray (7 day unit)

- | | |
|------------------------------|--------------------------------------------|
| 1 Tray | 3 Tensioning ring and tensioning mechanism |
| 2 Tachograph chart turntable | 4 Cover plate |

- Check the play of the tray (1), tachograph chart turntable (2) and tensioning ring (3).
- Check that the tensioning mechanism and cover plate (4) are working.

5.6.3 Checking the operating keys

All keyson the MTCO 1390 must work correctly.

- Check the mechanical elements and operating function of each key.

Additional information

Descriptions of the operating key functions can be found in *Chapter 2.1 "MTCO 1390"*, from page 2-2.

5.6.4 Checking the indicator unit warning LED (if available)

The warning LED on the Electronic Speedometer or Cluster indicates that there is a malfunction in the tachograph system to alert the driver.

When the warning LED lights up this tells the driver that there is a malfunction in the tachograph system. The following are differentiated:

- system errors and
- operating errors.



Important

When the warning LED indicates a malfunction a message is also shown on the MTCO 1390's display and the corresponding error code is entered into the error memory.

A description of error codes, their meaning and remedies can be found in *Chapter 6.4 "Error correction measures"*, from page 6-14.



Condition

Before checking the warning LED make sure that:

- the tachograph chart(s) is/are inserted into the MTCO 1390
- the MTCO 1390 tray is closed
- the ignition is turned on
- the display does not show any malfunction messages
- the warning LED on the indicator unit is off.



Important

You can use menu 6 "V PULSE SIMULATION" to simulate driving.

Caution: When executing this function error entries or error messages can be recorded in other electronic components of the vehicle.

Cause: "v" pulse emitted while the vehicle is stationary.

- Check the functions of the warning equipment as described in the table below:

!

Important

If the warning LED (if available) lights up, the MTCO 1390's display also indicates a malfunction.



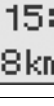





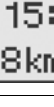
MTCO 1390 tachograph			Indicator unit
Display reading	Vehicle	Tachograph chart(s)	Warning LED
<div>10.04.01 15:02 100436.8km </div>	stationary	inserted	
<div>10.04.01 15:02 100436.8km</div>	stationary	missing	
<div>10.04.01 15:02 100436.8km  </div>	moving	missing	
<div>10.04.01 15:02 100436.8km  </div>	moving	inserted	

Table 5-2: Warning equipment function check (tachograph system 1390)

- If the warning LED does not perform as shown, either correct the error or replace the unit.

5.6.5 Checking the time difference of the clock

Test condition	The clock must work properly so that the legally prescribed journey data is recorded correctly.
Permissible tolerance	Regarding the accuracy of the tachograph clock, the following time differences are permitted by law: <ul style="list-style-type: none">• ± 2 minutes per day or• ± 10 minutes for 7 days.



Condition

Make sure that:

- the MTC and the MTCO 1390 are connected by the test cable
- the tachograph chart/ tachograph chart pack is inserted into the MTCO 1390
- The display shows the "basic display".

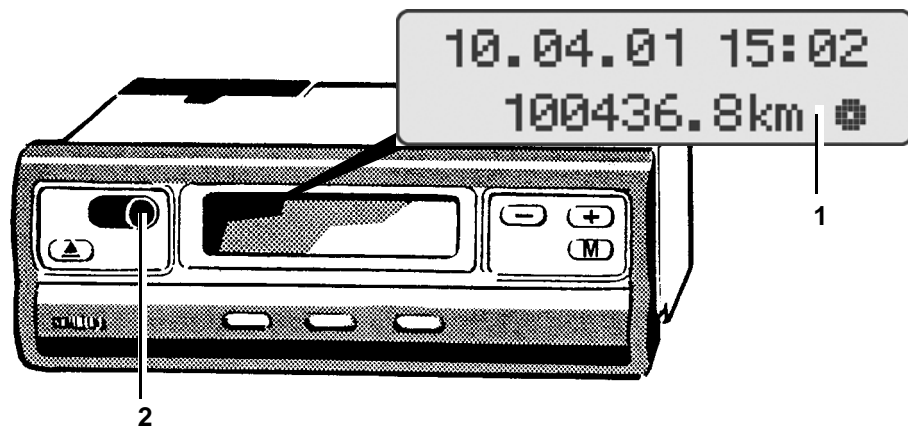


Fig. 5-15: MTCO 1390: Checking the clock

- 1 Display "Basic display" 2 Test/ programming interface

Testing steps

- 1 **Check whether the correct date and the correct time of day are shown on the display (1).**
If the date and/or time are not right, correct the settings using the "PROGRAMMING" program (see *Chapter 3.8.4 "Programming the MTCO 1390"*, from page 3-39).



Important

Please refer to the MTCO operating instructions for a description of the "Clock test" workflow. The only difference is that the test cable and the test sensor are not required. With the MTCO 1390 the "CLOCK TEST" is carried out by connecting the test cable to the test interface (2).

- 2 On the BTC start the "CLOCK TEST" program to determine the time difference.
- 3 Read the measured value (indicated without "+" and "-" signs) on the BTC's display and enter it on the test certificate in the "+" or "-" fields.
If you believe that the result of the measurement is not correct repeat the measurement. Press **[Enter]** to start a new measurement.
- 4 Press the Cancel key **[C]** to terminate the program.



Important

If the measured time difference is within the permissible tolerance range, the difference measured for a period of 24 hours must be entered on the test certificate.

5.6.6 Checking the speed display and recording

Scope of check

The following tolerances (permissible inherent errors) are prescribed by law for:

- the speed display (on the indicator unit and/or MTCO "Stand alone" display)
- speed recording (tachograph chart)
- the timed speed recording.

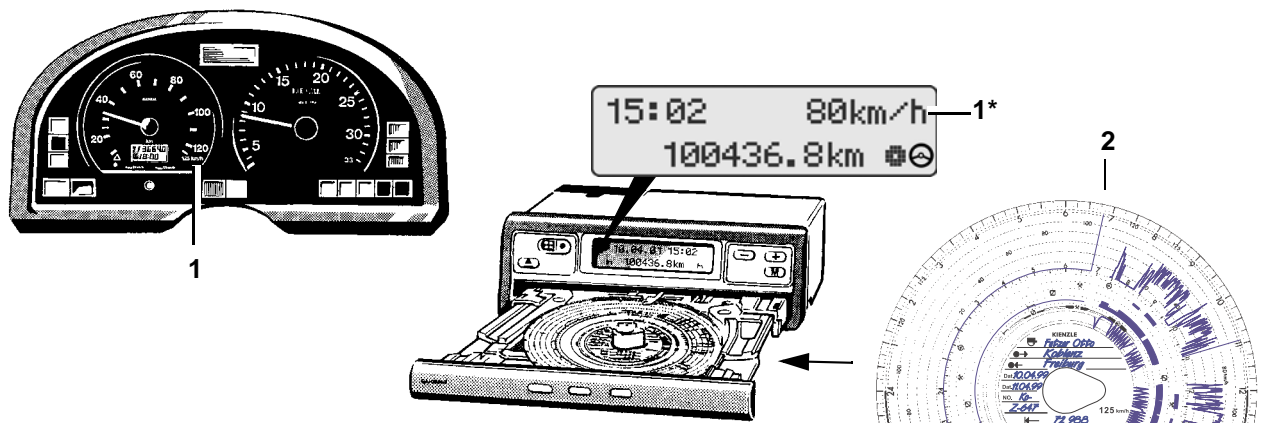


Fig. 5-16: Tachograph system: Scope of speed display and recording check (overview)

- | | |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <p>1 "v" display: e.g. indicator unit/
Electronic Speedometer or on display
(1*, MTCO "Stand alone" only)</p> | <p>2 Tachograph chart:</p> <ul style="list-style-type: none"> • "v" recording • Correct recording time |
|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|

Permissible tolerances

The maximum permissible difference between the indicated/ recorded speed and the real speed (reference value) is ± 3 km/h.

Measuring range table

The speed must be correct for the whole measuring range. Therefore, 3 measuring points are defined and checked. The measuring points are stated in the table below:

Final value (km/h)	Measuring points (km/h)		
125	40,	80,	120
180	40,	100,	160

Table 5-3: Tachograph speed measuring range table



Important

The indicator unit, MTCO 1390 and the tachograph charts must have the same upper speed limits.

- Check whether the upper speed limits match:
 - on the indicator unit
 - on the MTCO 1390 by selecting the "4. PROGRAMMING DATA" menu and
 - on the tachograph chart inserted into the MTCO 1390.

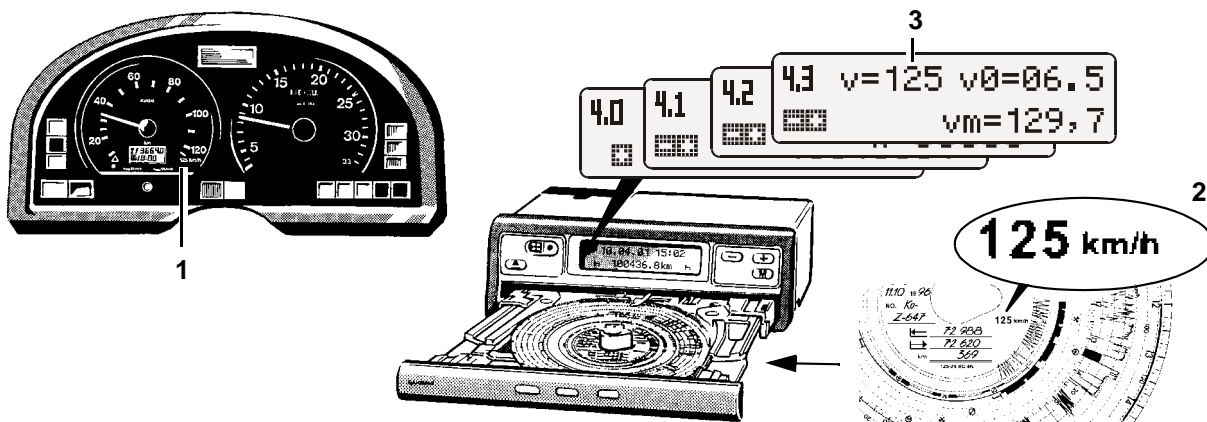


Fig. 5-17: Tachograph system: Overview of upper speed limit information on the individual components

- 1 Indicator unit
- 2 Tachograph chart
- 3 Programmed final value (sub-menu)



Condition

Make sure that:

- the MTC and the MTCO are connected by the test cable
- the tachograph chart/ tachograph chart pack is inserted into the tachograph
- the display shows the "basic display".

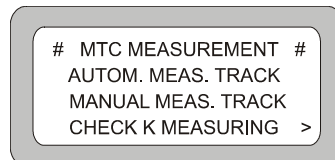


Important

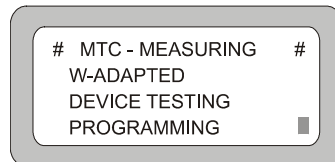
When testing make sure that you do not exceed the measuring points. Therefore, the starting value for the individual measuring points should always be at least 3 km/h lower than the actual measuring point.

The program can be aborted at any time by pressing the **[C]** key.

1 Run the "SPEED TEST" program on the BTC:



Use the DOWN arrow key to move the cursor to the next page of the main menu.



Use the arrow keys to select "DEVICE TESTING" and press **[Enter]** to confirm.

- Use the DOWN arrow key to move the cursor to the next page of the "DEVICE TESTING" sub-menu, select "SPEED TEST" and press **[Enter]** to confirm.
- Enter the starting value for measuring point 1 (e.g. 037 km/h for measuring point 40 km/h) and press **[Enter]** to confirm.
- Press **[Enter]** to confirm the "k" value determined during the previous check of the tachograph system.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches 1st measuring point exactly. After **1 minute** press **[Enter]** to confirm.

2 Read the measured speed for measuring point 1 on the BTC display and enter it on the test certificate.

- Enter the starting value for measuring point 2 (e.g. 077 km/h for measuring point 80 km/h) and press **[Enter]** to confirm.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches the 2nd measuring point exactly.
- After **1 minute** press **[Enter]** to confirm.

3 Read the measured speed for measuring point 2 on the BTC display and enter it on the test certificate.

- Enter the starting value for measuring point 3 (e.g. 117 km/h for measuring point 120 km/h) and press **[Enter]** to confirm.
- Use the UP arrow key and gradually increase the speed indicated on the display instrument until it reaches the 3rd measuring point exactly. After **1 minute** press **[Enter]** to confirm.

4 Read the measured speed for measuring point 3 on the BTC display and enter it on the test certificate.

- 5 When the "SPEED TEST" program is terminated open the tray of the MTCO and remove the tachograph chart.

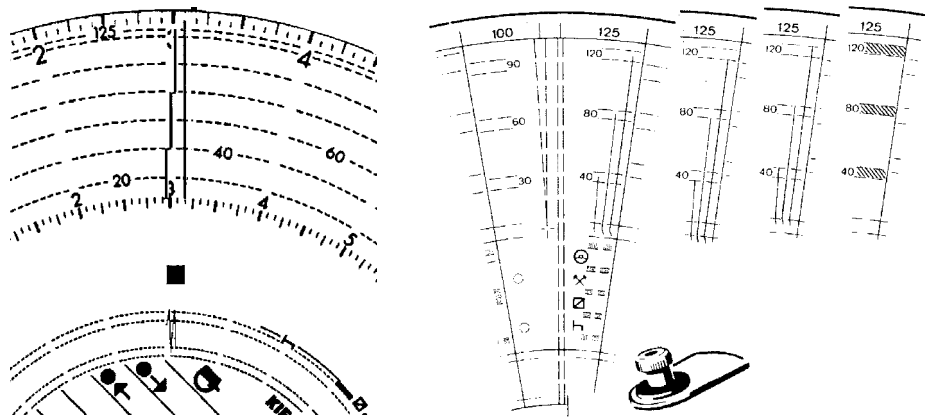


Fig. 5-18: Tachograph chart: Speed recording

- 6 Check the speed recording using the test template.



Important

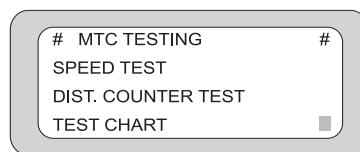
If the speed differs by more than ± 3 km/h, the following components must be replaced:

- When checking the display:
 - indicator unit or
 - MTCO "Stand alone"
- When analysing the recording: MTCO 1390.

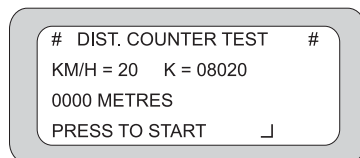
5.6.7 Checking the odometer

Permissible tolerance According to the law, the permissible tolerance for the odometer is ± 10 metres per kilometre.

- 1 Insert the tachograph chart(s).
- 2 Close the tray.
- 3 Check the odometer.



Use the arrow keys to select "DIST. COUNTER TEST" and press **[Enter]** to confirm:



The MTCO is driven automatically at a speed of 20 km/h.

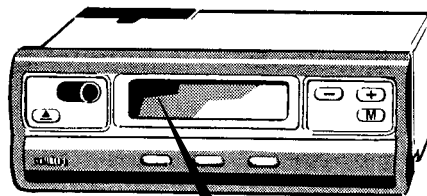


Fig. 5-19: MTCO 1390: Odometer reading, example of odometer check

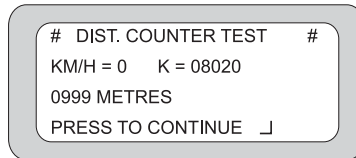
- 1 Initial reading of odometer 2 Final reading of odometer

- 4 Watch the odometer on the MTCO 1390's display and press the **[Enter]** key on the BTC when the odometer advances, select the first decimal place "100436.8", for example.

Now the MTCO 1390 is driven at a speed of 100 km/h automatically. After 950 m the MTC reduces the speed of the MTCO 1390 automatically to 20 km/h.

- 5 **Watch the odometer and press the BTC [Enter] key at 1000 m precise (in this example, do this at "100437.8").**

The MTCO 1390 is no longer driven. The MTC and the MTCO should remain connected by the test cable.



The display indicates the actual distance travelled.

- 6 **Read the actual distance measured on the BTC display and enter it on the test certificate.**

Not within prescribed tolerances

If, as a result of the check, the actual value of the odometer is not within the prescribed tolerance range of ± 10 m/km, the MTCO 1390 is defective and a replacement tachograph must be used.



Important

When installing a replacement or original equipment tachograph, the odometer reading (kilometre reading (mileage) of the vehicle) of the replaced tachograph must be programmed into the new tachograph.

Additional information on how to program the odometer can be found in *Chapter 3.8.4 "Programming the MTCO 1390"*, from page 3-39.

5.7 Drawing up and analysing the test chart

A test chart must be drawn up for each routine check. The test chart proves that the tachograph system has been duly checked. Carry out the following steps:

- Prepare the tachograph chart(s)
- Draw up the test chart
- Analyse the test chart.

Preparing the tachograph chart(s)

The test chart is part of the test certificate and has to be assigned to the tachograph and the vehicle checked.



Important

So that the test can be carried out as prescribed you must make sure when drawing up the test chart that:

- you use new tachograph chart(s) prescribed for the tachograph
- all the required information is entered completely.

Recommendation

The tachograph chart should be stamped and any entries made in the area of the 24:00 hour mark so that the entries are not overwritten by the test chart and test drive data.

- 1 Stamp the new correct tachograph chart(s) with the test stamp.
- 2 Fill in the tachograph chart(s) completely.

5.7.1 Drawing up the test chart

Measuring range

The program sequence (cf. "Program sequence for drawing up the test chart automatically for 125 km/h tachographs") and the following workflow description relate to an MTCO 1390 with:

- final measuring range value for speed of 125 km/h
- constant $k = 7500 \text{ imp/km}$.



Important

The measuring points used for drawing up the test chart depend on the MTCO's final measuring range value that you enter into the BTC (see Table 5-3: "Tachograph speed measuring range table", page 5-26).

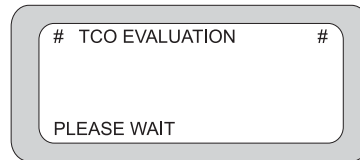
- 1 Unlock the tray and open it completely.
- 2 Insert a new test chart that is filled in completely into the MTCO 1390.
- 3 Close the tray.
- 4 Run the “TEST CHART” program on the BTC.
The program sequence can be found in the *following table*.

Program sequence for drawing up the test chart automatically

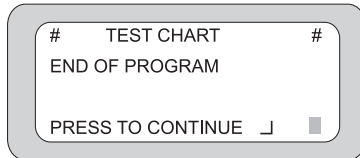
Speed		Duration
km/h		seconds
1	0	2
	Final value	10
	0	20
2	0	2
	40	2
	80	2
	120	1
	Final value	2
	120	2
	80	2
	40	20
	0	
3	0	
	40	1
	0	20
	80	1
	0	20
	120	1
	0	
4	0	20
	Final value	2
	120	120
	80	120
	40	120
	0	120

Table 5-4: Program sequence for drawing up the test chart automatically
(Example: final measuring value of 125 km/h)

- 5 If all the settings in the BTC are correct, press the [Enter] key to confirm.
The program runs automatically to the end.



The MTC checks the type of MTCO connected and starts the correct control program automatically.



You will hear a signal tone.
The test chart has been drawn up.
Press **[Enter]** to continue.

6 Open the tray and remove the test chart.

Automatically drawn up test chart

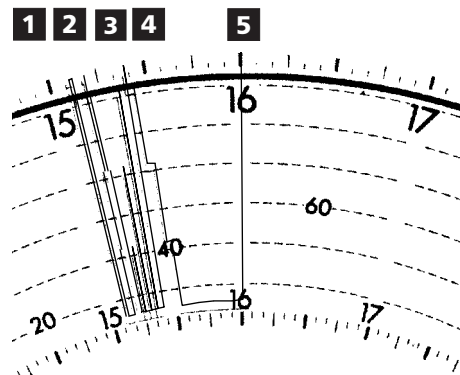


Fig. 5-20: Test chart recordings

- 1 - 4 Straight and perpendicular recording (reference line diagram)
- 5 Ejection mark

5.7.2 Analysing the test chart

■ Analyse the test charts.

Additional information

You will find all the necessary information and instructions on "How to analyse test charts" in *the test template operating instructions*.

5.8 Programming installation data

When the unit has been tested, the necessary installation data must be programmed:

Installation data

- Effective tyre circumference
- Calibration date (test date)
- Any further data such as:
 - Current time of day
 - Current date.

Additional information

The detailed programming workflow is described in *Chapter 3.8.4 "Programming the MTCO 1390"*, from page 3-39.

5.9 Testing using the STC Automatic

You can also use an STC Automatic (STC and BTC) for commissioning and testing an MTCO 1390 tachograph or Electronic Speedometer outside the vehicle.

The following firmware/ software versions include the extended "Programming" and "Testing" functions:

- Connection cable (order number X12-160-125-103)
- MTCO 1390 tachograph mount (order number X12-160-125-102)
- Upgrade kit for MTCO 1390 (order number 1602-89-902-00) consisting of:
 - Programming cable (**1, Fig. 5-19**)
 - Software version **07.xx** for BTC
 - MTCO 1390 programming instructions



Important

From the MTCO 1390's firmware version 001.07 we recommend that you adapt the "MTCO to Electronic Speedometer" connection cable if it does not match the one shown (**5, Fig. 5-20**) (see section *"Recommendations for the test equipment"* on the next page).

Additional information

Additional information on the STC can be found in the separate *"STC 1601.25" operating instructions and supplements*.

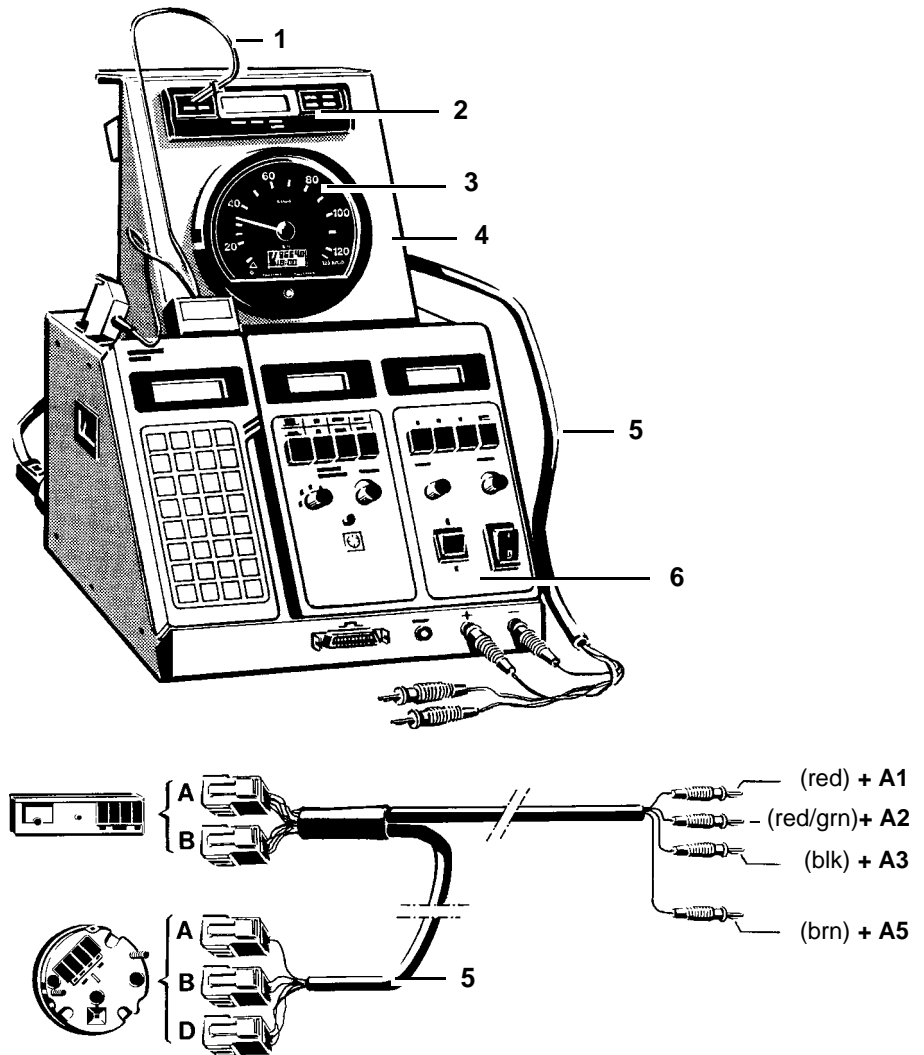


Fig. 5-21: STC Automatic: Connection diagram for MTCO and E-Speedometer

- | | | | |
|---|-----------------------------|---|-------------------------------------|
| 1 | Programming cable | 4 | MTCO 1390 tachograph mount |
| 2 | MTCO 1390 | 5 | "MTCO to E-Speedo" connection cable |
| 3 | Electronic Speedometer 1323 | 6 | STC Automatic |


Recommendations for the test equipment

If the "MTCO to E-Speedo" connection cable (5) does not match the cable version shown (two banana plugs A1/A2/A3 and A5), we recommend that you fit a switch (e.g. toggle switch) into the following cables:

Dimming function for display illumination

- "red grey" lead (+ A2) for checking the MTCO 1390's dimming function: If voltage is applied to pin A2, the display illumination gets darker. The dimming function is activated when the vehicle lights are switched on.

Service mode

- "black" lead (+ A3) for activating the service mode: Press the  key and, at the same time, turn the ignition on.

5.10 Test drive, sealing and completing the test

5.10.1 Carry out the test drive

When the installation data has been programmed and the analysis of the test charts has proved that the MTCO 1390 is working correctly, the test drive must be carried out with a test chart inserted. The test drive is an integral part of the required testing steps.

Test condition	For the test drive the vehicle must be driven on a test track with a minimum length of 1 km.
Recommendation	For road safety reasons we recommend that you check the unit as a co-driver.



Important

It is also possible to carry out the test drive and its related checks on an APS/ATC rolling road test bench (do **not** use a brake test bench).

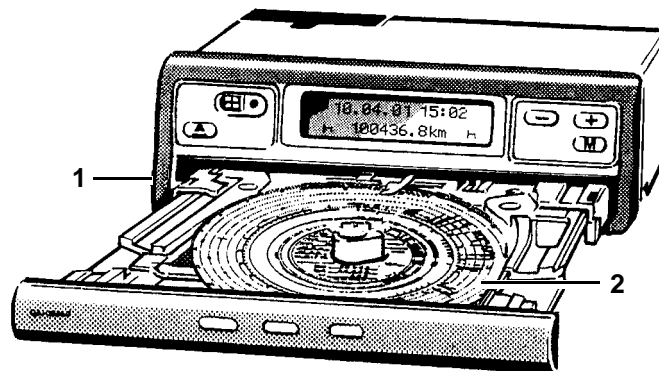


Fig. 5-22: Open MTCO 1390 ready for inserting the tachograph chart

- 1 MTCO 1390 with open tray 2 Tachograph chart

- 1 Prepare the vehicle for the test drive:
 - Unlock the tray and open it completely.
 - Insert the test chart.
 - Close the tray.
- 2 Drive along test track with a minimum length of 1 km.

3 As co-driver during the test drive:

- Ensure that the indicator unit display is regular.
- Monitor the reference display on the MTCO display.
- Check any additional functions/ equipment.

4 After the test drive:

- Check the initial position of the pointers on the indicator unit.
- Remove the test chart and analyse the recordings using the test template.

Check the recording time for the ejection mark; track the tachograph chart turntable or adjust the tachograph chart pack, if necessary.

The time difference between the ejection mark recording and the clock must not exceed ± 5 minutes.

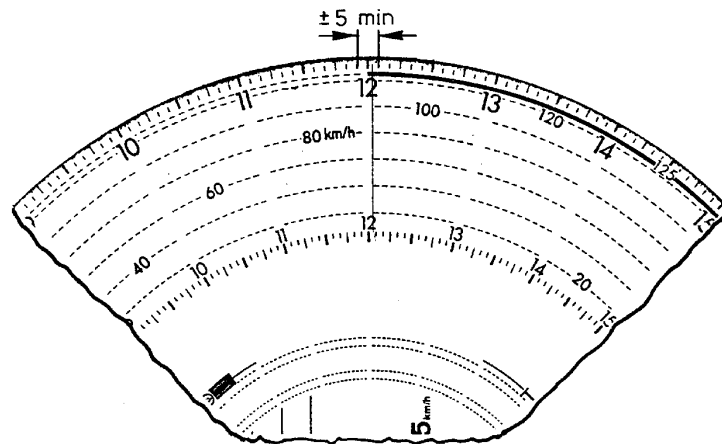


Fig. 5-23: Tachograph chart: Ejection mark

5 Insert the original tachograph chart/ tachograph chart pack used for driving to the workshop.



Important

Before handing the vehicle over to the customer, any errors stored in the error memory must be deleted (see *Chapter 3.8.4 "Programming the MTCO 1390", section "Clearing the error memory"*, page 3-56).

5.10.2 Sealing

After the test drive:

- Seal the test/ programming interface on the MTCO 1390.
- Check the seal on the KITAS sensor/ generator.

Sealing the
test/ programming
interface

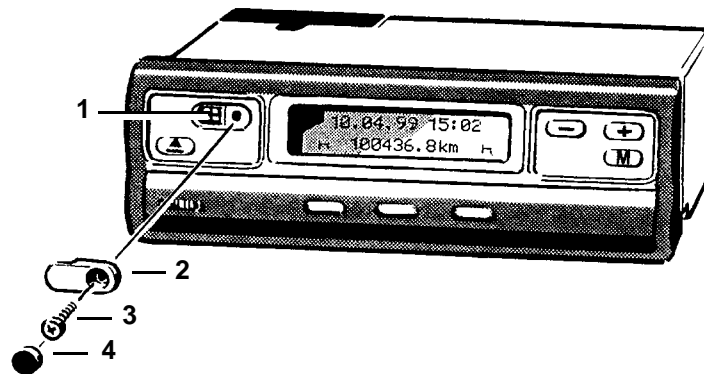


Fig. 5-24: MTCO 1390: Test/ programming interface

- 1 Insert the seal plate into the test/ programming interface (1) and fix it with the screw (3).
- 2 Stamp the seal cap (4) and press it into the seal cup.
- 3 Check the seals on the KITAS sensor on the gearbox; seal the unit correctly if necessary.

Additional information

You will find information on sealing points and how to seal the tachograph system correctly in *Chapter 4.2.1 "MTCO 1390 sealing plan"*, from page 4-3.

5.10.3 Completing the test

To complete the tests for the test certificate:

- Fill in, attach and seal the installation label.
- Attach and seal the "k" label.
- Complete and file the test certificate.



Important

The additional entry on the test certificate relating to EA tachograph systems and the adjusted characteristic coefficient " w_{adjusted} " is no longer necessary.

Completing and attaching the installation label

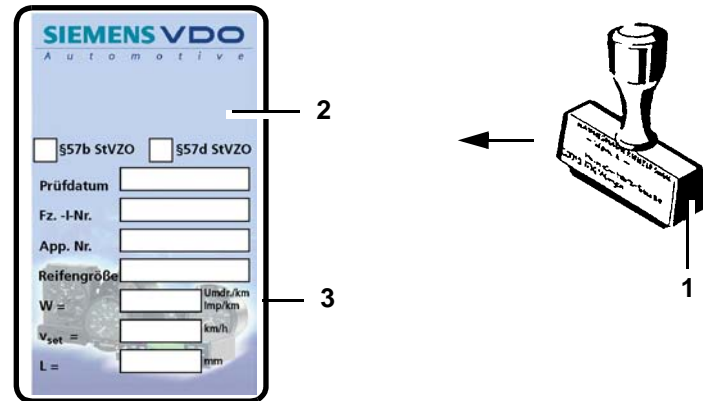


Fig. 5-25: Installation label with company logo and sealing foil

- 1 Company stamp
- 2 Installation label
- 3 Kienzle sealing foil with printed logo

! Important

When checking the unit using a rolling road test computer (ATC) / rolling road test bench (ATS), the data is printed on the installation label.

1 Fill in the following data on the installation label:

- Test date
- Last eight digits of the vehicle identification number
- Tachograph number.
- Size of tires
- Characteristic coefficient "w" (imp/km)
- Speed limit value "v_{set}" (if applicable)
- Effective tyre circumference "L"

2 Stamp the installation label with the company stamp.

If sealing foils with company logo are used, the installation label need not be stamped.

3 Stick the completed installation label on the vehicle.

The position of the installation label depends on the vehicle type and the vehicle manufacturer. Generally, the installation label is attached to the A or B pillar.

4 Seal the installation label.

After the installation label has been attached, use sealing foil to seal it.

Completing and attaching the constant label

Constant labels showing the speed constant "k" imp/km are attached to the tachograph systems.

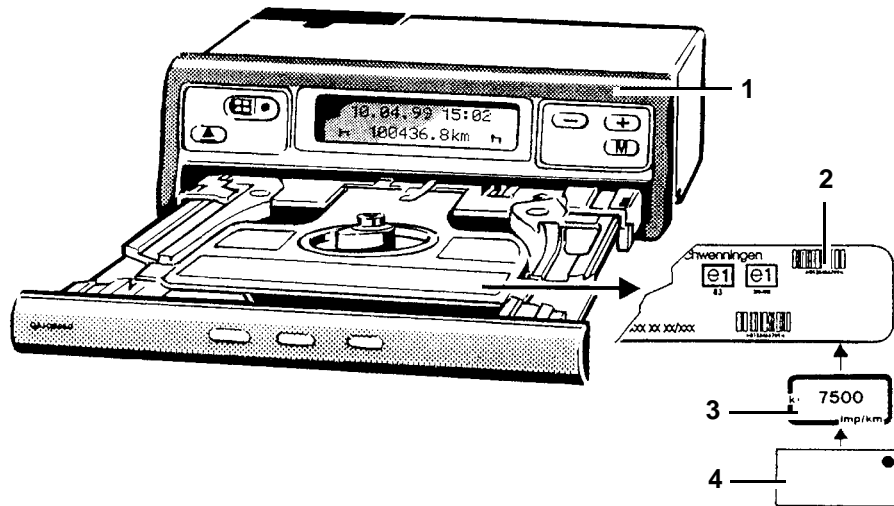


Fig. 5-26: MTCO 1390: Sealing the constant label

- | | |
|----------------------------|------------------------------|
| 1 MTCO 1390 with open tray | 3 Constant label |
| 2 Type plate | 4 Sealing foil for "k" label |

- 1 Enter the set tachograph constant "k" on the constant label and stick it on the type plate on the tray.
- 2 Seal the constant label with sealing foil.

Completing and filing the test certificate

A test certificate must be drawn up for each routine check. The test certificate and the test chart prove that the check has been carried out correctly.

- 1 Check that the test certificate has been completed in full.
- 2 Stamp the test certificate using the company stamp and sign it.
- 3 Attach the test chart(s) to the test certificate and file the test certificate.
- 4 Enter the check on the test record.
- 5 Hand the vehicle over to the customer and inform the driver about any legal provisions or hand out an instruction manual (with new and replacement tachographs).

Chapter 6

Fault analysis

6.1 Error messages

The MTCO 1390 monitors the correct functioning of the system and displays errors/ malfunctions of system components or operating errors.

A message consists of:

- the error symbol on the MTCO 1390's display
- the error entry in the MTCO 1390's error log
- the warning LED lights (if available) on the indicator unit.

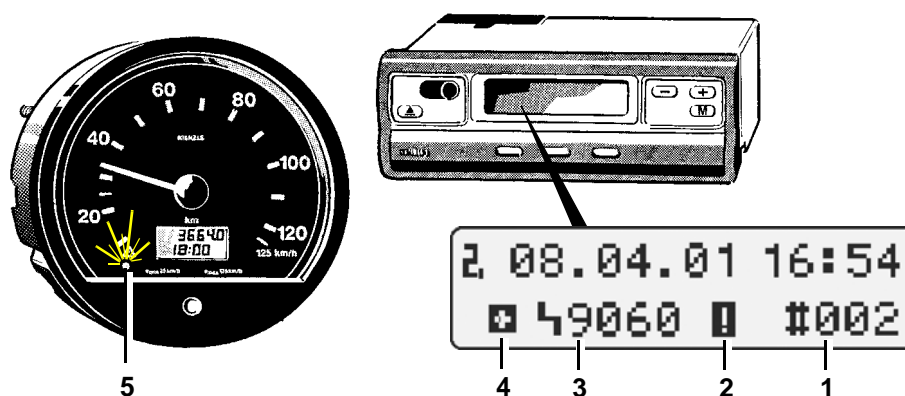


Fig. 6-1: Error messages: Tachograph system 1390, e.g. operating errors

- 1 Error frequency, i.e. how often did the error occur, max. 126 entries
- 2 "Error active" symbol
- 3 Error symbol and error code
- 4 "Further errors stored" symbol
- 5 Warning LED (if available) on the indicator unit lights up

Displaying the error memory

The entries in the error memory can be called up for further analysis by selecting the "Error Memory" menu. As well as the types of error the error memory also shows how often the error occurred.

Additional information can be found in *Chapter 2.1.2 "Operation", section "Displaying the Error Memory (menu 2.)", page 2-18.*



Important

You can only clear the error memory using an SDS test unit, e.g. MTC/ATC.

If the unit displays system or tachograph errors that cannot be corrected or deleted, the MTCO 1390 must be replaced.

6.2 Representation of error messages

Depending on the type of error, the MTCO 1390 displays different messages. The MTCO 1390 distinguishes between:

- messages that relate to a difference between the displayed time (system time) and the time set for the tachograph chart turntable (recording time). Depending on the unit, the messages and the measures for correcting this error are different:
 - 1 day unit and
 - 7 day unit
- operating error message
- system error message.

Additional information

A description of the cause of the error, specific features and recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, from page 6-14.

6.2.1 Message relating to a difference between the recording time and the system time with MTCO 1390 1 day unit

The time is flashing and the error symbol appears

MTCO 1390
1 day unit

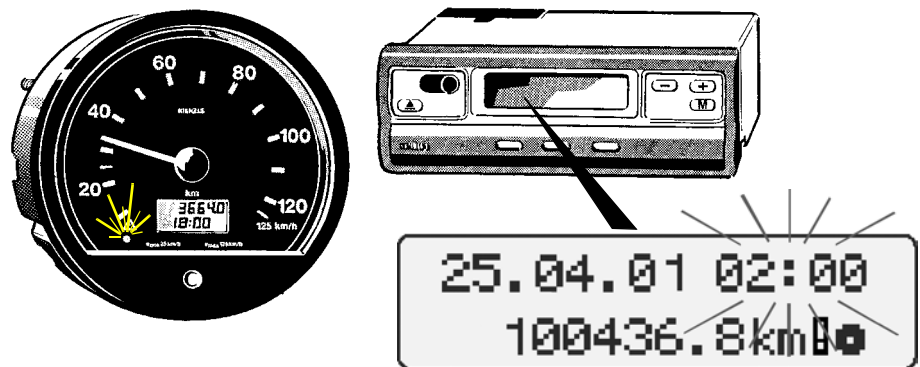


Fig. 6-2: Error message (1 day unit): Difference between system time and recording time

The MTCO 1390 indicates that:

- either the system time on the display and the tachograph chart's recording time differ. **Code 9053:** Track the tachograph chart turntable.
- or an error occurred when tracking the tachograph chart turntable to match the system time. **Code 9064:** Error when tracking the tachograph chart turntable.

Cause

This error occurs if:

- the MTCO 1390 sets the beginning/ end of daylight saving time automatically
- the MTCO 1390's system time was reset (> 2 min) without tracking the tachograph chart turntable or
- after a voltage cut of more than 2 minutes.

Display

The message consists in detail of:

- the error symbol on the MTCO 1390's display
- the flashing system time on the display
- the warning LED lights (if available) on the Electronic Speedometer 1323 or indicator unit
- the entry in the error memory (Code 9064**only**)
- a status output on the CAN bus (tachograph systems with CAN bus **only**).



Important

So that the tachograph chart turntable is set to the current system time automatically:

- the vehicle must be stationary, i.e. no distance pulses are stored
- the ignition must be on
- the tray **without** tachograph chart must be closed.

Measure

■ Track the tachograph chart turntable:

- Turn the ignition on.
- Open the MTCO 1390's tray and remove the tachograph chart, if necessary.
- Close the tray.

When the tray is closed the MTCO 1390 tracks the tachograph chart turntable automatically and adjusts it to the current system time.

The system time is no longer flashing on the display and the error symbol is reset. Insert a new tachograph chart, if necessary.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-14 for recommended measures for error correction.

The colon (clock) is not flashing and the error symbol appears

MTCO 1390
1 day unit

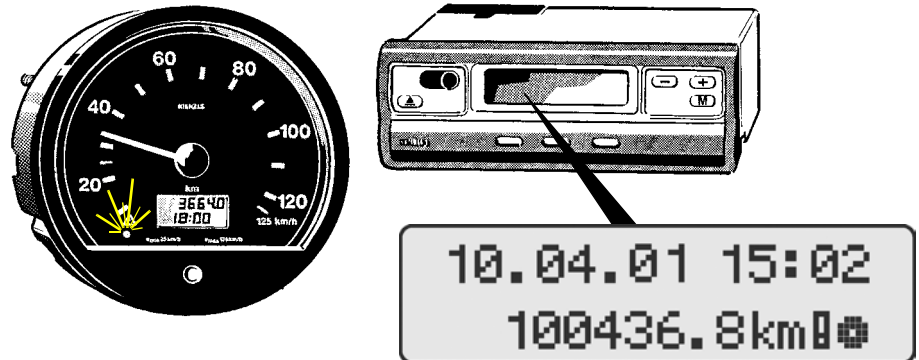


Fig. 6-3: Error message (1 day unit): Tachograph chart turntable drive malfunction

The MTCO 1390 indicates that the tachograph chart turntable drive is faulty and that the tachograph chart turntable is not turning (running control).

Code 9064: Tachograph chart turntable drive error

Cause

This error occurs when there is a malfunction in the MTCO 1390's tachograph chart turntable drive.

Display

The message consists in detail of:

- the error symbol on the MTCO 1390's display
- the non-flashing system time colon on the display
- the warning LED lights (if available) on the Electronic Speedometer 1323 or indicator unit
- the entry in the error memory
- a status output on the CAN bus (tachograph systems with CAN bus **only**).

Measure

■ Check whether the tachograph chart is inserted correctly:

- Turn the ignition on.
- Open the MTCO 1390 tray and check the position of the tachograph chart.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-14 for recommended measures for error correction.

6.2.2 Message relating to a difference between the recording time and the system time with MTCO 1390 7 day unit

The time is flashing and the error symbol appears

MTCO 1390
7 day unit

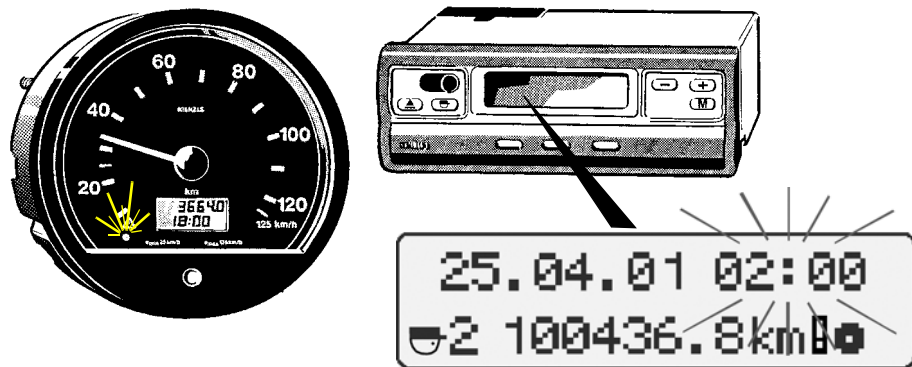


Fig. 6-4: Error message (7 day unit): Difference between the system time and the recording time

The MTCO 1390 indicates that:

- the system time on the display and the tachograph chart pack's recording time differ.
Code 9053: Track the tachograph chart pack.

Cause

This error occurs if:

- the MTCO 1390 sets the beginning/ end of daylight saving time automatically.
- the MTCO 1390's system time was reset (> 2 min) or
- after a voltage cut of more than 2 minutes.

Display

The message consists in detail of:

- the error symbol on the MTCO 1390's display
- the flashing system time on the display
- the warning LED lights (if available) on the Electronic Speedometer 1323 or indicator unit
- a status output on the CAN bus (tachograph systems with CAN bus **only**).

Measure

■ Track the tachograph chart pack:

- Turn the ignition on.
- Open the MTCO 1390's tray.
- Unlock the tensioning ring by turning it anti-clockwise.
- Lift the cover plate up.
- Set the tachograph chart pack to the current time of day.
- Put the cover plate down and lock the tensioning ring by turning it clockwise.
- Close the tray.

The system time is no longer flashing on the display and the error symbol is reset. Insert a new tachograph chart pack, if necessary.



Important

Generally, the flashing time display disappears and the error symbol is reset when the tray is closed, regardless of whether the tachograph chart pack was adjusted to the current time or not.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-14 for recommended measures for error correction.

The colon (clock) is not flashing and the error symbol appears

MTCO 1390
7 day unit

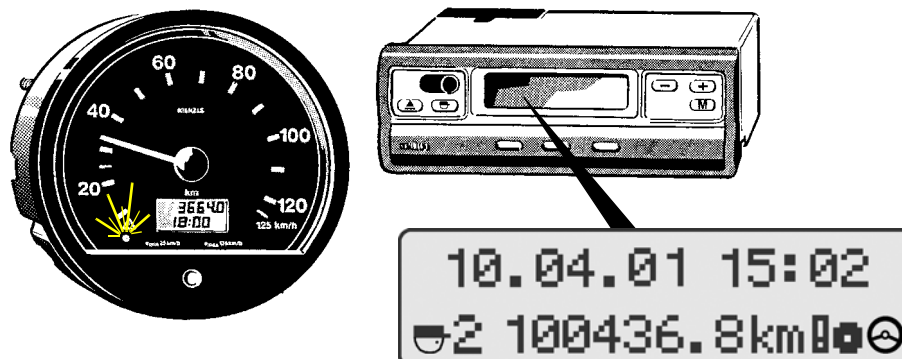


Fig. 6-5: Error message (7 day unit): Tachograph chart turntable drive malfunction

The MTCO 1390 indicates that the tachograph chart turntable drive is faulty and that the tachograph chart turntable is not turning.

Code 9064: Tachograph chart turntable drive error.

Cause

This error occurs when there is a malfunction in the MTCO 1390's tachograph chart turntable drive.

Display

The message consists in detail of:

- the error symbol on the MTCO 1390's display
- the non-flashing system time colon on the display
- the warning LED lights (if available) on the Electronic Speedometer 1323 or indicator unit
- the entry in the error memory
- a status output on the CAN bus (tachograph systems with CAN bus **only**).

Measure

- Check whether the tachograph chart pack is inserted correctly:
 - Turn the ignition on.
 - Open the MTCO 1390 tray and check the position of the tachograph charts.

Additional information

If error code 9064 repeats itself, please refer to *Chapter 6.4 "Error correction measures"*, from page 6-14 for recommended measures for error correction.

6.2.3 Operating error messages

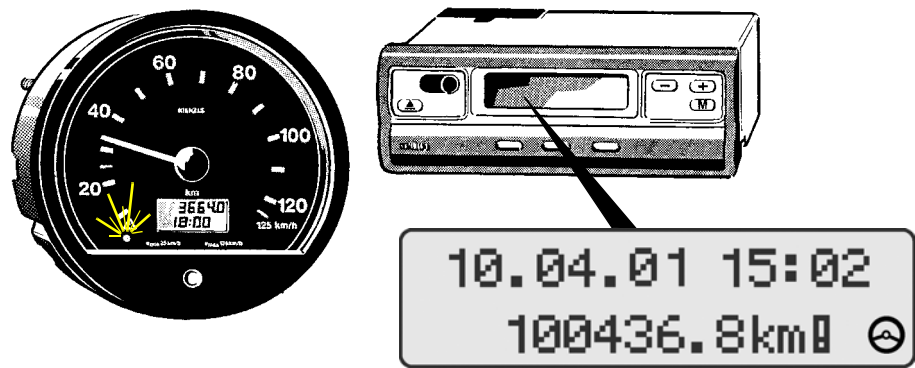


Fig. 6-6: Error message: Sample display for operating error messages

List of operating errors

Display messages	Code	Meaning	Remarks	
10.04.01 15:02 100436.8km Ⓢ	A050	Journey without a tachograph chart/ tachograph chart pack	●	
25.04.01 02:00 100436.8km Ⓢ	9053	The system time was set while the tachograph chart was inserted (1 day unit only) or the MTCO 1390 has set the beginning/ end of daylight saving time automatically		○
10.04.01 15:02 100436.8km Ⓢ	900F	Key pressed too long (> 3 min.)		○

Table 6-1: Error list: Operating errors

Key

- No entry is added to the error memory.
- The error is stored in the error memory.

6.2.4 System/ tachograph error messages

Malfunctions (electronic/ mechanical) of the MTCO 1390 and of other system components and their connections are:

- automatically displayed whenever they occur or
- when closing the tray, the device indicates that errors have occurred or are about to.

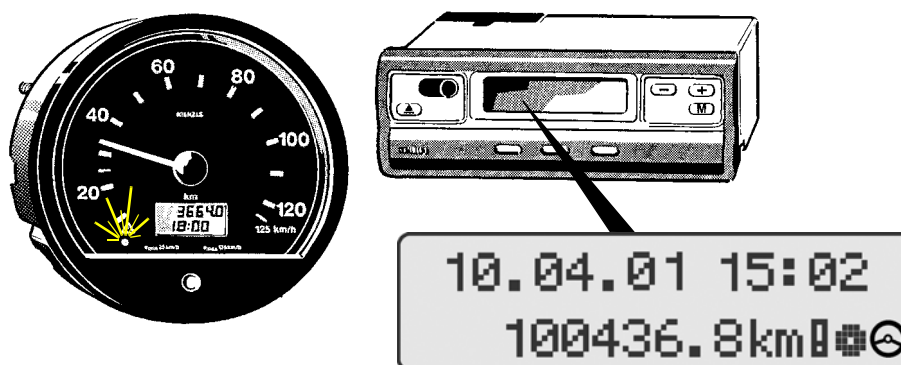


Fig. 6-7: Error message: Sample display of system/ tachograph error messages

List of system/ tachograph errors

Display messages	Code	Meaning	Remarks	
<div>10.04.01 15:02</div> <div>100436.8km</div>	900A	Other errors with CAN transmission		
	900B	Error "CAN bus off"		
	900F	Keypad error: Key[s] jammed		
	9010	LCD error: Display defective or faulty		
	9060	Tray defective, e.g. tray does not open		
	9061	"v" system error	○	
	9062	Multi-stylus system (MFS) defective	○	
	9063	Stylus lifting system (SAS) defective	○	
<div>10.04.01 15:02</div> <div>100436.8km</div>	9064	Tachograph chart turntable driver faulty/ defective (1 day unit only)		
<div>10.04.01 15:02</div> <div>100436.8km</div>	9430	"v" pulse output error (B7)		

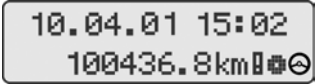
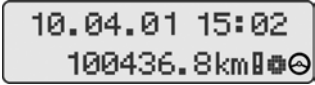
Display messages	Code	Meaning	Remarks	
	A00C	Electronics error, e.g. FRAM defective/ clock defective Internal error Operating system error: Watchdog overflow Program memory error		•
none	A400	Voltage cut	○	
	A411	Communication error between the MTCO 1390 and the indicator unit		
	A423	Sensor communication error (MTCO 1390 with KITAS 2170/ 2171 only)	○	
	A822	KITAS 2170/2171: Sensor key, serial number/ signal error Pulse generator 2159: Sensor communication error (double pulse control)	○	

Table 6-2: Error list: System/ tachograph errors

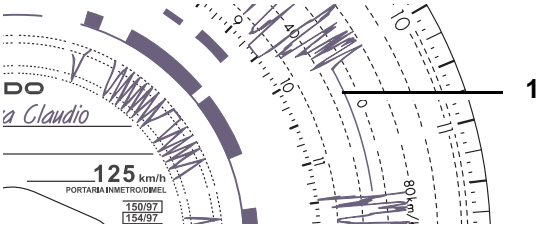
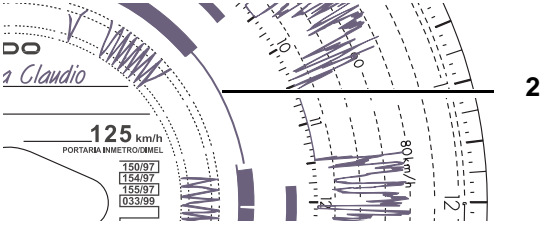
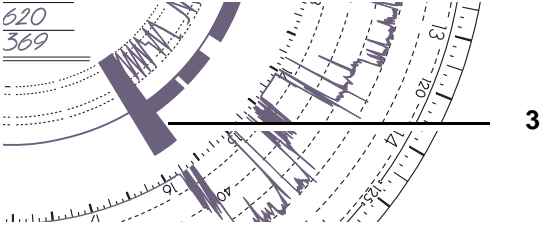
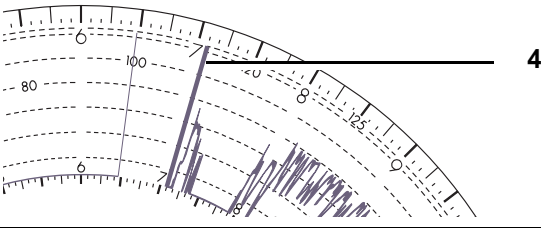
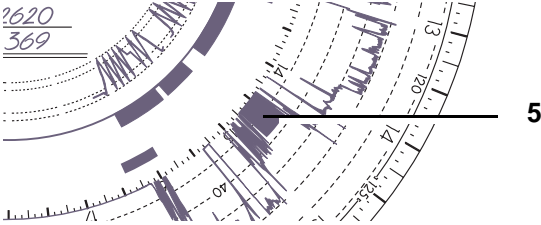
Key

- **No entry** is added to the error memory.
- These errors are also recorded on the tachograph chart (see *Chapter 6.3 "Recording system malfunctions"*, from page 6-12).

Additional information

Recommended measures for error correction can be found in *Chapter 6.4 "Error correction measures"*, page 6-14.

6.3 Recording system malfunctions

Code	Meaning/ Description	Recording
Mechanical defects in the MTCO 1390		
9061	"v" system error, drive defective (1)	
9062	Multi-stylus system (MFS) defective, drive defective (2)	
9063	Stylus lifting system (SAS) defective (3)	
Voltage cut to the MTCO 1390		
A400	If power is restored, the device inscribes a thick trace (4) on the tachograph chart shortly after start off. Prerequisite: No operating error has been recorded, i.e. the tachograph chart/ tachograph chart pack is inserted and the tray is closed.	
Sensor communication error on the MTCO 1390		
A423	No data signal: <ul style="list-style-type: none"> As soon as the vehicle is stationary this marking (5) is inscribed. When driving "v" is recorded again. (MTCO 1390 with KITAS 2170/ 2171 only)	

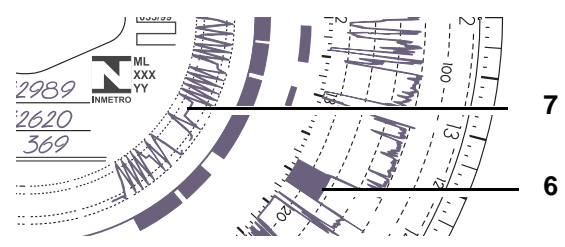
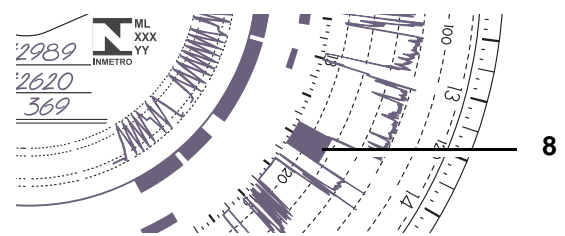
Code	Meaning/ Description	Recording
A423	<p>No data signal and no real time signal:</p> <ul style="list-style-type: none"> This marking (6) is inscribed directly after the error occurred. At regular intervals a radial line (7) is recorded in the area reserved for distance travelled. The period of time set before the error occurred is recorded. <p>(MTCO 1390 with KITAS 2170/ 2171 only)</p> <p>These error markings are recorded until the errors are corrected.</p>	
A822	<p>KITAS 2170/2171: No real time signal or pulse generator 2159: Double pulse comparison faulty</p> <ul style="list-style-type: none"> This marking (8) is inscribed directly after the error occurred; it is recorded until the error is corrected. The distance travelled is recorded constantly (derived from data signal). 	

Table 6-3: System malfunctions: Recordings on the tachograph chart

6.4 Error correction measures

The following table lists the recommended measures for error correction.

No error correction possible

If the error cannot be corrected, the MTCO 1390 is defective and must be replaced by an exchange tachograph.



Important

Please do not try to repair the units. If the MTCO 1390 or the related system component are defective, they must be replaced completely.

Code	Meaning	Remedy (ies)
900A	Other errors with CAN transmission, e.g. no subscriber, no acknowledgement etc. When ignition is switched "on" the error is suppressed for approx. 10 seconds	Check BUS medium and plug and socket connections: <ul style="list-style-type: none"> Check the voltage supply to the CAN subscribers T. 15, 30, 31. Check the timing behaviour of the CAN subscribers on T. 15 "on/off". <i>*The MTCO does not have to be the cause of the error.</i>
900B	Major malfunction on the CAN bus, possible causes: <ul style="list-style-type: none"> BUS medium malfunctions Physical layer malfunctions Log errors 	Check BUS medium and plug and socket connections: <ul style="list-style-type: none"> Voltage supply to the CAN subscribers T. 15, 30, 31 Timing behaviour of the CAN subscribers on T. 15 "on/off" Wiring, connector assignment The terminal resistance may be missing CAN subscribers with different baud rate on CAN bus <i>*The MTCO need not be the cause of the error.</i>
900F	Keypad error: <ul style="list-style-type: none"> Key pressed too long or key[s] jammed 	<ul style="list-style-type: none"> Identify jammed key and try to remove the cause of the jamming. If the error cannot be remedied or repeats itself, replace the MTCO 1390.
9010	LCD error: Display defective or faulty	If the error message repeats itself replace the MTCO 1390.
9053	Difference between the system time and the tachograph chart's recording time > 2 minutes	1 day unit: Track the tachograph chart turntable. 7 day unit: Track the tachograph chart pack.

Code	Meaning	Remedy (ies)
9060	Tray does not open; possible causes: <ul style="list-style-type: none"> Tachograph chart/ tachograph chart pack not inserted properly or damaged Jamming or motor does not start. 	<p>Unlock the tray (wait until the chart is ejected):</p> <ul style="list-style-type: none"> Open the tray and check the position of the tachograph chart(s). Insert new tachograph chart(s) if necessary. Check the dimensions of the radio compartment. The housing of the MTCO 1390 may be deformed so that the tray is jamming. <p>Replace the MTCO 1390 if the error repeats itself (cannot be corrected) although the tachograph chart(s) is/are inserted properly and not damaged and the MTCO is fitted correctly.</p>
9061	"v" system error, drive defective	Replace the MTCO 1390.
9062	Multi-stylus system (MFS) defective	Replace the MTCO 1390.
9063	Stylus lifting system (SAS) defective, e.g. drive, motor or driver defective.	<ul style="list-style-type: none"> Open the tray and check whether the inserted tachograph charts are damaged. <p>If the error repeats itself (cannot be remedied), replace the MTCO 1390.</p>
9064	Tachograph chart turntable tracking error (1 day unit only) or tachograph chart turntable drive error	<ul style="list-style-type: none"> Track the tachograph chart turntable, 1 day unit only (i.e. open the tray, remove the tachograph chart and close the tray again). <i>The MTCO 1390 tracks the tachograph chart turntable automatically and adjusts it to the current time.</i> <p>Replace the MTCO 1390 if the error repeats itself (cannot be corrected) although the tachograph chart(s) is/are inserted properly and not damaged.</p>
9430	"v" pulse output B7 not working, possible causes: <ul style="list-style-type: none"> MTCO 1390 defective Control unit connected to B7 defective Cable between MTCO and control unit defective 	<ul style="list-style-type: none"> Check the connections and cables between the MTCO 1390 and the control unit: <ul style="list-style-type: none"> Short circuit on earth? Short circuit on +U_B? <p>If the error repeats itself (cannot be remedied), replace the MTCO 1390 or the control unit.</p>
A00C	Internal error, e.g. no communication between the MTCO 1390 and internal components	If the error message repeats itself replace the MTCO 1390.
A050	Journey without tachograph chart, tachograph chart is missing	<ul style="list-style-type: none"> Insert the tachograph chart/ tachograph chart pack or check whether the tray is closed <p>If the error cannot be remedied, replace the MTCO 1390.</p>

Code	Meaning	Remedy (ies)
A400	Voltage cut to MTCO 1390 or MTCO 1390 has detected low voltage	<p>Check the power supply:</p> <ul style="list-style-type: none"> Check the plug connection and cables. A connection in the power supply could also be loose (constant Plus, terminal 30). Check the voltage (T. 30) when starting the vehicle engine (are the voltage values within the specified range?). <p>If the error cannot be remedied, replace the MTCO 1390.</p>
A411	Error (disruption) in communication between the MTCO 1390 and the indicator unit	<p>Check the connection between the MTCO and the indicator unit (K-Line):</p> <ul style="list-style-type: none"> Carry out a continuity check. Check the plug connections and the connector assignment If necessary, replace the indicator unit. <p>If the error cannot be remedied, replace the MTCO 1390.</p>
A423	<p>Error communicating with the KITAS 2170:</p> <ul style="list-style-type: none"> Communication on line "B4" faulty (MTCO 1390 with KITAS 2170/ 2171 only) 	<ul style="list-style-type: none"> Check recording on the tachograph chart (see <i>Table 6-3</i>, page 6-13 for explanations): <i>Constant or only sporadic recording errors (indicates a loose connection)</i> Test the KITAS sensor cable for continuity Check the plug connections and the connector assignment Activate the KITAS sensor <p>If the error cannot be remedied, replace the MTCO 1390.</p>
A822	<p>Error communicating with KITAS 2170:</p> <ul style="list-style-type: none"> KITAS sensor not activated MTCO detects a faulty KITAS serial number/ key Communication on line "B3" (real time signal) faulty Unexpected generator reset (voltage drop in generator of > 100 ms) <p>Error communicating with generator 2159:</p> <ul style="list-style-type: none"> Double pulse monitoring error (pulse comparison) 	<ul style="list-style-type: none"> Activate the KITAS sensor (MTCO 1390 with KITAS 2170/ 2171 only) Check recording on the tachograph chart (see <i>Table 6-3</i>, page 6-13 for explanations): <i>Constant or only sporadic recording errors (indicates a loose connection)</i> Check the sensor/ pulse cable for continuity. Check the plug connections and the connector assignment. Check the voltage (T. 30) when starting the vehicle engine (are the voltage values within the specified range?). Check the sensor/ generator. Check the sensor/ generator input on the MTCO 1390. <p>If the error cannot be remedied, replace the MTCO 1390.</p>

Table 6-4: Error correction measures

Chapter 7

Maintenance/ minor repairs

7.1 Replacing the MTCO 1390 buffer battery

Depending on load, temperature, humidity etc., the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.



Important

If no voltage is supplied to the unit and if the date and the clock stop, the battery **must** be replaced and the current date and time programmed again using an MTC/ ATC.

Detailed information and instructions on how to program "Date-Time" can be found in *Chapter 3.8.4 "Programming the MTCO 1390"*, section "Adjusting date and time", from page 3-51

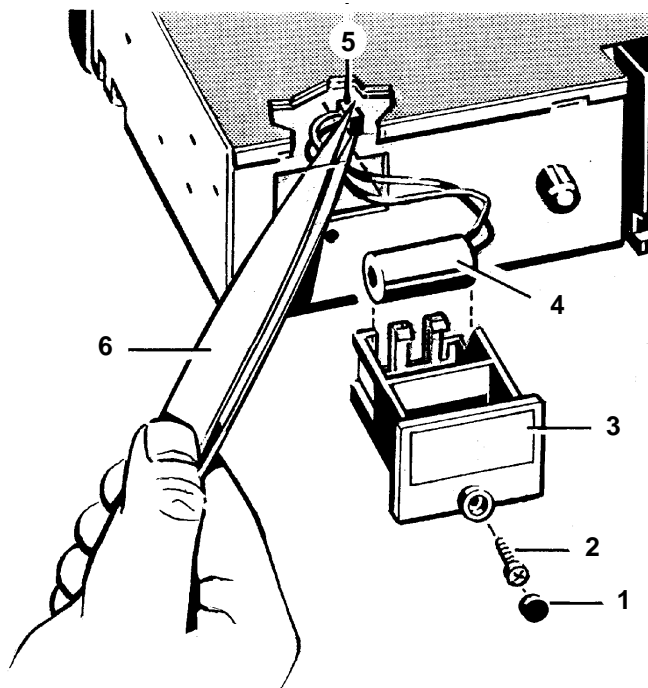


Fig. 7-1: MTCO 1390: Removing the buffer battery

- | | |
|-----------------------|--------------------|
| 1 Seal cap | 4 Battery |
| 2 Torx T9 screwdriver | 5 Connector |
| 3 Battery compartment | 6 Plastic tweezers |

- 1 Remove the seal cap (1) and unscrew the screw (2) underneath.

- 2 Pull out the battery compartment (3).

When opening the battery compartment ensure that the battery lead does not get stuck.

- 3 Remove the lithium battery (4) from the holder.



Caution

Risk of short circuit!

To avoid system circuit board malfunctions caused by short circuits use plastic tweezers/ insulated tweezers.

- 4 Using the tweezers (6), carefully remove the connector (5) from its socket on the system circuit board.

- 5 Put a new lithium battery (4) into the socket.

- 6 Using the tweezers (6), carefully plug the connector (5) into its socket on the system circuit board.

- 7 Then slide the battery compartment (3) into the housing until it locks into place and fix it again using the screw (2).

When closing the battery compartment ensure that the battery lead does not get stuck.

- 8 Stamp the new seal cap (1) and press it into the seal cup.

- 9 Then slide the MTCO 1390 into the fitting/ radio compartment and adjust the time and date.

- 10 Finally check that the MTCO 1390 is working properly.

7.2 Minor repairs

Except for the minor repairs described herein, the components of the MTCO 1390 tachograph system must not be repaired.

General repair instructions



Important

The same general repair instructions as for older tachograph systems apply to the MTCO 1390 tachograph and its system components (indicator unit, sensor, cables).

7.2.1 Replacing MTCO 1390 tray cover

Vehicle specific tray cover

The tray cover of the MTCO 1390 is vehicle specific. When replacing an MTCO 1390 the tray cover must therefore match the specific vehicle version.

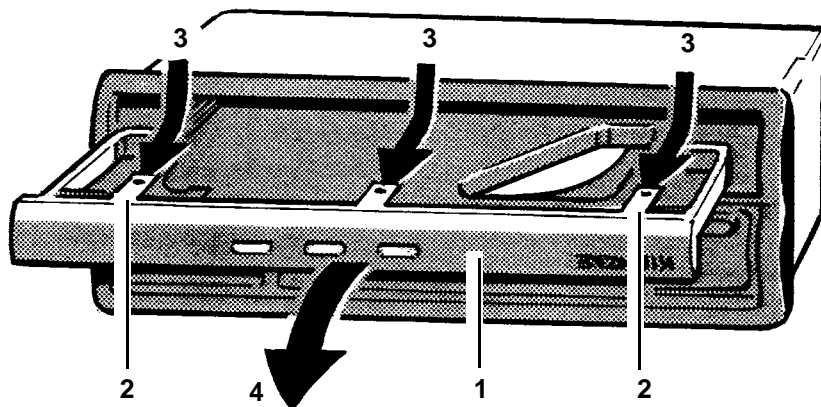


Fig. 7-2: MTCO 1390: Replacing the tray cover

- | | |
|--------------|----------------------------|
| 1 Tray cover | 3 Insert screw driver here |
| 2 Clips (3x) | 4 Direction of removal |

- 1 **Unlock the tray and pull it out approx. 4 cm.**
- 2 **Turn the MTCO 1390 so that the bottom faces up.**
Refer to Fig. 7-2 for positions of tray and MTCO.
- 3 **Slide the screw driver (width 1.5 mm) under the three clips (2) one after the other and lift the clips carefully.**
- 4 **Tilt the tray cover towards you as indicated by the arrow (4).**
Installation is done in reverse order of removal.

When reprogramming the MTCO 1390's product number (product code), the type plate must be replaced. The product number on the circuit diagram must also be updated.

When the MTCO 1390 is reprogrammed label the correct type plate using a typewriter or a permanent black pen (e. g. "Staedler Lymocolor 313").

When labelling the new type plate make sure that:

- ## Type plates

Table 7-1: MTCO 1390 type plate

05 = 125 km/h

SiemensVDO Automotive AG D-78052 Villingen-Schwennigen

1 Typ 1390.105112100005

2 No. 245300

3 Jahr L 01

v_{min} 25 km/h v_{max} 125 km/h

102301

4 5 6

1	Product number	4	"v" measuring range v_{\min}
2	Serial number	5	"v" measuring range v_{\max}
3	Year of manufacture	6	New type plate

Measuring range for speed display

1390-xXXxxxxxxxxx

Measuring range	v_{\min} [km/h]	v_{\max} [km/h]
01 02 03 04 05 06	25	125
11 12 13 14 15 16	30	180

Table 7-2: Measuring range table, speed display with v_{\min} and v_{\max}

- 1 Enter the new product number (1).
- 2 Copy the serial number (2) and the year of manufacture (3).
- 3 Refer to the table and copy the measuring range speed values for " v_{\min} " (4) and " v_{\max} " (5).
- 4 Remove the original type plate.
- 5 Stick the new labelled type plate (6) into the space provided on the tray.

For the correct position refer to *Chapter 2.1.1 "Product description"*, Fig. 2-1, page 2-4 and Fig. 2-2, page 2-5.

Replacing the circuit diagram

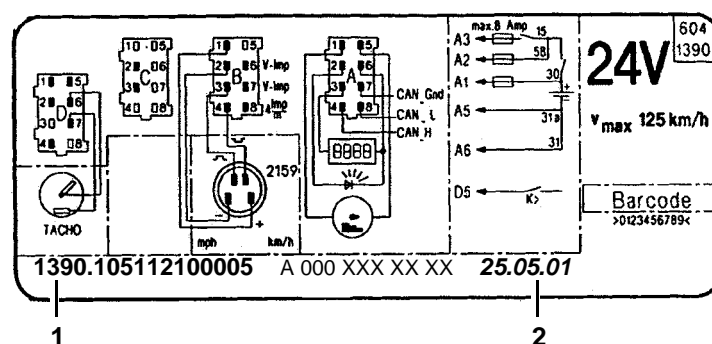


Fig. 7-4: MTCO product number: Entries on the circuit diagram

- 1 Product number
- 2 Date when circuit diagram was replaced

- 1 Enter the product number (1).
- 2 Enter the date when the circuit diagram was replaced (4).

Chapter 8

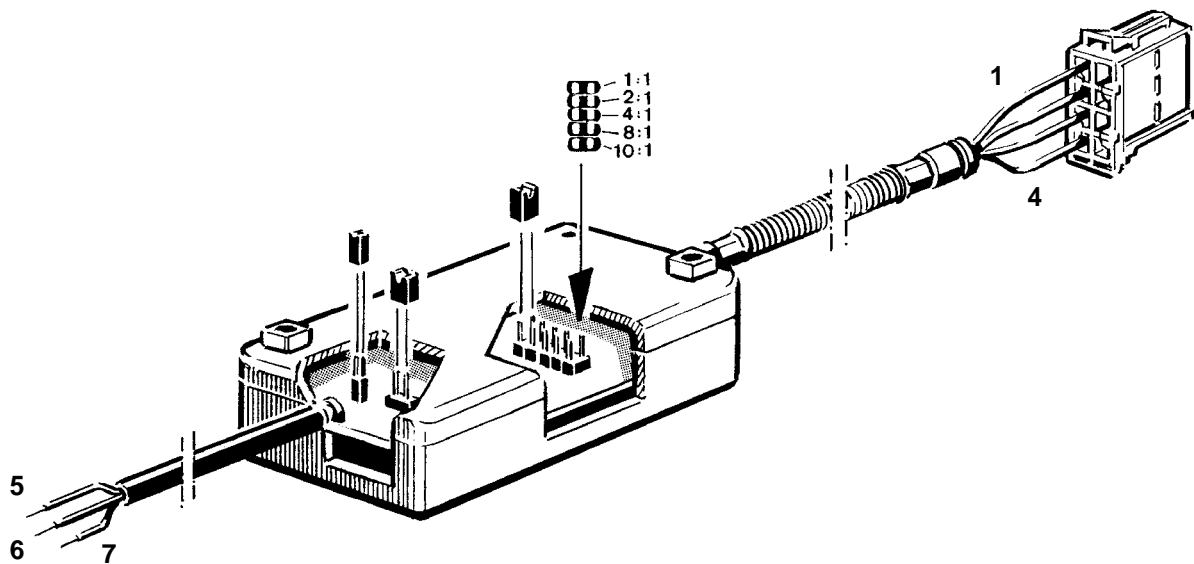
Special equipment

8.1 Pulse shaper X10-415-000-008

The pulse shaper can be installed into vehicles with mandatory equipment if:

- the vehicle only sends a sinusoidal or rectangular signal
- the vehicle's characteristic coefficient (imp/km) is outside the standard tachograph's adjustment range.

Technical data



Pulse shaper X10-415-000-008

Operating voltage: 8 V
 Current consumption: 10 mA
 Input voltage: $U_L < 2 \text{ V}$ $U_H > 6 \text{ V}$
 Signal shape: sinus./
 Output voltage: $U_L \leq 0.8 \text{ V}$ $U_H \geq 5.2 \text{ V}$
 Signal shape:
 Pulse outputs: 2 inverted

Dimensions: L x W x H
 100 x 50 x 30 mm

Pulse generator:

Generator frequency max. 6 kHz

Connector assignment:

1 black	Voltage 8 V
2 brown	Earth
3 blue	"v" signal
4 white	Inverted "v" signal
5 brown	Earth
6 white	Signal E low sinus. >300 mV
7 blue	Signal E high sinus. >2 V

>6 V

8.2 Pulse shaper X10-415-000-013 (for MTCO 1390)

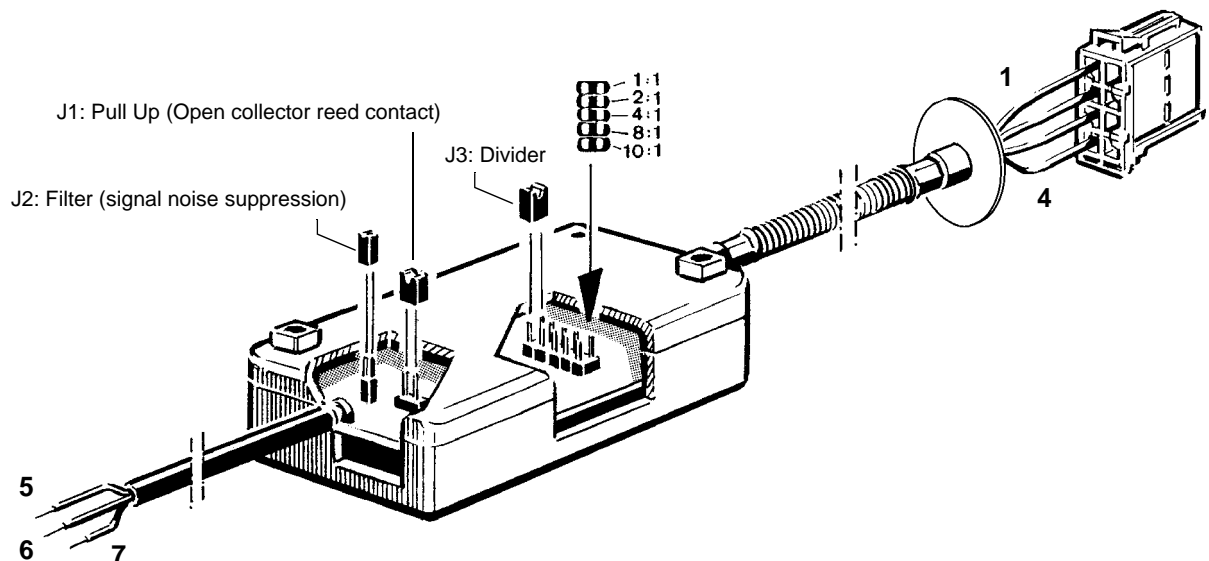
The pulse shaper can be installed into vehicles with mandatory equipment (vehicle classes M/N1 only) if a KITAS 2170/ 2171 cannot be fitted.



Important

When the pulse shaper is installed in the vehicle the unit and the MTCO 1390 must be adjusted to each other. As is usual with the KITAS sensor the units are adjusted by selecting the "ACTIVATE KITAS" menu item when programming the unit using an MTC/ ATC (see Chapter 3.8.2 "Activating KITAS 2170/ 2171 (if installed)", page 3-37).

Technical data



Pulse shaper X10-415000013

Operating voltage: 8 V
Current consumption: 10 mA
Input voltage: $U_L < 2 \text{ V}$ $U_H > 6 \text{ V}$
Signal shape: sinus./
Output voltage: $U_L \leq 0.8 \text{ V}$ $U_H \geq 5.2 \text{ V}$
Signal shape:
Pulse outputs: Real time and data signal
Operating temperature: -30 to + 80 °C
Type of protection (IEC 529): IP 30
Dimensions: L x W x H
100 x 50 x 30 mm

Signal input:

Generator frequency max. 6 kHz

Connector assignment:

1 black	Voltage 8 V
2 brown	Earth
3 blue	"v" signal
4 white	Data signal
5 brown	Earth
6 white	Signal E low sinus. >300 mV
7 blue	Signal E high sinus. >2 V

>6 V

Manufacturer's setting:

- J1: open (Pull Up not active)
- J2: closed (filter active)
- J3: closed on 1 : 1 (divider)

General:

- J1: closed (for Open Collector/Reed contact)
- J2: open (filter not active)



Section 3

TSU 1391

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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General safety precautions

Kienzle Tachographs and the vehicles into which the tachographs are installed are quality products manufactured to comply with recognised rules of engineering.

The products comply with the quality assurance standards currently in force and are officially authorised for use on public roads.

The products left the factory in a perfectly safe condition.

In order to maintain them in this condition you must carry out your work as an engineer

- in accordance with the descriptions in these instructions,
- correctly and with great accuracy and
- by observing the Health and Safety regulations for safety and accident prevention at work.

Designated use

Kienzle Tachographs may only be used for the purpose for which they have been constructed.

Fitting instructions

There is no need to have access to the safety technology of the vehicles to fit Kienzle Tachographs.

Correct installation will not involve any changes to or affect the structure or driving properties of the vehicle.

- Before installing the tachograph consult the vehicle documentation to find out exactly what sort of vehicle it is and whether it has any special characteristics.
- Refer to the vehicle drawings to identify the position of fuel, hydraulic and compressed air lines and electrical cables.
- Ask the vehicle owner or the driver about any (private) changes to the vehicle which must be taken into consideration when installing the unit.
- During installation and removal, avoid damaging lines and cables and severing line and cable connections.
- Only use original Siemens VDO parts and original Siemens VDO accessories for fitting.
- Only fit undamaged parts to a vehicle.
- When installing the tachograph and its cables, ensure that these parts do not affect or prevent the proper operation of the vehicle and that the parts are not damaged.

General safety precautions

- Do not reduce the cross section of a line; this can lead to the corresponding section of the cable becoming overheated.
- Only solder the new cable connections with soft solder.
- Check all (!) vehicle functions before handing the vehicle back to the customer.

Vehicle hand-over

- Instruct the customer in the operation of the tachograph and give him the relevant operating instructions.

Summary of changes

Date	Chapter/page	Subject, change, measure

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Chapter 1

System overview

1.1 General system description

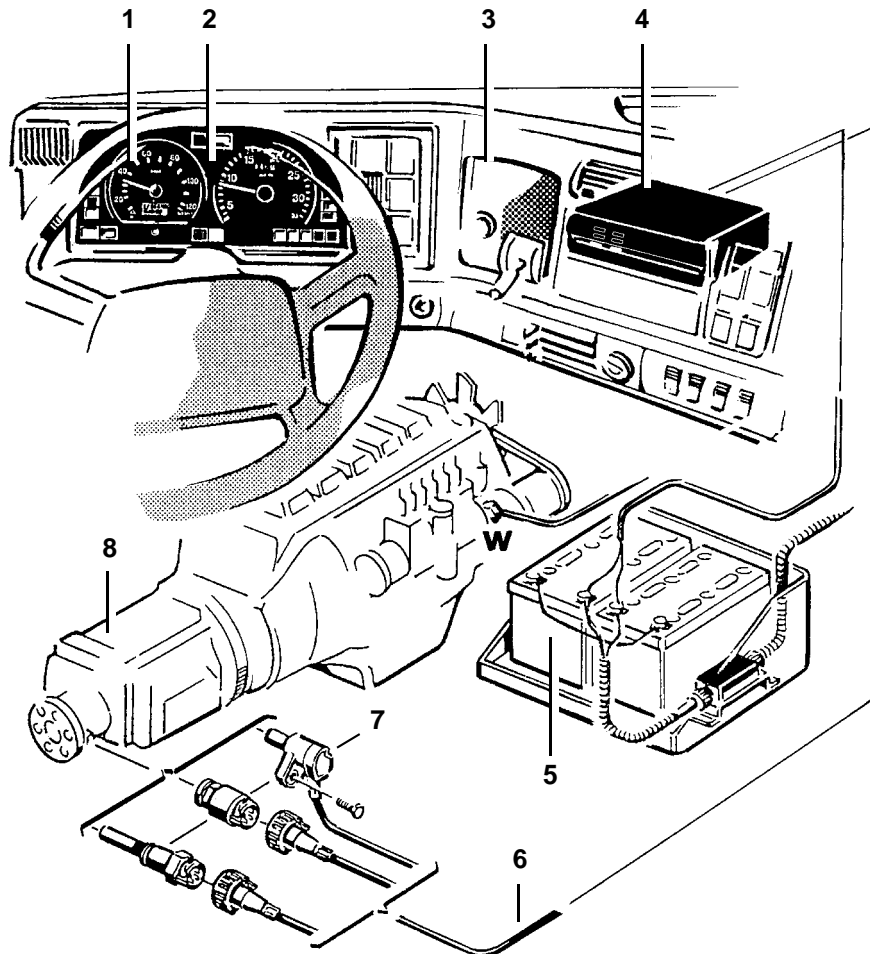


Fig. 1-1: TSU 1391 system components

- 1 Indicator unit (for cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 TSU 1391 (in dashboard radio compartment)
- 5 Vehicle battery
- 6 Pulse/ sensor cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EU Directive 95/54 EMC)
- 7 KITAS sensor 2170/ 2171 or pulse generator 2159
- 8 Gearbox



Important

The TSU is not subject to the legally prescribed Directive (EEC) No. 3821/85 or proposed Directive (EEC) No. 2135/98 but must observe all legal standards, guidelines and directives for registering commercial vehicles.

The "new generation" of speedometer systems has a modular structure and consists of autonomous devices:

- Interface unit: Indicator unit - speed generator
- Indicator unit
- Sensor/ pulse generator and sensor/ pulse cable.

Interface unit

In vehicles without prescribed EU control units the Speedometer Simulator Unit (TSU) 1391 provides the interface between the pulse generator and the indicator unit.

The TSU 1391 provides the data for speed, distance travelled, time and date to the indicator unit via CAN bus.

Indicator unit

The indicator unit or a permitted Cluster is in the driver's direct line of sight.

Usually the indicator unit displays the speed (analogue) and the distance travelled (digital). Depending on the design, the daily trip recorder, data and time as well as malfunctions are also displayed.

The Cluster components are specific to the vehicle. Design and operation can differ from the indicator unit shown in this documentation. Please refer to the relevant operating instructions for detailed information.

Sensor

KITAS 2170/ 2171 (Kienzle Tachograph Sensor), the intelligent pulse generator transforms the gearbox revolutions into pulses and transmits these as real-time signals to the TSU 1391.

Sensor cable (DIN 72551 Kfz)

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz.

Generator

The pulse generator converts the gearbox revolutions into double pulses and transmits these to the TSU 1391 interface unit.



Important

An interference free (EMC) sensor/ generator connection cable with twisted wires is required for the TSU 1391.

The speedometer system with TSU 1391 **only needs** a single pulse signal to transmit the speed pulse to a separate indicator unit.

1.2 System performance characteristics

Basic characteristics	<ul style="list-style-type: none">• Separate indicator and interface units• 24 V vehicle voltage version• TSU housing dimensions complying with the dimensions for radio compartments specified by DIN/ ISO 7736• Additional mounting sleeve for installation into radio compartment• Two buttons for setting the time• Read-only memory for storing required parameters, such as housing variant, "w", measurement range etc.• Battery buffered real time clock with automatic, country-specific daylight saving time/ standard time switchover settings, programmed for 5 years.• Interfaces from interface unit to indicator unit: Data bus compliant "CAN" interface SAE J1939, CAN 2.0B• Special interference-free (EMC) sensor/ pulse cable with twisted wires
Options/ Additional equipment	<ul style="list-style-type: none">• Possibility of connecting different "v" pulse generators/ sensors such as pulse generator 2159, KITAS 2170/ 2171

1.3 TSU 1391 data transmission using the CAN bus

CAN (Controller Area Network) is a serial bus concept that is used to network various control units. The CAN bus provides high data transmission speed and ensures high data security. Therefore, the Can bus is particularly suitable for real-time applications. It offers the following features:

- Maximum transmission rate 1 Mbit/s
- High reliability if interference from other sources is high
- Open concept.

Data transmission. General.

Data content

When transmitting data on the Can bus no station is addressed, but the data content (e.g. speed display) is identified using a unique identifier. As well as the content identification the identifier also determines the priority level of the message. This is important for bus allocation if several stations want to access the bus.

If the CPU wants to send a message to one or several stations, it forwards the data, its identifier and the transmission request to the CAN controller. The CAN controller then creates and transmits the message. As soon as the CAN

controller has access to the bus ("send message") all the other stations on the CAN network are recipients ("receive message").

Acceptance check

After all the stations have received the message correctly, they carry out an acceptance check ("select") and check the identifier to determine whether the data received is relevant for them or not. If the data is important for the station, the information is processed ("accept"). If not, it is ignored.

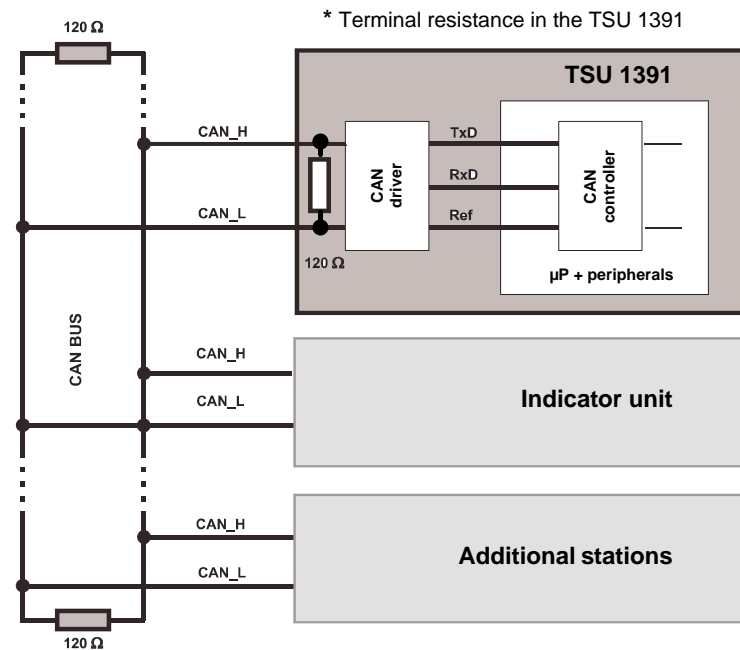


Fig. 1-2: CAN bus and TSU 1391 (diagram)

1.4 TSU - CAN bus system variant

The new speedometer system with TSU 1391 is available in a TSU - CAN-Bus and Cluster variant.

TSU - CAN bus and Cluster

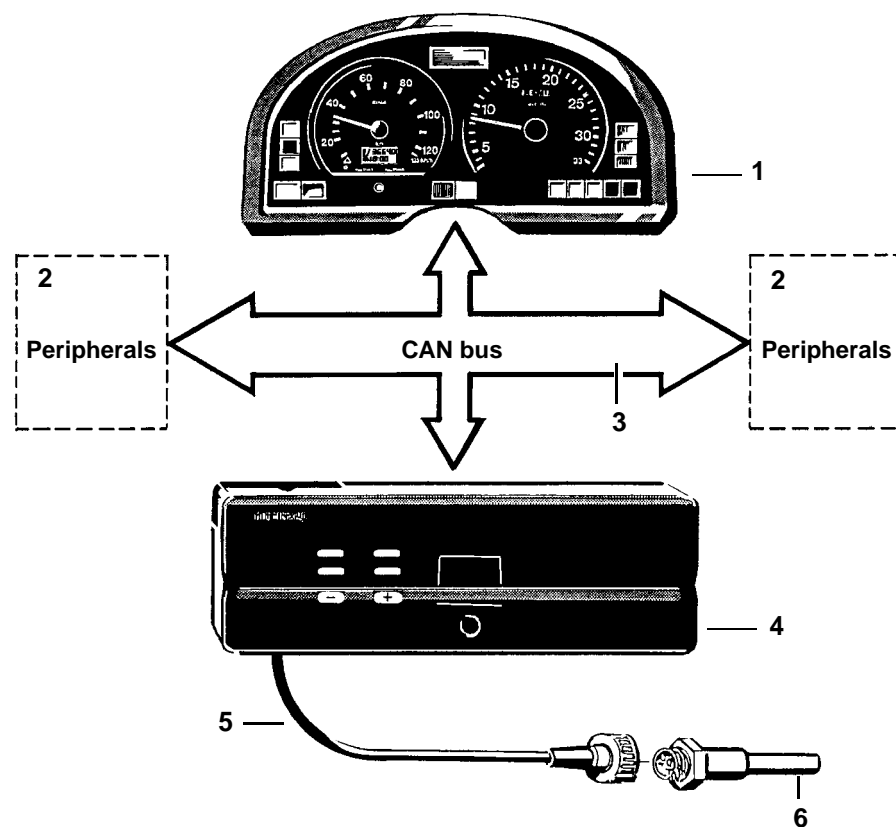


Fig. 1-3: TSU - CAN bus and Cluster system variant

- | | |
|-------------------------------|---------------------------------------------------|
| 1 Cluster | 4 TSU 1391 |
| 2 Further vehicle instruments | 5 Sensor/ pulse cable |
| 3 CAN bus (serial interface) | 6 KITAS sensor 2170/ 2171 or pulse generator 2159 |

CAN bus

CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus provides high data transmission speed and ensures high data security. Therefore, it is suitable for real-time applications.

Chapter 2

Product description/ description of functions

2.1 TSU 1391

2.1.1 Product description

The dimensions of the modular TSU 1391 correspond to the dimensions prescribed for DIN/ ISO 7736 radio compartments. Thus, the TSU 1391 can be integrated into the dashboard of modern commercial vehicles. Depending on the type of vehicle, the unit features a customised front cover and customised instruments.

Adjusting the speed of the TSU 1391 can be programmed with an MTC/ATC:

Setting ranges

- Speed: 4000 - 25000 imp/km

Displaying malfunctions

Auto-diagnosis function The TSU 1391 carries out a constant auto-diagnosis to check for:

- voltage breaks
- defects in the KITAS sensor/ pulse generator and its cable
- communication errors between the TSU 1391 and the indicator unit
- system errors.



Important

The auto-diagnosis function is only performed when the ignition is on.

If the TSU 1391 detects a malfunction it does not differentiate between malfunctions or warning messages. Regardless of the cause of the fault, the TSU 1391 always:

- adds an entry to the event or error protocols
- triggers the warning LED on the indicator unit (if available).

Displaying malfunctions The driver will be made aware of system malfunctions by the warning LED on the indicator unit (if available).

Additional information Detailed information on error messages as well as recommended measures for error correction can be found in *Chapter 6 "Fault analysis"*.

TSU 1391 device description

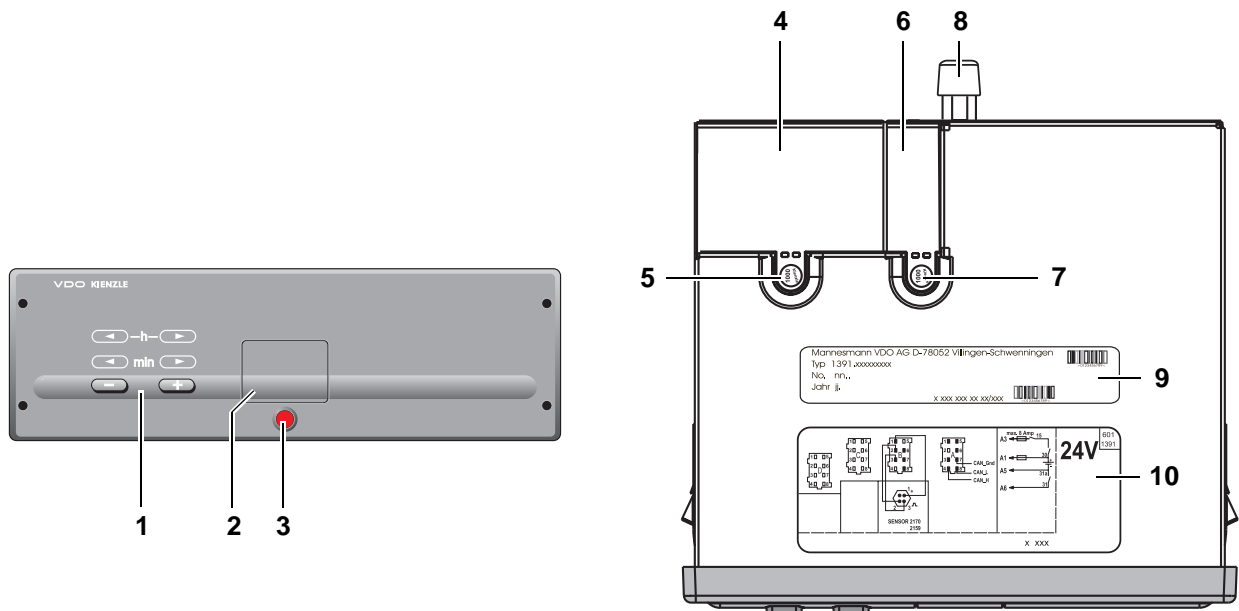
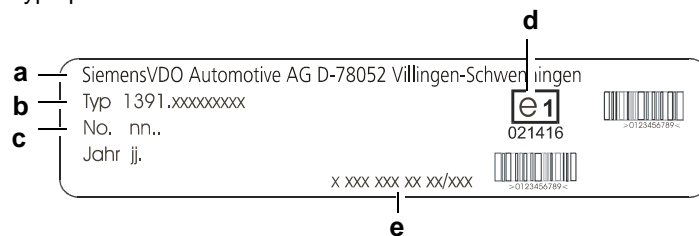


Fig. 2-1: TSU 1391: Front and bird's eye view of the unit

- 1 Keys for setting the clock:
 - Key selects the next menu item
 - Key selects the previous menu item
- 2 Test and programming interface
- 3 Unit seal
- 4 Connector hood: to cover the connectors
- 5 Connector hood seal
- 6 Battery compartment: Buffer battery
- 7 Battery compartment seal (sealed at the factory)
- 8 Fixing screw with cap (radio compartment)
- 9 Type plate



- (a) Manufacturer
 - (b) Device type
 - (c) Serial number
 - (d) EMC approval sign
 - (e) Third party item number
- 10 Circuit diagram with voltage indication, serial no., device type (label)

2.1.2 Operation, setting the clock

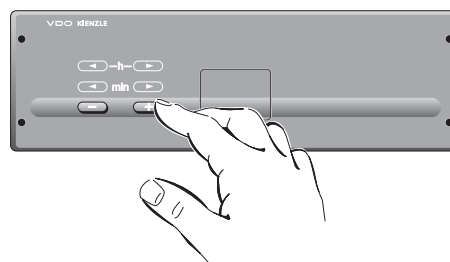
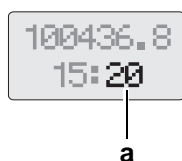


Important

The date will be corrected automatically when setting the clock back or forward (0.00 hours).

Changing the minutes

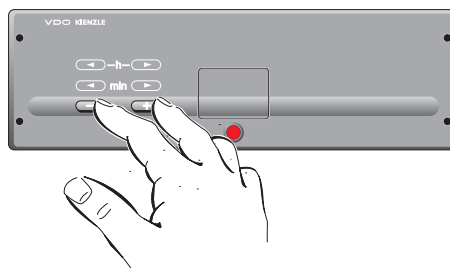
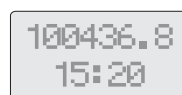
- 1 Press the **+** or **-** key and keep it held down until the required minute (a) is displayed on the indicator instrument.



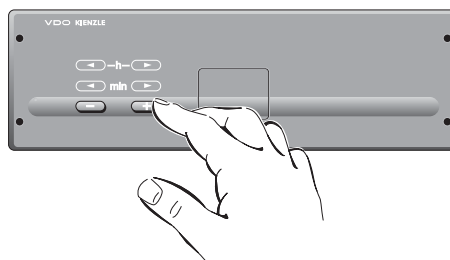
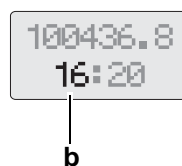
The minutes are set when the key is released.

Changing the hours

- 2 Press the key **+** and **-** keep it down for three seconds.



- 3 Press the **+** or **-** key within three seconds and keep it held down until the required hour (b) is displayed on the indicator instrument.



The hours are set when the key is released. After three seconds the TSU 1391 switches back to the original mode.

2.1.3 Interfaces

Overview of interfaces

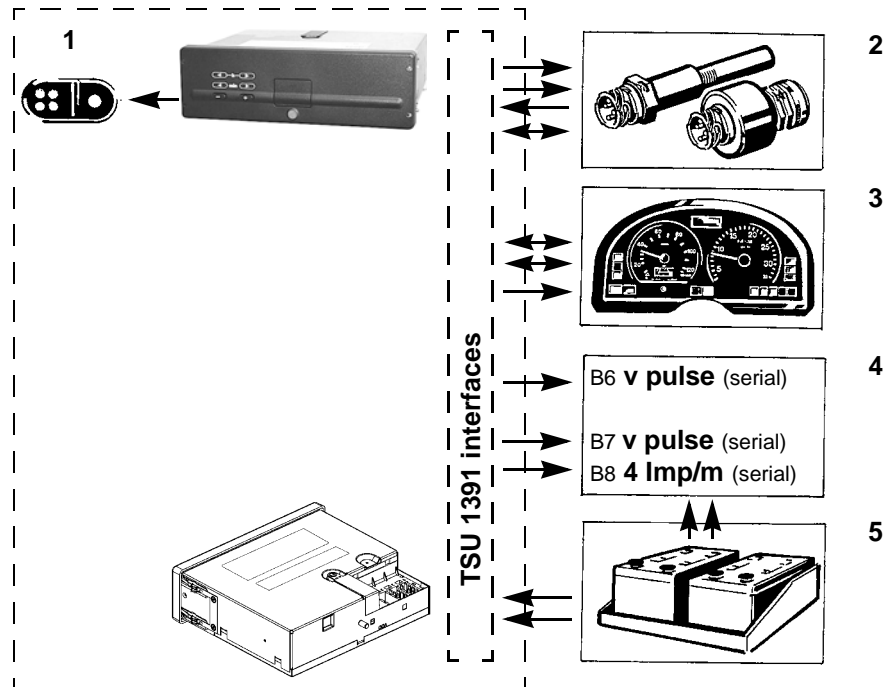


Fig. 2-2: TSU 1391: Overview of interfaces (all interfaces connected, not possible in real-time operation)

- 1 Test and programming interface
- 2 Speed sensor or speed pulse generator
- 3 CAN bus for Cluster
- 4 Outputs (e.g. "v" pulse, 4 imp/m)
- 5 Vehicle supply voltage (vehicle battery)

CAN interface

CAN is a standard synchronous serial interface. It is used to network several control units using the so-called CAN bus. The CAN bus has a high data transmission speed. Therefore, it is suitable for real-time applications.

An identifying address which identifies the message content (e.g. engine speed) is assigned to the data transmitted on the CAN bus. A station connected to the CAN bus interprets the address to find out whether the data is relevant or not. If so, the data is processed; otherwise the message is ignored.

2.1.4 Interface specification

Connector A

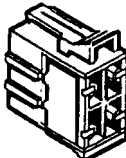
Connector contact	Parameters	Values			[Unit]	Connector A
		min.	typ.	max.		(natural white)
						Remarks
						
A1 O						T. 30 constant voltage (relating to A5)
Battery +	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current		38		mA	"v" standby
				48		Total "v" current
Standby definition: no RPM, work status on break time and ignition off						
A2						
A3 O						T. 15 (relating to A6)
Battery + ignition	24 V					
	Voltage	20	24	30	V	
				32		Short term (max. 1 h)
	Current			22	mA	Total "v" current
The total current is defined including tray discharge.						
A4 O						(relating to A7)
CAN_H						Technical description according to ISO/WD 16844
A5 O						T. 31a (relating to A1)
Battery -						
A6 O						T. 31 (relating to A2, A3)
GND						
A7 O						(optional)
CAN_GND						Galvanised/ capacitive connection
A8 O						(relating to A7)
CAN_L						Technical description according to ISO/WD 16844

Table 2-1: Interfaces: Connector A (current and CAN bus connection)

Connector B

Connector contact	Parameters		Values			[Unit]	Connector B km/h MPH	Remarks
			min.	typ.	max.		(yellow)	
B1 O KITAS sensor reference								
	Voltage		6,5		9	V		
B2 O								
	Battery "–"						T. 31, minus internal bridge with A5	
B3 I Sensor and generator reference								
"v" signal (real time)	Voltage	Low High	3,8		1,0	V	I = -250 µA I = -150 µA	
B4								
B5								
B6 O Standard (cf. definition of B7) or customised								
"v" pulse								
B7 O Instrument interface/ K-Line (relating to A6)								
"v" pulse	Voltage	Low High	5,5		1,5	V	I = 1 mA I = -1 mA	
	Frequency				1,5	kHz		
	Pulse length		0,64		4	ms	±1%	
	Tachograph constant		4000		25000	imp/km		
B8 O								
4 imp/m	Voltage	Low High	5.5		1.5	V	I = 1 mA I = -1 mA	
	Frequency				244	Hz	v = 220 km/h	
	Pulse length		1.6			ms		

Table 2-2: Interfaces: Connector B "km/h MPH"

Connector C (not used)

Connector D (not used)

2.1.5 Type key

Device type

1391

Speedometer Simulator Unit

Device variant

1

MTCO Base 24 V

2

DTCO Base 24 V

Hardware interface 1

0

none

1

CAN 120 ohms

Hardware interface 2

0

none

Additional equipment

0

none

Sensor/ pulse generator

1

KITAS 2170/ 2171 or pulse generator 2159

Vehicle-/ manufacturer-specific versions

001

VDO-KIENZLE (cover lettering), DAF, RVI

002

No (cover lettering), Daimler-Chrysler

003

No (cover lettering), MAN

Firmware/ cluster connection

01

CAN repetition rate 50 ms

02

--

03

CAN repetition rate 10 ms

Interface/ customer firmware

00

without customer firmware

1391

.

2

1

0

0

1

001

01

00

Table 2-3: TSU 1391: Type key

2.1.6 Technical data

Measuring range	up to 220 km/h
Operating voltage	24 V _{DC}
Current consumption (on connector "A1")	Stand by typically 38 mA Operation max. 50 mA
External fuse (on PINs "A1" and "A3")	7.5 A
Operating temperature	-25 °C to +70 °C
Storage temperature	-40 °C to +85 °C
v pulse range	3000 to 25000 imp/km
Maximum v frequency	1,5 kHz
Inputs	v generator
Outputs	2 x "v" pulses, 1 x 4 imp/m
Interfaces	Test and programming interface, CAN interface
Accuracy	Speed ± 3 km/h Distance ± 1 % Time (electronic) ± 5 s/day
EMC	Directive 95/54/EU ISO 7637 e1 021416
Noise	5 to 150 Hz; 0.02 g ² /Hz = 1.7 g RMS
Buffer battery	Lithium
Housing	Galvanised sheet steel
Earth	~ 650 g

2.2 Speed sensor/ generator

2.2.1 KITAS 2170/ 2171

Sensor cable acc. to DIN 72551 Kfz

A new type of sensor cable has been developed for the KITAS 2170/ 2171 sensor which can be used in motor vehicles complying with DIN 72551 Kfz. Main differences between the new sensor cable and existing pulse cables:

- The cable can only be used up to 50 V direct voltage; existing cables can be used up to 230 V alternating voltage.
- The cables are twisted 15 revolutions per metre which means that the sensor cable complies with EU Directive 95/54 EMC.

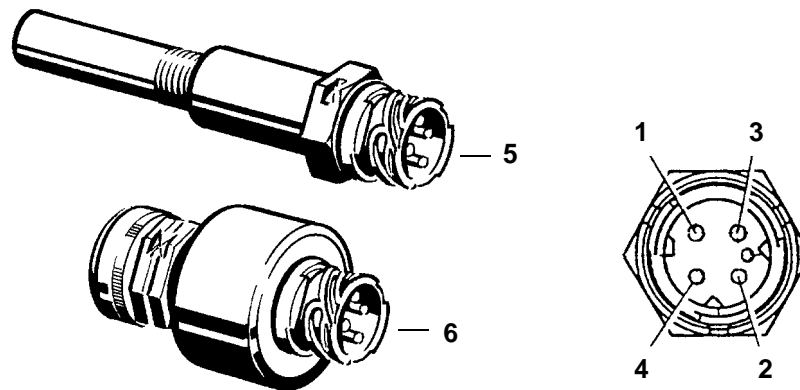


Fig. 2-3: Sensors: KITAS 2170/ 2171

- | | |
|----------------------------|-----------------------------------------|
| 1 Sensor supply (+ U_E) | 4 Data signal I/O (is not used) |
| 2 Sensor supply (- U_0) | 5 Integrated sensor |
| 3 "v" real time signal | 6 Standard sensor |



Important

An interference free (EMC) connection cable with twisted wires is required for the TSU 1391.

The speedometer system with TSU 1391 **only needs** a single pulse signal to transmit the speed pulse to a separate indicator unit.

Additional information

You will find detailed information on KITAS 2170/ 2171 in *Section 4 "Sensors and pulse generators", Chapter 1 "Kienzle sensors"*.

2.2.2 Kienzle pulse generator 2159

The pulse generator converts the gearbox revolutions into double pulses and transmits these to the TSU 1391.

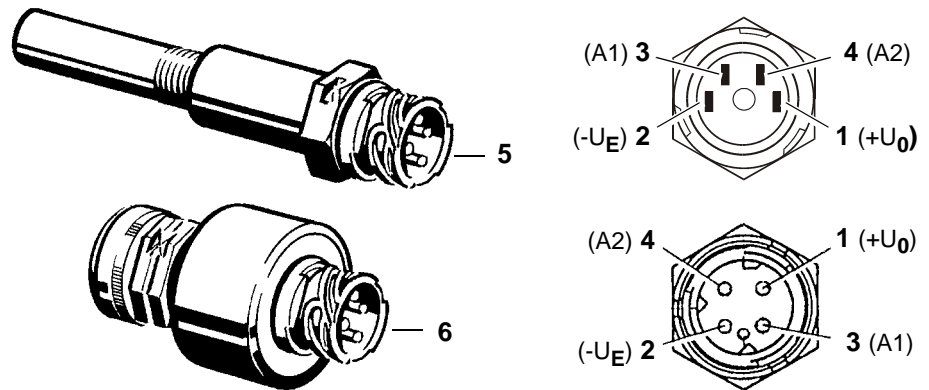


Fig. 2-4: Generator: Kienzle pulse generator 2159

- | | |
|-------------------------------------------------------------------------------------------------------------------|--------------------------|
| 1 Generator supply (+ U_E) | 4 A2- is not used |
| 2 Generator supply (- U_0) | 5 Integrated generator |
| 3 A1 output signal () | 6 Standard generator |



Important

An interference free (EMC) connection cable with twisted wires is required for the TSU 1391.

The speedometer system with TSU 1391 **only needs** a single pulse signal to transmit the speed pulse to a separate indicator unit.

Additional information

Detailed information on pulse generator 2159 can be found in *Section 4 "Sensors and pulse generators", Chapter 2 "Kienzle pulse generator"*.

Chapter 3

Installation instructions

3.1 Necessary equipment

3.1.1 Service Diagnosis Systems

The following service diagnosis systems can be used for setting the parameters for and checking the TSU 1391 speedometer system:

- MTC (checking/ parameter setting inside the vehicle)
- ATC (checking/ parameter setting inside the vehicle)
- STC (checking/ parameter setting outside the vehicle).

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1 "Test equipment and service diagnosis systems"* as well as in the separate *"MTC 1602.04" operating instructions and supplements*.

Upgrade kit for TSU 1391

An upgrade kit can be used for retrofitting the above service diagnosis systems for use in combination with the speedometer system with TSU 1391.

Interface firmware version 06.00

The upgrade kit for the TSU 1391 is based on the interface firmware version 06.00. Interfaces with older firmware versions must be updated to version 06.00 (see circular dated 14.08.1997).

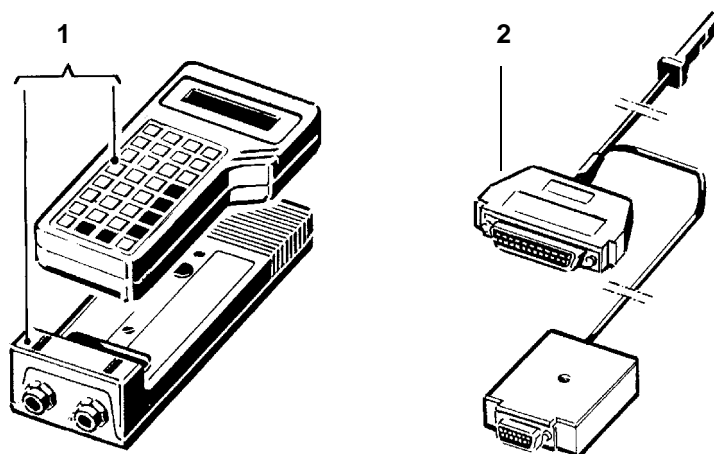


Fig. 3-1: Service diagnosis systems MTC/ ATC and upgrade kit for TSU 1391

- 1 MTC or ATC consisting of interface and BTC
- 2 Upgrade kit for TSU 1391

The TSU 1391 upgrade kit includes:

- a programming cable
- BTC software version **07.xx**
- TSU 1391 programming instructions.

Additional information

The order numbers for the various diagnosis systems and accessories can be found in the appendix Section 6.

3.1.2 Special tools/ sealing tools

Special tools

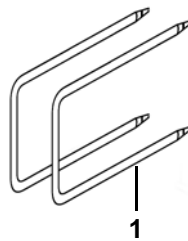


Fig. 3-2: Special tools for TSU 1391

- 1 Special tools for removing the TSU 1391



Important

To disassemble dashboard components vehicle specific tools may be required.

Sealing tools

Original Siemens VDO tools and sealing equipment must be used for sealing (if prescribed by law).



Important

The prescribed and required/ necessary seals for operating the TSU 1391 speedometer system according to the law are subject to national laws and regulations.

Check the legal regulations prevailing in your country to find out whether the test and programming interface on the TSU 1391 must be sealed.

Nevertheless, we recommend that you seal the speedometer system with TSU 1391 for security reasons.

Additional information

A complete overview of the necessary sealing tools can be found in *Section 6, Chapter 2.2 "Special tools"*, from page 2-5.

3.2 Installation workflow

3.2.1 Check list

			Chap./ page
1	Determine the installation site/ installation position	Speedometer system 1391	<ul style="list-style-type: none"> Determine (when retrofitting) 3-5
2	Running cables and making connections	TSU 1391	<ul style="list-style-type: none"> Determine the connector allocation and wiring diagram Run 3-6
		Sensor/ generator	<ul style="list-style-type: none"> Running the sensor/ pulse cable 3-11
3	Installing the sensor/ generator	KITAS 2170/ 2171, pulse generator 2159	<ul style="list-style-type: none"> Install Seal (if applicable) 3-11
4	Installing the tachograph	TSU 1391	<ul style="list-style-type: none"> Connect the unit using the connectors Seal the back of the unit Install 3-13
5	Commissioning the speedometer system	TSU 1391 and sensor/ generator	<ul style="list-style-type: none"> Adjust the units to each other 3-17
		Characteristic coefficient	<ul style="list-style-type: none"> Determine "w" [imp/km] 3-20
		TSU 1391	<ul style="list-style-type: none"> Programming installation data 3-21
6	Vehicle with TSU 1391	in roadworthy condition	<ul style="list-style-type: none"> Hand the vehicle back to the customer

Table 3-1: Installation check list

3.2.2 Installation site requirements

The speedometer system must be fitted to the vehicle in such a way that:

- the driver can set the clock easily from the driving seat and
- all components including the transmission elements are protected against accidental damage.

3.3 Overview of installation site/ position

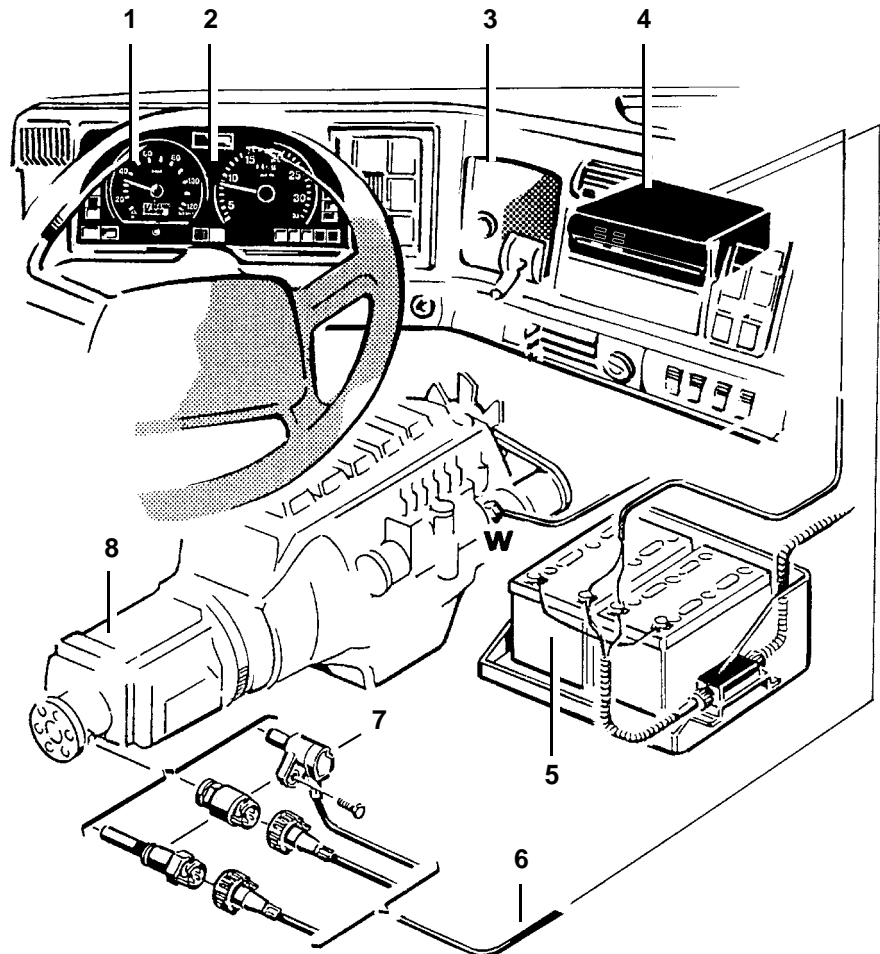


Fig. 3-3: TSU 1391: Speedometer system installation overview

- 1 Indicator unit (for cluster)
- 2 Cluster
- 3 Dashboard (driver's workplace)
- 4 TSU 1391 (in dashboard radio compartment)
- 5 Vehicle battery
- 6 Pulse/ sensor cable for KITAS 2170/ 2171 (4-wire, black)
(cable design acc. to EU Directive 95/54 EMC)
- 7 KITAS sensor 2170/ 2171 or pulse generator 2159
- 8 Gearbox



Important

Refer to the current ordering documents for complete order numbers and spare part types.

3.4 Running cables and making connections

Connection cables are necessary:

- for connecting the TSU 1391 to the vehicle battery
- the indicator unit connection
- for transmitting data/ pulses (e.g. "v" pulses, electronically triggered special equipment etc.).

3.4.1 Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired "side effects" such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

3.4.2 Making connection cables



Important

Electrical connection leads must have a cross section of 0.75 mm^2 .

All "positive" wires must be protected with 8 A with a 24 V operating voltage.

Depending on the conditions in the vehicle, you must make your own connection cables or adapt the cables contained in the accessory kit.

Example: TSU 1391 connection cables

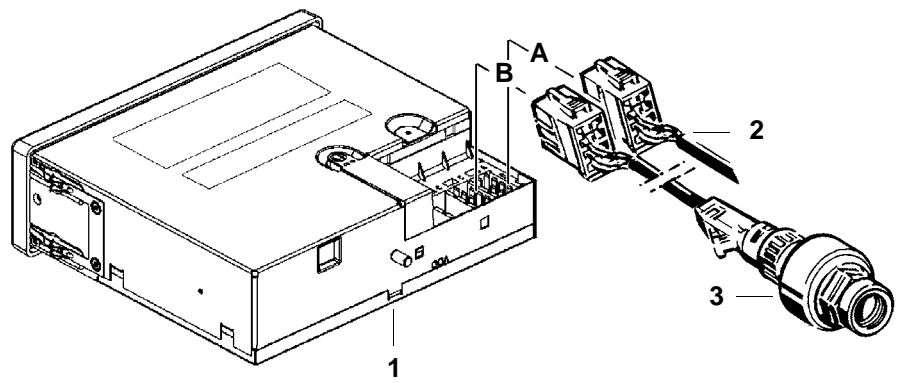


Fig. 3-4: TSU1391: Connection cable overview

- | | |
|------------------------------------------------------------------|-------------------------------------------|
| 1 TSU 1391 connector sockets | 3 Sensor/ generator with connection cable |
| 2 Connector with connection cable:
CAN bus and voltage supply | |

Making connection cables

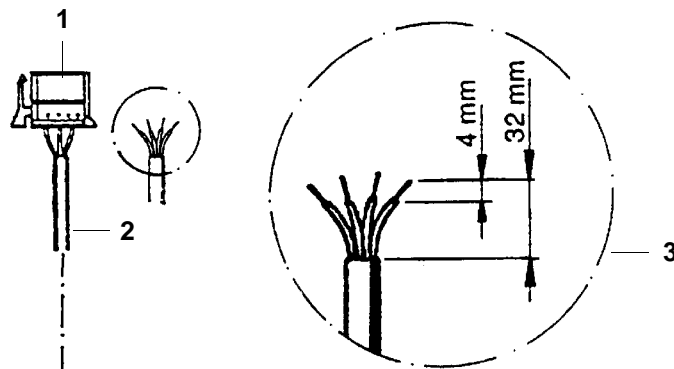


Fig. 3-5: Making connection cables (example)

- | | | | |
|---|--------------------------------------|---|------------------------------|
| 1 | Connector | 3 | Cable sheathing (bared ends) |
| 2 | Connection cables connectors A and B | | |

- 1 Cut the connection cable to the required length.
- 2 Strip the insulation on the lead ends as shown in the figure.
- 3 Crimp the cable shoes onto the lead ends and insert them into the connector socket until they lock into place.

Disengaging the mini-timer connector

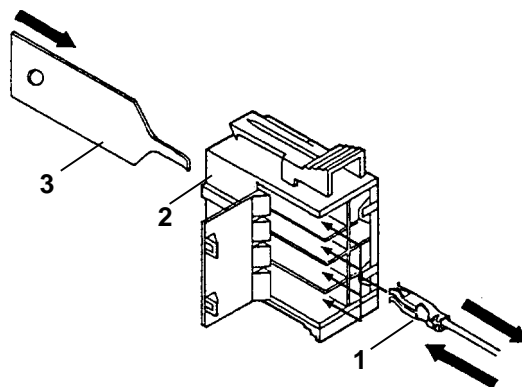


Fig. 3-6: Disengaging the mini-timer connector

- | | | | |
|---|------------------------|---|------------------|
| 1 | Cable shoe (with lead) | 3 | Disengaging tool |
| 2 | AMP connector socket | | |

- 1 Insert the disengaging tool (3) into the correct connector socket.
- 2 Pull the lead out of the AMP connector socket (2).

3.4.3 CAN bus connection diagram

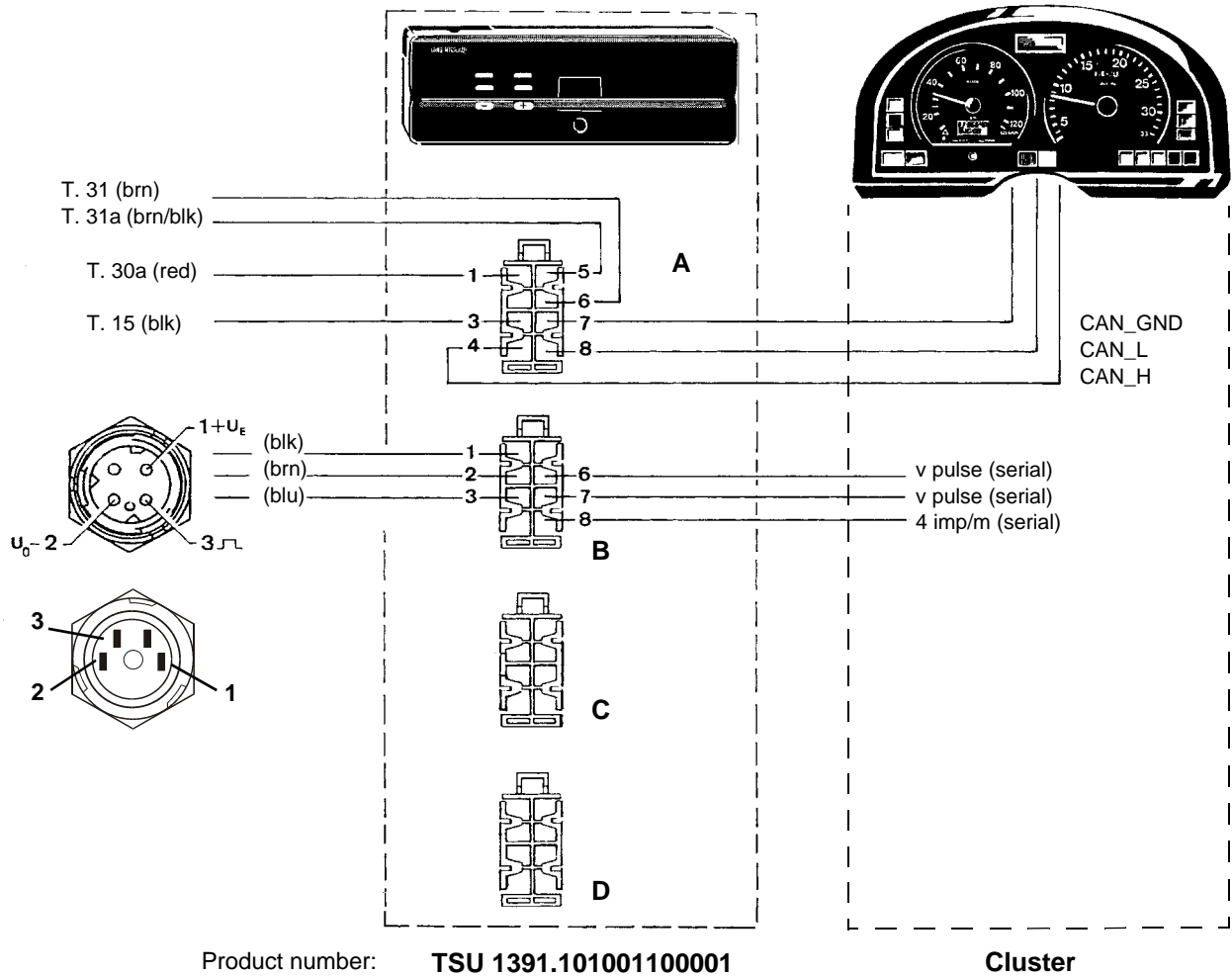
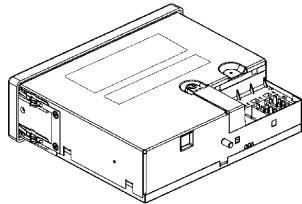


Fig. 3-7: TSU system 1391: CAN busconnection diagram



TSU 1391

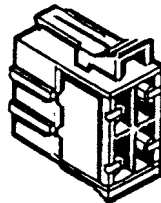
A 1 -	T. 30a (red)	Constant voltage
A 2 -	not used	
A 3 -	T. 15 (blk)	Ignition
A 4 -		CAN_H
A 5 -	T.31a(brn/blk)	Minus
A 6 -	T. 31 (brn)	Earth
A 7 -		CAN_GND
A 8 -		CAN_L

B 1 -	+	(blk)	"v" sensor supply
B 2 -	-	(brn)	"v" sensor supply
B 3 -		(blu)	Real-time signal
B 4 -			not used
B 5 -			not used
B 6 -			"v" pulse output
B 7 -			"v" pulse output
B 8 -			4 imp/m signal output

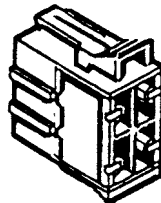
C 1	not used
C 2	not used
C 3	not used
C 4	not used
C 5	not used
C 6	not used
C 7	not used
C 8	not used

D 1	not used
D 2	not used
D 3	not used
D 4	not used
D 5	not used
D 6	not used
D 7	not used
D 8	not used

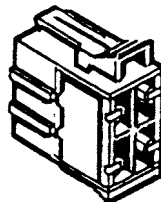
Connector A white



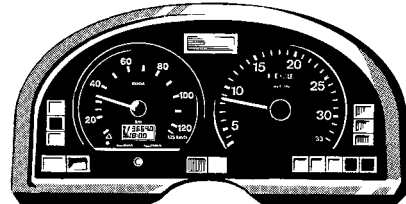
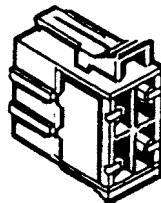
Connector B yellow



Connector C red



Connector D brown



Cluster

T. 30	Constant voltage
T. 58d	Illumination
T. 15	Ignition
T. 31	Earth
	CAN_H
	CAN_L
	CAN_GND
	Warning LED

Table 3-2: TSU 1391: CAN bus connector assignment with Cluster

3.4.4 Running connection and sensor cables

Connection cables



Condition

Before running connection cables the following information must be available:

- Speedometer system components
- Special conditions for running the cables in the vehicle such as exhaust, shift axle, tiltable cabin...



Important

When running and connecting connection cables make sure that the connection cables are:

- fixed at short intervals (approx. every 500 mm) and in such a way that they do not vibrate
- not exposed to tensile, compressive or shearing forces
- protected with rubber grommets when run through sheet metal or plastic.

Sensor/ pulse cable



Important

When running and connecting the sensor/ pulse cable make sure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cabins
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

An interference free (EMC) connection cable with twisted wires is required for the TSU 1391.

The speedometer system with TSU 1391 **only needs** a single pulse signal to transmit the speed pulse to a separate indicator unit.

3.4.5 Installing the sensor/ pulse generator

Additional information

More detailed information and instructions on making connection cables and installing the KITAS sensor and pulse generator can be found *Section 4 "Sensors and pulse generators"*.

3.5 Installing/ removing the TSU 1391

3.5.1 Fitting dimensions

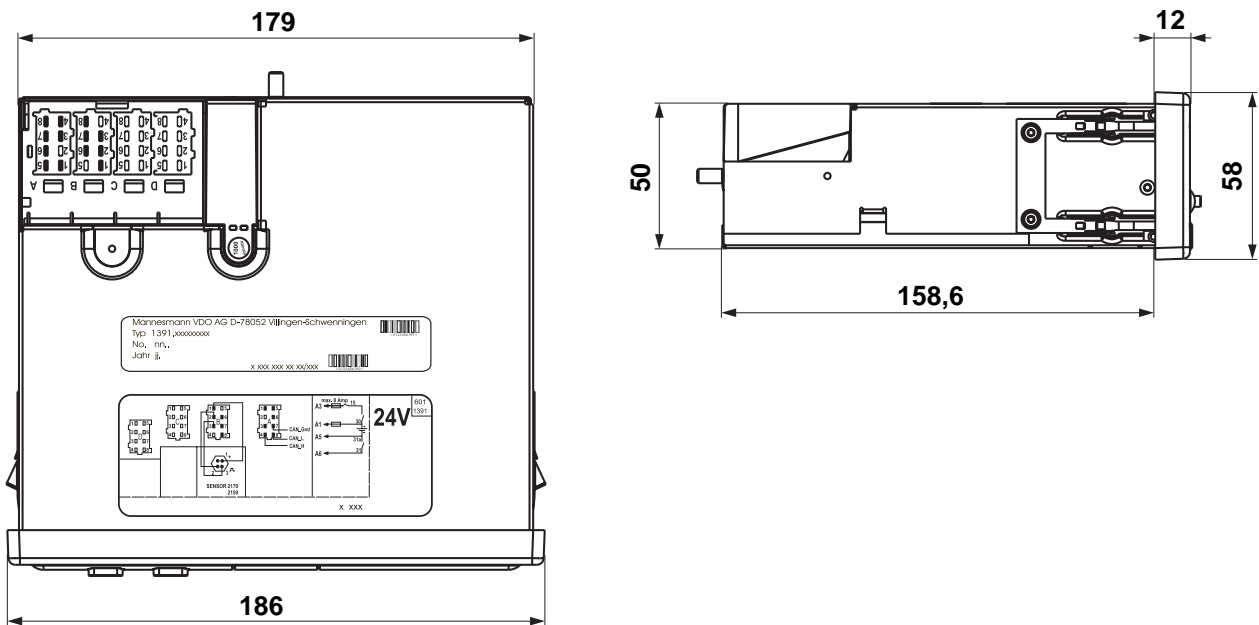


Fig. 3-8: TSU1391: Housing dimensions



Important

Dimensions acc. to DIN/ ISO 7736 radio compartment.

3.5.2 Installation instructions

The TSU 1391 installation site depends on the vehicle. Observe the instructions contained in the service manual of the vehicle when installing the device.

Before fitting the unit

! Important

Before installing the components into the driver's cabin, run all necessary connection cables. When installing the TSU 1391 into the radio compartment, the connection cables must be shortened so that they can be connected and removed safely.

Installing the mounting frame into the radio compartment

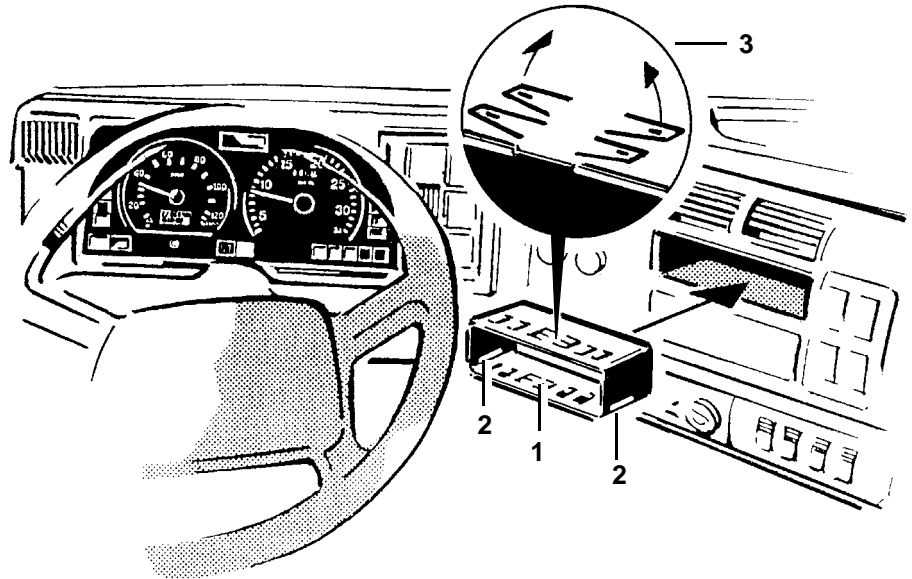


Fig. 3-9: TSU1391: Mounting frame for radio compartment

- | | |
|------------------|--------|
| 1 Mounting frame | 3 Tabs |
| 2 Catch springs | |

- 1 Slide in the mounting frame (1).**
Make sure that the catch springs (2) are at the bottom.
- 2 Bend the tabs (3) up using a screw driver to secure the frame in the dashboard.**
The mounting frame must sit firmly in the radio compartment.

Connecting and sealing the TSU 1391

- 1 Plug connectors A and B into the TSU 1391's sockets on the back.
For connector assignments and connections refer to the "Tachograph system wiring diagrams" Fig. 3-7 from page 3-9.
- 2 Put the seal hood on and seal it.

Installing the TSU 1391

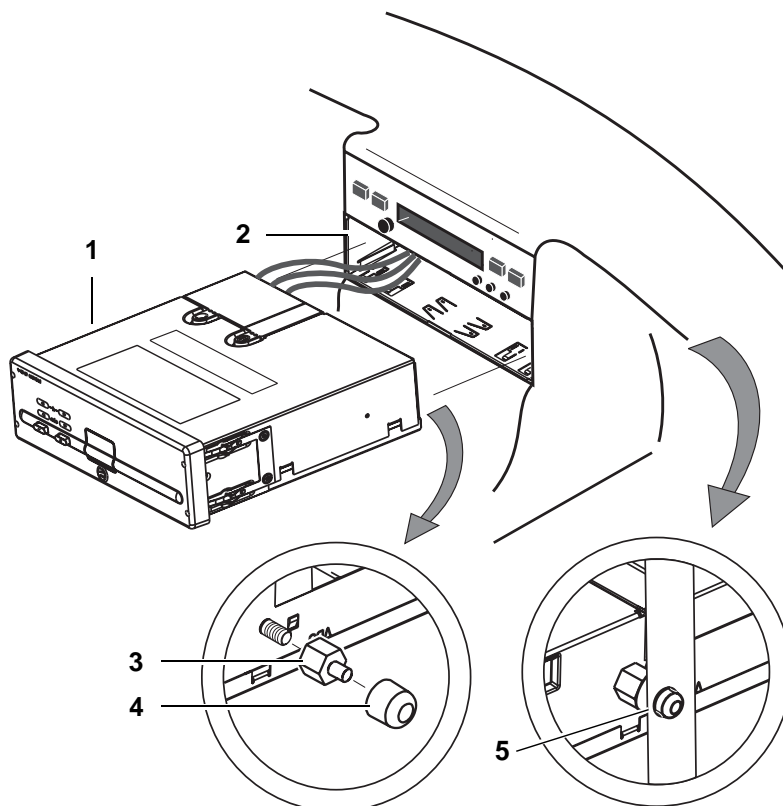


Fig. 3-10: TSU 1391: Installing into the radio compartment

- | | |
|---------------------|----------------------------------------|
| 1 TSU 1391 | 4 Fixing cap |
| 2 Radio compartment | 5 Holding bracket in radio compartment |
| 3 Threaded bolts | |
- 1 Screw the threaded bolts (3) onto the back of the TSU 1391 (1) and press the fixing cap (4) on.
 - 2 Slide the TSU 1391 (1) into the radio compartment (2) until the unit locks into place and the front cover is flush with the dashboard.
Generally, there is a holding bracket (5) with a drilled hole on the radio compartment's back panel. When sliding the TSU 1391 into the radio compartment, the fixing cap (4) fits into this hole and holds the unit in place.

3.5.3 Removal instructions

The steps for removing the TSU 1391 depend on the vehicle. Observe the instructions contained in the vehicle's service manual when removing the unit.

Before removal



Important

Before removing the TSU 1391 you will have to determine the following:

- Current odometer reading of the vehicle
- The following additional details in case of warranty claims:
 - Installation date
 - Kilometre reading (mileage) of the TSU 1391.

■ **Determine the vehicle's current total odometer reading and write it down:**

- Refer to the display reading on the indicator unit.
- When the display is defective ask the vehicle owner.

■ **In case of a warranty claim, use an MTC to determine the date of installation via the "INSTALLATION DATA" program.**

The "INSTALLATION DATA" program description can be found in *Chapter 3.6.3 "Programming the TSU 1391"* from page 3-21.

Removal

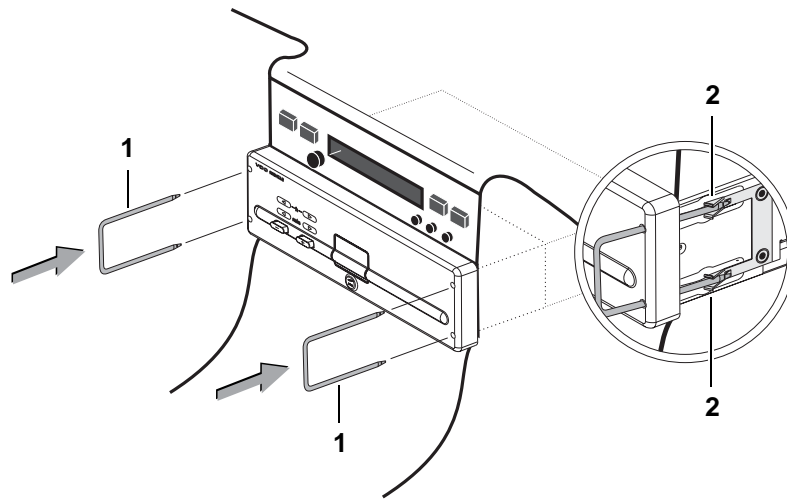


Fig. 3-11: Removing the TSU 1391, step 1

- 1 Special removal tools 2 Catch springs

- 1 Push the special removal tools along both sides of the TSU 1391 (1) until the catch springs (2) on the TSU 1391 disengage.

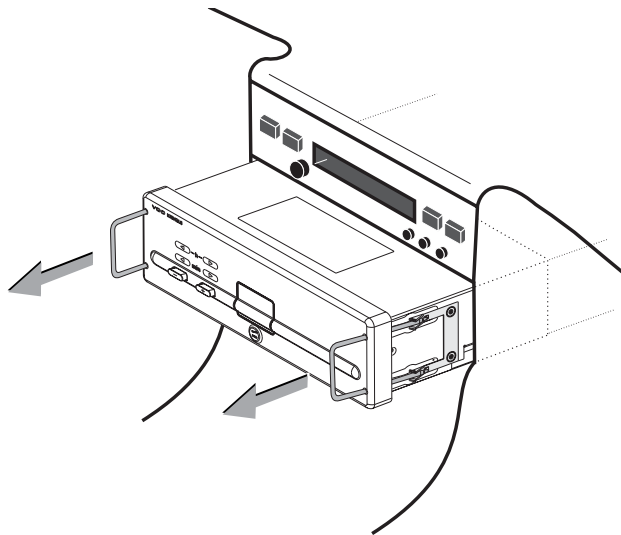


Fig. 3-12: Removing the TSU 1391, step 2

- 2 Then pull the TSU 1391 out of the radio compartment with the special removal tools.

3.6 Commissioning the speedometer system

During the initial operation all modular components of the TSU 1391 speedometer system are adjusted. This ensures that the speedometer system forms a unit that is ready for operation.

The commissioning completes the initialisation of the individual components which have already been pre-set at the factory. It is carried out when programming the system using an MTC/ ATC.

The following service diagnosis systems are used to set the parameters for and program the TSU 1391 in the vehicle:

- MTC 1602.04, including the following accessories:
 - Interface with software version 6.00
 - BTC software version 07.xx
 - Programming cable (1602-78-170-00)
 - Diagnosis cable (1602-78-171-00)
- Automatic measuring track, including MTC accessories such as light barrier, Start/ Stop reflectors and light barrier cable or
- Rolling Road Test Computer (ATC) with programming cable.

Additional information

Additional information on the MTC can be found in *Section 6, Chapter 1.3 "Mobile Test Computer (MTC)"* from page 1-8 as well as in the separate "MTC 1602.04" operating instructions and supplements.

Commissioning workflow



Important

When the speedometer system is fitted to the vehicle and all electrical connections are made, the vehicle must be put in a roadworthy condition again so that it can be moved safely.

- 1 Prepare programming.
- 2 Determine the wheel circumference and the vehicle's characteristic coefficient "w" (imp/km).
- 3 Set the parameters for the TSU 1391:
 - Enter/ set the determined vehicle and installation data.
 - Set the date and the clock.

MTC 1602.04 menu structure

MTC MEASUREMENT

- └─ AUTOM. MEAS. TRACK
- └─ MANUAL MEAS. TRACK
- └─ CHECK K MEASURING
- └─ W-ADAPTED
- └─ DEVICE TESTING

PROGRAMMING

MTCO installation data

- └─ v constant
- └─ Wheel circumference
- └─ Distance counter
- └─ VIN (vehicle identification number)
- └─ Configuration
- └─ CAN configuration
- └─ Product code
- └─ Drive shaft PPR
- └─ Initial installation
- └─ Calibration date
- └─ Seal number
- └─ Maximum speed
- └─ RPM recording
- └─ Rear axles

Date - Time

- └─ TCO programming
 - Prog-Time zone
 - Prog-System time
- └─ BTC programming
 - Time zone
 - Change-over times 01/ 05

Activate KITAS

Manufacturing data

Distance covered

Erase error memory

3.6.1 Before programming

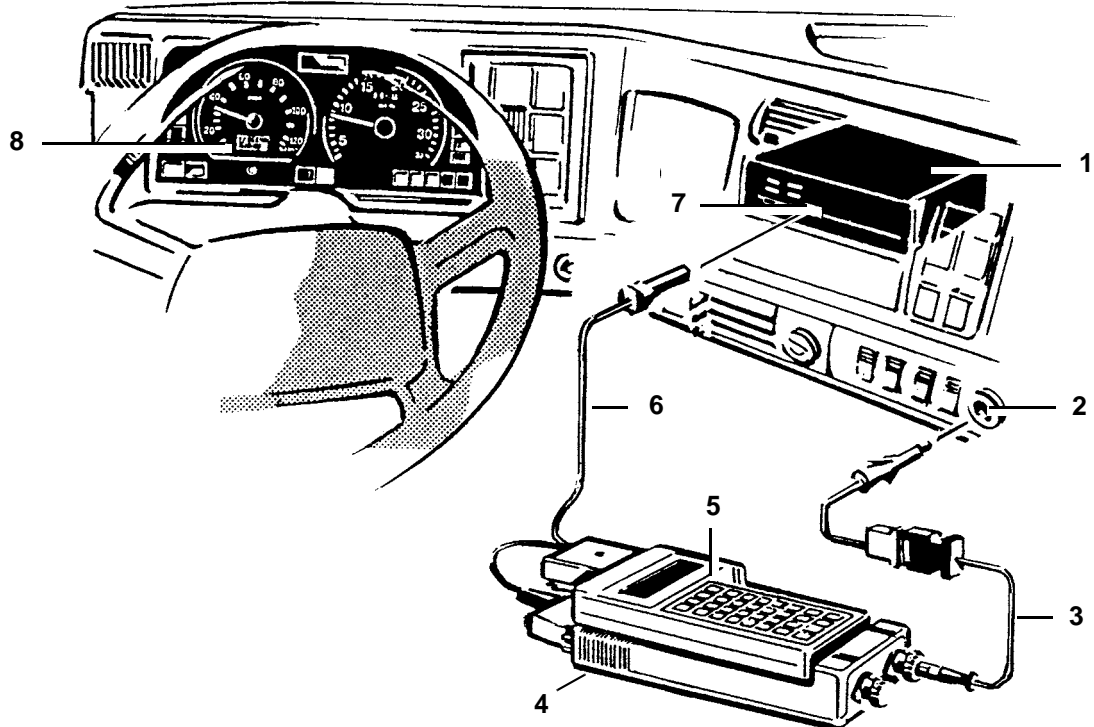


Fig. 3-13: TSU 1391: MTC connection overview

- | | |
|---------------------|----------------------------------|
| 1 TSU 1391 | 5 BTC |
| 2 Cigarette lighter | 6 Test cable |
| 3 Power cable | 7 Test and programming interface |
| 4 MTC interface | 8 Indicator unit/ Cluster |

- 1 Turn the ignition on.
- 2 Access the programming interface (7) on the TSU 1391.
- 3 Connect the MTC to the TSU's programming interface (7) using the test cable (6).
- 4 Connect the MTC to the vehicle's electrical system using the power cable (3).
When the MTC is connected to the vehicle's electrical system, the programme starts automatically and the main menu is displayed.
- 5 Start programming.

```
# MTC MEASUREMENT #
AUTOM. MEAS. TRACK
MANUAL MEAS. TRACK
CHECK K MEASURING >
```

Use the DOWN arrow key to move the cursor to the next page of the main menu.

3.6.2 Determining the vehicle's wheel circumference and characteristic coefficient "w" (imp/km)

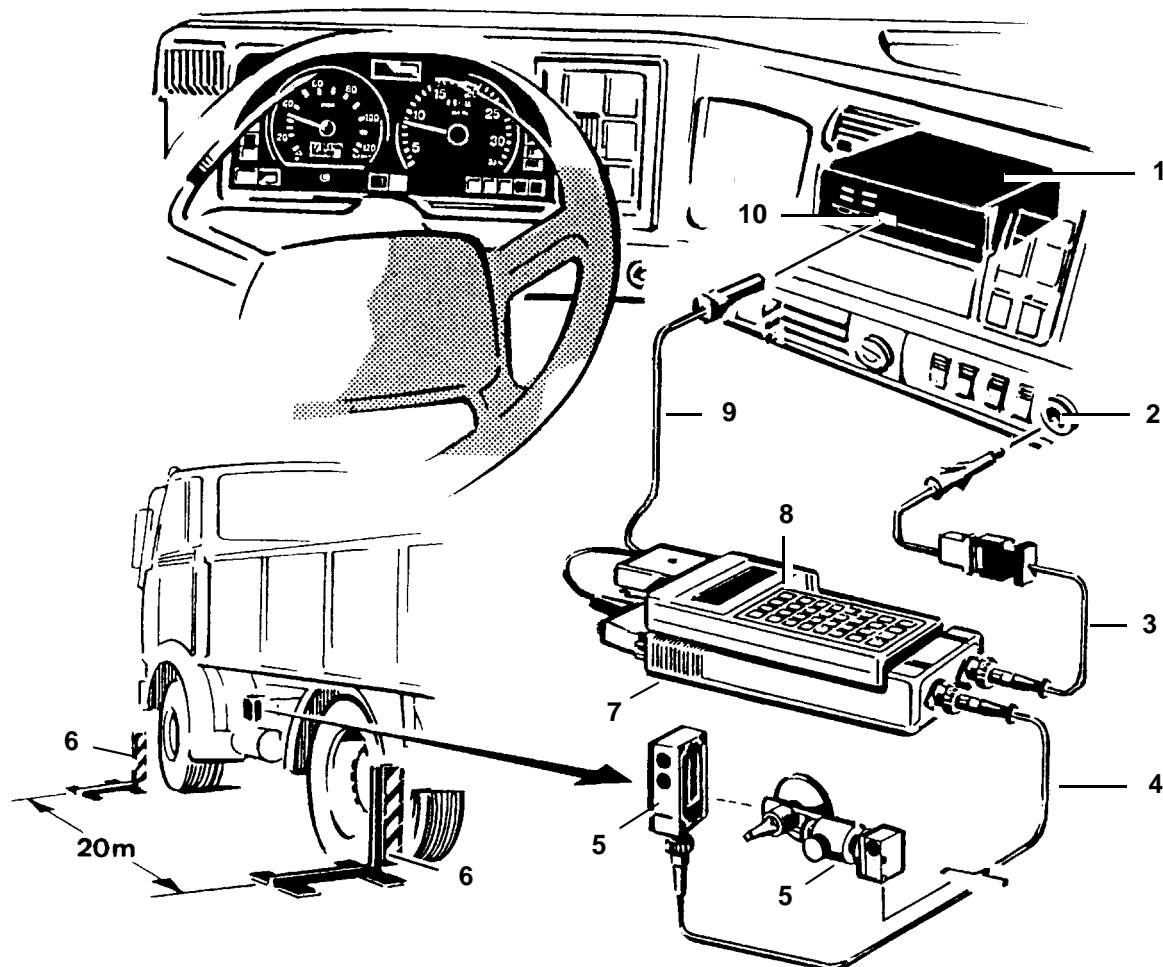


Fig. 3-14: TSU 1391: MTC connection overview with automatic measuring track

- | | |
|-----------------------|-----------------------------------|
| 1 TSU 1391 | 6 Start/ Stop reflectors |
| 2 Cigarette lighter | 7 MTC interface |
| 3 Power cable | 8 BTC |
| 4 Light barrier cable | 9 Test cable |
| 5 Light barrier | 10 Test and programming interface |
- 1 Attach the light barrier (5) to the vehicle and connect it to the MTC using the light barrier cable (4).
 - 2 Check that the measuring track is set up correctly.

Additional information

A detailed description of the measurement workflow and instructions on how to determine the wheel circumference and the vehicle's characteristic coefficient "w" can be found in the corresponding SDS MTC/ATC testing unit instructions.

3.6.3 Programming the TSU 1391

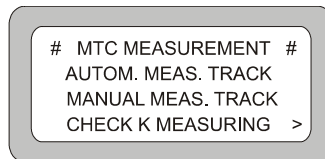


Condition

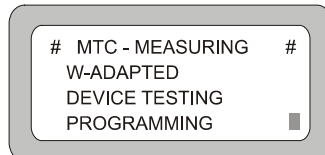
Make sure that:

- the MTC and the TSU 1391 are connected by the test cable
- the ignition is turned on.

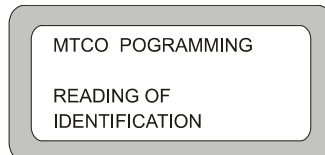
■ Start programming.



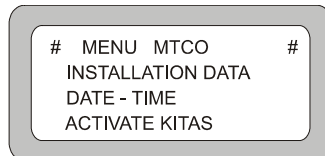
Use the DOWN arrow key to move the cursor to the next page of the main menu.



Select the "PROGRAMMING" menu and press **[Enter]** to confirm.



When "PROGRAMMING" is selected this mask is displayed for approx. 2 seconds.



The "INSTALLATION DATA" menu is already selected. If not, select it and press **[Enter]** to confirm.

TSU 1391 installation data

■ Program the installation data:

Summary

- | | | | |
|---|--------------------------------------------|----|-----------------------------|
| 1 | v constant | 7 | Product code |
| 2 | n constant | 8 | Drive shaft PPR |
| 3 | Wheel circumference | 9 | Initial installation |
| 4 | VIN (vehicle identification number) | 10 | Calibration date |
| 5 | Configuration | 11 | Seal number |
| 6 | CAN configuration | | |



Important

When programming the TSU 1391 proceed as for the MTCO 1324 (see *Section 1 "MTCO 13245" Chapter 3.8.4 "Programming the MTCO 1324"*, from *Page 3-31*). Programming functions that do not apply to the TSU 1391 will not be listed.

Chapter 4

Sealing



Important

There is no legislation for sealing speedometer systems with TSU 1391 (Regulation (EC) No. 1056/97).

Chapter 5

Test instructions



Important

Installing and operating speedometer systems with TSU 1391 are not subject to legal testing obligations.

Chapter 6

Fault analysis

6.1 Error message procedure

Regardless of the cause of an event, the TSU 1391 does not differentiate between operating errors, malfunctions and system and unit errors. There is the same internal mechanism for each event.

When the TSU 1391 detects an event that occurs both in the unit and in communicating with the system components, it makes an entry in the error log. The TSU 1391 continually scans this log. If there is an entry there it is further processed using a control table.

It is processed using: Output to CAN bus (tachograph status)

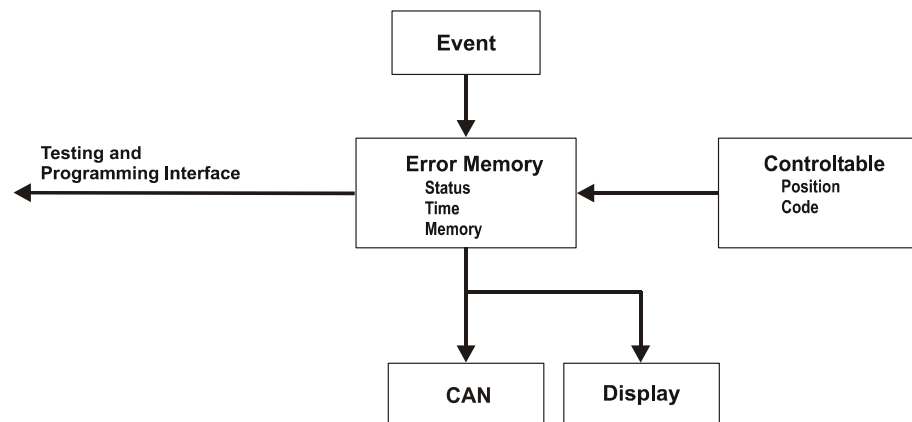


Fig. 6-1: Error message on the system, diagram



Important

It is also possible to read out or delete the error memory using the test and programming interface.

6.2 Error code list

Code	Meaning
A00C	Electronics error, e.g. FRAM defective/ clock defective Internal error Program memory error
A400	Voltage cut
A411	Communication error between TSU 1391 and the indicator unit (Cluster)
900A	Other errors during CAN transmission (CAN Rest)
900B	CAN bus transmission error (CAN bus off)
9430	"v" pulse output error (B7)

Table 6-1: Error list: System/ speedometer errors

Chapter 7

Maintenance

7.1 Replacing TSU 1391 buffer battery

Depending on load, temperature, humidity etc., the life of the battery which supplies the clock module (system time) and buffers the date, time and switchover settings for beginning/ end of daylight saving time can be reduced. According to the manufacturer the battery has a service life of approx. 10 years if voltage is supplied constantly.



Important

If no voltage is supplied to the unit and if the clock stops on the indicator unit in combination with TSU 1391 the battery **must** be replaced and the current date and time be programmed again using an MTC/ ATC.

Detailed information and instructions on how to program "Date-Time" can be found in *Section 1 Chapter 3.8.4 "Programming the MTCO 1324", section "Adjusting date and time", from page 3-39.*

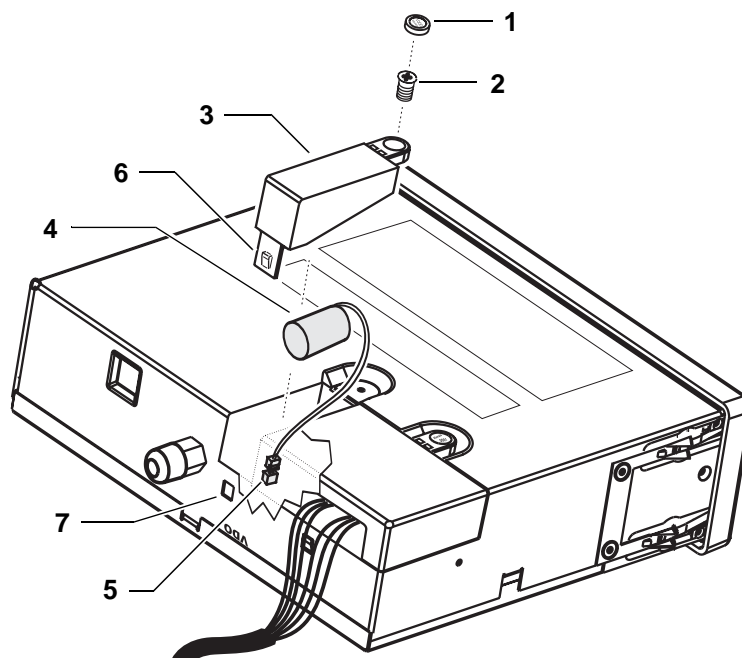
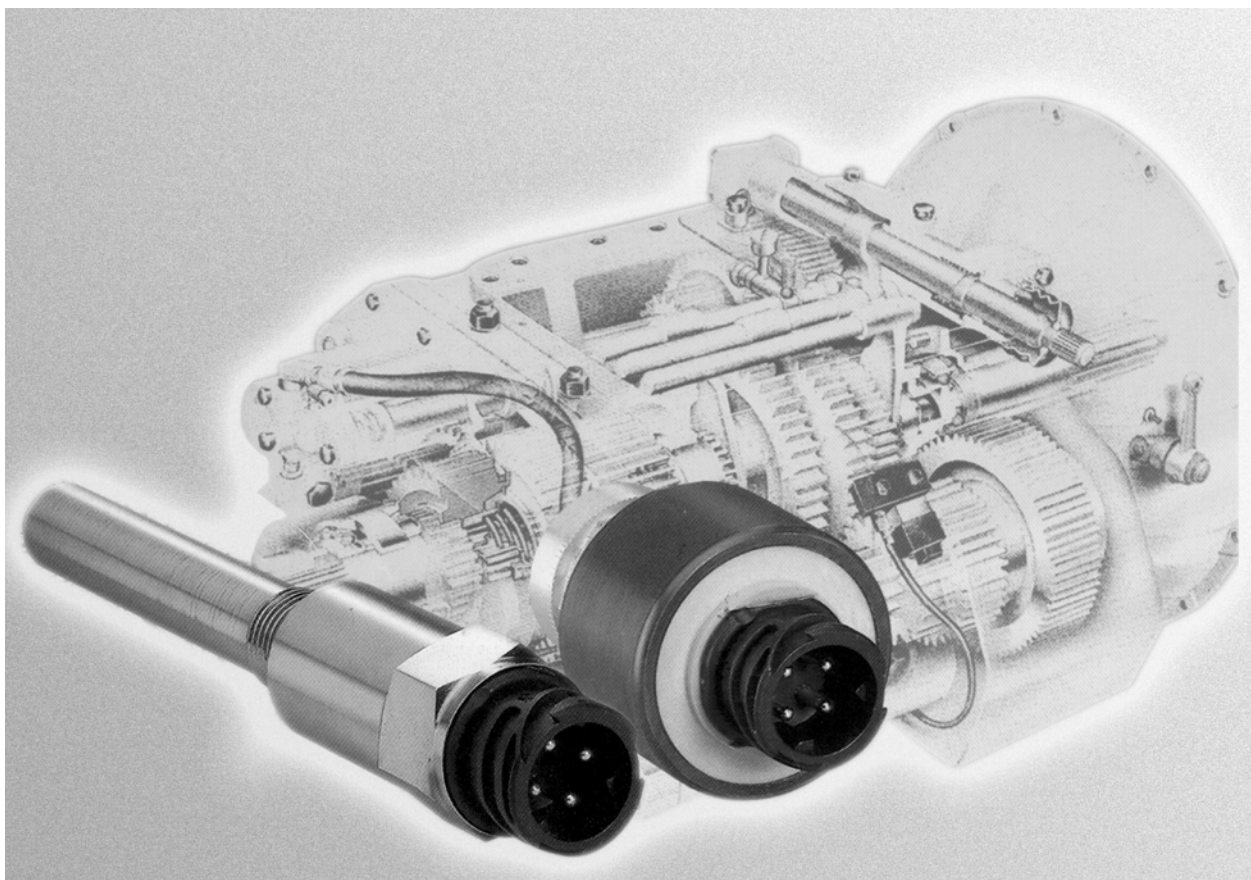


Fig. 7-1: TSU 1391: Removing the buffer battery

- | | |
|------------------------------------|-----------------------------------|
| 1 Seal cap (battery compartment) | 5 Socket |
| 2 Screw (battery compartment) | 6 Cover catch lug |
| 3 Battery compartment cover | 7 Locking opening in unit housing |
| 4 Buffer battery (lithium battery) | |

- 1 Remove the TSU 1391 from the radio compartment.
- 2 Remove the seal cap (1) and unscrew the screw (2) underneath it.
- 3 Pull out the battery compartment cover (3).

- 4 Take the lithium battery (4) out of the battery compartment and pull the plug carefully out of the socket (5) on the circuit board.**
- 5 Carefully put the plug of the new battery into the socket (5) on the circuit board and insert the battery into the battery compartment.**
- 6 Then push the cover (6) into the housing until it locks into place.**
When closing the battery compartment ensure that the cover lug **(6)** locks into the locking opening (slit) **(7)** in the housing and that the battery lead is not caught up.
- 7 Then fasten the battery compartment again with the screw (2).**
- 8 Stamp the new seal cap (1) and press it into the seal cup.**
- 9 Then slide the TSU 1391 into the fitting/ radio compartment and adjust the time and date.**
- 10 Finally, check that the TSU 1391 is working properly.**



Section 4

Sensors and pulse generators

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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General safety precautions

Kienzle Tachographs and the vehicles into which the tachographs are installed are quality products manufactured to comply with recognised rules of engineering.

The products comply with the quality assurance standards currently in force and are officially authorised for use on public roads.

The products left the factory in a perfectly safe condition.

In order to maintain them in this condition you must carry out your work as an engineer:

- in accordance with the descriptions in these instructions,
- correctly and with great accuracy and
- by observing the Health and Safety regulations for safety and accident prevention at work.

Designated use

Kienzle Tachographs may only be used for the purpose for which they have been constructed.

Fitting instructions

There is no need to have access to the safety technology of the vehicles to fit Kienzle Tachographs.

Correct installation will not involve any changes to or affect the structure or driving properties of the vehicle.

- Before installing the tachograph consult the vehicle documentation to find out exactly what sort of vehicle it is and whether it has any special characteristics.
- Refer to the vehicle drawings to identify the position of fuel, hydraulic and compressed air lines and electrical cables.
- Ask the vehicle owner or the driver about any (private) changes to the vehicle which must be taken into consideration when installing the unit.
- During installation and removal, avoid damaging lines and cables and severing line and cable connections.
- Only use original Siemens VDO parts and original Siemens VDO accessories for fitting.
- Only fit undamaged parts to a vehicle.
- When installing the tachograph and its cables, ensure that these parts do not affect or prevent the proper operation of the vehicle and that the parts are not damaged.

General safety precautions

- Do not reduce the cross section of a line; this can lead to the corresponding section of the cable becoming overheated.
- Only solder the new cable connections with soft solder.
- Check all (!) vehicle functions before handing the vehicle back to the customer.

Vehicle hand-over

- Instruct the customer in the operation of the tachograph and give him the relevant operating instructions.

Summary of changes

Date	Chapter/page	Subject, change, measure

Section 4: Sensors and pulse generators • Edition 03/2002

Notes

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Chapter 1

Kienzle sensors

1.1 KITAS 2170/ 2171

Sensor cable in accordance with DIN 72551 Kfz

A new type of sensor cable has been developed for the KITAS 2170/2171 sensor which can be placed in motor vehicles designed in accordance with DIN 72551 Kfz. The main differences between the new sensor cable and existing pulse cables are:

- The cable can only be used up to 50 V direct voltage; existing cables can be used up to 230 V alternating voltage.
- The cables are twisted 15 revolutions per metre which means that the sensor cable complies with EC Directive 95/54 EMC.

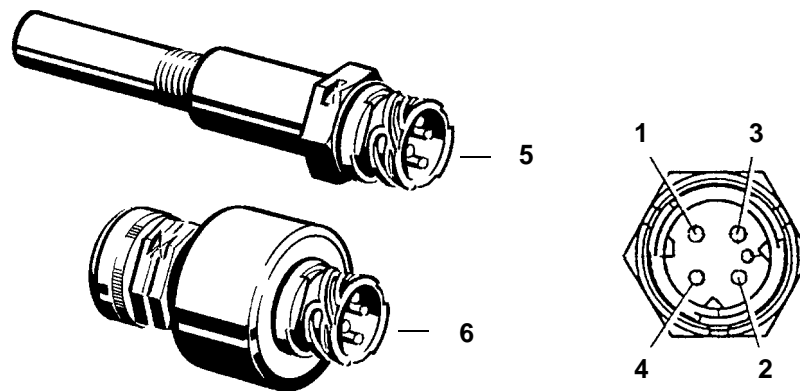
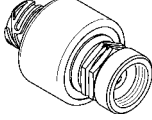
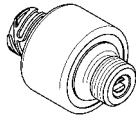
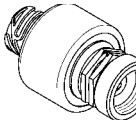
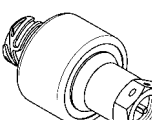
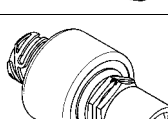
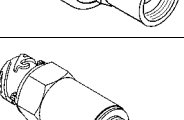
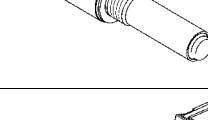
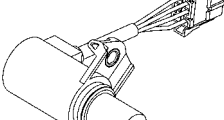
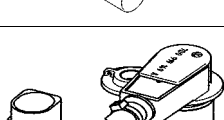
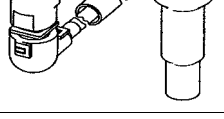


Fig. 1-1: KITAS 2170/ 2171: Sensors (general)

- | | | | |
|---|--------------------------|---|-------------------|
| 1 | Sensor supply (+ U_E) | 4 | Data signal I/O |
| 2 | Sensor supply (- U_0) | 5 | Integrated sensor |
| 3 | „v“ real time signal | 6 | Standard sensor |

1.1.1 Sensor variants

	Sensor type 2170/ 2171	
	2170.01 2171.01	Standard sensor: - For screwing it onto the gearbox output - M22 x 1.5 clockwise internal thread
	2170.02 2171.02	Standard sensor: - For screwing it onto the gearbox output - M22 x 1.5 anti-clockwise external thread
	2170.03 2171.03	Standard sensor: - For screwing it onto the gearbox output - 7/8" internal thread
	2170.07 2171.07	Standard sensor VW : - For screwing it onto the gearbox output - M18 x 1.5 clockwise internal thread
	2170.08 2171.08	Standard sensor RENAULT : - For screwing it onto the gearbox output - M18 x 1.5 clockwise internal thread
	2170.20 2171.20	Integrated sensor (static): - For screwing it into the gearbox opening - Various lengths available
	2170.50 2171.50	Integrated sensor (dynamic): - Used with eddy-current brake
	2170.30 2171.30	Integrated sensor: - Special customer-specific version
	2170.31 2171.31	Integrated sensor VW : - Customer specific version



Important

KITAS sensors can only be used in conjunction with the "New Generation of Tachographs", i.e. MTCO 1324 and MTCO 1390.

Sensor cable

The sensor cable is a 4-wire cable where the wires are twisted. It corresponds to EC Directive 9554 EMC and can be used in vehicles complying with DIN 72551 Kfz.

1.1.2 Technical data

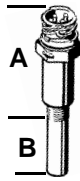
	KITAS integrated sensor 2170.20xx/ 2171.20xx	KITAS standard sensor 2170.0x/ 2171.0x
Operating voltage	6.5 to 9 V	6.5 to 9 V
Power consumption	max. 15 mA	max. 15 mA
Operating temperature	Range A: -30 to +135 °C Range B: -30 to +145 °C 	-30 to +125 °C
Storage temperature	-40 to +140 °C	-40 to +140 °C
Pulses/ Revolution	—	8
Pulse ratio	—	30 to 70 % or 70 to 30 %
Connection	no connection to earth	no connection to earth
Frequency range	1 up to 2000 Hz	1 up to 1000 Hz
Voltage interference protection	DIN 40 839 T1 + T3	DIN 40 839 T1 + T3
Magnetic compatibility	DIN 40 839 T4 (100 V/m)	DIN 40 839 T4 (100 V/m)
Type of protection	IEC 529, IP 67/ IP 69K	IEC 529, IP 67
Vibration fatigue limit	30 g	10 g
Resistance to shocks	1000 g	50 g, 11 ms
Pulse wheel material	St 4 LG RP	—
Pulse wheel thickness	2 mm	—
Pitch	minimum 1.5 x width of thread	—
Height of thread	16 mm	—
Clearance: Sensor/ pulse wheel	1.4 mm ±0.6 mm	—
Not to be used with external magnetic fields	> 2 mT (Tesla)	—
Connection of sensor to sensor cable	Plug connection in accordance with DIN 72585-A1-4.1-Ag/K2	Plug connection in accordance with DIN 72585-A1-4.1-Ag/K2
Connecting sensor to vehicle gearbox	Thread M 18 x 1.5	with thread M 22 x 1.5 or 7/8" 18 UNS 2B
Torque (spanner size)	maximum 50 ±10 Nm (SW 27)	maximum 50 ±10 Nm (SW 27)
Weight	approx. 100 to 180 g, depending on length	approx. 135 - 150 g

Table 1-1: KITAS 2170/ 2171: Technical data

1.2 Running cables and making connections

Connection cables are required for transmitting data/ pulses (e.g. “v”/ “n” pulses, electronically triggered special equipment etc.)



Important

Vehicles used for the carriage of hazardous good that are fitted with a battery disconnection switch and a current limiter must comply with specific safety regulations (ADR). The electrical circuit of the tachograph system placed in such vehicles must be intrinsically safe according to EN 50020 and EN 50014.

1.2.1 Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired “side effects” such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

1.2.2 Making sensor cables

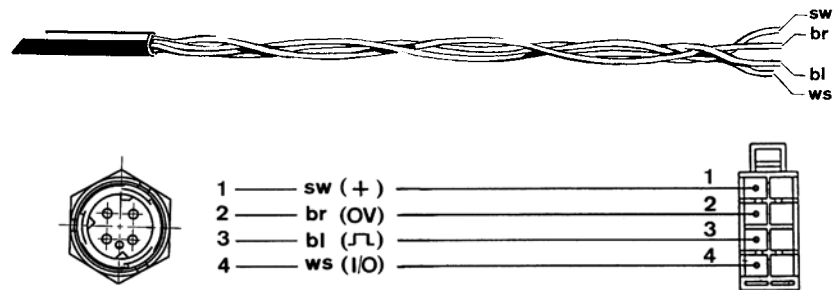


Fig. 1-2: KITAS 2170/2171: Sensor cable and connector assignment

- | | | | |
|---|--------------------------|---|----------------------|
| 1 | Sensor supply (+ U_E) | 3 | „V“ real time signal |
| 2 | Sensor supply (- U_O) | 4 | Data signal I/O |

The sensor cable is a 4-wire cable where the wires are twisted. It corresponds to EU-Directive 9554 EMC and can be used in vehicles complying with DIN 72551 Kfz.

1.2.3 Running sensor cables



Important

When running and connecting the sensor cable ensure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cabs
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

- Place the new sensor cable next to the existing pulse cable.
- Remove the existing cable, if possible. Otherwise make sure it is “no longer live”.

1.3 Installing KITAS 2170/ 2171

1.3.1 Installation dimensions

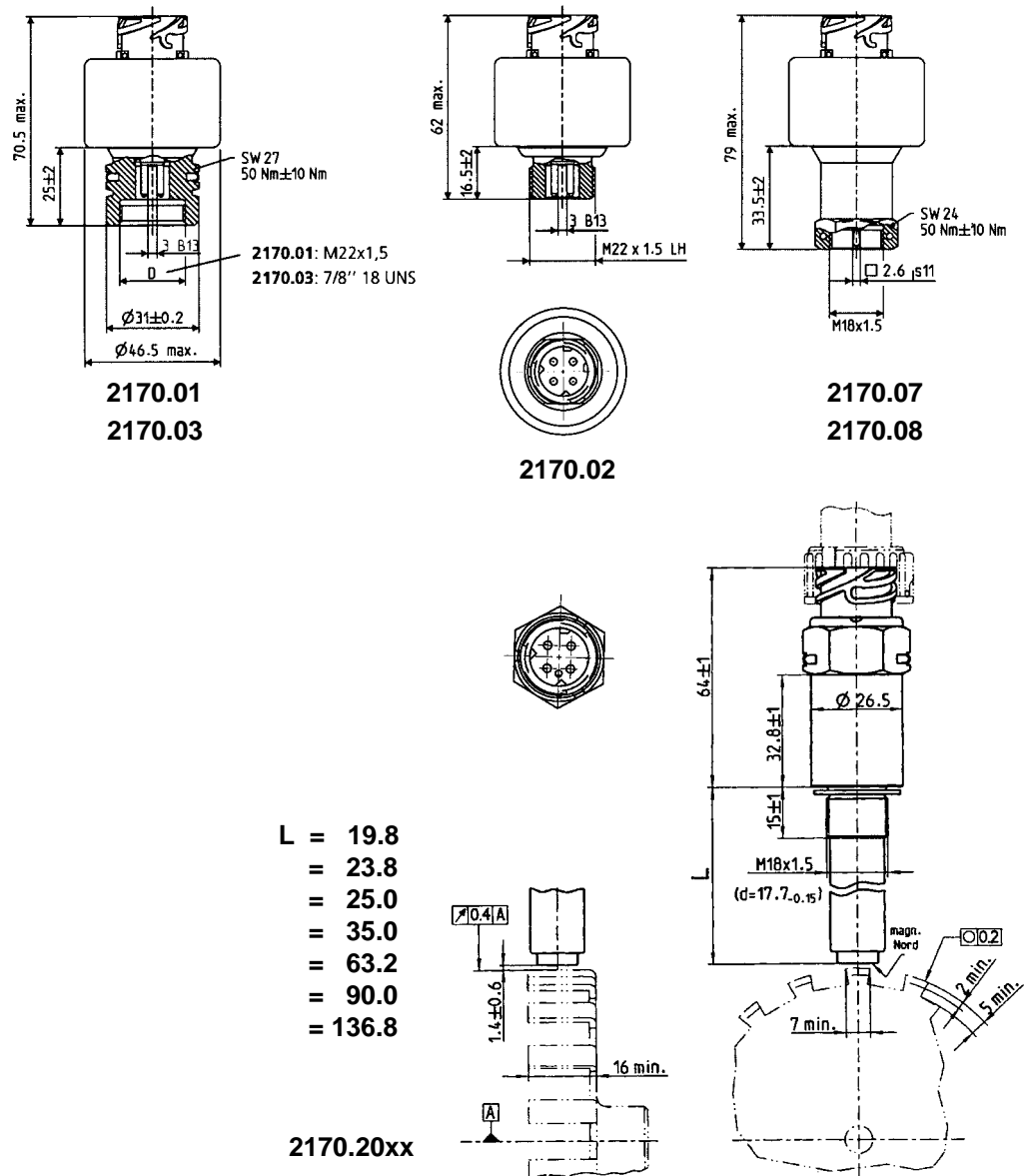


Fig. 1-3: KITAS 2170/ 2171: Housing dimensions



Important

Only use a KITAS sensor type which is fitted in the same way as the existing pulse generator (screwed on or in the gearbox output). An integrated KITAS sensor must be the same length.

1.3.2 Installing the sensor

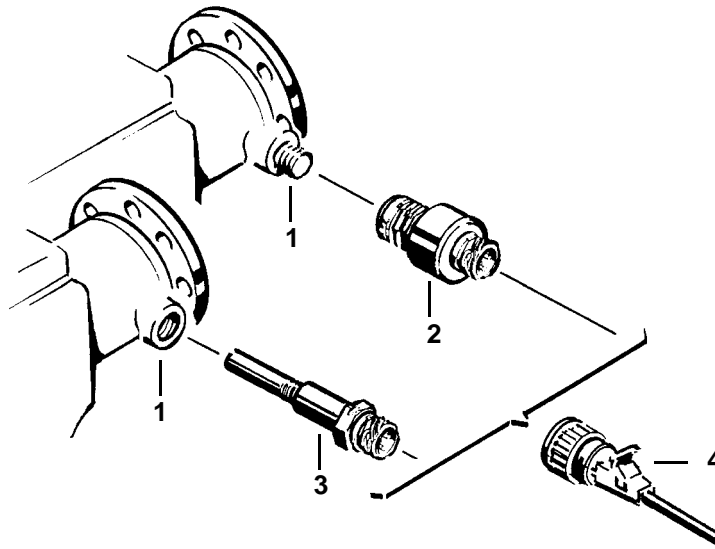


Fig. 1-4: KITAS 2170/2171: Examples of installation

- 1 Unscrew the existing pulse generator connected to the gearbox output (1).

- 2 Screw the correct KITAS sensor type (2) or (3) on or in the gearbox output and seal.

Observe the maximum torque of 50 ± 10 Nm. For instructions on sealing see Chapter 1.3.3 „Sealing the KITAS 2170/2171 to the gearbox”, from page 1-9.

- 3 Connect the bayonet connector of the sensor cable (4) to the KITAS sensor and seal it.

1.3.3 Sealing the KITAS 2170/ 2171 to the gearbox

Sealing variant with locking wire and two-hole seals

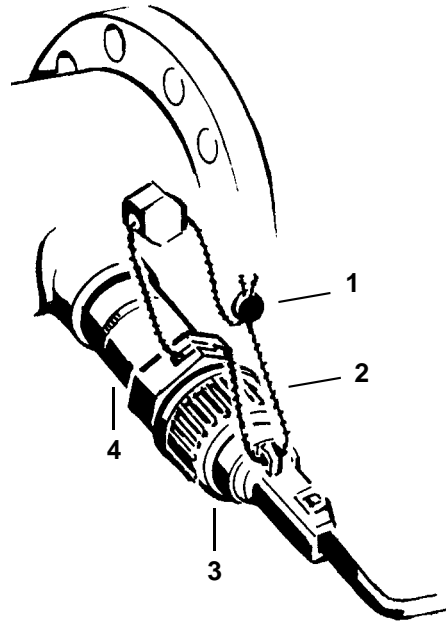


Fig. 1-5: KITAS 2170/ 2171: Sealing points with locking wire and two-hole seals

- | | | | |
|---|---------------|---|---------------------------|
| 1 | Two-hole seal | 3 | Sensor cable (KITAS plug) |
| 2 | Locking wire | 4 | KITAS 2170/ 2171 |

- 1 Feed the locking wire through the grommet (or similar) on the gearbox output.
- 2 Then feed the locking wire (2) through all sealing eyelets on the KITAS sensor (4) and its plug (3).
- 3 Run the two-hole seal (1) over the two ends of the wire and twist them together.
- 4 Then clamp the two-hole seal together with the sealing pliers.

The seal is stamped by this.



Important

The Federal Office for Motor Traffic in Germany (KBA) no longer requires the sensor cable (KITAS plug (3)) to be sealed.

But we recommend that the sensor cable on the KITAS 2170/ 2171 should be sealed for safety reasons.

The KITAS sensor (4) itself **must** be protected against being pulled out and must be sealed.

Sealing variant with KITAS seal

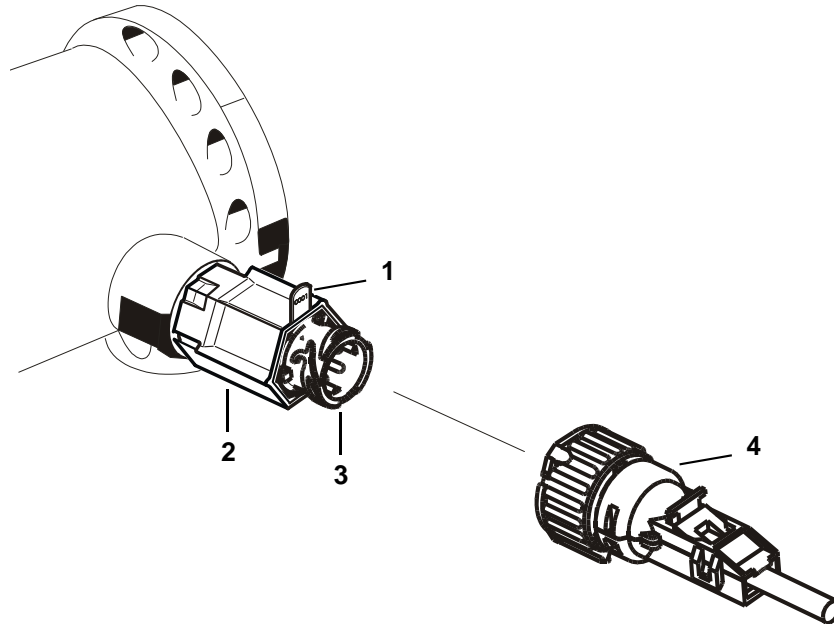


Fig. 1-6: KITAS 2170/ 2171: Sealing points with KITAS seal

- | | | | |
|---|-----------------|---|---------------------------|
| 1 | KITAS seal clip | 3 | KITAS 2170/ 2171 |
| 2 | KITAS seal | 4 | Sensor cable (KITAS plug) |

- 1 Push the KITAS seal (1) into the pulse generator until it can go no further.
- 2 Then pinch the clip on the KITAS seal (2) together with the sealing pliers.
The seal is stamped by this.
- 3 Connect the pulse cable (4) to the KITAS sensor (3) using the bayonet connector.



Important

The Federal Office for Motor Traffic in Germany (KBA) no longer requires the sensor cable (KITAS plug (4)) to be sealed.

But we recommend that the sensor cable on the KITAS 2170/ 2171 should be sealed for safety reasons.

The KITAS sensor (3) itself **must** be protected against being pulled out and must be sealed.

Chapter 2

Kienzle pulse generator

2.1 Pulse generator 2159

The pulse generator converts the gearbox revolutions into pulses and transmits these to the tachograph as output signals.

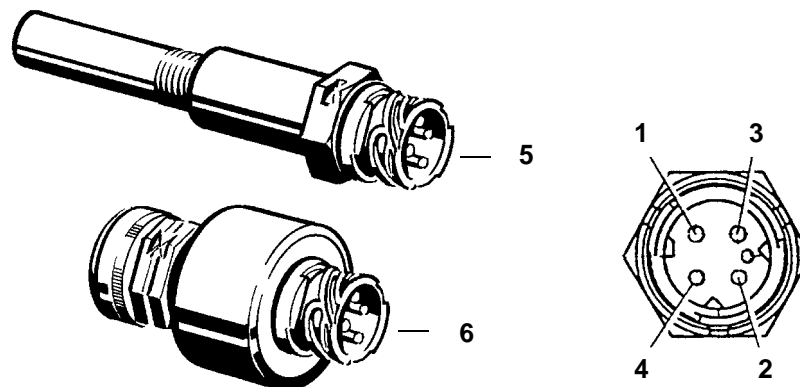
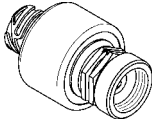
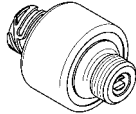
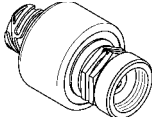
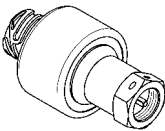
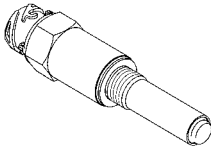
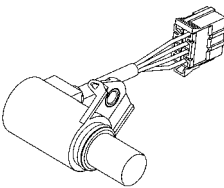
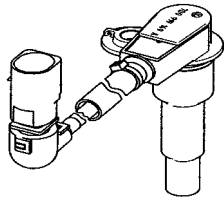


Fig. 2-1: Pulse generator 2159: Generators (general)

- | | | | |
|---|-----------------------------|---|------------------------|
| 1 | Generator supply (+ U_E) | 4 | Inverted output signal |
| 2 | Generator supply (- U_0) | 5 | Integrated generator |
| 3 | Output signal | 6 | Standard generator |

2.1.1 Pulse generator variants

Device type 2159		
	2159.01	Standard pulse generator: - For screwing it onto the gearbox output - M22 x 1.5 clockwise internal thread
	2159.02	Standard pulse generator: - For screwing it onto the gearbox output - M22 x 1.5 anti-clockwise external thread
	2159.03	Standard pulse generator: - For screwing it onto the gearbox output - 7/8" internal thread
	2159.07	Standard pulse generator VW : - For screwing it onto the gearbox output - M18 x 1.5 clockwise internal thread
	2159.20	Integrated pulse generator (static): - For screwing it into the gearbox opening - Various lengths available
	2159.50	Integrated pulse generator (dynamic): - used with eddy-current brake
	2159.30	Integrated sensor: - Special customer-specific version
	2159.31	Integrated sensor VW : - Customer specific version

Pulse cable

The pulse cable is a 4-wire cable where the wires are twisted. It corresponds to EC Directive 9554 EMC and can be used in vehicles complying with DIN 72551 Kfz.

2.1.2 Technical data


	Integrated pulse generator 2159.20xx	Standard pulse generator 2159.0x
Operating voltage	6.5 to 30 V	6.5 to 30 V
Power consumption	max. 16 mA	max. 15 mA
Operating temperature	<div> <div> Range A: -30 to +135 °C Range B: -30 to +145 °C </div>  </div>	-30 to +125 °C
Storage temperature	—	-40 to +140 °C
Pulses/ Revolution	—	8
Pulse ratio	—	30 to 70 % or 70 to 30 %
Connection	no connection to earth	no connection to earth
Frequency range	1 up to 2000 Hz	1 up to 1000 Hz
Voltage interference protection	DIN 40 839 T1 + T3	DIN 40 839 T1 + T3
Magnetic compatibility	DIN 40 839 T4 (100 V/m)	DIN 40 839 T4 (100 V/m)
Type of protection	IEC 529, IP 66	IEC 529, IP 66
Vibration fatigue limit	30 g	10 g
Resistance to shocks	100 g, 11 ms, 50 cycles	50 g, 11 ms
Pulse wheel material	St 4 LG RP	—
Pulse wheel thickness	2 mm	—
Thread width/ pitch	1/1.5 to 1/2	—
Height of thread	16 mm	—
Clearance: Pulse generator/ pulse wheel	1.4 mm ±0.6 mm	—
Not to be used with external magnetic fields	> 2 mT (Tesla)	—
Connecting pulse generator to pulse cable	using bayonet connection	using bayonet connection
Connecting pulse generator to vehicle gearbox	with thread M 18 x 1.5	with thread M 22 x 1.5 or 7/8" 18 UNS 2B
Torque (spanner size)	maximum 50 ±10 Nm (SW 27)	maximum 50 ±10 Nm (SW 27)
Weight	approx. 80 to 150 g, depending on length	120 g

Table 2-1: Pulse generator 2159: Technical data

2.2 Running cables and making connections

Connection cables are required for transmitting data/ pulses (e.g. “v”/ “n” pulses, electronically triggered special equipment etc.).

2.2.1 Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired “side effects” such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

2.2.2 Making the pulse cable

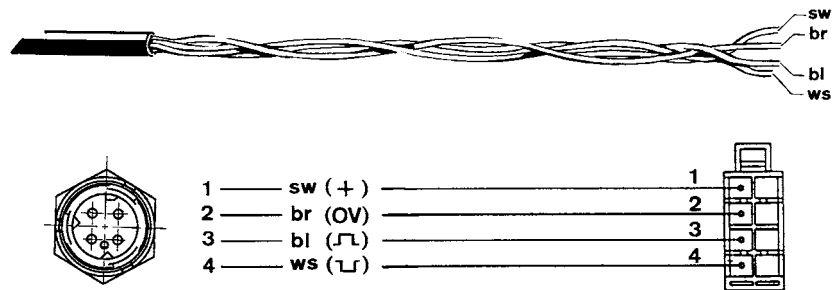


Fig. 2-2: Pulse generator 2159: Pulse cable and connector assignment

- | | | | |
|---|-----------------------------|---|------------------------|
| 1 | Generator supply (+ U_E) | 3 | Output signal |
| 2 | Generator supply (- U_0) | 4 | Inverted output signal |

2.2.3 Running pulse cables



Important

When running and connecting the sensor cable ensure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cabs
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

- Place the new pulse cable next to the existing pulse cable.
- Remove the existing cable, if possible. Otherwise make sure it is “no longer live”.

2.3 Installing the pulse generator 2159

2.3.1 Fitting dimensions

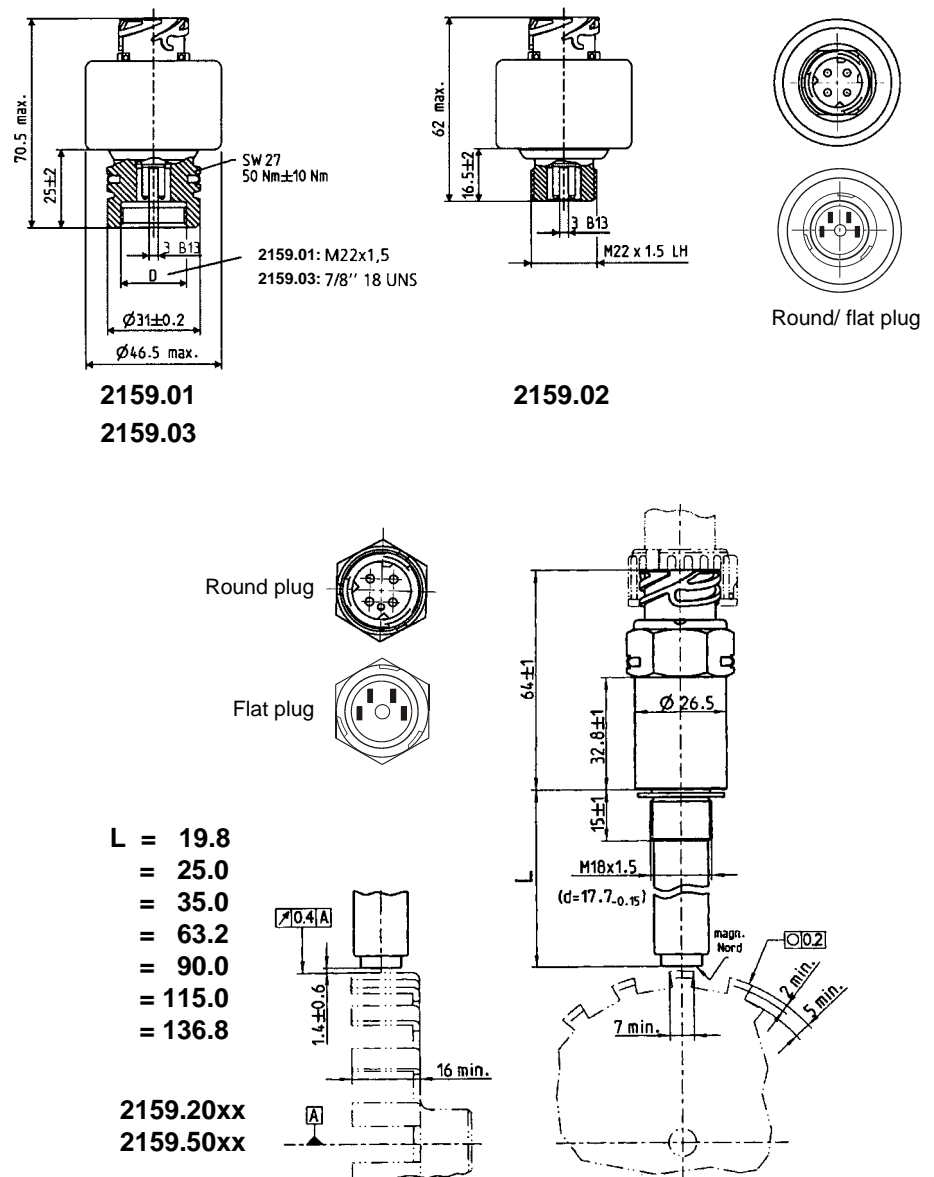


Fig. 2-3: Pulse generator 2159: Housing dimensions



Important

Only use the pulse generator type which is fitted in the same way as the existing generator (screwed on or into the gearbox output).
An integrated pulse generator must be exactly the same length.

2.3.2 Installing generators

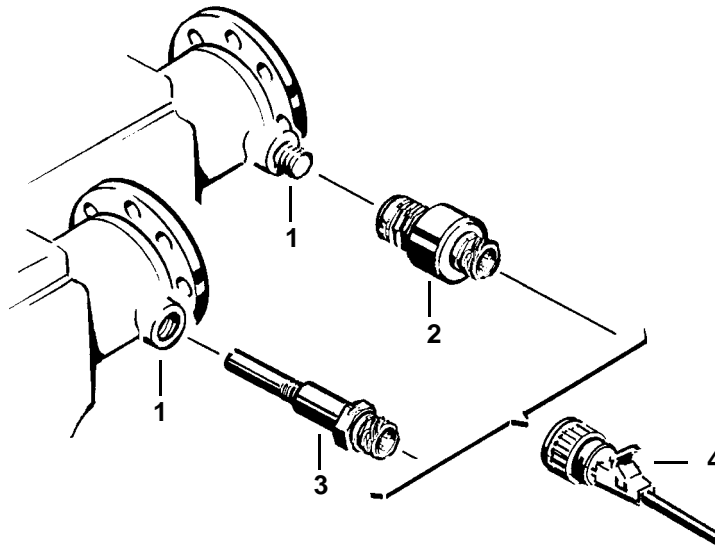


Fig. 2-4: Pulse generator 2159: Examples of installation

- | | |
|----------------------------|---------------------------------------|
| 1 Gearbox output | 3 Integrated pulse generator |
| 2 Standard pulse generator | 4 Pulse cable with bayonet connection |

- 1 **Unscrew the existing pulse generator connected to the gearbox output (1).**
- 2 **Screw the correct pulse generator type (2) or (3) on or into the gearbox output.**
Observe the maximum torque of 50 ± 10 Nm.
- 3 **Connect the pulse cable bayonet connection (4) to the pulse generator and seal.**
For instructions on sealing see *Chapter 2.3.3 „Sealing pulse generator 2159”,* from page 2-9.

2.3.3 Sealing pulse generator 2159

Round plug sealing variant

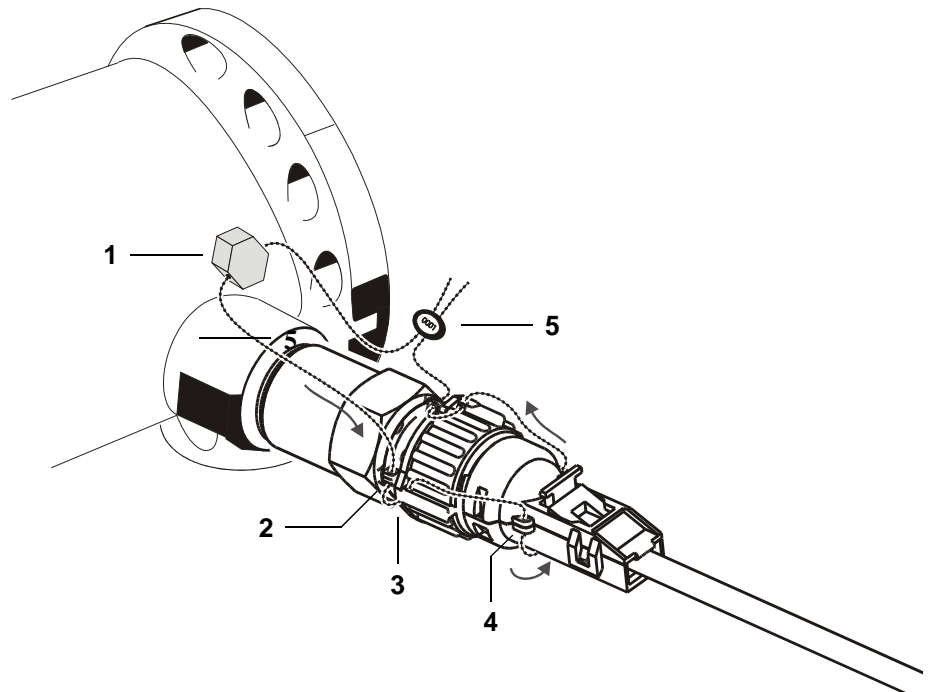


Fig. 2-5: Sealing pulse generator 2159 (round plug) with gearbox

- | | | | |
|---|------------------------------------|---|--------------------------------|
| 1 | Screw | 4 | Tension relief sealing grommet |
| 2 | Pulse generator sealing grommet | 5 | Two-hole seal |
| 3 | Bayonet connection sealing grommet | | |

- 1 Feed locking wire through the:
 - screw hole (1) (or similar) on the gearbox output.
 - sealing grommets on the v pulse generator 2159 (2), into the bayonet connection (3) and onto the tension relief (4).
 - Feed the sealing grommets on the other side through the sealing grommets.
- 2 Run the two-hole seal (5) over the two ends of the wire and twist them together.
- 3 Pinch the two-hole seal together with the sealing pliers.
The seal is stamped by this.



Important

We recommend that you seal the pulse generator 2159 to the gearbox for safety reasons.

Flat plug sealing variant

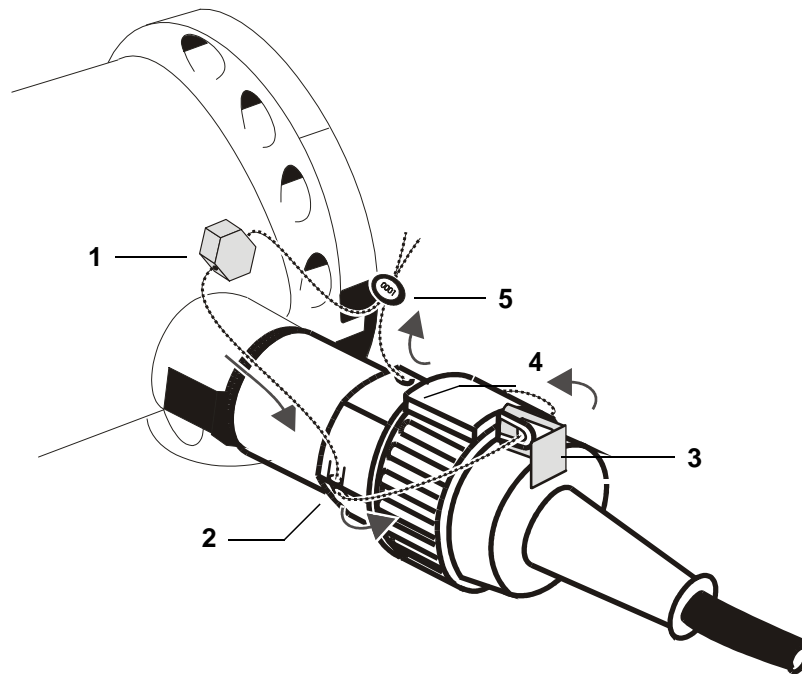


Fig. 2-6: Sealing pulse generator 2159 (flat plug) with gearbox

- | | | | |
|---|------------------------------------|---|---------------------------------|
| 1 | Screw | 4 | Pulse generator sealing grommet |
| 2 | Pulse generator sealing grommet | 5 | Two-hole seal |
| 3 | Bayonet connection sealing grommet | | |

- 1 Run the locking wire through the grommet hole (1) (or similar) on the gearbox output.
- 2 Then run the locking wire through the sealing grommets on the hexagonal screw on the pulse generator 2159 (2), through the locking device on the pulse cable bayonet connection (3) and through the sealing grommet on the opposite side of the pulse generator (4).
- 3 Run the two-hole seal (5) over the two ends of the wire and twist them together.
- 4 Then clamp the two-hole seal together with the sealing pliers.

The seal is stamped by this.



Important

We recommend that you seal the pulse generator 2159 to the gearbox for safety reasons.

Chapter 3

Eaton generator

3.1 Eaton generator 4302691

3.1.1 Running cables and making connections

Connection cables are required for transmitting data/ pulses (e.g. "v"/ "n" pulses, electronically triggered special equipment etc.)

Safety precautions



Important

Read the vehicle manufacturer's instructions before modifying the electrical system.

Disconnecting the vehicle battery can have undesired "side effects" such as deleting:

- the radio's security code
- engine control data (error memory) or
- parameters for intelligent vehicle diagnosis systems.

When disconnecting the battery terminals, make sure that:

- you switch off all electrical consumers first and
- disconnect the negative battery terminal before the positive battery terminal.

Running pulse cables



Important

When running and connecting the sensor cable ensure that:

- the sensor cable is run in front of the hinging point on vehicles with tiltable cabs
- the sensor cable is not run close to those parts of the vehicle that can damage it, such as the exhaust etc.

- Place the new pulse cable next to the existing pulse cable.
- Remove the existing cable, if possible. Otherwise make sure it is “no longer live”.

3.1.2 Installing and sealing the Eaton generator

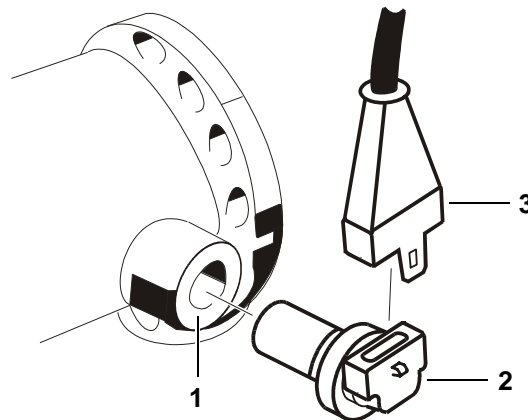


Fig. 3-1: Eaton generator type 4302691: Example of installation

- | | |
|----------------------------------|---------------|
| 1 Gearbox output | 3 Pulse cable |
| 2 Eaton generator (type 4302691) | |

- 1 **Unscrew the existing pulse generator connected to the gearbox output (1).**
- 2 **Screw the correct Eaton generator type (2) on or into the gearbox output.**
Observe the maximum torque of 50 ± 10 Nm.
- 3 **Connect the pulse cable (3) with the Eaton generator and seal.**

Please refer to the manufacturer's (Eaton's) handbook for information or guidelines/ regulations for sealing.

Section 5

Third party units

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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Chapter 1

TVI Series 2400

1.1 Short product description

Operating elements

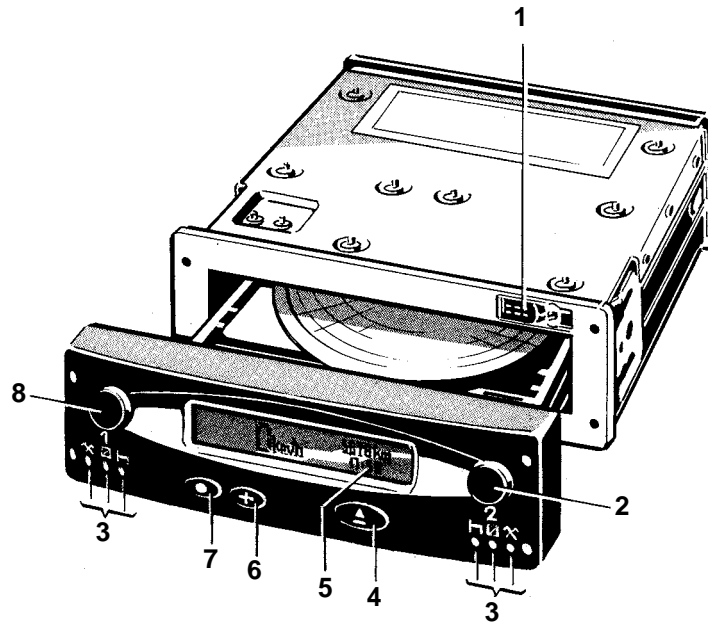


Fig. 1-1: TVI Series 2400: Front view

- | | | | |
|---|-------------------------|---|-------------------------|
| 1 | Test interface | 5 | Display |
| 2 | Driver 2 time group key | 6 | Forward key |
| 3 | Time group display LED | 7 | Display mode key |
| 4 | Ejection button | 8 | Driver 1 time group key |

Opening the TVI unit

- 1 **Press the ejection button (4).**
Then all LED's will flash individually in turn (3) to start the unlocking procedure.
- 2 **Wait for the TVI unit to unlock.**
When three LED's (3) flash at the same time in blocks (left and right), this shows that the unlocking procedure is complete.
- 3 **Then press the front cover under the display (5) and open the unit.**

TVI test/ programming interface

The test/ programming interface (1) is located behind the front cover and can only be accessed when the TVI unit is open.

1.2 Commissioning/ programming

Commissioning



Important

TVI unit connection cables and connector assignment (Connectors A - D) correspond to those on the MTCO 1324 (see *Section 1 „MTCO 1324 EC“ Chapter 2.1.4 „Interface specification“*, from page 2-23 or *Table 3-2, Table 3-3*, from page 3-12).

The TVI unit's error codes correspond to the error codes listed for the MTCO 1324. You will find further information on error codes in *Section 1 „MTCO 1324 EC“ Table 6-1, Table 6-2*, from page 6-6.

Programming the TVI unit

The following TVI data prescribed by law can be programmed with the SDS:

- v constant
- n constant
- Wheel circumference
- Distance counter
- VIN
- Drive shaft PPR
- Initial installation (installation date)
- Calibration date
- Determining the characteristic coefficient “w” of the vehicle
- Activate KITAS
- Erase error memory.



Important

When selecting non-corresponding MTC menu items for the TVI unit, the function is not carried out and the cursor jumps back to the main menu.

1.3 Test instructions

Testing equipment required

The following service diagnosis systems are needed to check, set parameters for and programme the unit:

- MTC / ATC software version 07.30 or later
- Programming cable:
 - Interface adapter 1602-78-170-00
 - TVI Service 2400 diagnosis cable 1602-78-175-00

The following service diagnosis systems are necessary to check the unit outside the vehicle:

- STC 1602-25
- KITAS sensor 2170-01000000

Test procedure

Except for drawing up the test chart the test procedure for the TVI unit is the same as the process described for the MTCO 1324 in *Section 1 „MTCO 1324 EC“, Chapter 5.1 „Overview of test workflow“,* from page 5-2.

Drawing up the test chart workflow overview

Drawing up the test chart

The test chart for the TVI unit can be drawn up while the unit is in the vehicle. Follow these instructions:

- Prepare the unit and tachograph charts
- Draw up test chart.

- 1 Unlock the TVI unit and open it completely.**
- 2 Insert a new, completely labelled tachograph chart.**



Important

Make sure that the diagnosis cable (1602-78-175-00) is disconnected before connecting the interface adapter (1602-78-170-00) to the TVI unit and if necessary disconnect it.

- 3 Connect the diagnosis cable to the test interface (1, Fig. 1-1) and close the TVI unit.**
- 4 Then, after one LED (3) has lit up for each driver, connect the diagnosis cable to the interface adapter (DIN connector).**



Important

Make sure that you do not start to draw up the test chart until the running control (the colon on the time display) flashes.

- 5 Delete the TVI unit error memory completely.**
- 6 Determine the characteristic coefficient “w” of the vehicle**
- 7 On the BTC run the “TEST CHART” program.**
For the program procedure see *Section 1 „MTCO 1324 EC”, Chapter 5.7.1 „Drawing up the test chart”,* from page 5-32.

Section 6

Appendix

**Technical Product Manual
MTCO EC/ NEC and TSU
Installation/ Fitting/ Checking**

Any changes will be notified by service information or circular.

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Summary of changes

Date	Chapter/page	Subject, change, measure

Notes

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Chapter 1

Test equipment and service diagnosis systems

1.1 Test equipment and SDS overview

1.1.1 Test equipment for tachographs

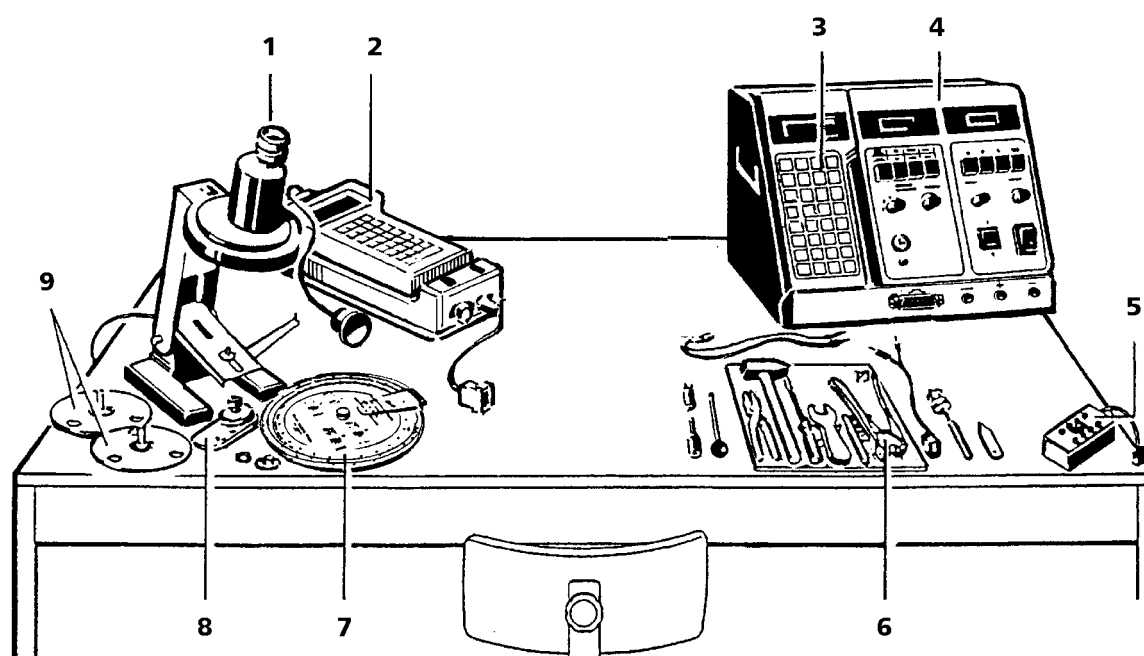


Fig. 1-1: Test equipment for tachographs

- | | |
|------------------------------------------|----------------------------------|
| 1 Chart analyser | 5 Test adapter |
| 2 MTC with clock mechanism test function | 6 Sealing pliers and tool |
| 3 Operation Test Computer | 7 Working time analysis chart |
| 4 Stationary Test Computer | 8 Test template |
| | 9 Test template support 1/7 days |

1.1.2 Test equipment for tachograph systems

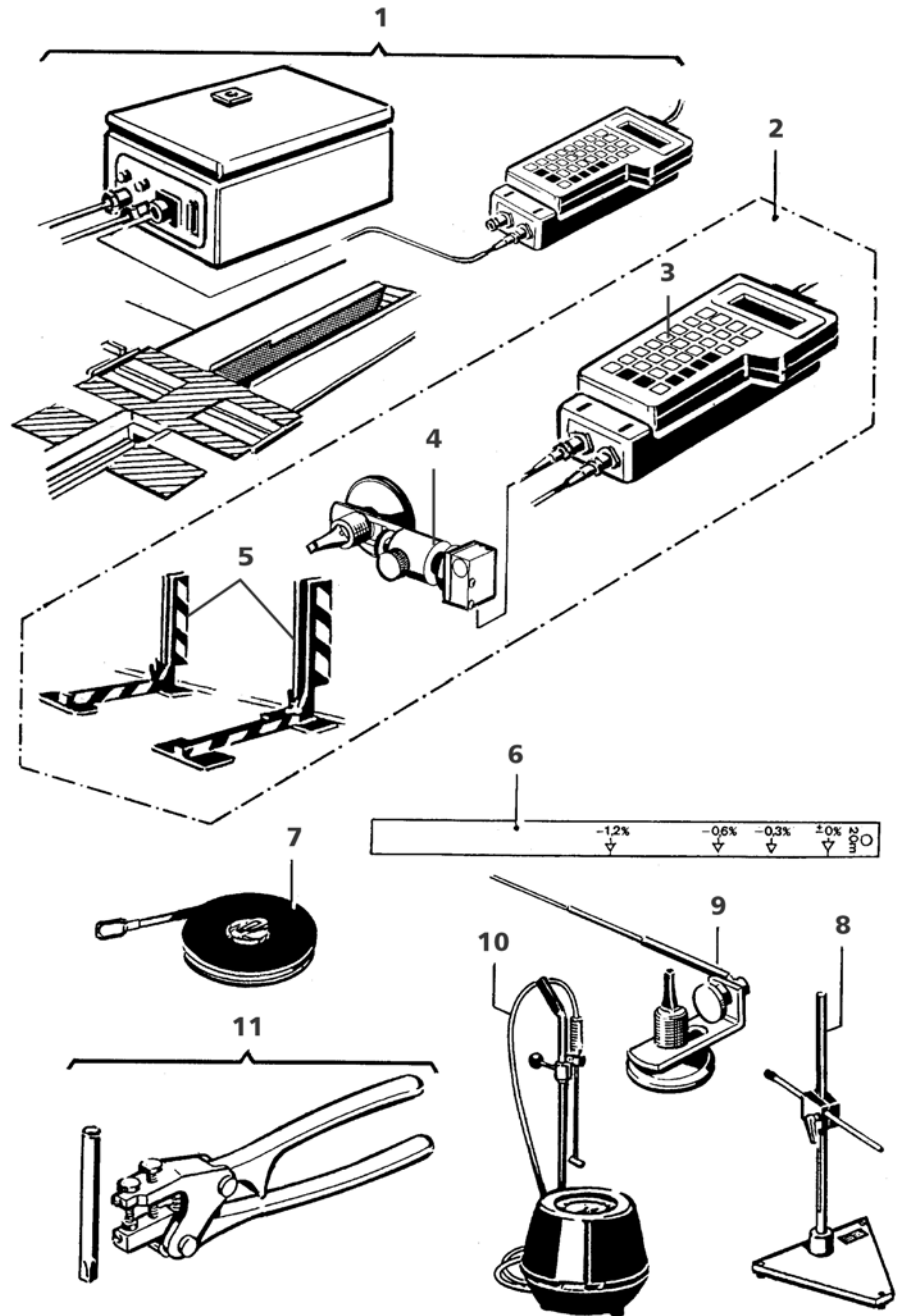


Fig. 1-2: Test equipment for tachograph systems

- | | |
|-------------------------------------|------------------------------------------------------------------------|
| 1 Rolling road test computer | 7 Measuring tape complying with local weights and measures regulations |
| 2 Mobile Test Computer, complete | 8 Wheel circumference gauge |
| 3 Mobile Test Computer | 9 Marking rod, complete |
| 4 Light barrier with clip, complete | 10 Calibrated tyre pressure testing unit |
| 5 Start/ Stop reflectors | 11 Sealing pliers and stamp |
| 6 Correcting measuring rod | |

1.2 Stationary Test Computer (STC)

The Stationary Test Computer (STC) is a diagnosis system with integral power supply and drive for stationary checking of tachographs and taximeters. The STC replaces the local weights and measures office test bench.

There are the following STC versions:

- STC Standard
- STC Automatic.

STC Standard

Test/ measuring functions

The STC standard (without BTC) is used for the following tests/ measurements:

- Counting revolutions or pulses emitted
- Determining tachograph constants
- Checking speed indicator
- Checking odometer
- Drawing up test chart.

Front of unit

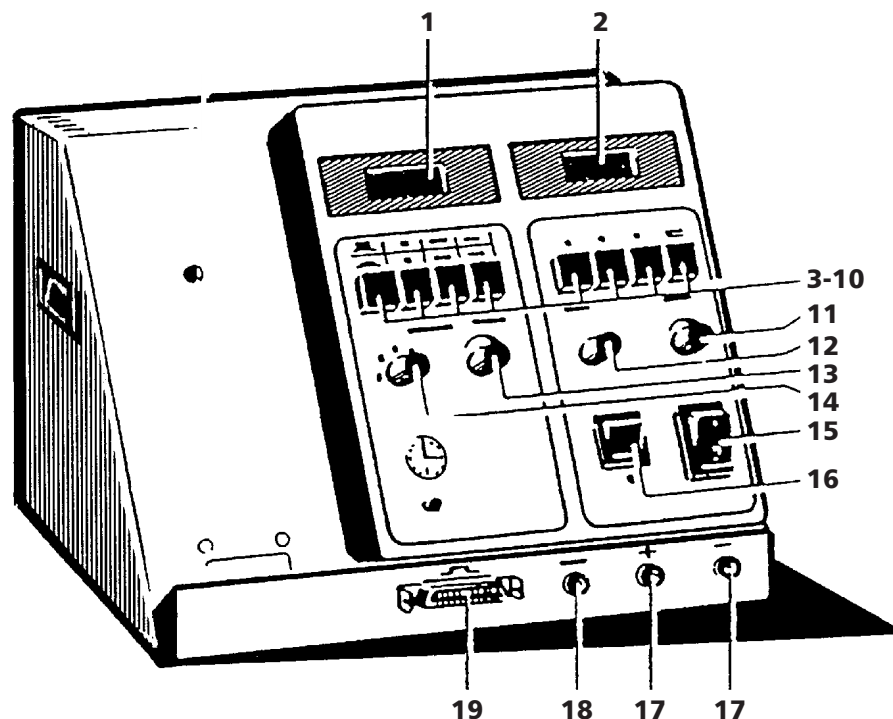


Fig. 1-3: Front of STC

- | | |
|--------------------------------------|---------------------------|
| 1 Display (measured value display) | 14 Function switch |
| 2 Display (voltage/ current display) | 15 Mains switch |
| 3 - 10 Function keys | 16 V/A switch for display |
| 11 Voltage regulator | 17 Plug for power pack |
| 12 Current regulator | 18 IO test plug |
| 13 "v/n" regulator | 19 "v/n" test plug |

Back of unit

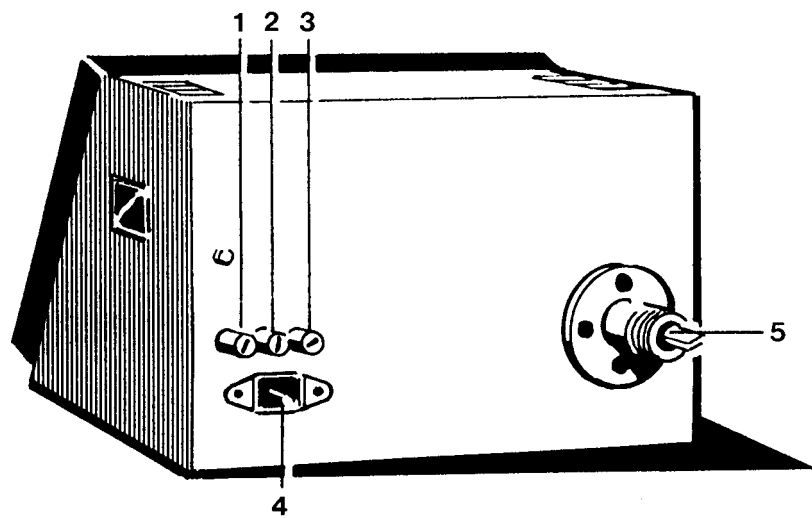


Fig. 1-4: Back of STC

- | | |
|----------------|---------------------------|
| 1 Fuse T 1.6 A | 4 Mains connection plug |
| 2 Fuse T 4 A | 5 Mechanical drive output |
| 3 Fuse F 6.3 A | |

Power pack functions

The integral power pack has the following functions:

- Fixed voltage source for 6, 12, 24 V
- Variable voltage source for approx. 3.0...30.0 V
- Variable current source for approx. 0.4...30.0 A
- Separate display (2, Fig. 1-3) of the voltage set or the amount of current the TCO is using.

Plug and socket connections

Depending on the test/ measurement required the corresponding test cables and/or adapters must be connected from the TCO to the STC using the plug connections.

Accessories

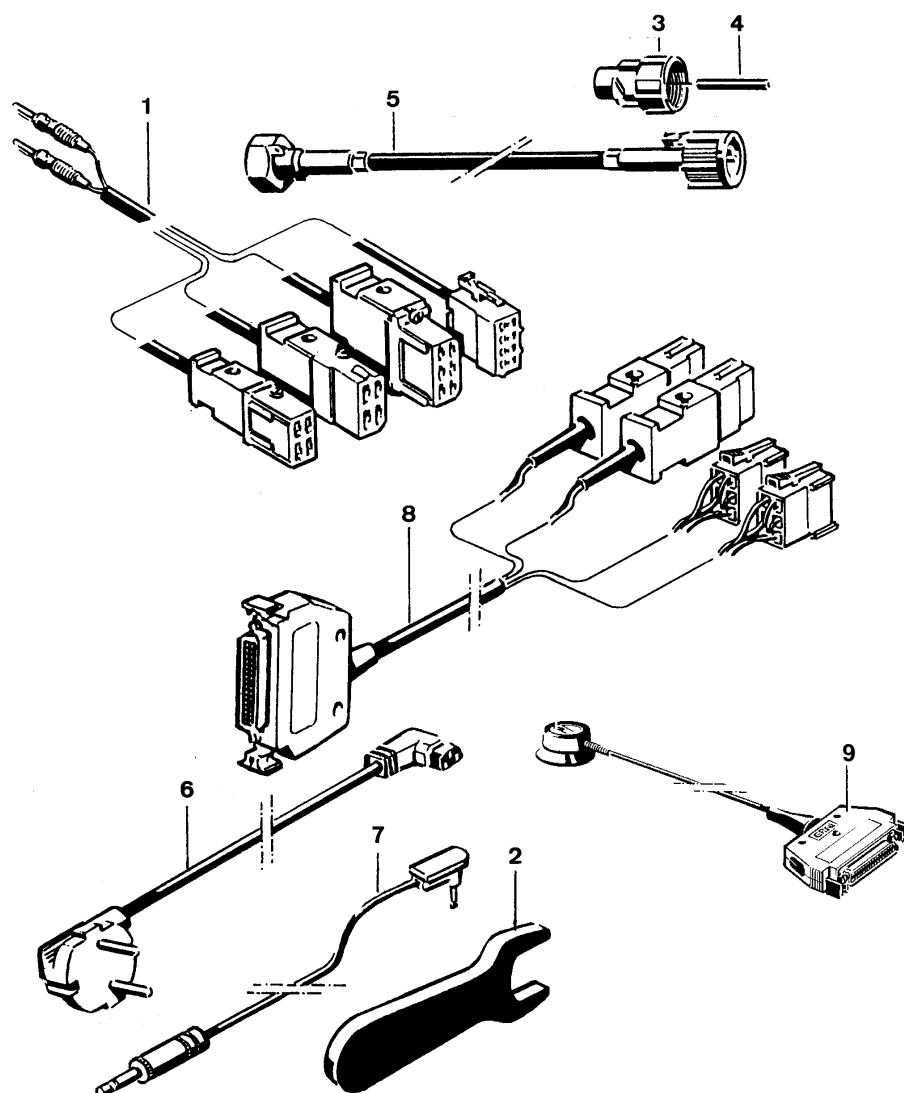


Fig. 1-5: STC accessories

- | | | | |
|---|-----------------------------|---|--------------------------------|
| 1 | Power supply cables | 5 | Drive shaft 1040 |
| 2 | Special 27 mm key | 6 | Power cable |
| 3 | Connection plug (M22 x 1.5) | 7 | IO cable with plug with handle |
| 4 | Adapter | 8 | „v/n“ cable |
| | | 9 | Test cable for clock test |

STC Automatic

Operation Test Computer

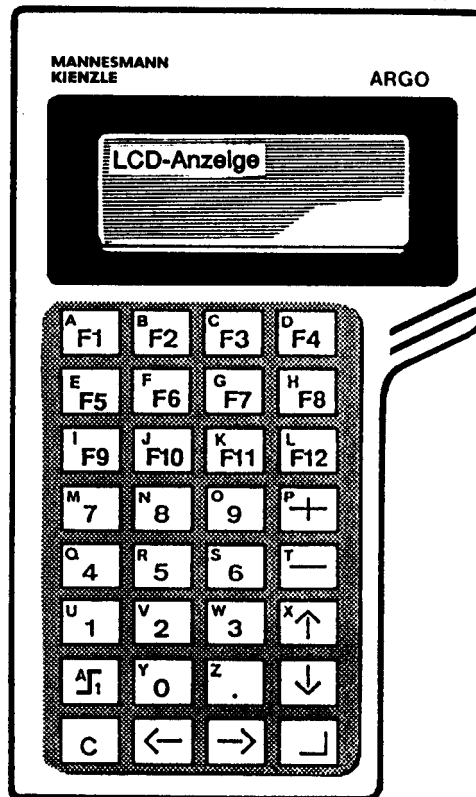


Fig. 1-6: Operation Test Computer (BTC)

Additional testing/ measuring functions with BTC

STC functions are extended when equipped with the BTC and the optical interface by:

- variable speed selection
- process controlled speed display check
- clock mechanism check
- semi-automatic odometer check
- automatic test chart creation
- programming the MTCO 1324 tachograph: Installation data.

1.3 Mobile Test Computer (MTC)

The Mobile Test Computer (MTC) is a diagnosis system for checking tachographs and taximeters in the vehicle.

The MTC includes the functions of the distance constant and revolution constant tester and replaces the automatic measuring track.

Test/ measuring functions

The following tests/ measurements can be carried out:

- Determining characteristic coefficients imp/km and revs/km
- Determining tachograph constants
- Checking pulse generator functions
- Determining rpm pulses
- Inherent error check/ drawing up test chart, clock check etc.
- Programming the MTCO 1324.

MTC components

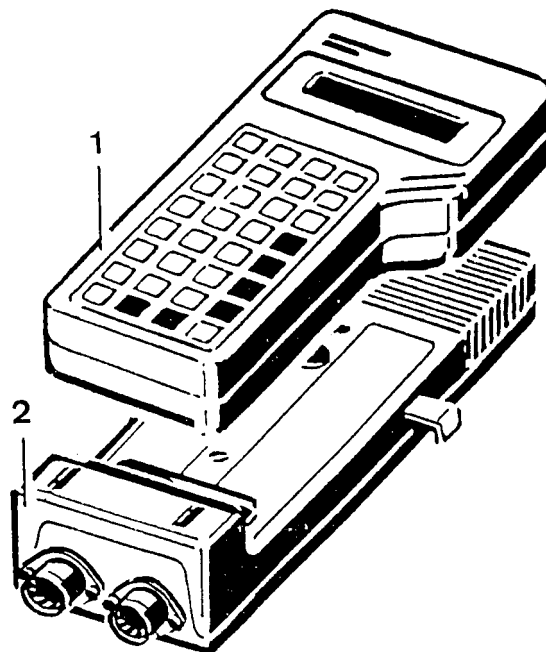


Fig. 1-7: Mobile Test Computer (BTC with MTC interface)

- 1 Operation Test Computer (BTC)
- 2 MTC interface

MTC interface functions

The interface (2) is a device that records measured values. Information is exchanged by means of the integral optical interface. It is the connection between the TCO and the BTC. The power supply comes from the vehicle's on-board electrical system.

MTC cable/ accessories for MTCO check

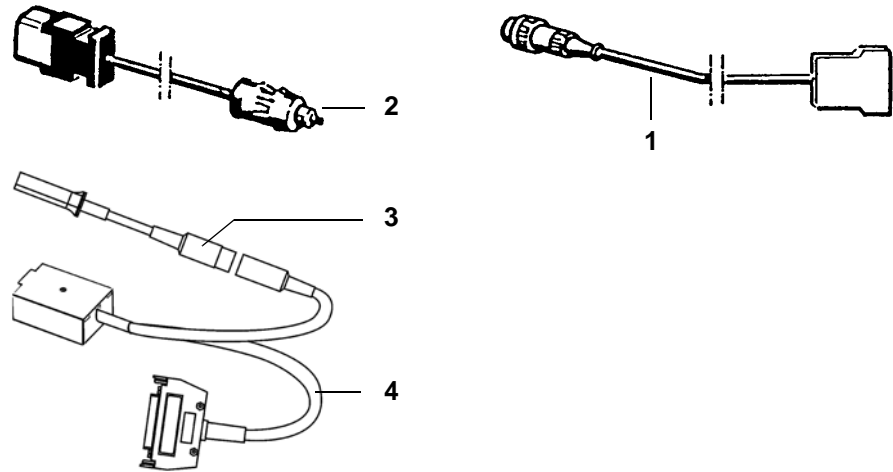


Fig. 1-8: MTC cable/ accessories

- | | |
|--------------------------------------|------------------------------|
| 1 Battery cable | 3 Diagnosis cable for MTCO |
| 2 Operating voltage connection cable | 4 Interface adapter for MTCO |

MTC accessories for „w“ adjustment

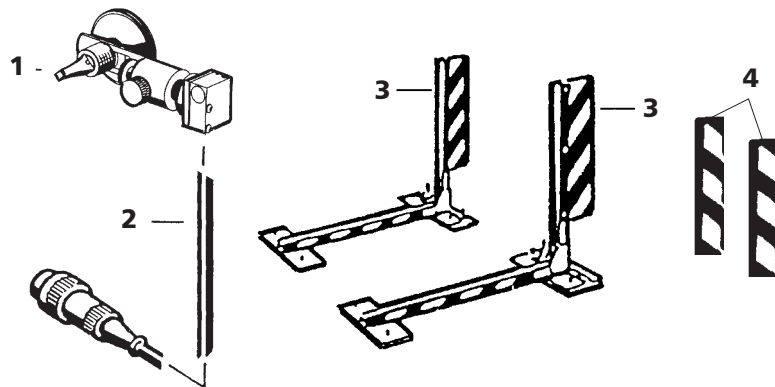


Fig. 1-9: Light barrier, connection cable and reflectors

- | | |
|--------------------|---------------------------|
| 1 Light barrier | 3 Reflectors (mobile) |
| 2 Connection cable | 4 Reflectors (stationary) |

Chapter 2

Sealing equipment and accessories order overview

2.1 Service Diagnosis Systems

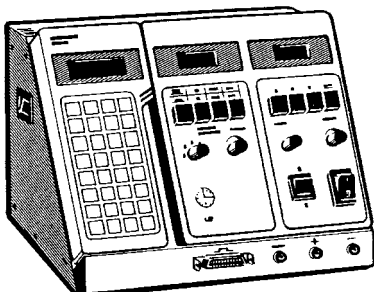
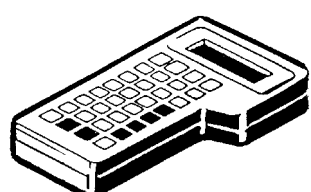
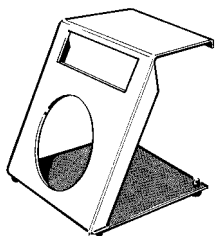
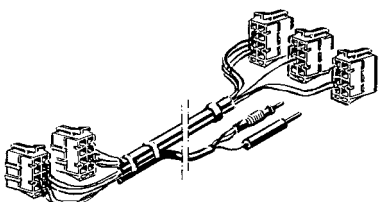
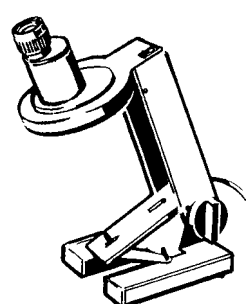
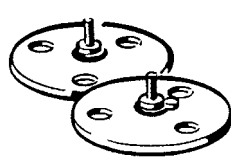

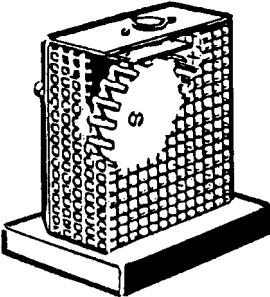
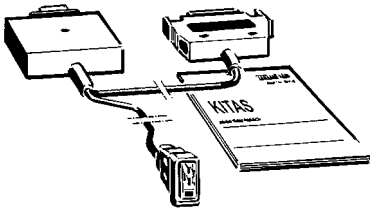
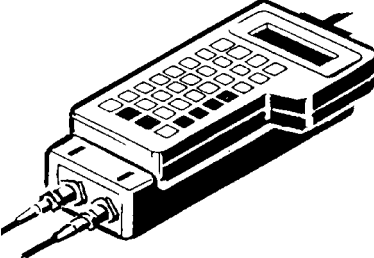
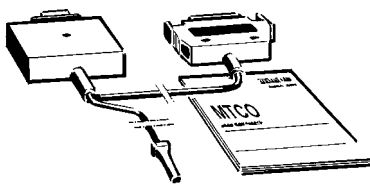
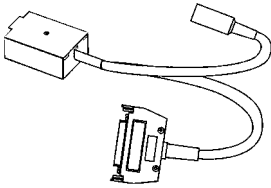
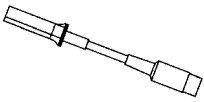
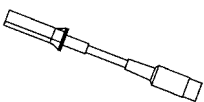
Figure	Designation	Application	Version	Order no.
	Stationary Test Computer STC (with clock check)	SDS check	Automatic	1601-25000010
		SDS check	Standard	1601-25001010
		SDS check	pre-equipped with interface with or without BTC	1601-25006010
	Operation Test Computer BTC version 07-xx	STC and MTC		1601-31-001-00
	MTCO tachograph mount	Checking MTCO Electronic Speedometer	complete	X12-160-125-102
	Connection cable MTCO Electronic Speedometer	Checking MTCO Electronic Speedometer STC	complete	X12-160-125-103
	Chart analyser	SDS check	complete with measuring microscope	1612-50530400
	Turntable	Test template	1 day	1999-7016-003-000
		Test template	7 day	1999-7016-002-000

Figure	Designation	Application	Version	Order no.
	Test template	Check	002	1999-7016-004-001
	Simulator	Checking integral pulse generator	complete	1604-00-000-00
	KITAS upgrade set	KITAS sensor check	complete	1602-89-905-00
	Mobile Test Computer MTC (with clock check) version 06.00	SDS check	Mobile	1602-04001050
			Stationary	1602-04002050
			without reflectors/ light barrier	1602-04000050
	MTCO upgrade set	Checking and programming MTCO error search	complete	1602-89-902-01
	Interface adapter	Checking and programming MTCO error search	Interface adapter	1602-78-170-00
	Diagnosis cable	Checking and programming MTCO error search	Diagnosis cable for MTCO	1602-78-171-00
	Diagnosis cable	Checking and programming TVI 2400 error search	Diagnosis cable for TVI 2400	1602-78-175-00

2 Sealing equipment and accessories order overview

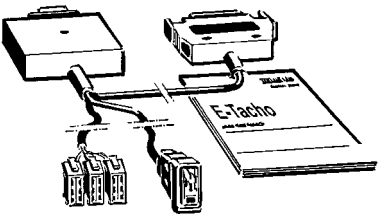
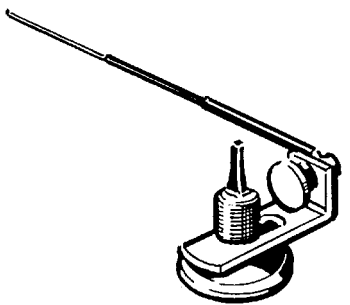
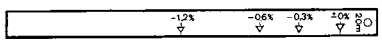
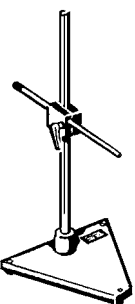
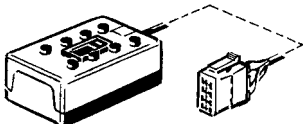
Figure	Designation	Application	Version	Order no.
	Upgrade kit for Electronic Speedometer „Stand-alone“	Checking and programming Electronic Speedometer	complete	1602-89-901-00
	Marker	MTC and HTC	complete	1602-16-100-00
	Correcting measuring rod	MTC and HTC		1999-9999-034-010
	Wheel circumference gauge	SDS check	complete	1602-11000000
	Test adapter	Test/ error search 1318	complete	1601-9900-001-000

Table 2-1: Service Diagnosis Systems

2.2 Special tools

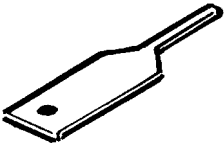
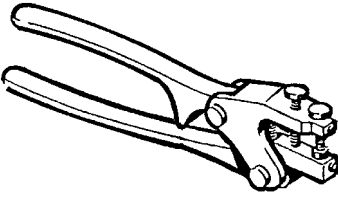

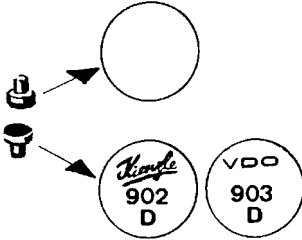
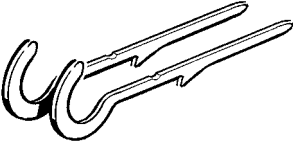
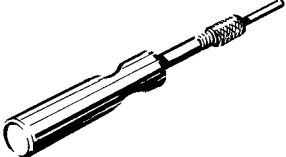
Figure	Designation	Application	Version	Order no.
	Mini timer disengaging tool	Mini timer electronic cable		1999-9999-058-000
	Sealing pliers	Sealing plastic seals	complete	X12-199-989-001
	Sealing stamp	Sealing adapter	complete (specify seal number when ordering)	1999-1213-001-06
	Sealing pliers/ insert for plastic seals	Sealing plastic seals	neutral	1999-1213-006-000
			Kienzle (specify seal number when ordering)	1999-1213-005-010
	Sealing pliers/ insert for lead seals	Sealing lead seals	neutral	1999-1213-002-000
			Kienzle (specify seal number when ordering)	1999-1213-002-020
	Special tools for MTCO	Removing the MTCO		1322-81-701-02
	Disengaging tool	- Armoured cable - KITAS cable	AMP	872070-1 AMP obtainable from specialist dealers

Table 2-2: Special tools

2.3 Service and accessories

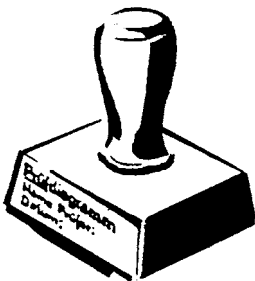
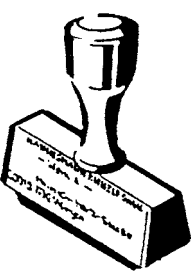

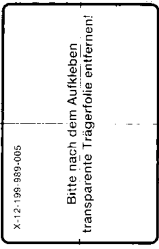
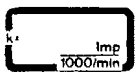
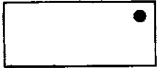
Figure	Designation	Application	Version	Order no.
	Test chart stamp	Test chart check	complete	3998-0100-141-000
	Company stamp (wood or plastic)	Installation label check	specify seal number when ordering	1999-9999-033-000
	Test certificate	Check	pack of 50	X12-199-989-008
	Sealing foil	Installation label (new)	pack of 50	X12-199-989-005
	Constant label (green)	RPM check	pack of 100	1310-0111-039-010
	Sealing label	v+n constant label	pack of 100	1310-0111-037-001



Figure	Designation	Application	Version	Order no.
	Two-hole seal (lead)	Sealing gear box	lead	HW52-001
	Two-hole seal (plastic)	Sealing gearbox	plastic	81-129-003
	Locking wire	Sealing two-hole seals	1 roll	X11-000-002-027

Table 2-3: Service and accessories

Chapter 3

Replacement parts

3.1 MTCO 1324 EC and 1390 NEC

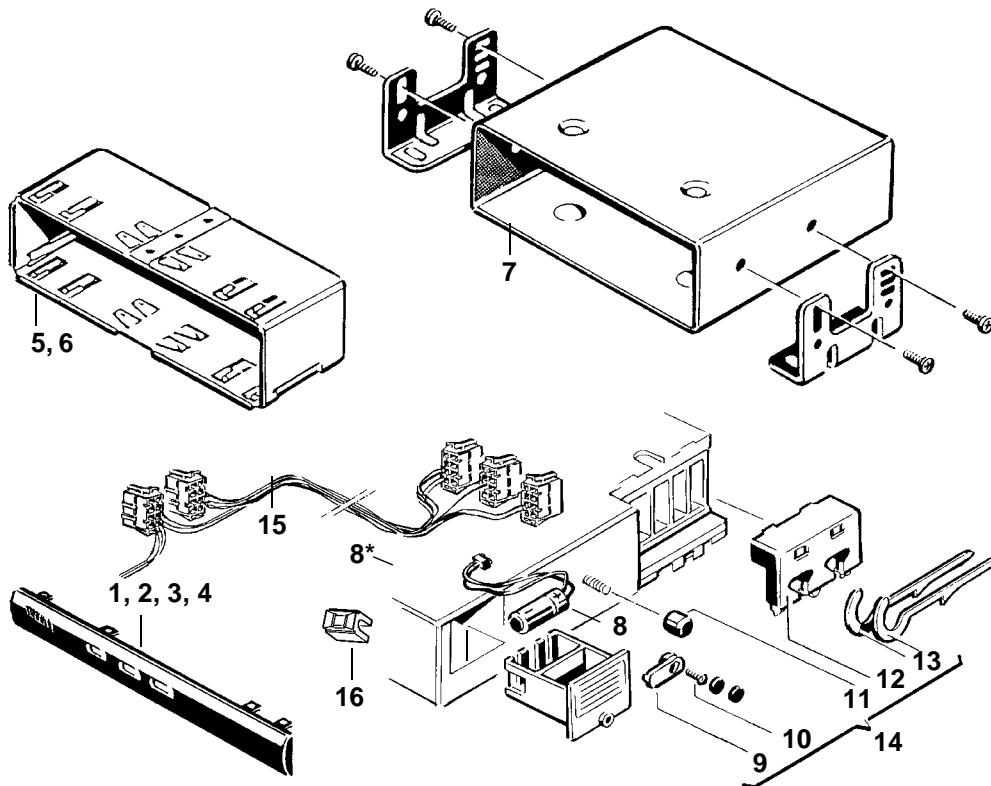


Fig. 3-1: MTCO 1324/ 1390: Fitting accessories

Item no.	Order no.	Designation
1	1322-33-011-00	Kienzle tray cover comp.
2	1324-33-012-00	IVEKA tray cover comp.
3	1322-84-223-02	Neutral tray cover comp.
4	1324-33-027-00	IVECO tray cover comp.
5	1324-90010005	Mounting frame (for upgrading with radio compartment)
6	1324-90010200	Atego DC mounting frame
7	X39-140-000-009	Mounting console (for upgrading without radio compartment)
8	HS53-1600-052	Buffer battery
8*	HS53-1600-049	Buffer battery for MTCO 1324 without NFU
9	1322-84-602-02	Seal plate
10	KN07-0139-047	Screw
11	1322-50-003-00	Cap
12	1324-90020200	Sealed connector hood
13	1322-81-701-02	Special tools

Item no.	Order no.	Designation
14	1324-90100101	Accessories (sealing set)
15	1324-90040001	MTCO/ Electronic Speedometer connection cable
16	1324-84-614-00	Tray stop (25 pieces/PU)

Table 3-1: MTCO 1324/ 1390: Fitting accessories

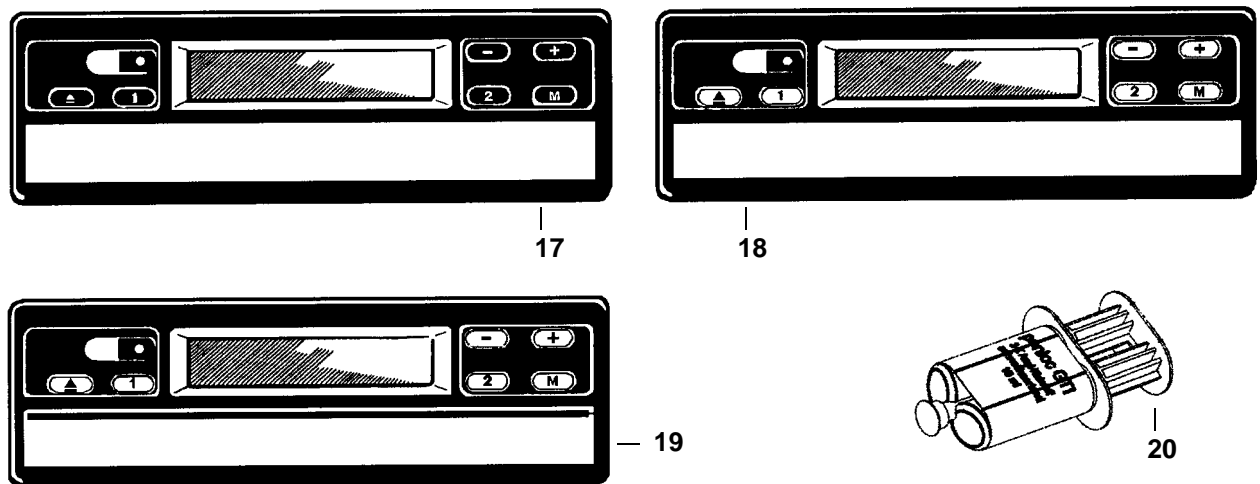


Fig. 3-2: MTCO 1324: Front cover for catching and sticking

Item no.	Order no.	Designation
17	1324-89-620-00	IS front cover complete, keys blk Illumination
18	1324-89-621-00	IS front cover complete, keys blu Illumination
19	1324-89-623-00	IS front cover complete, keys blu Illumination with seal
20	X11-140-000-155	PENLOC-Glue

Table 3-2: MTCO 1324: Front cover for catching and sticking

3 Replacement parts

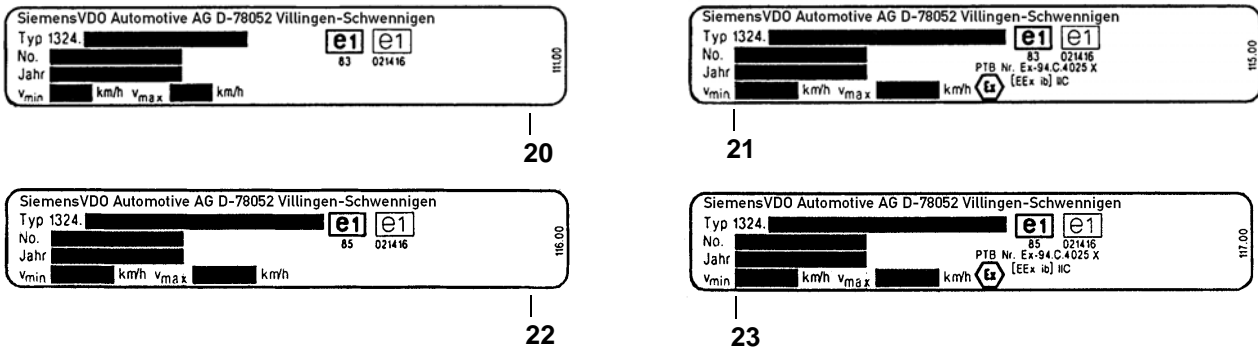


Fig. 3-3: MTCO 1324: Type plates

Item no.	Order no.	Designation
20	1324-50-111-01	MTCO 1324 type plate e1 83 EC, without RPM
21	1324-50-115-01	MTCO 1324 type plate e1 83 EC, ADR without RPM
22	1324-50-116-01	MTCO 1324 type plate e1 85 EC, with RPM
23	1324-50-117-01	MTCO 1324 type plate e1 85 EC, ADR with RPM

Table 3-3: MTCO 1324: Type plates

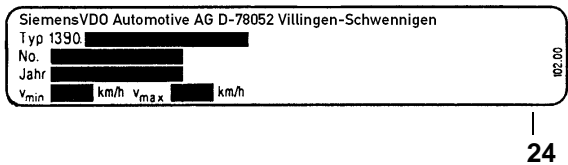


Fig. 3-4: MTCO 1390: Type plates

Item no.	Order no.	Designation
24	1390-50-102-01	MTCO 1390 type plate

Table 3-4: MTCO 1390: Type plates

3.2 TSU 1391

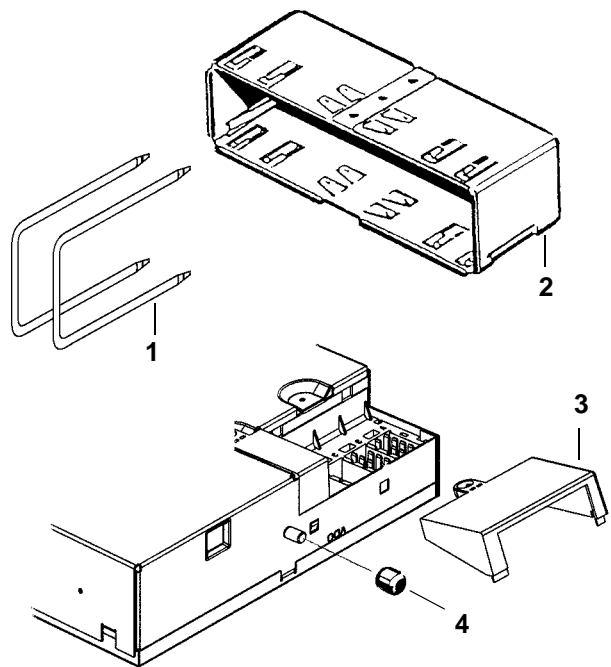


Fig. 3-5: TSU 1391: Fitting accessories

Item no.	Order no.	Designation
1	1380-90040000	Special tools (bracket)
2	1324-90010005	Mounting frame
3	1380-90050000	Connector hood
4	1324-90030300	Fixing cap

Table 3-5: TSU 1391: Fitting accessories

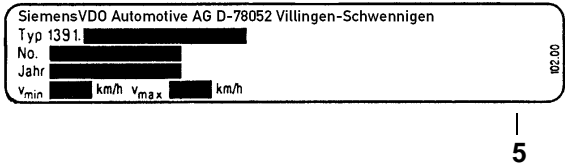


Fig. 3-6: TSU1391: Type plates

Item no.	Order no.	Designation
5	1391-50-102-00	TSU 1391 type plate

Table 3-6: TSU 1391: Type plates

3.3 Electronic Speedometer 1323

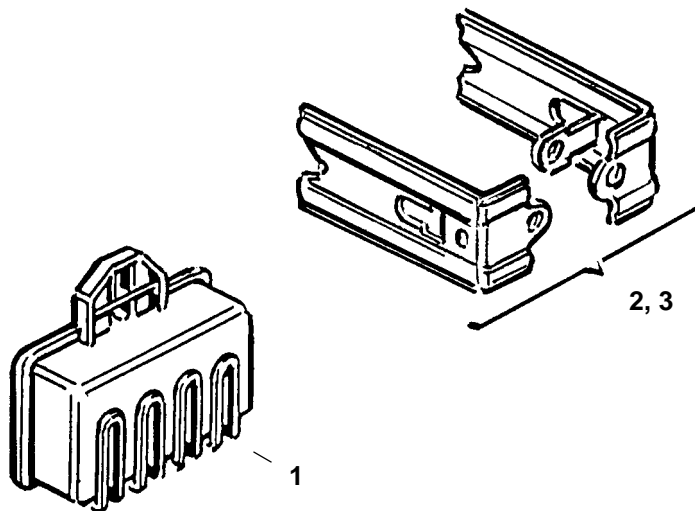


Fig. 3-7: Electronic Speedometer 1323: Accessories

Item no.	Order no.	Designation
1	1318-90025200	Sealed connector hood
2	1318-90031002	50 mm mounting bracket
3	1318-90031006	55 mm mounting bracket

Table 3-7: Electronic Speedometer 1323: Accessories

3.4 KITAS 2170/ 2171

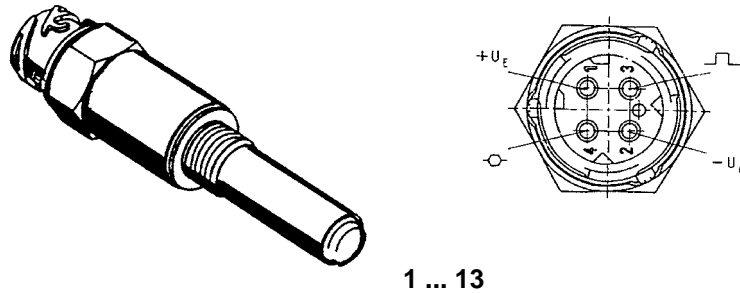
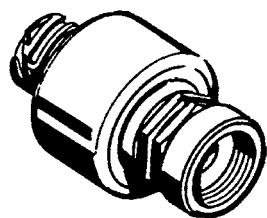


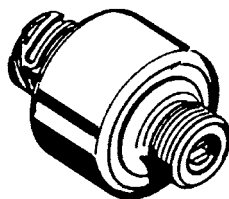
Fig. 3-8: KITAS sensor (integral version)

Item no.	Order no.	Designation
1	2170-20002100	KITAS pulse generator, L = 19.8 mm, with 1.2 mm washer
2	2170-20006100	KITAS pulse generator, L = 19.8 mm, with 1.8 mm washer
3	2170-20100300	KITAS pulse generator, L = 23.8 mm, without washer with O ring
4	2170-50002500	KITAS pulse generator, L = 35.0 mm, with 1.2 mm washer (eddy current brake)
5	2170-20000100	KITAS pulse generator, L = 25.0 mm, without washer
6	2170-20002300	KITAS pulse generator, L = 25.0 mm, with 1.2 mm washer
7	2170-20002500	KITAS pulse generator, L = 35.0 mm, with 1.2 mm washer
8	2170-20000200	KITAS pulse generator, L = 63.2 mm, without washer
9	2170-20002400	KITAS pulse generator, L = 63.2 mm, with 1.2 mm washer
10	2170-20002200	KITAS pulse generator, L = 90.0 mm, with 1.2 mm washer
11	2170-50002200	KITAS pulse generator, L = 90.0 mm, with 1.2 mm washer (eddy current brake)
12	2170-50002800	KITAS pulse generator, L = 115.0 mm, with 1.2 mm washer (eddy current brake)
13	2170-20002600	KITAS pulse generator, L = 136.8 mm, with 1.2 mm washer

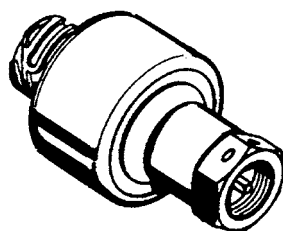
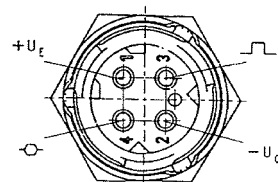
Table 3-8: KITAS sensor (integral version)



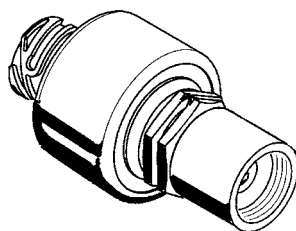
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Fig. 3-9: KITAS sensor (standard version)

Item no.	Order no.	Designation		
14	2170-01000000	KITAS pulse generator	internal thread	M 22 x 1.5 clockwise
15	2170-02000000	KITAS pulse generator	external thread	M 22 x 1.5 anti-clockwise
16	2170-03000000	KITAS pulse generator	internal thread	7/8"
17	2170-07010100	KITAS pulse generator	internal thread	M 18 x 1.5 clockwise 4 imp/revs
18	2170-08010000	KITAS pulse generator	internal thread	M 18 x 1.5 clockwise 8 imp/revs

Table 3-9: KITAS sensor (standard version)

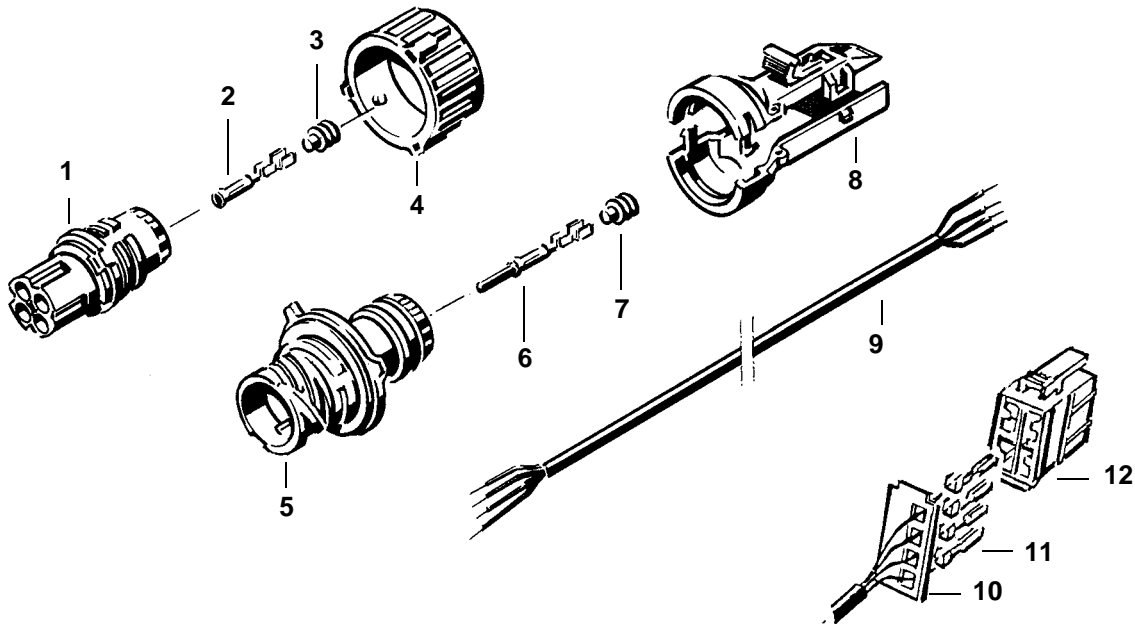


Fig. 3-10: Sensor cable (standard)

Item no.	Order no.	Designation
1	2159-8500-002-000	Plug housing 4 pin
2	HS53-6600-695	Plug contact (tin plated)
3	HS53-6600-698	Single wire seal
4	2159-8500-003-000	Bayonet nut
5	HS53-6600-696	Pin housing 4 pin
6	HS53-6600-694	Contact, Junior power timer 2.8
7	HS53-6600-703	Single wire seal
8	HS53-6600-787	Cap
9	KN05-5425-109	KITAS cable, twisted*
10	2159-8000-011-000	Template
11	HS53-6600-702	Contact, Junior power timer
12	HS53-6600-082	8 pin housing km/h
* supplied in 100 metre lengths		

Table 3-10: Sensor cable (standard)

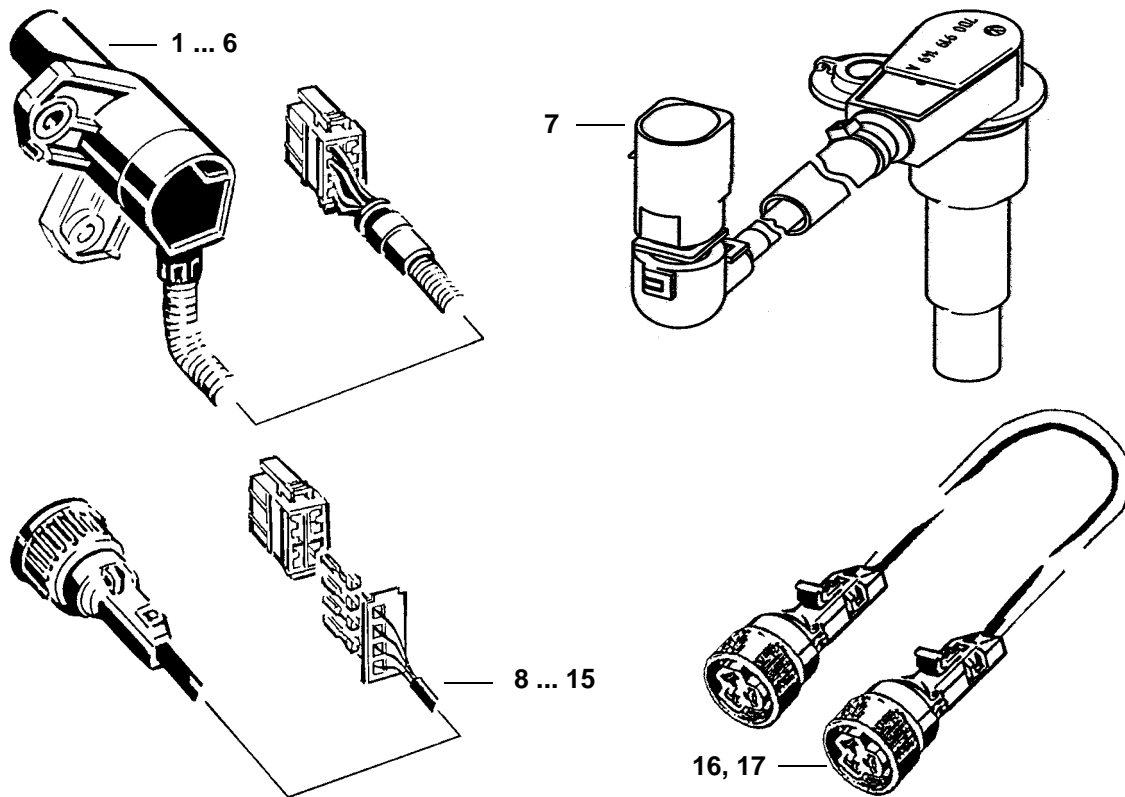


Fig. 3-11: KITAS sensor (vehicle specific)

Item no.	Order no.	Designation
1	2170-30210350	KITAS pulse generator, cable output 0° divider 1:1 L = 3.50 m
2	2170-30210385	KITAS pulse generator, cable output 0° divider 1:1 L = 3.85 m
3	2170-30240375	KITAS pulse generator, cable output 0° divider 4:1 L = 3.75 m
4	2170-30240410	KITAS pulse generator, cable output 0° divider 4:1 L = 4.10 m
5	2170-30610360	KITAS pulse generator, cable output 90° divider 1:1 L = 3.60 m
6	2170-30610395	KITAS pulse generator, cable output 90° divider 1:1 L = 3.95 m
7	2170-31010110	KITAS pulse generator, vehicle specific for VW T4
8	2170-80210420	KITAS cable for Nissan L = 4.2 m
9	2170-80650400	KITAS cable for Nissan L = 4.0 m
10	2170-80010280	KITAS standard cable L = 2.8 m
11	2170-80011500	KITAS standard cable L = 15.0 m
12	2170-80012000	KITAS standard cable L = 20.0 m
13	2170-80012200	KITAS standard cable L = 22.0 m
14	2170-80220280	KITAS standard cable L = 2.8 m offset 90°
15	2170-80010850	KITAS standard cable L = 8.5 m
16	X11-140-000-153	KITAS interface cable L = 11.0 m
17	X11-140-000-154	KITAS interface cable L = 13.0 m

Table 3-11:KITAS sensor (vehicle specific)

3.5 Pulse generator 2159

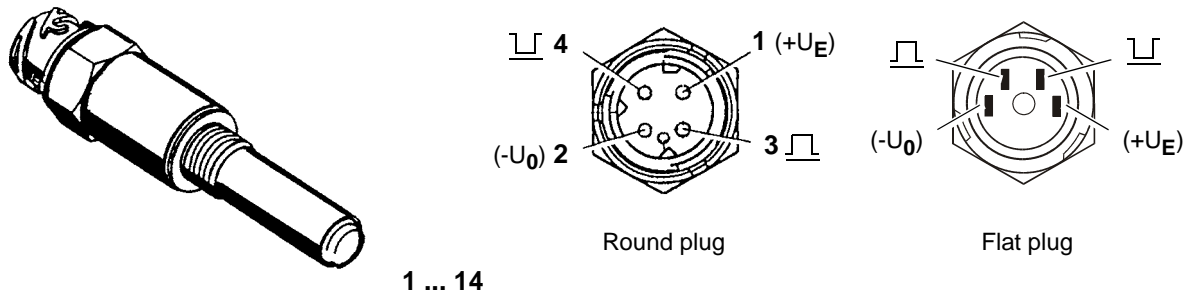
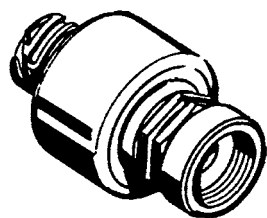


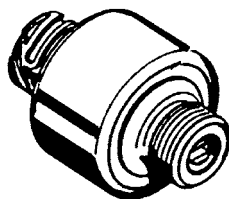
Fig. 3-12: Pulse generator 2159 (integral version)

Item no.	Order no.	Designation
1	2159-20002100	Pulse generator, L = 19.8 mm, with 1.2 mm washer, bayonet with flat plug
2	2159-20002300	Pulse generator, L = 25.0 mm, with 1.2 mm washer, bayonet with flat plug
3	2159-50004501	Pulse generator, L = 35.0 mm, with 1.2 mm washer, bayonet with flat plug
4	2159-50004401	Pulse generator, L = 63.2 mm, with 1.2 mm washer, bayonet with flat plug
5	2159-20002200	Pulse generator, L = 90.0 mm, with 1.2 mm washer, bayonet with flat plug
6	2159-20102200	Pulse generator, L = 90.0 mm, with 1.2 mm washer, bayonet Round plug
7	2159-20102100	Pulse generator, L = 19.8 mm, with 1.2 mm washer, bayonet Round plug
8	2159-20102300	Pulse generator, L = 25.0 mm, with 1.2 mm washer, bayonet Round plug
9	2159-20102500	Pulse generator, L = 35.0 mm, with 1.2 mm washer, bayonet Round plug
10	2159-20102400	Pulse generator, L = 63.2 mm, with 1.2 mm washer, bayonet Round plug
11	2159-20102800	Pulse generator, L = 115.0 mm, with 1.2 mm washer, bayonet Round plug
12	2159-20102600	Pulse generator, L = 136.8 mm, with 1.2 mm washer, bayonet Round plug
13	2159-20104100	Pulse generator, L = 19.8 mm, with 1.8 mm washer, bayonet Round plug
14	2159-20102200	Pulse generator, L = 90.0 mm, with 1.8 mm washer, bayonet Round plug

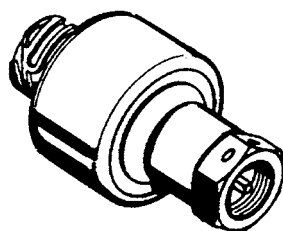
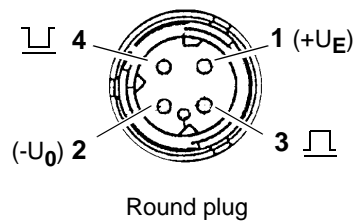
Table 3-12: Pulse generator 2159 (integral)



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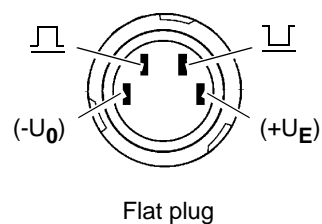


Fig. 3-13: Pulse generator 2159 (standard)

Item no.	Order no.	Designation
15	2159-01000000	Pulse generator internal thread M 22 x 1.5 clockwise
16	2159-02000000	Pulse generator external thread M 22 x 1.5 anti-clockwise
17	2159-03000000	Pulse generator internal thread 7/8"
18	2159-07010001	Pulse generator internal thread M 18 x 1.5 8 imp/revs

Table 3-13: Pulse generator 2159 (standard)

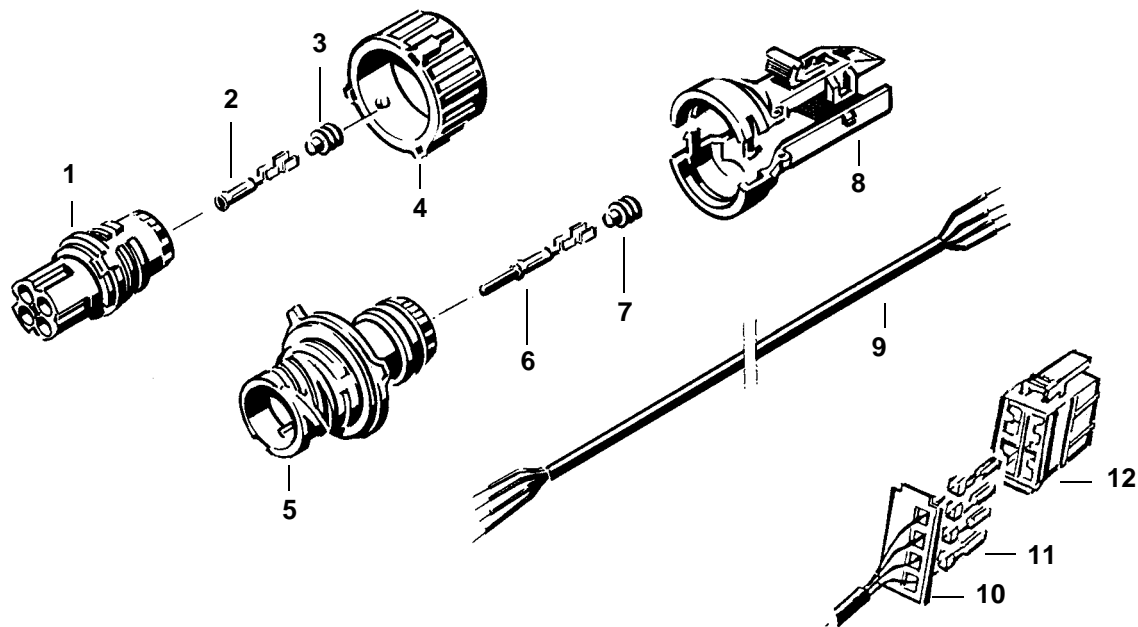


Fig. 3-14: Pulse cable (standard)

Item no.	Order no.	Designation
1	2159-8500-002-000	Plug housing 4 pin
2	HS53-6600-695	Plug contact (tin plated)
3	HS53-6600-698	Single wire seal
4	2159-8500-003-000	Bayonet nut
5	HS53-6600-696	Pin housing 4 pin
6	HS53-6600-694	Contact, Junior power timer 2.8
7	HS53-6600-703	Single wire seal
8	HS53-6600-787	Cap
9	KN05-5425-109	KITAS cable, twisted*
10	2159-8000-011-000	Template
11	HS53-6600-702	Contact, Junior power timer
12	HS53-6600-082	8 pin housing km/h
* supplied in 100 metre lengths		

Table 3-14:Pulse cable (standard)

