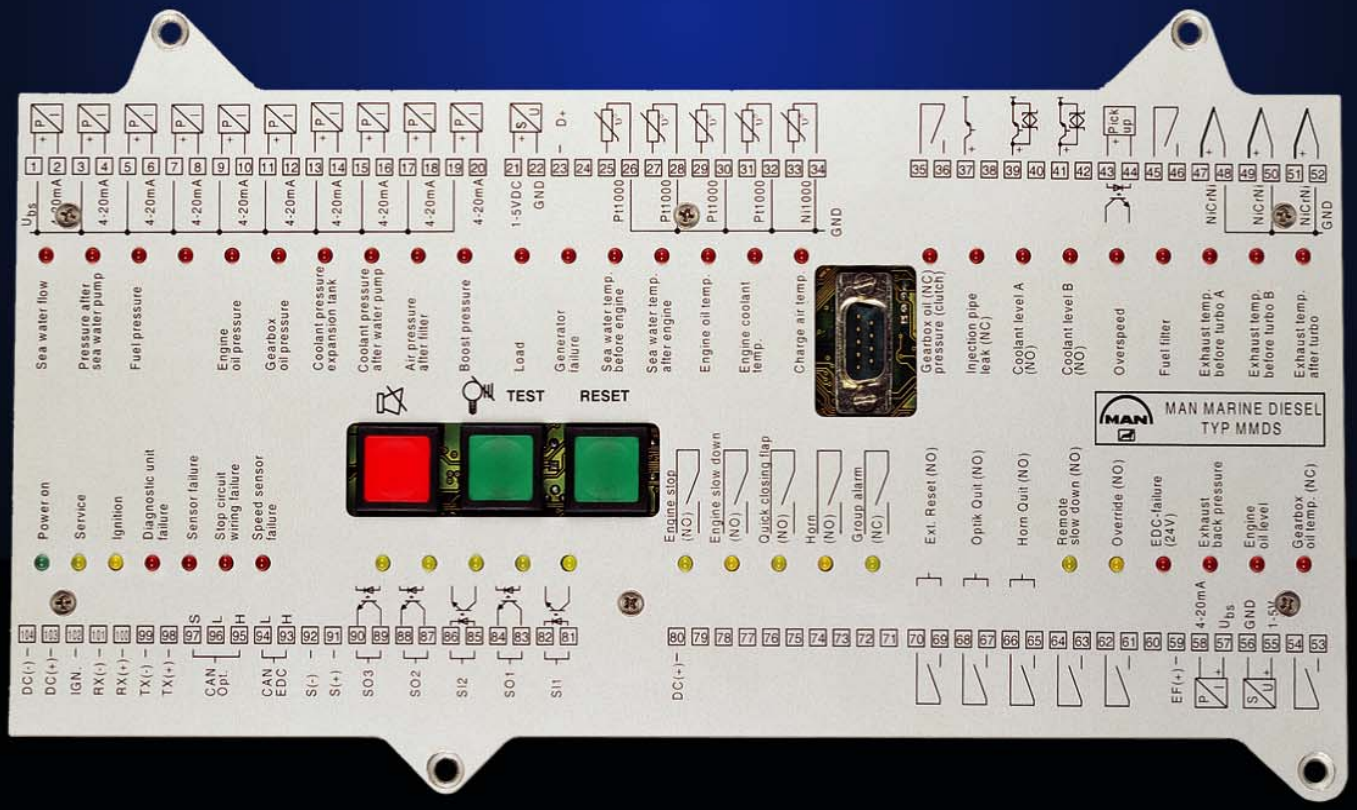
Technical information

MAN Monitoring and Diagnostic System (MMDS)

D 28 in-line and V marine engines with EDC
D 28 V marine engines with mechanical governor

Description, checking, interfaces



Dear Customer

This manual is intended to help you:

- Familiarize yourself with the components of the MAN Monitoring Diagnostic System (MMDS for short)
- Recognize the interaction of the individual MMDS components
- Install the system correctly in the ship
- Rectify faults and malfunctions

This manual must be read together with Publication 51.99598–8043 “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”.
This Publication was devised under the assumption that its readers will have the necessary basic knowledge of handling and working with marine engines and their electrical systems.

Best regards
MAN Nutzfahrzeuge Aktiengesellschaft
Nuremberg Plant

Since our products are in continuous development, we reserve the right to make technical modifications.

MTDA Technical status: 03.2002 51.99598–8054

Contents

Page

General

Important safety regulations are summarized in this quick-reference overview and arranged by topic to effectively convey the knowledge necessary to avoid accidents causing injury, damage or environmental hazard.
The engine operating manual contains further information.

Important:
Should an accident occur despite all precautionary measures, particularly one involving contact with corrosive acid, penetration of fuel under the skin, scalding by hot oil, antifreeze splashing into the eyes etc. **you must seek medical assistance immediately.**

1. Instructions for avoiding accidents likely to cause injury

Only authorized and qualified personnel are permitted to carry out inspection, adjustment and repair work

- Put gearbox of ship into neutral, if necessary unhinging gearshift lever (disconnect via remote control)

- Firmly secure units and assemblies on disassembly
- Only authorized personnel are permitted to start and operate the engine
- Do not stand too close to rotating parts while the engine is running
  Wear close–fitting working clothes

- Do not touch the engine with your bare hands while it is at normal operating temperature:
  risk of burning

- Keep area surrounding engine, ladders and stairways free of oil and grease. Accidents caused by slipping can have serious consequences
- Only work with tools which are in good condition. Damaged or expanded wrenches will slip: risk of injury!
- Persons must not stand under an engine suspended on a crane hook. Keep lifting gear in perfect condition

- Only open coolant circuit once the engine has cooled down. Follow the instructions given under “Care and Maintenance” in the Operating Manual exactly if it is not possible to avoid opening the coolant circuit with the engine at operating temperature.

- Do not retighten or open pipes and hoses (lube oil circuit, coolant circuit and if necessary downstream hydraulic fluid circuit): risk of injury by escaping fluids!

- Do not place hands under the fuel jet when checking injection nozzles. Do not inhale fuel mist
- Always disconnect battery when working on the electrical system
- Do not use rapid charger to start the engine. Rapid charging of batteries is only permitted with the positive and negative leads disconnected!
- Disconnect batteries only with the ignition turned off
- Follow the manufacturer's instructions for handling batteries.
  Caution:
  Battery acid is toxic and corrosive. Battery gasses are explosive

- Only use suitable measuring instruments to **measure voltages**! The minimum input resistance of a measuring instrument should be 10 MΩ
- Only disconnect or connect wiring harness plugs on electronic control units with the **ignition turned off!**

Disconnect batteries and connect the positive lead to the negative lead such that they are electrically conductive before carrying out any electric welding work. Earth the welding set as close to the weld as possible. Do not route cable of welding apparatus parallel to electric lines on board the ship.

Refer to the "Welders' Code of Practice" for further accident prevention measures.

- **For painting work** electronic components should only be exposed for brief periods to high temperatures (max. 95°C); at max. 85°C a period of approx. 2 hours is permitted, disconnect batteries

Limitation of liability for parts and accessories

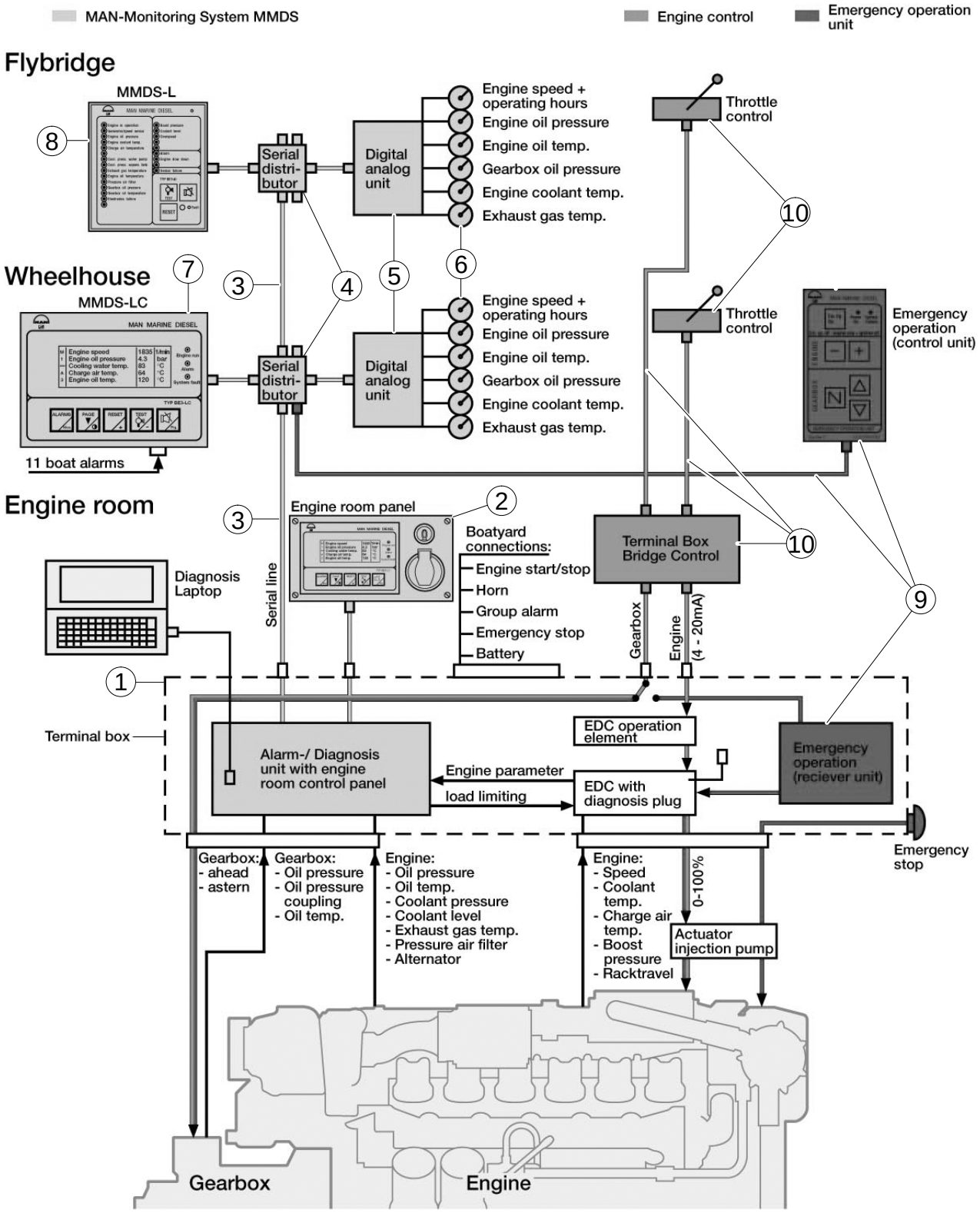
In your own interest, we strongly recommend you use only accessories and original MAN parts expressly approved by MAN for your MAN engine. The reliability, safety and suitability of these parts and accessories have been tested specially for MAN engines. Despite us keeping a constant eye on the market, we cannot assess and be held responsible for these properties in other products, even if they bear TÜV (German testing and inspection institute) approval or any other official approval in any particular case.

Laying up or storage

Special measures must be implemented in accordance with MAN Company Standard M 3069 Part 3 if engines are to be laid up or placed into storage for more than 3 months.

MMDS for engines with EDC

The engine monitoring and diagnostic system developed by MAN is called the “MAN Monitoring Diagnostic System” or “MMDS” for short. The following diagram shows a complete overview of the system.



The MMDS consists of the following components:

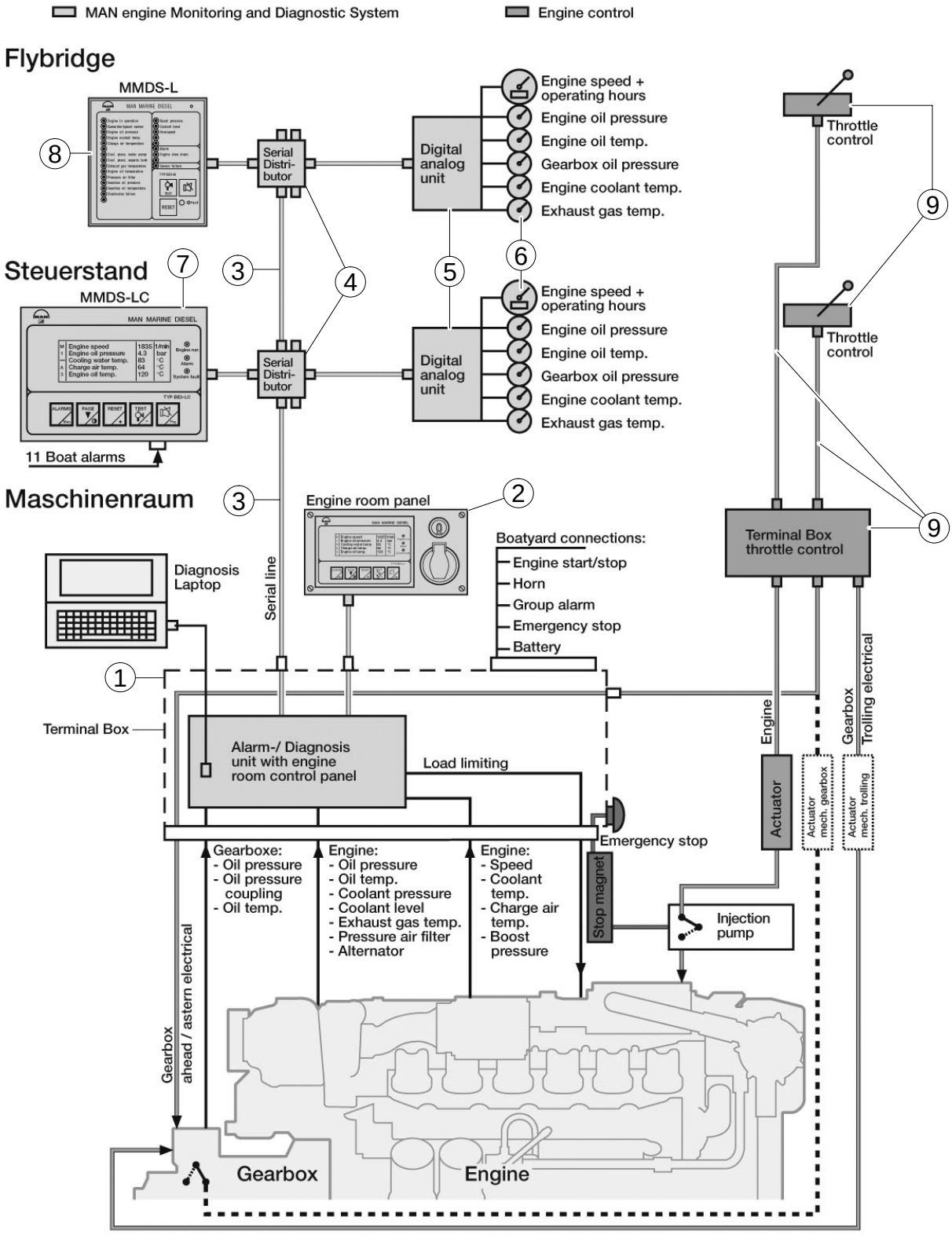
① Terminal box with
- – Diagnostic and monitoring unit
- – Emergency running unit receiver (EM-R, optional)
- – EDC control unit
- – Expanded EDC control box

② Engine room instrument with 5m cable, connectable to terminal box (optional)
③ Serial data line
④ Serial distribution box
⑤ Digital/analog converter for activating instrument dials with 4–20 mA input signal
⑥ Instrument dials for displaying current engine data
⑦ Display unit of MMDS-LC for displaying current engine operating data and alarm states on LCD display
⑧ Display unit with LEDs, MMDS-L for fault indication via LEDs
⑨ Emergency unit (option)
⑩ Engine speed and gearbox control

Note:
Components ① and ⑩ are partly described in the manual “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”.
There is however a detailed manual for component ⑩: “Throttle Lever Control”.
There is a separate manual for component ⑨: “Emergency Running Unit”.

MMDS for engines with mechanical governor

The engine monitoring and diagnostic system developed by MAN is called the “MAN Monitoring Diagnostic System” or “MMDS” for short. The following diagram shows a complete overview of the system.



The MMDS consists of the following components:

① Terminal box with
- – Diagnostic and monitoring unit
- – Emergency running unit receiver (EM-R, optional)
- – EDC control unit
- – Expanded EDC control box

② Engine room instrument with 5m cable, connectable to terminal box (optional)
③ Serial data line
④ Serial distribution box
⑤ Digital/analog converter for activating instrument dials with 4–20 mA input signal
⑥ Instrument dials for displaying current engine data
⑦ Display unit of MMDS-LC for displaying current engine operating data and alarm states on LCD display
⑧ Display unit with LEDs, MMDS-L for fault indication via LEDs
⑨ Engine speed and gearbox control

Note:
Component ① is partly described in the manual “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”.
There is however a detailed manual for component ⑨: “Throttle Lever Control”.

System properties and function

The MMDS is a modular monitoring and diagnostic system for diesel engines with electronically (EDC) and mechanically controlled diesel injection.
The following are stored in the central diagnostic unit in the terminal box:

– The last 50 alarms with history (1 hour before and 10 mins. after alarm) with date, time and all sensor measured values covering the entire engine status
– The last 8000 alarms with date, time, value, alarm duration
– Recording of the load profile (by recording the control rod travel and the EDC load signal) over the corresponding time period
– Collective load recording: recording of how many hours have been run at what engine speed in what load range.

This enables the customer to carry out more rapid troubleshooting and fault rectification. It also makes it considerably easier to identify the causes of faults and breakdowns.
The following devices are available for displaying the engine data:
– MMDS-LC (with LCD display, 5 lines)
– MMDS-L (with LEDs)
– Instrument dials
– Engine room instrument MMDS-EP
– Terminal box with diagnostic unit (to identify alarms from outside via LEDs)

The MMDS-LC and MMDS-L display units and the instrument dials are activated by means of a serial data bus and thus only one sensor is required for all bridges.

In EDC engines data communication takes places between MMDS and EDC. The MMDS obtains the required operating data values (boost pressure, charge–air temperature, control rod travel, coolant temperature, engine speed) directly from the EDC control unit. In mechanically controlled engines, corresponding sensors for these operating data are installed in the engine.

Further functions of the CAN bus:
– Speed reduction/engine shutdown in the event of critical operating values

Further system features:
– Online measurements during measurement operation
– Simultaneous startup of up to 3 engines with a laptop (automatic completion of the startup record)

Cabling

Serial data line:

The serial distribution box receives the engine and gearbox data from the terminal box via the serial data line and distributes these data to the MMDS-LC (or MMDS-L) and the D/A converter. The number of serial distribution boxes is dependent on the number of bridges. These distribution boxes are accommodated below the bridge.

The serial data line is available in 3 different lengths (15, 20 and 25 m). It is to be connected to the X2 plug in the terminal box and leads to the first serial distribution box. If a second distribution box is fitted, a further line must be laid from the first to the second. This can be repeated as many times as required.

MMDS-LC and MMDS-L display units: connected to the serial distribution box via a 3 m long cable (with plugs at both ends). These units are interchangeable. The MMDS-LC has a 5-line LCD display while the MMDS-L has LEDs.

A further 11 boat alarms can be read in and displayed on the MMDS-LC via a 5 m long cable with free strand ends (cable is fitted as standard). These alarms are programmed by special software.

MMDS–DA digital/analog converter and instrument dials:

If instrument dials activated with 4–20mA are fitted, this requires the upstream connection of a D/A converter (included as standard in the scope of delivery). This device is connected to the serial distribution box via a 3 m long connecting cable (with plugs at both ends). A further cable to the D/A converter (10-pin with open end) serves to connect the instrument dials.

Monitored variables

EDC engines	Mechanically controlled engines
EDC sensors (supplied to MMDS via CAN bus)	**Installed sensors for mechanically controlled engines**
– Engine speed	– Engine speed: Hall-HT
– Coolant temperature	– Coolant temperature: PT1000
– Charge-air temperature	– Charge–air temperature: Ni1000
– Boost pressure	– Boost pressure: 0–2.5 bar / 4–20 mA
– Fuel temperature	
– Control rod travel	
Following sensors / inputs are the same in EDC engines and mechanically controlled engines:	
– Engine oil pressure: 0–6 bar / 4–20 mA	
– Coolant pressure in expansion tank: 0–2.5 bar / 4–20 mA	
– Coolant pressure after water pump: 0–6 bar / 4–20 mA	
– Intake depression: –0.5 bar – +0.5 bar / 4–20 mA	
Other sensors:	
– Exhaust temperature: NiCrNi (for V engines: 2x)	
– Engine oil temperature: PT1000	
– Gearbox oil pressure: 0–25 bar / 4–20 mA	
Switch inputs:	
– Coolant level 2x (NO transistor, open-circuit monitoring)	
– Injection line leakage (NC transistor, level probe)	
– Gearbox oil temperature (option) (NC contact, opens in event of alarm)	
– Gearbox oil pressure (option) (NO contact, opens in event of pressure drop and issues alarm)	
Miscellaneous:	
– Generator charging voltage: terminal D+	
– External fuel filter (Racor, Separ with NO contact, shipyard scope of delivery)	

Sensors

The EDC sensors are connected via a separate EDC wiring harness to the EDC control unit and from there via the CAN bus to the diagnostic unit.

In mechanically controlled engines, these sensors (except for fuel temperature and control rod travel) are connected via the engine wiring harness to the diagnostic unit.

Sensors and switch inputs for gearbox

The sensors for the gearbox can be optionally connected and must be taken into account with the gearbox setting.

– Gearbox oil pressure (sensor with 4–20 mA corresponds to 0–25 bar)
– Gearbox oil pressure (NO switch input of clutch shift pressure, opens in event of pressure drop and issues alarm)
– Gearbox oil temperature (NC switch input, opens in event of alarm)

Further optional monitoring features

– Fuel prefilter (NO switch contact, closes in event of alarm)
– Injection line leakage (measuring probe with NO transistor, alarm when transistor conducts)

Note:
The sensors featured in this chapter are directly read into the MMDS.
Sensors for the EDC, which as an additional function also record measured values for the MMDS, are documented in the publication “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”.

V-engine

Intake depression sensor

Fig. 1

Item no. 51.27421–0124

Signal: 4–20 mA at (–0.5)–(+0.5) bar

Location: right side of engine, intake manifold

1

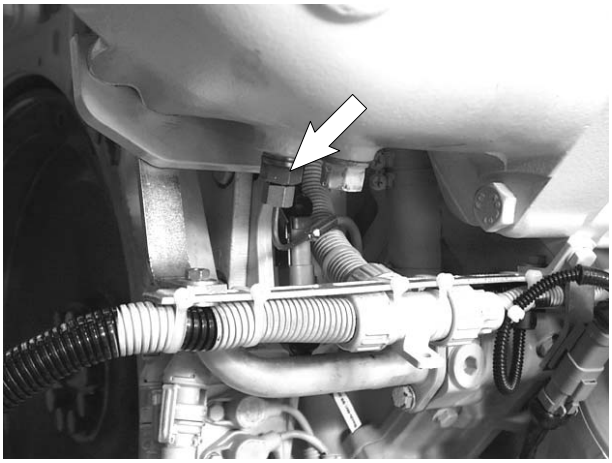
Exhaust temperature sensor before turbocharger

Fig. 2

Item no. 51.27421–0175

Signal: thermocouple, NiCrNi

Location: right side of engine, exhaust manifold before turbocharger


2

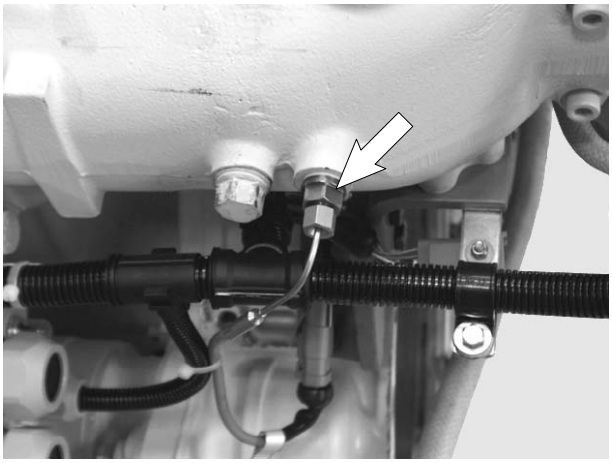
Exhaust temperature sensor before turbocharger

Fig. 3

Item no. 51.27421–0175

Signal: thermocouple, NiCrNi

Location: left side of engine, exhaust manifold before turbocharger


3

V-engine (engines with mechanical control only)

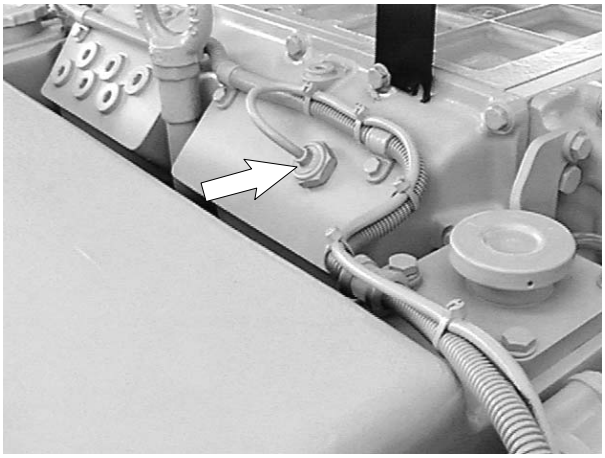
Charge–air temperature sensor

Fig. 1

Item no. 51.27421–0103

Signal: resistance measurement, Ni 1000

Location: charge–air manifold after intercooler, left side of engine



1

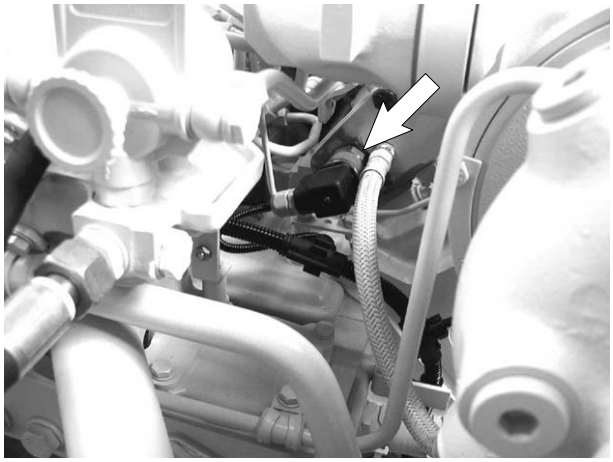
Boost pressure sensor

Fig. 2

Item no. 51.27421–0125

Signal: 4–20 mA at 0–2.5 bar

Location: flywheel side, near fuel feed



2

In-line engine

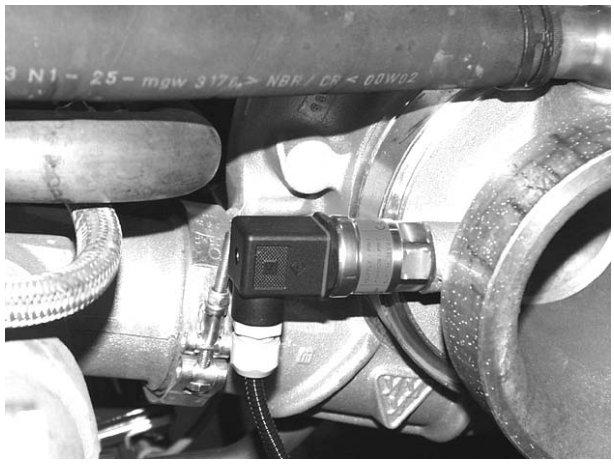
Intake depression sensor

Fig. 1

Item no. 51.27421–0124

Signal: 4–20 mA at (–0.5)–(+0.5) bar

Location: flywheel side, on intake fitting



1

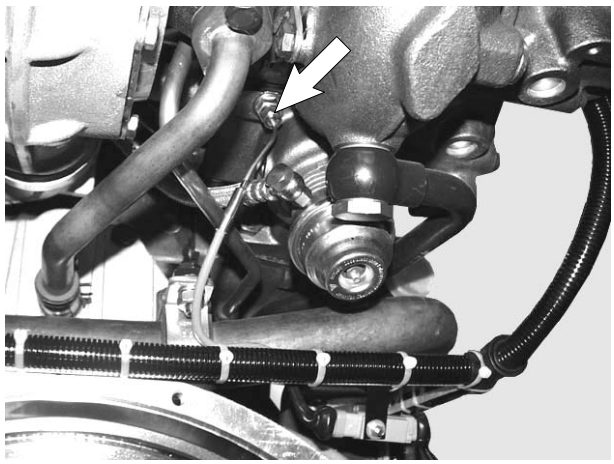
Exhaust temperature sensor before turbocharger

Fig. 2

Item no. 51.27421–0158

Signal: thermocouple, NiCrNi

Location: flywheel side, on turbocharger



2

Note:
The sensors featured in this chapter are only directly read into the MMDS.
Sensors for the EDC, which as an additional function also record measured values for the MMDS, are documented in the publication “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”.

V-engine

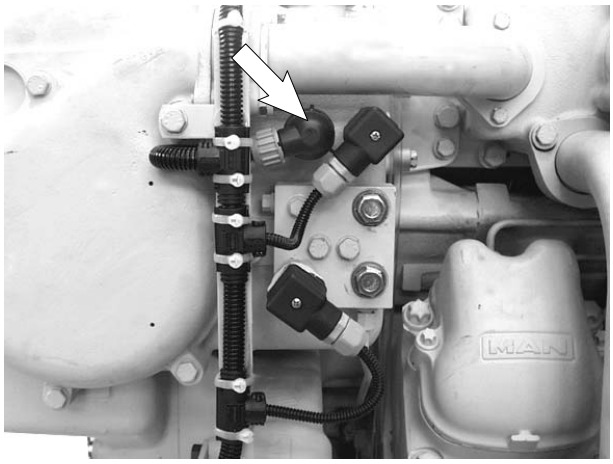
Coolant level sensor in expansion tank

Fig. 1

Item no. 51.27421–0116

Signal: NO transistor

Location: on both sides of expansion tank



1

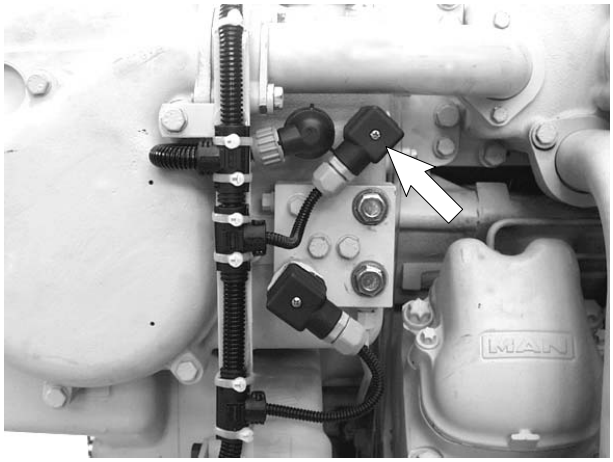
Coolant pressure sensor in expansion tank

Fig. 2

Item no. 51.27421–0125

Signal: 4–20 mA at 0–2.5 bar

Location: near expansion tank



2

Coolant pressure sensor after engine water pump

Fig. 3

Item no. 51.27421–0126

Signal: 4–20 mA at 0–6 bar

Location: coolant pipe before oil cooler

3

V-engine (engines with mechanical control only)

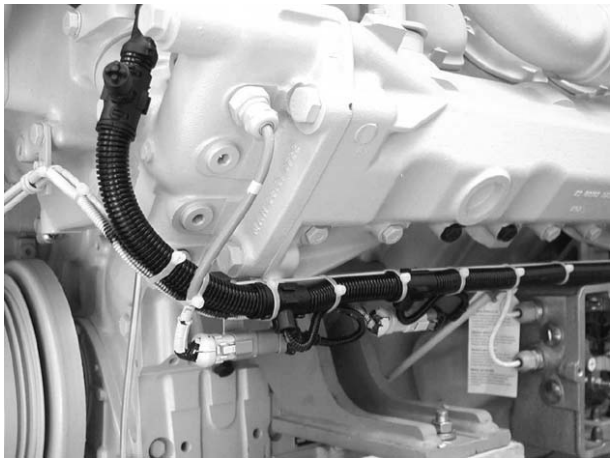
Coolant temperature sensor

Fig. 4

Item no. 51.27421–0150

Signal: resistance measurement PT 1000

Location: left side of engine



4

In-line engine

Coolant level sensor in expansion tank

Figs.1 and 2

Item no. 51.27421–0116

Signal: NO transistor

Location: on both sides of expansion tank

1

2

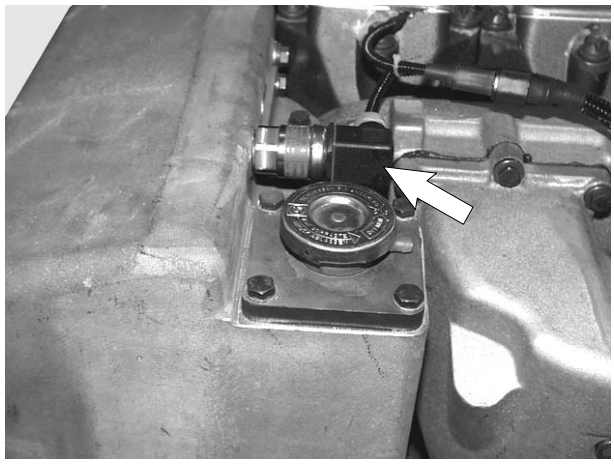
Coolant pressure sensor in expansion tank

Fig. 3

Item no. 51.27421–0125

Signal: 4–20 mA at 0–2.5 bar

Location: left side of engine, near expansion tank



3

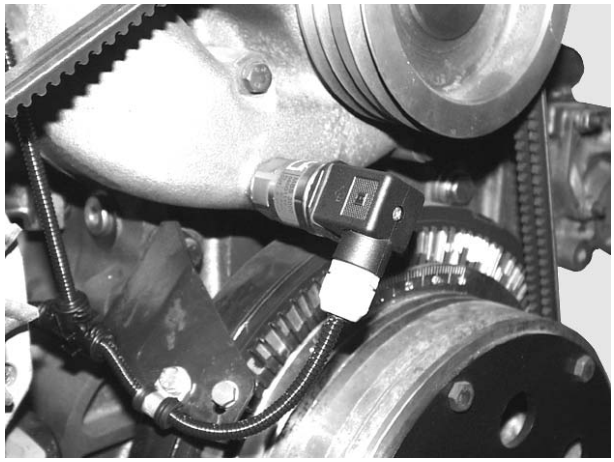
Coolant pressure sensor after engine water pump

Fig. 4

Item no. 51.27421–0126

Signal: 4–20 mA at 0–6 bar

Location: counter flywheel side, near water pump



4

V-engine

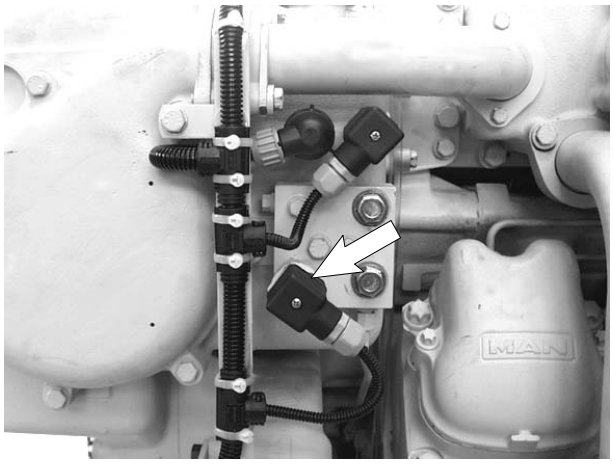
Oil pressure sensor

Fig. 1

Item no. 51.27421–0126

Signal: 4–20 mA at 0–6 bar

Location: left side of engine, near heat exchanger



1

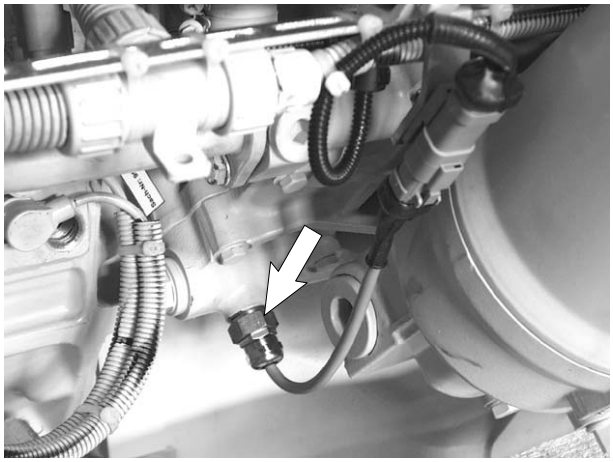
Oil temperature sensor

Fig. 2

Item no. 51.27421–0150

Signal: resistance measurement PT 1000

Location: right side of engine, on oil cooler



2

In-line engine

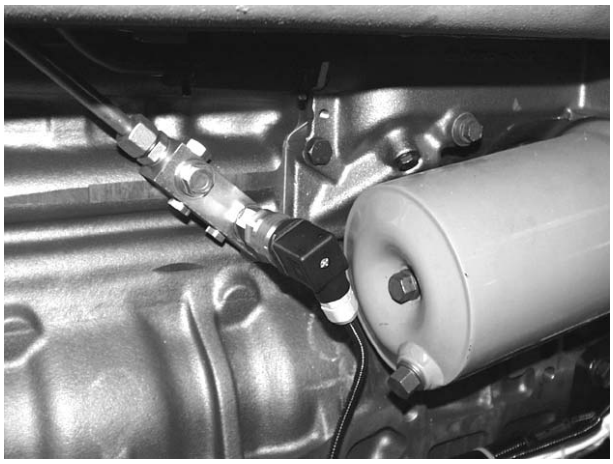
Oil pressure sensor

Fig. 3

Item no. 51.27421–0126

Signal: 4–20 mA at 0–6 bar

Location: right side of engine, near heat exchanger



3

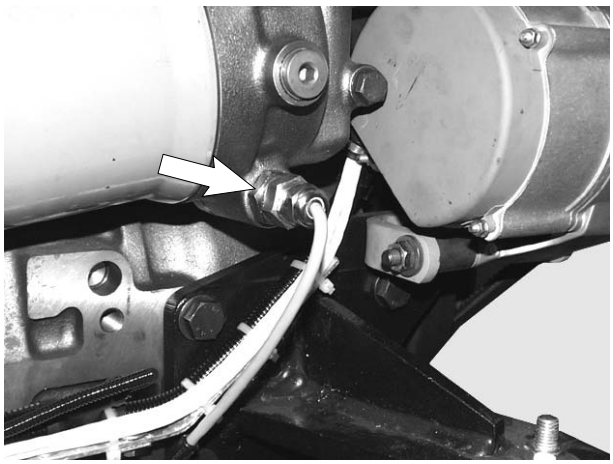
Oil temperature sensor

Fig. 4

Item no. 51.27421–0150

Signal: resistance measurement PT 1000

Location: right side of engine, on oil filter



4

V-engine (engines with mechanical control only)

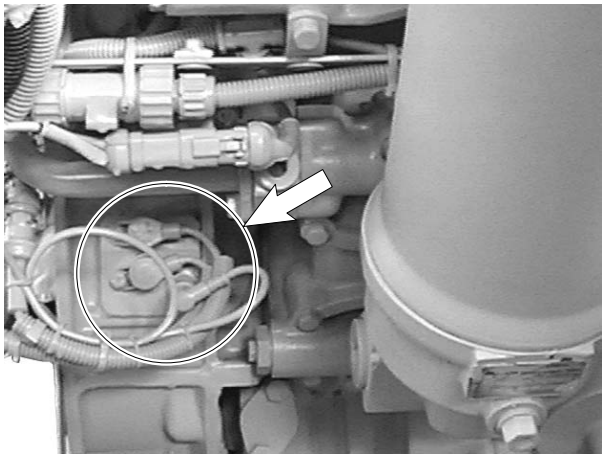
RPM sensor

Figs.1 and 2

Item no. 51.27120–0010

Signal: frequency 0–6 kHz

Location: flywheel housing, right side of engine

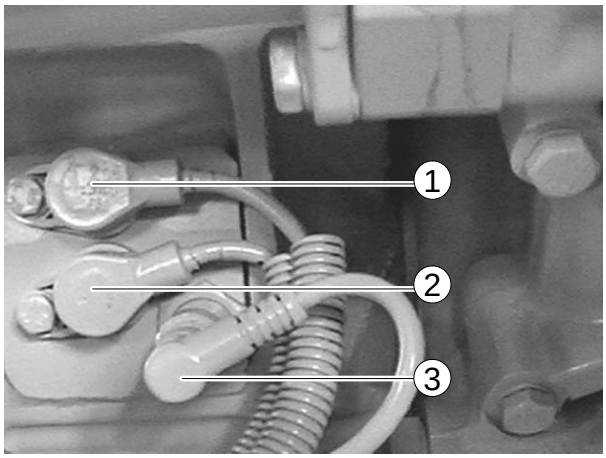


1

① EDC engines only, not fitted in engines with mechanical control

② EDC engines only, not fitted in engines with mechanical control

③ RPM sensor for MMDS diagnostic system



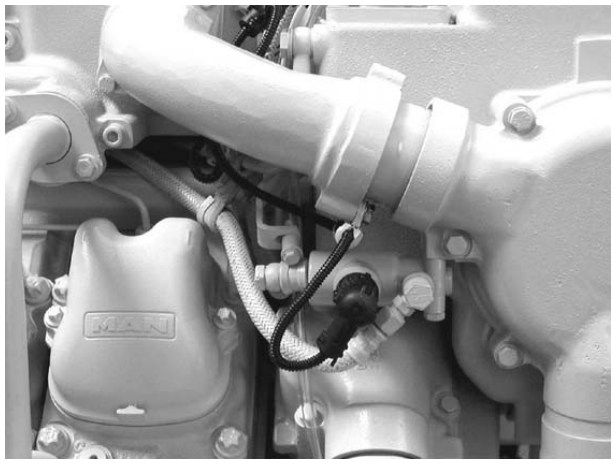
2

Sensor for RPM reduction

Fig. 3

Item no. 81.52160–6119

Location: right side of engine, to right of cylinder 4

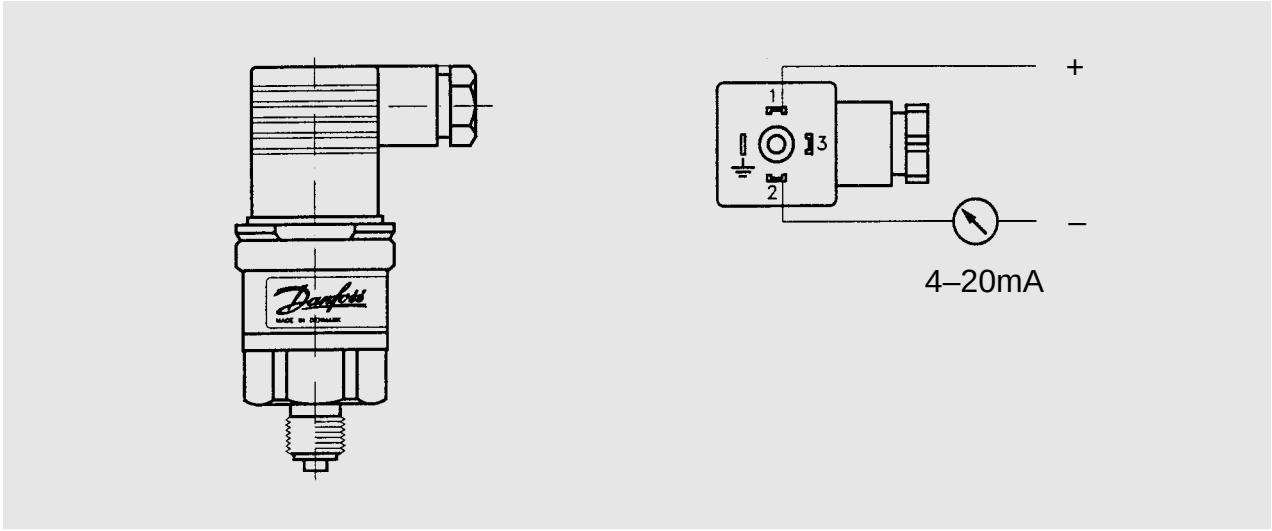


3

Sensors for pressure measurement

Pressure sensors with 4–20 mA current signal

The following drawing and measuring circuit for function testing apply to all 4–20mA sensors :



1 Supply +
2 Supply –
3 Not used
⏚ Connected to pressure transducer housing

Caution:
False poling of pressure sensors results in destruction of the input resistance (100Ω) of the MMDS.

Test:

A basic current of 4 mA must flow in the idle state. This must be tested with the above measuring circuit with an ammeter in the milliampere range. The plug must be attached to the sensor. It is easiest to interrupt the circuit to measure the current in the terminal box at the corresponding terminal of the diagnostic unit. If the corresponding current does not flow, the sensor is faulty or there is a wire breakage.

A correspondingly higher current flows when the sensor is subjected to load.
With the 0–6 bar oil pressure sensor, an oil pressure of 6 bar thus corresponds to 20 mA.

The sensor delivers 28 mA if it is subjected to a higher load, e.g. an oil pressure of 9 bar.
It can deliver a maximum of 32 mA; at 33 mA a fault rating is issued by the MMDS.

Overview of pressure sensors	
Item number	Pressure range
51.27421–0124	–0.5 – +0.5 bar
51.27421–0125	0 – 2.5 bar
51.27421–0126	0 – 6 bar
51.27421–0127	0 – 25 bar

Sensors for temperature measurement

PT1000 temperature sensor: 51.27421–0150

The PT1000 temperature sensor is a thermistor which changes it values as a result of different temperatures.

PT1000 thermistors are used for the following measuring points:

– Oil temperature (engine)
– Coolant temperature:
  – PT1000 element for mech. controlled engines
  – NTC thermistor for EDC engines, refer to manual “Electronically Controlled Diesel Injection in Conjunction with MAN Monitoring Diagnostic System (MMDS)”

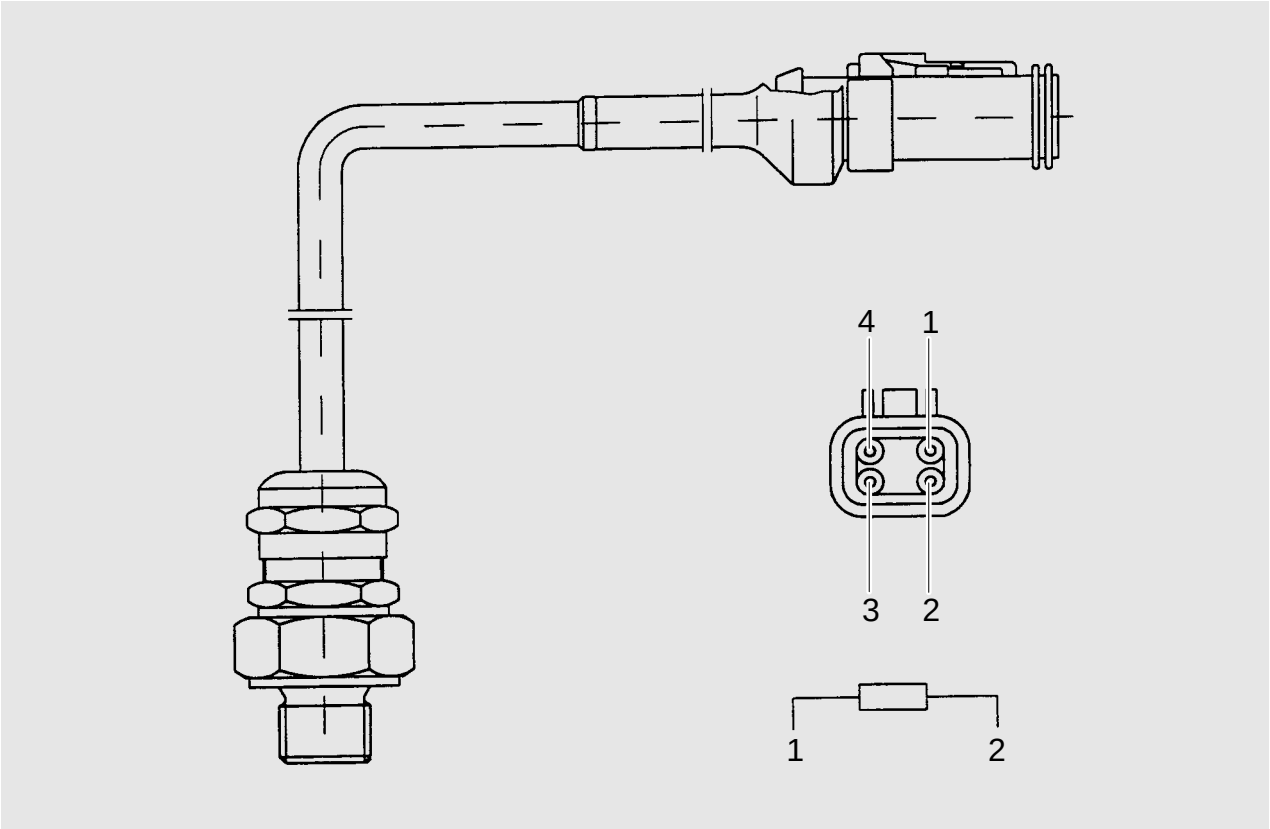
Test:

- Determine roughly the temperature of the medium to be measured,
- detach the plug next to the sensor or disconnect the wire at appropriate terminals in the terminal box,
- measure the resistance value of the PT1000 with an ohmmeter using the following table.

Terminals at MMDS:
– Engine oil temperature: 29, 30
– Coolant temperature: 31, 32 (not connected in EDC engines as signal via CAN bus)

Resistance of PT1000 coolant temperature sensor as function of temperature (Ω)										
°C	0	1	2	3	4	5	6	7	8	9
0	1,000	1,003	1,007	1,012	1,016	1,019	1,023	1,027	1,031	1,035
10	1,039	1,042	1,046	1,050	1,054	1,058	1,062	1,066	1,070	1,074
20	1,078	1,082	1,086	1,090	1,094	1,097	1,101	1,105	1,109	1,112
30	1,117	1,121	1,125	1,128	1,132	1,136	1,139	1,144	1,148	1,151
40	1,155	1,159	1,163	1,167	1,171	1,174	1,179	1,182	1,186	1,190
50	1,194	1,198	1,202	1,206	1,209	1,213	1,217	1,221	1,225	1,228
60	1,232	1,236	1,240	1,244	1,247	1,252	1,255	1,259	1,263	1,266
70	1,271	1,275	1,278	1,282	1,286	1,290	1,294	1,298	1,301	1,305
80	1,309	1,313	1,317	1,320	1,324	1,328	1,332	1,336	1,339	1,343
90	1,347	1,351	1,355	1,358	1,362	1,366	1,370	1,373	1,377	1,381
100	1,385	1,388	1,393	1,396	1,400	1,404	1,408	1,412	1,415	1,419
110	1,423	1,427	1,430	1,434	1,438	1,442	1,445	1,449	1,453	1,456
120	1,461	1,454	1,463	1,472	1,476	1,479	1,483	1,487	1,490	1,494
130	1,498	1,502	1,506	1,510	1,513	1,517	1,521	1,525	1,528	1,532
140	1,536	1,540	1,543	1,547	1,551	1,555	1,558	1,562	1,566	1,569

PT1000 temperature sensor and plug contact assignment



Ni1000 temperature sensor: 51.27421–0103

The Ni1000 temperature sensor is a thermistor.

Ni1000 thermistors are used to measure the charge–air temperature in mechanically controlled engines. The signal is sent via the CAN bus in EDC engines.

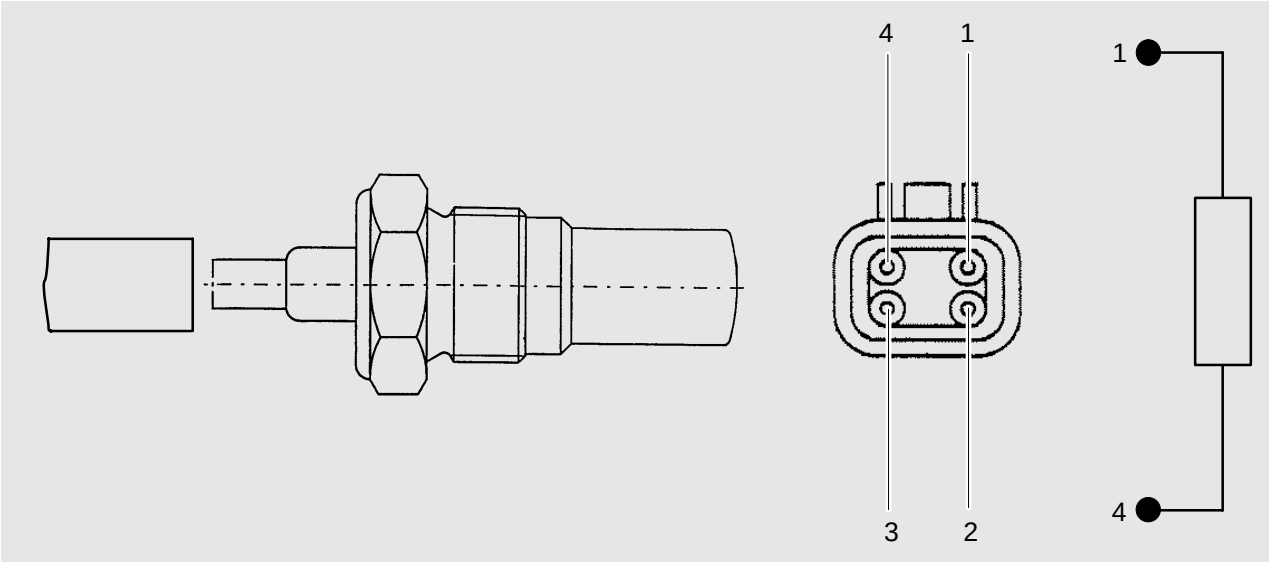
Test:

- Determine roughly the temperature of the medium to be measured,
- detach the plug next to the sensor or disconnect the wire at appropriate terminals in the terminal box,
- measure the resistance value of the Ni1000 with an ohmmeter using the following table.

Terminals at MMDS: Charge–air temperature: 33, 34

Resistance of charge–air temperature sensor as function of temperature (Ω)										
°C	0	1	2	3	4	5	6	7	8	9
0	1,000	1,005	1,011	1,017	1,022	1,028	1,033	1,039	1,044	1,050
10	1,056	1,061	1,067	1,072	1,078	1,084	1,089	1,095	1,101	1,107
20	1,112	1,118	1,124	1,130	1,135	1,141	1,147	1,153	1,159	1,165
30	1,171	1,176	1,182	1,188	1,194	1,200	1,206	1,212	1,218	1,224
40	1,230	1,236	1,242	1,248	1,254	1,260	1,267	1,273	1,279	1,285
50	1,291	1,297	1,303	1,310	1,316	1,322	1,328	1,335	1,341	1,347
60	1,335	1,360	1,366	1,372	1,379	1,385	1,392	1,396	1,404	1,411
70	1,417	1,424	1,430	1,437	1,443	1,450	1,456	1,463	1,469	1,476
80	1,483	1,489	1,496	1,502	1,509	1,516	1,522	1,529	1,536	1,543
90	1,549	1,556	1,563	1,570	1,577	1,583	1,590	1,597	1,604	1,611
100	1,618	1,625	1,632	1,639	1,646	1,653	1,660	1,667	1,674	1,681
110	1,688	1,695	1,702	1,709	1,716	1,724	1,731	1,738	1,745	1,753
120	1,760	1,767	1,774	1,782	1,789	1,796	1,804	1,811	1,819	1,826
130	1,833	1,841	1,848	1,856	1,863	1,871	1,879	1,886	1,894	1,901
140	1,909	1,917	1,924	1,932	1,940	1,948	1,955	1,963	1,971	1,979
150	1,987	1,994	2,002	2,010	2,018	2,026	2,034	2,042	2,050	2,058

Ni1000 temperature sensor and plug contact assignment



Thermocouple: NiCrNi, in–line engine: 51.27421–0158, V-engine: 51.27421–0175

The NiCrNi thermocouple delivers an increasing voltage as temperature increases.

NICR-NI thermocouples are used to measure the exhaust-gas temperature.

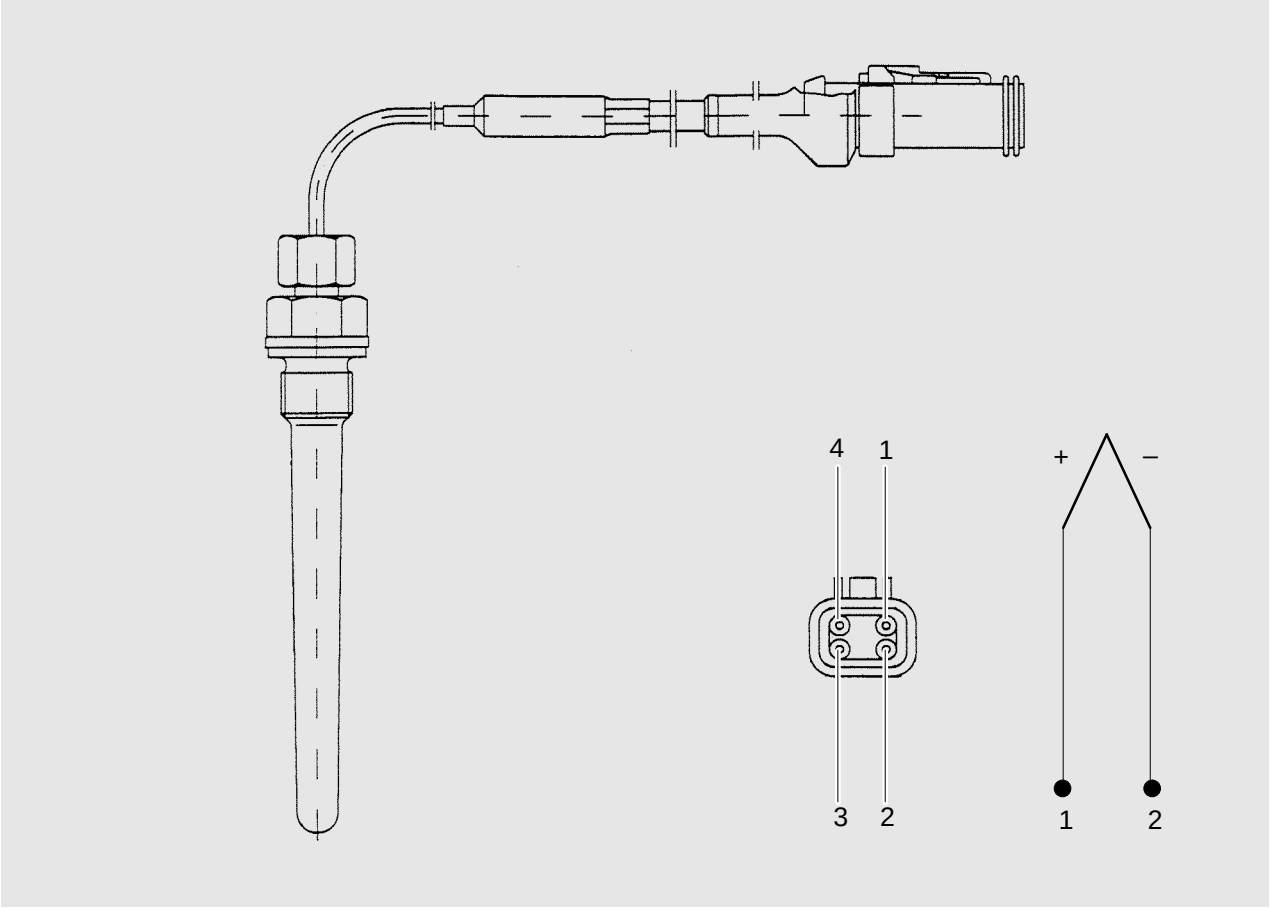
Test:

Determine whether the thermocouple is faulty with a voltmeter in the millivolt range using the table below. The bipolar thermocable (twisted green-white) must not be reversed (green=plus, white=minus).
To measure the voltage, it is not necessary to disconnect the cable to the thermocouple. The measurement is performed by parallel connection of the voltmeter.

Terminals at MMDS:
– Exhaust-gas temperature before turbocharger: 47, 48
– Exhaust-gas temperature before turbocharger: 49, 50 (V-engine only)

Voltage at NiCrNi thermocouple (mV) as function of temperature (°C)															
°C	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800
mV	3.3	5.3	7.3	9.4	11.4	13.5	15.6	17.7	19.8	22.0	24.1	26.2	28.3	30.4	32.5

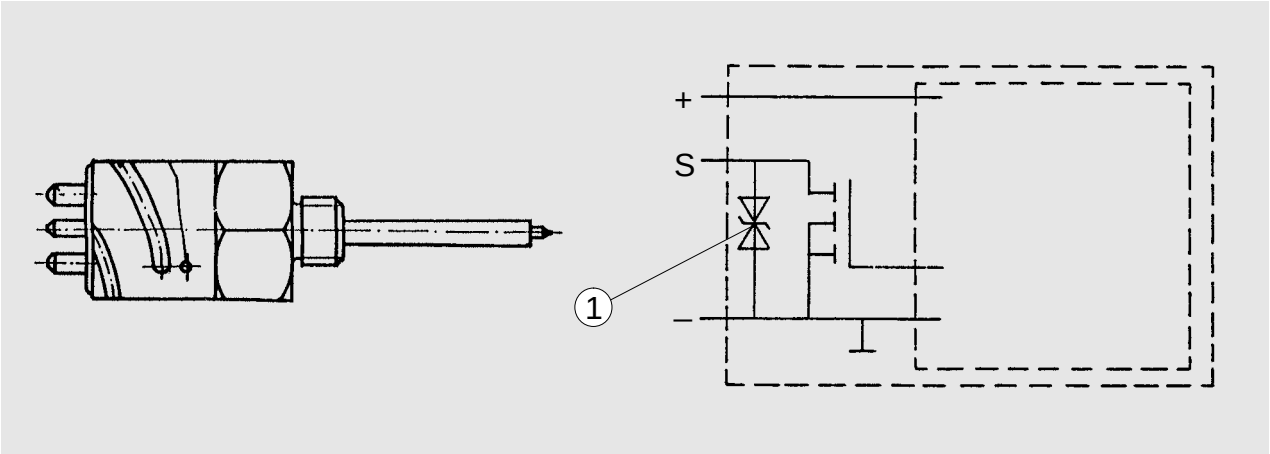
NiCrNi T thermocouple and plug contact assignment



Sensors for coolant level

Coolant level probe: 51.27421–0116

The coolant level probe monitors the coolant level in the expansion tank.



① Suppressor diode (7.5 V) for open–circuit monitoring

2 probes are attached to the expansion tank. An alarm is issued if both probes are dry for 5s.

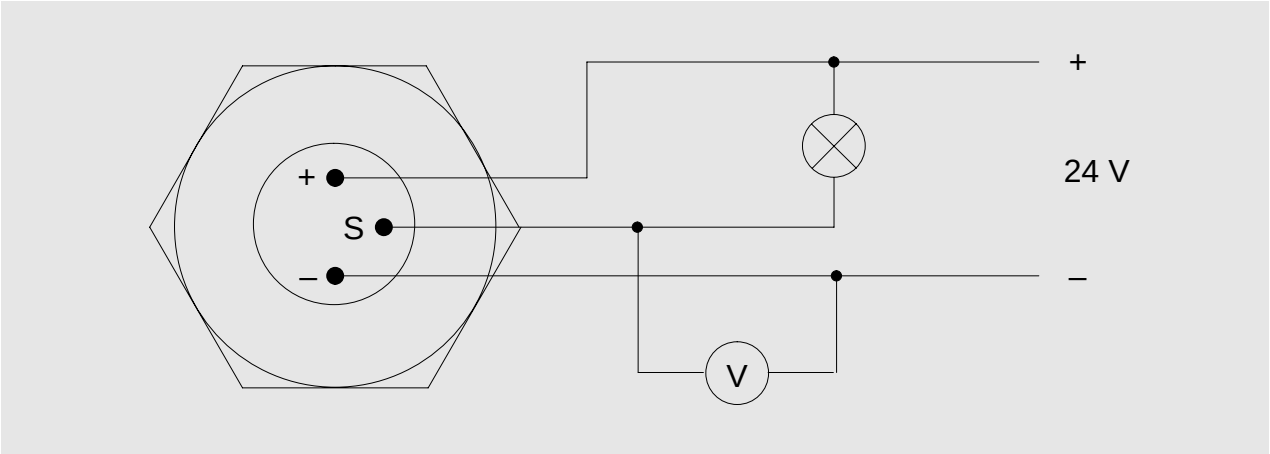
Test (probe installed):

Ignition ON, sufficient coolant level in expansion tank

	Probe OK / function OK	Probe faulty or cable break
Coolant probe connected	No fault indication	Alarm “Coolant level” and “Sensor fault” or “Coolant level”only
Disconnect coolant probe plug	Fault indication “Coolant level” and “Sensor fault”	
Voltage measurement at MMDS: 104 (MMDS “–”) / 39 (MMDS, probe 1) 104 (MMDS “–”) / 41 (MMDS, probe 2)	U < 7V every 30 seconds: U = 7.5 - 8V	U < 7V every 30 seconds: U > 8V

Test (probe not installed):

Supply the probe as shown in the figure with 24 volts and connect a voltmeter or test lamp (24V, max. 3W).
Caution: “S” must not be applied directly to “+”!



	Probe OK / probe dry	Probe OK / probe wet
Voltage measurement between “S” and “–” at probe	Replace probe, after 7 seconds, U < 7V	Immerse probe in water, after 2 seconds U=7.5V
Test lamp	Shows bright	Shows dark

Testing three–phase generator

Charging voltage of three–phase generator

Monitoring of the charging voltage (terminal D+) at the three–phase generator is connected to terminal 23 of the diagnostic unit.
Fault indication: engine running, voltage under 6 volts.

Test:

Measurement with voltmeter between terminal 23 and terminal 104 (–)

- Engine not running, ignition OFF: 0V
- Engine not running, ignition ON: approx. 2 V
- Engine running: approx. 28 V

RPM sensor Hall-HT: 51.27120–0010

In mechanically controlled engines, the RPM sensor serves to record the engine revolutions and thus also to identify excessive engine speeds.
(0–3770 crankshaft revolutions/min correspond to 0–10000 pulses/s)

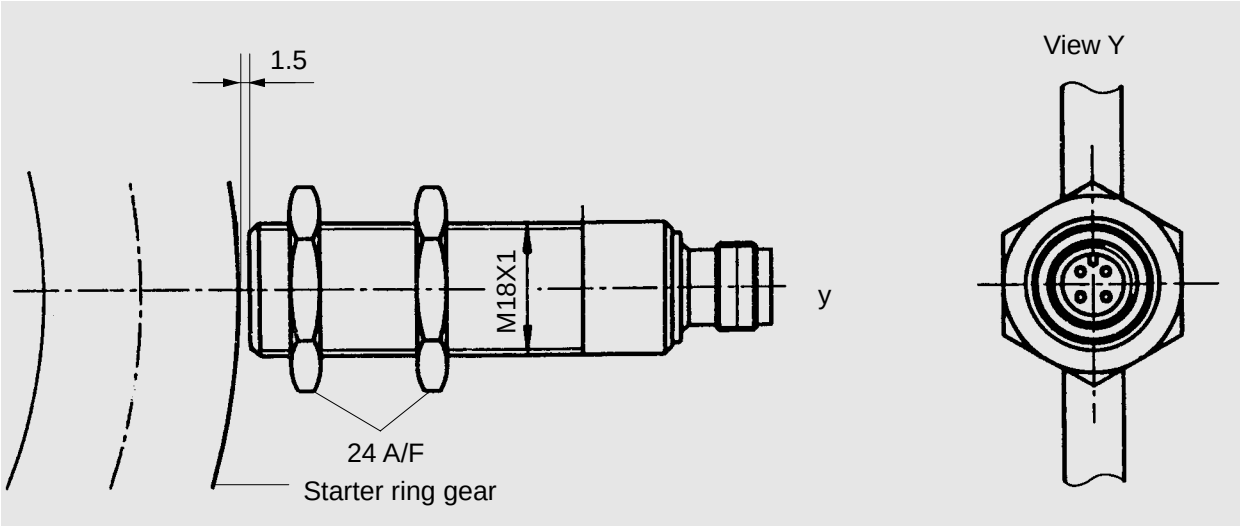
Test:

Voltage measurement: at 600 rpm between 10 and 12 V must be applied at MMDS terminal 43 and 44 (–).
Frequency measurement: with engine running at MMDS terminal 43 and 104 (–)

$$f = \frac{n \quad z}{60}$$

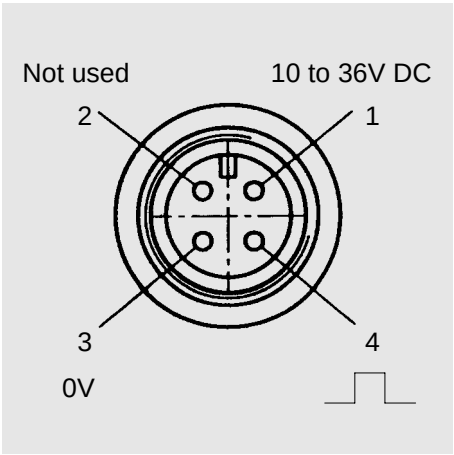
In this formula:

- f Frequency in Hz
- n Engine speed in rpm
- z Number of teeth on ring gear (160 for D 28 engines)



The frequency of the output voltage is proportional to the speed of the gear.

Contact assignment



Boost pressure sensor: 51.27421–0125

In mechanically controlled engines, the boost pressure is monitored with a 4–20 mA sensor at 0–2.5 bar.

Test see Page 21.

Coolant temperature sensor: 51.27421–0150

In mechanically controlled engines, the coolant temperature is measured with a PT1000 thermistor.

Test see Page 22.

Charge–air temperature sensor: 51.27421–0103

In mechanically controlled engines, the charge–air temperature is measured with an Ni1000 thermistor.

Test see Page 24.

Sensors for engine monitoring

Leakage monitor for injection lines

The leakage monitor is designed to detect any leakages from the injection lines.
It has an NO transistor and is wired to terminal 37 of the MMDS.

Test:

Remove the probe, immerse in liquid or unscrew the plug from the probe and set up a wire jumper between “B” (–) and “C” (signal). A corresponding fault indication must appear.

Water level probe on fuel prefilter (Racor, Separ)

The prefilter is also used for water separation. The contact switches when the water level in the filter reaches the max. value.
This contact can be connected to the X3 gearbox plug. The MMDS is programmed for NO contact.

Test:

Set up a wire jumper directly at the NO contact of the monitor. Alarm must be triggered.

Sensors for gearbox monitoring

Gearbox oil pressure for MMDS and analog display

Oil pressure sensor with 4–20 mA at 0–25 bar
No alarm is generated. The sensor merely serves to activate the analog and digital displays (MMDS-LC).

Test see Page 21.

Gearbox oil pressure

NO contact.
Monitors the lube oil pressure in the gearbox or at the clutch. Is necessary for gearbox oil pressure alarm and storage.
Supplier: gearbox manufacturer
If a monitor is not fitted to the gearbox, contacts 3 and 4 on the X3 plug must be jumpered.

Test:
1. Disconnect the plug on the pressure monitor.
2. Bring the engine up to a speed of min. 1400 rpm, alarm must be triggered.

Gearbox oil temperature

Oil temperature monitor with NC contact.
Supplier: gearbox manufacturer
If a monitor is not fitted to the gearbox, contacts 5 and 6 on the X3 plug must be jumpered.

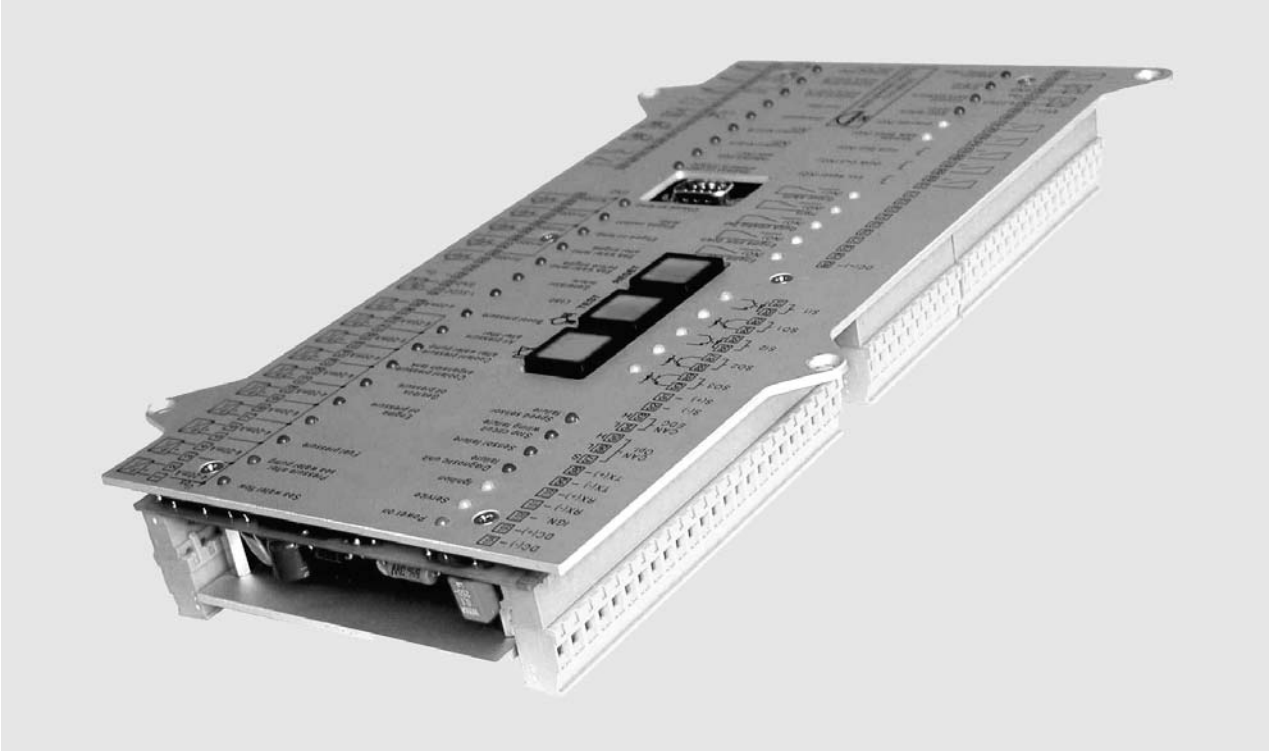
Test:

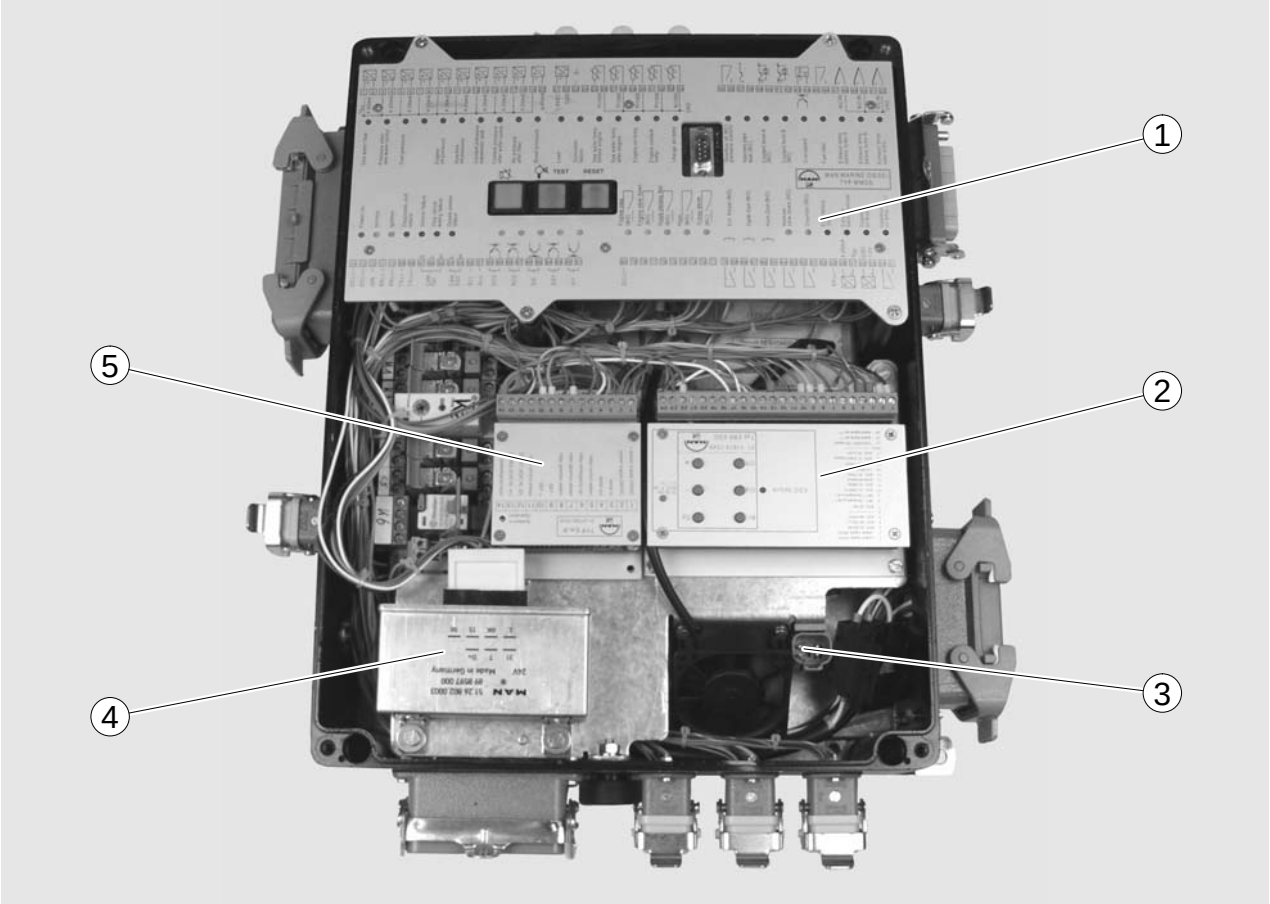
Disconnect the wire at terminal 53 on the MMDS. Alarm must be indicated.

Central diagnostic unit

The central diagnostic unit essentially consists of the following components:

- Electronics board, which is connected by way of spacer pins to the front plate and the end plate.
- 6 plug-in terminal strips with a total of 104 terminals for all electrical connections.
- Light-emitting diodes (LEDs), which indicate the status of virtually all the inputs and outputs.
  The LEDs are located where the associated inputs and outputs are situated. The fact that the terminal connection diagram is printed on the front plate ensures a good overview and simplifies service.
- 3 buttons for “Horn off”, “Optic acknowledge”, “Reset”.
- RS 232 C interface for diagnostic and online measurement.





① MMDS diagnostic unit
(specify engine type when ordering)
② EDC control box, item no. 51.11615–7243
③ MAN–Cats diagnostic plug
④ Option: Glow control unit (V-engine only), item no. 51.26802–0003
⑤ Option: Emergency running unit receiver EM-R, item no. 51.27720–7013

Alarm and status indications

The cover plate incorporates 49 LEDs, which can indicate the following states:

- Alarm status “red”
- Status indication “yellow”
- Power supply (Power On) “green”

Indicating an alarm

An alarm is indicated by a flashing LED situated above the terminal of the sensor affected. In the event of a sensor failure or open circuit, the ”Sensor failure” LED also flashes at the same flashing frequency.

Each alarm causes the horn and group alarm relays to switch. The integrated safety function issues a slow-down or shutdown command via further relays provided there is a corresponding alarm.

Red alarm LEDs are provided for each sensor.
These are positioned at the corresponding terminal connection. The associated measuring point text is printed on the front plate.
There are for specific alarm states 4 additional LEDs, which signify the following failure indications:

- Sensor failure (group alarm*)*
- Speed sensor failure
- Stop circuit wiring failure
- Diagnostic unit failure

Yellow LEDs are provided for the input states

- Ignition
- Remote slowdown

and for the input and output levels of the serial optocoupler interfaces (S1/S2/S3)
Further LEDs are provided for indicating the status of the relay outputs.
The Service and Override LEDs (with relay output) are currently not activated.

Pre-alarm, master alarm, sensor failure, system failure

The following different alarm states, which are also signalled to the engine room panel, MMDS-LC and MMDS-L (via the serial master data bus), can be read off at the central diagnostic unit in the terminal box.

Pre-alarm

- **Triggering:**

  In the event of a limit violation, a pre–alarm is issued first with analog monitoring of the engine or gearbox parameter.

- **Recognition:**
  - Slow flashing (frequency: 0.6 Hz corresponds to approx. 1.5 seconds) of the corresponding sensor LED.
  - Activation of the “Horn” and “Group Alarm” relays.

- **Remedy:**
  - Press the “Horn off” button to acknowledge the warning equipment.
  - Press the “Test” button.
    LED goes out: alarm no longer present.
    LED continuously lit: search for cause.

- **Possible cause:**

  A pressure or a temperature at the engine has deviated from the normal range, i.e. it is necessary to check why this has occurred.

Master alarm

- **Triggering:**

  Limit violation of the monitored engine or gearbox parameter. Important measured engine values result in a reduction of the engine speed.

- **Recognition:**
  - Rapid flashing (frequency: 2.5 Hz corresponds to approx. 0.5 seconds) of the corresponding sensor LED.
  - Activation of the “Horn” and “Group Alarm” relays.
  - Possible reduction of engine speed (if alarm for speed reduction is activated).

- **Remedy:**
  - Press the “Horn off” button to acknowledge the warning equipment.
  - Press the “Test” button.
    LED goes out: alarm no longer present.
    LED continuously lit: search for cause.
  - Press the “Reset” button. An alarm which resulted in speed reduction is acknowledged.

- **Possible cause:**

  A pressure or a temperature at the engine has deviated significantly from the normal range, i.e. it is necessary to check why this has occurred.

Sensor failure

- **Triggering:**

  All the important sensors are checked for plausibility. Open circuits, wiring faults or faulty sensors are generally recognized by the fact that the measured value at the input is distorted to such an extent as to deviate from a defined range of validity (signal range check).

- **Recognition:**

  An occurring sensor failure activates for acoustic alarm purposes the ”Horn” output (term. 73, 74) and issues a group alarm via the “Group Alarm” output (term. 71, 72). The corresponding LED flashes slowly *in sequence* with the “Sensor failure” LED.
  The Sensor failure LED flashes in opposing sequence to the sensor LED of the faulty sensor. A separate ”Speed sensor failure” LED is provided to indicate engine speed failure.

- **Possible cause:**

  – Open circuit
  – Sensor faulty
  – Wiring fault

- **Remedy:**

  – Press the “Horn off” button to acknowledge the warning equipment.
  – Press the “Test” button.
  LED goes out: alarm no longer present.
  LED continuously lit: search for cause.

System failure

- **Triggering:**

  The entire MMDS central system is continuously monitored with the aid of a monitoring circuit (watchdog). The integrated software monitors all the essential function units and also checks the program flow.

- **Recognition:**

  If serious faults occur, the monitoring logic activates the “System failure” status and the corresponding LED flashes cyclically. Depending on the type of fault, the LED is predominantly active or flashes at intervals of 1.5 seconds.
  When the “System failure” LED is activated, the “Group Alarm” relay drops out at the same time so that the failure can also be noticed by higher–level systems. The *Horn* relay on the MMDS however is not activated as an acknowledgement is no longer possible. Because data transmission over the serial master bus (SO2) also fails, an alarm is issued for such a malfunction by the MMDS-L and MMDS-LC signalling systems or in the case of a PC connection as a data failure alarm.

- **Possible cause and remedy:**

  – “System failure” LED predominantly active: Serious fault in the program flow, memory fault or hardware fault. In this case, you can try to isolate the system for a short period. It may then start up again correctly. The device must be checked in each case.
  – “System failure” LED flashes (every 1.5 seconds): A hardware fault has occurred. The device must be replaced.

Operator buttons, acknowledgement

The following buttons are integrated in the front plate:

Horn ackn button: The horn relay is immediately reset provided it was activated by an alarm that has occurred.
The contact opens and deactivates a connected audible signal device.

Optic ackn button: A flashing alarm LED is optically acknowledged. The status switches from flashing to continuously lit provided the alarm is still active or was saved. Otherwise the LED goes out.

Reset button: A critical alarm which triggers a slowdown or shutdown by the safety system is stored internally.
If the corresponding alarm or fault status has been cancelled, this alarm can be reset again with the Reset button. The precondition for this is that the engine has actually slowed down (reduced) or stopped.

All 3 button functions can also be triggered by means of externally connectable buttons, corresponding terminals for direct connection are provided:

– Terminal 65, 66=Horn acknowledge
– Terminal 67, 68=Optic acknowledge
– Terminal 69, 70=Reset

Acknowledgement can also be effected by means of externally connected display systems (e.g. MMDS-L or MMDS-LC) with the buttons integrated there.

The acknowledgement signals then pass serially via the master data bus to the MMDS central unit.

Relay outputs

The system has 5 floating relay contacts. These are designed as NO contacts and are assigned to the following functions:

- **Group Alarm** (NC contact at terminal 71/72, load capability 6 A):

  The Group Alarm contact is closed in idle state and with the engine ignition switched on.
  It is opened as soon as any alarm signal occurs. This can be a pre–alarm, master alarm or sensor failure.
  The contact normally remains open until the alarm has been cancelled. But if a second alarm occurs during this period, the Group Alarm relay outputs a short repeat pulse. It picks up for 3 or 4 seconds and then drops out again. A status LED at the corresponding terminals indicates whether an alarm is active. The LED is thus active in this case when the relay contact is *open*.

- **Horn** (NO contact at terminal 73/74, load capability 6 A):

  As soon as an alarm occurs, the Horn relay is activated and the contact closes. A status LED at the corresponding terminals lights up when the relay contact is closed.

- **Engine slow down** (NO contact at terminal 77/78, load capability 6 A):

  The slowdown relay is activated in the event of all alarms which result in slowdown or shutdown. The corresponding contact closes and the status LED at the corresponding terminals lights up.

- **Quick closing flap** (NO contact at terminal 75/76, load capability 6 A):

  In the event of an overspeed alarm, a shutdown device can be activated with this relay. The corresponding contact closes and the status LED at the corresponding terminals lights up.

- **Engine stop** (contact via terminal 79/80, load capability 16 A):

  The shutdown relay is activated after the ignition is turned off or if alarms resulting in shutdown occur. The corresponding contact can switch currents of up to 16 A and is therefore designed for the direct connection of a shutdown solenoid. The stop circuit is also monitored for wire breakage. The status LED at the corresponding terminals lights up when shutdown is active. The relay drops out again after a programmable shutdown time has elapsed.

Real-time clock

The diagnostic system integrated in the MMDS requires a precise specification of time in order to store alarms and other data.
A built–in real–time clock provides the system with the time and date. The clock is battery-powered and therefore continues to operate even when the system is deactivated. The time is preset to Central European Time.

Ignition, run-on

The MMDS module switches on when the engine is started through application of the ignition voltage (11–35 V) at the “Ignition” input (terminal 102) and activates the monitoring and diagnostic functions.
If the engine is then shut down again through switching off of the ignition, the MMDS module switches into run–on status. This results in a controlled rundown, thereby ensuring that any history data record that still needs to be stored is completely saved.
The run–on time is generally set to 660 seconds. The device switches off automatically once this period has elapsed.

Master data bus

The SI2/SO2 bidirectional serial interface (serial *in* 2 / serial *out* 2) is reserved as the master data bus. The SO2 output continuously makes all the engine and operating data available on the bus. If necessary, the SI2 input receives active acknowledgement commands. The overall bus length however should not exceed a length of 50m.

Activation of instruments on control stands

To activate instruments on the control stands, a special data path is set up which selectively makes available only the required data at the SO3 serial output and transmits to the D/A converter. In this case, data are transmitted with a high update rate in order to minimize the time delays particularly for the tachometer.

RS232 interface

The RS232 interface is accessible on the front via a 9-pin SUB-D connection and is therefore suitable for the direct connection of a PC or notebook. The following functions can thereby be implemented:

- Service: Direct operating data recording and visualization on running engine
- Diagnostics: Interrogation of stored data (alarms, histories, load blocks)

Special PC software has to be used for each application.

CAN bus for EDC

If the MMDS central diagnostic unit is in the “EDC active” operating mode, communication takes place with the EDC control unit via an integrated CAN bus interface.
EDC active means that the engine in question has EDC (see Publication 51.99598-8043).
In this way, specific engine data can be read by the EDC or a slowdown can be triggered in the event of an alarm. In this case, the engine power output is reduced (depending on the configuration) to a specific maximum speed and to a specific maximum torque.

Engine monitoring

All the recorded engine data are conditioned and standardized. Each measuring point can be monitored in a selectable mode and trigger an alarm. For this purpose, engine–dependent parameters and limit values are programmed in the data record.
A limit violation now results in optical and audible alarms after time delays have elapsed and possible activation criteria have been satisfied.

Distinctions are made between:

– Pre-alarm
– Master alarm
– Sensor failure

The two measuring points “Engine oil pressure” and “Coolant pressure after WAPU” (WAPU=water pump) are monitored as a function of a speed–dependent curve.

In order to avoid false alarms, individual ON and OFF delays are designated for all the sensors. This makes it possible to adapt special features of some measuring points.

In addition, short disturbing pulses, which can arise as a result of the effects of EMC, are effectively suppressed. As well as the time delay, some measuring points require further activation criteria in order for an alarm to be triggered in the event of a limit violation.

Refer to the table below:

Activation conditions for alarms

No.	Measuring point	Suppression with engine at standstill	Additional activation criteria
1	Gearbox oil pressure (clutch)	Yes	Time delay after engine start Defined minimum speed 1 with time delay Defined minimum speed 2 with time delay
2	Coolant level A		Coolant Level B=active
3	Coolant level B		Coolant Level A=active
4	EDC failure		EDC mode=active
5			
6			
7	Engine oil pressure	Yes	Time delay after engine start
8	Coolant pressure expansion pump	Yes	Time delay after engine start Defined coolant temperature
9	Coolant pressure after water pump	Yes	Time delay after engine start
10	Air pressure after filter	Yes	Time delay after engine start
11	Boost pressure	Yes	Time delay after engine start Defined speed window with time delay Defined load minimum with time delay
12			
13	Engine coolant temp.	Yes	Time delay after engine start
14	Charge-air temp.		Defined minimum speed
15	Generator D+	Yes	

The criterion “Suppression with engine at standstill” is defined as follows: The engine is running when

– the engine speed has reached a defined minimum threshold, or
– the oil pressure has reached a minimum value, or
– the input “Generator D+” is active.

If none of these conditions is satisfied, the engine status is defined as **“OFF”**. All the alarms which are suppressed with the engine at a standstill are activated in this case.

Safety function

The MMDS central control unit is in a position to intervene actively in the event of critical alarms (master alarms).
In the “EDC mode active” operating mode, both the engine speed and the torque are reduced to a preset maximum value. In the “EDC mode not active” operating mode, either the

– “Engine Slow down” relay (term. 77, 78) is activated on its own, or
– it is activated together with the “Engine Stop” relay (term.79, 80).

Reduction of engine speed and engine power output

If a critical alarm results in a limit violation and all the activation conditions are satisfied, the integrated safety system triggers a slowdown command.
The engine power output is reduced to preset values. A status of this nature remains stored in the system and can only be cancelled again under the following conditions:

– The alarm must be acoustically and optically acknowledged
– The engine speed must not have exceeded the preset reduced value
– The cause of the alarm must be eliminated, a limit violation must no longer be present

The alarm status can now be reset with the “RESET” button.
This can be done on the device itself or on a connected signalling unit MMDS-L or MMDS-LC (or PC).

The following measuring points are to be categorized as critical and trigger a slowdown command in the event of an alarm:

No.	Measuring point	Remark
1	Gearbox oil pressure (clutch)	
2	Coolant level A	Alarm: when probes A and B are dry
3	Coolant level B	Alarm: when probes A and B are dry
4	Remote Slow down	Direct input (term. 63, 64)
5	Engine oil pressure	
6	Coolant pressure after water pump	
7	Air pressure after filter	
8	Boost pressure	
9	Engine oil temp.	
10	Engine coolant temp.	
11	Charge-air temp.	
12	Exhaust temp. before turbo A	
13	Exhaust temp. before turbo B	On V-engine only
14	Speed	Additionally stop

The “Remote Slow down” input takes direct effect and triggers a slowdown command without a local alarm. This option of remote slowdown can be used with multi-engine plants to reduce the speed of an engine if the speed of the adjacent engine is reduced as the result of a malfunction. It is thus possible to avoid a sudden deviation from the course.

Engine shutdown

The safety system can trigger a shutdown command in the event of particularly critical alarms.
In the “EDC not active” operating mode, the shutdown device can be directly addressed. In the “EDC active” operating mode, the EDC control unit itself adopts the shutdown procedure. The following relays are activated:

– “Engine Stop” relay (term. 79, 80):
  The relay is activated for a predetermined time and then drops out again. The precondition for this however is that the engine really has stopped.
– “Engine slow down” relay (term. 77, 78):
  The adjacent engines in multi-engine plants can thereby be remotely slowed down.
– “Quick closing flap” relay (term. 75, 76):
  If fitted, this can activate a shutdown device.

A shutdown alarm that has occurred remains stored in the system and can only be cancelled again under the following conditions:

– The alarm must be acoustically and optically acknowledged
– The engine must have completed the shutdown sequence, the speed must be zero
– The cause of the alarm must be eliminated, a limit violation must no longer be present

This status can now be reset with the “RESET” button. This can be done on the device itself or on a connected signalling unit MMDS-L or MMDS-LC.
The measuring point “Speed” (overspeed) is to be categorized as particularly critical and triggers a shutdown command in the event of an alarm.

Overspeed test

The response of the safety system in the event of engine overspeed can be checked during startup with a specific test function.
The existing overspeed limit value is replaced by a lower value through activation of the SI1 input (terminal 81, 82). The overspeed alarm can be simulated as follows for an as yet uncritical speed (see “Engine Electrics” circuit diagram).

- Terminal 81=Plus (supply)
- Terminal 82=Minus

The overspeed alarm thus occurs currently at 2100 rpm.
The function is cancelled as soon as the SI1 input is no longer active.

Diagnostics

The comprehensive memory functions of the MMDS central control unit allow service technicians to carry out effective fault diagnosis in the event of problems.
The stored data offer an insight into engine states that have occurred and allow conclusions to be drawn on the causes and consequences of faults and malfunctions. Alarms, sensor failures, histories and the load profile of the engine are stored.

Storage of alarms and sensor failures

Pre–alarms, master alarms and sensor failures are stored in the order in which they occur with the following parameters:

– Date, time (internal time of real-time clock)
– Alarm duration in 0.5 second intervals
– For analog measuring points, also minimum or maximum value according to relevance

The last 8000 events are stored after which point the oldest are overwritten. The memory is deleted on initial delivery.
The memory can be read out by way of PC communication using special control codes.

Storage of histories

Each alarm can, once it has occurred, trigger the storage of a history data record.
In this case, the entire status of the engine is stored with all the sensors and measured values in a defined time base. Information is continually logged internally in the system such that up–to–date data are always available up to one hour ***before*** the actual alarm event.
When an alarm occurs, this data record is stored as a history and subsequently supplemented further up to 10 minutes ***after*** the alarm event.

The time base is set out as follows (time given in seconds):

Time (s) total	–3600	–1800	–600	–300	–60	–30	–3	0	+3	+30	+60	+600
Time interval (s)	1800	1200	300	240	30	27	3	3	27	30	540	
Time base (s) Measurements	180	60	30	10	2	1	0.5	0.5	1	2	30	
Number of measurements	11	20	10	24	15	27	6	5	27	15	19	

Each history contains a total of 178 measuring points which are recorded in the predetermined time interval.
The triggering alarm itself is added with the date and time. Each measuring point contains the measured values of **all** the sensors that are current at this point and thus the overall status of the engine. It is thus possible within the framework of maintenance work to analyse at a later stage which reasons have given rise to an alarm event or a secondary event.
The last 50 events in each case are stored after which point the oldest are overwritten. The memory is deleted on initial delivery. The memory can be read out by way of PC communication using special control codes.

Storage of load profile

During operation, the system continuously monitors the time period over which the engine is run in a particular speed range and a particular load range.
This produces a load profile, which is drawn up in the form of a table. Low speeds normally produce low load torques while high speeds generally produce high load torques.
Furthermore the entire engine load over a specific time period can be qualitatively determined. Necessary service intervals can be shortened with a high load profile. After a period of 250 operating hours in each case, the current load profile is stored and the creation of a new profile is started.

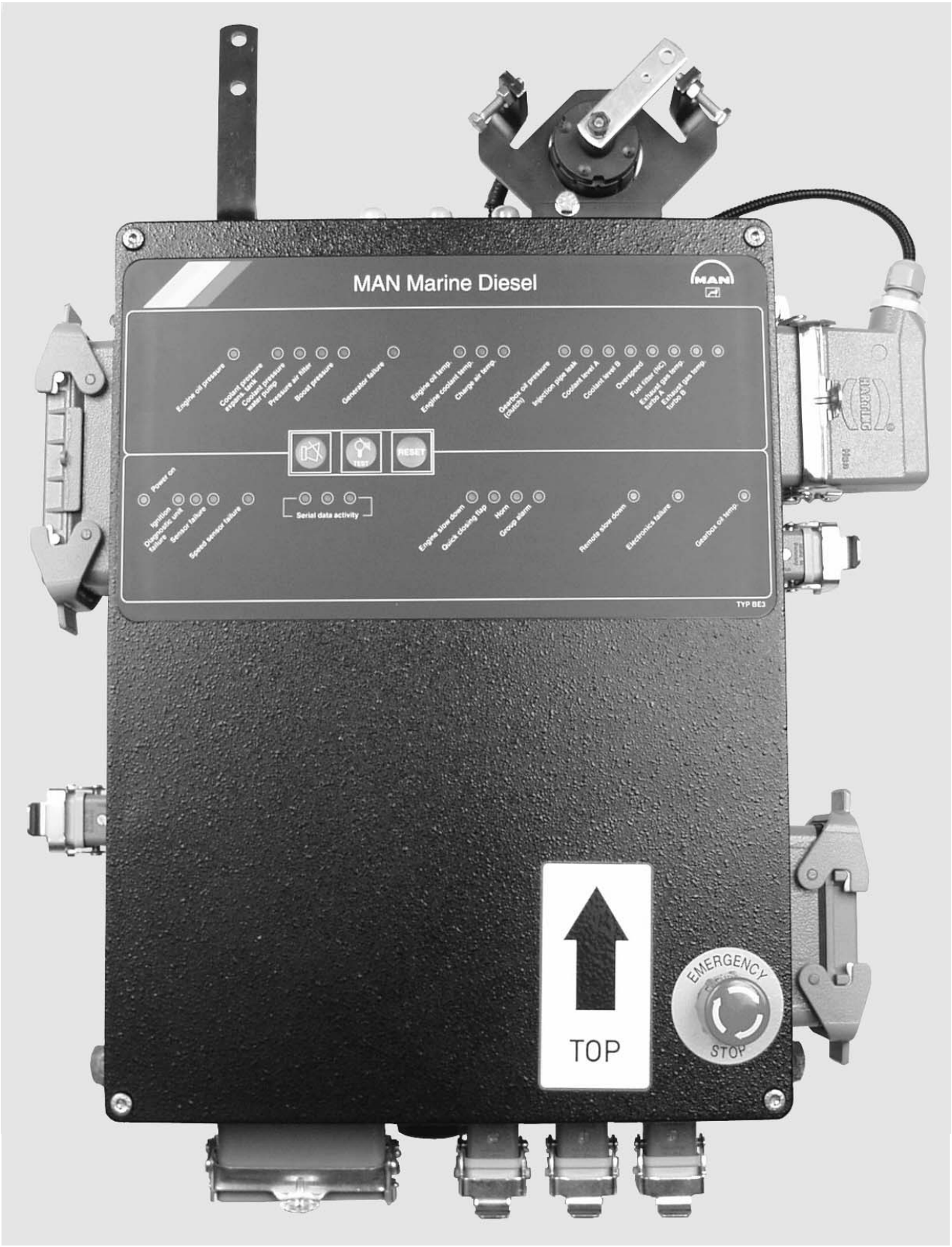
Example of a possible load profile over 250 hours:

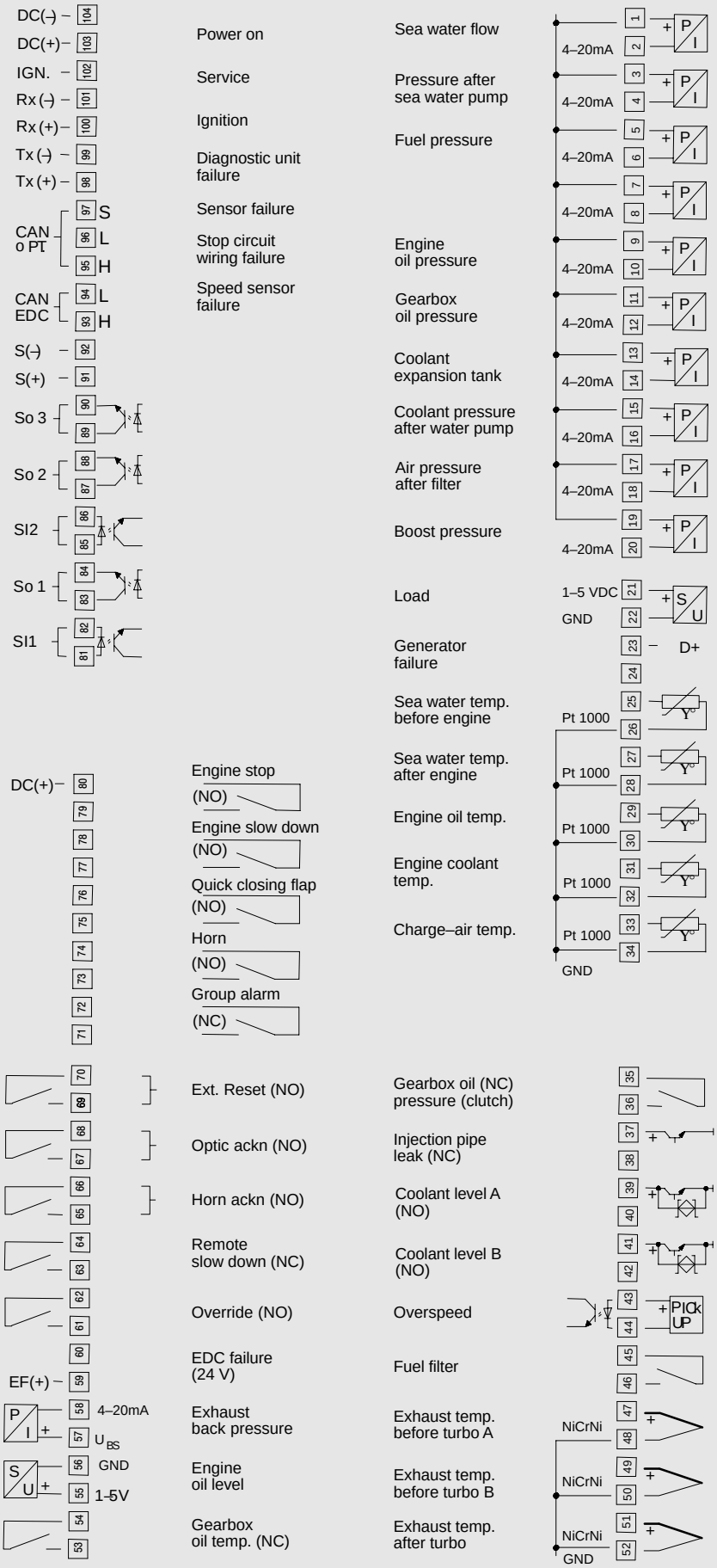
	0–20% load	20–40% load	40–60% load	60–80% load	80–100% load
0–750 rpm	**20 h**	2 h			
750–1000 rpm	12 h	8 h	2 h		
1000–1250 rpm	6 h	**20 h**	6 h		
1250–1500 rpm	2 h	12 h	12 h	2 h	
1500–1750 rpm		6 h	**20 h**	6 h	
1750–2000 rpm		2 h	12 h	12 h	
2000–2250 rpm			6 h	**20 h**	4 h
2250–2300 rpm			2 h	12 h	12 h
2300–2350 rpm				6 h	**20 h**
2350–2400 rpm				2 h	4 h

The last 128 load blocks are stored in each case after which point the oldest are overwritten.
However, in a cycle of 250h, this situation will only arise after 32 000 operating hours, which is generally hardly ever achieved.
The memory is deleted on initial delivery. The memory can be read out by way of PC communication using special control codes.

Terminal box with MMDS

Thanks to its external alarms (LEDs) with their acknowledgement option, the terminal box also acts as an engine information system in the engine room.




DC(–) 104
DC(+) 103
IGN. 102
Rx(–) 101
Rx(+) 100
Tx(–) 99
Tx(+) 98
CAN o PT 97 S 96 L 95 H
CAN EDC 94 L 93 H
S(–) 92
S(+) 91
So 3 90 89
So 2 88 87
SI2 86 85
So 1 84 83
SI1 82 81
Power on
Service
Ignition
Diagnostic unit failure
Sensor failure
Stop circuit wiring failure
Speed sensor failure
Sea water flow
Pressure after sea water pump
Fuel pressure
Engine oil pressure
Gearbox oil pressure
Coolant expansion tank
Coolant pressure after water pump
Air pressure after filter
Boost pressure
4–20mA
Load
1–5 VDC
GND
Generator failure
D+
Sea water temp. before engine
Sea water temp. after engine
Engine oil temp.
Engine coolant temp.
Charge–air temp.
Pt 1000
GND
DC(+) 80 79 78 77 76 75 74 73 72 71
Engine stop (NO)
Engine slow down (NO)
Quick closing flap (NO)
Horn (NO)
Group alarm (NC)
70 69 Ext. Reset (NO)
68 67 Optic ackn (NO)
66 65 Horn ackn (NO)
64 63 Remote slow down (NC)
62 61 Override (NO)
60
EF(+) 59
58 4–20mA
57 U BS
56 GND
55 1-5V
54 53
EDC failure (24 V)
Exhaust back pressure
Engine oil level
Gearbox oil temp. (NC)
Gearbox oil (NC) pressure (clutch)
Injection pipe leak (NC)
Coolant level A (NO)
Coolant level B (NO)
Overspeed
Fuel filter
Exhaust temp. before turbo A
Exhaust temp. before turbo B
Exhaust temp. after turbo
NiCrNi
GND

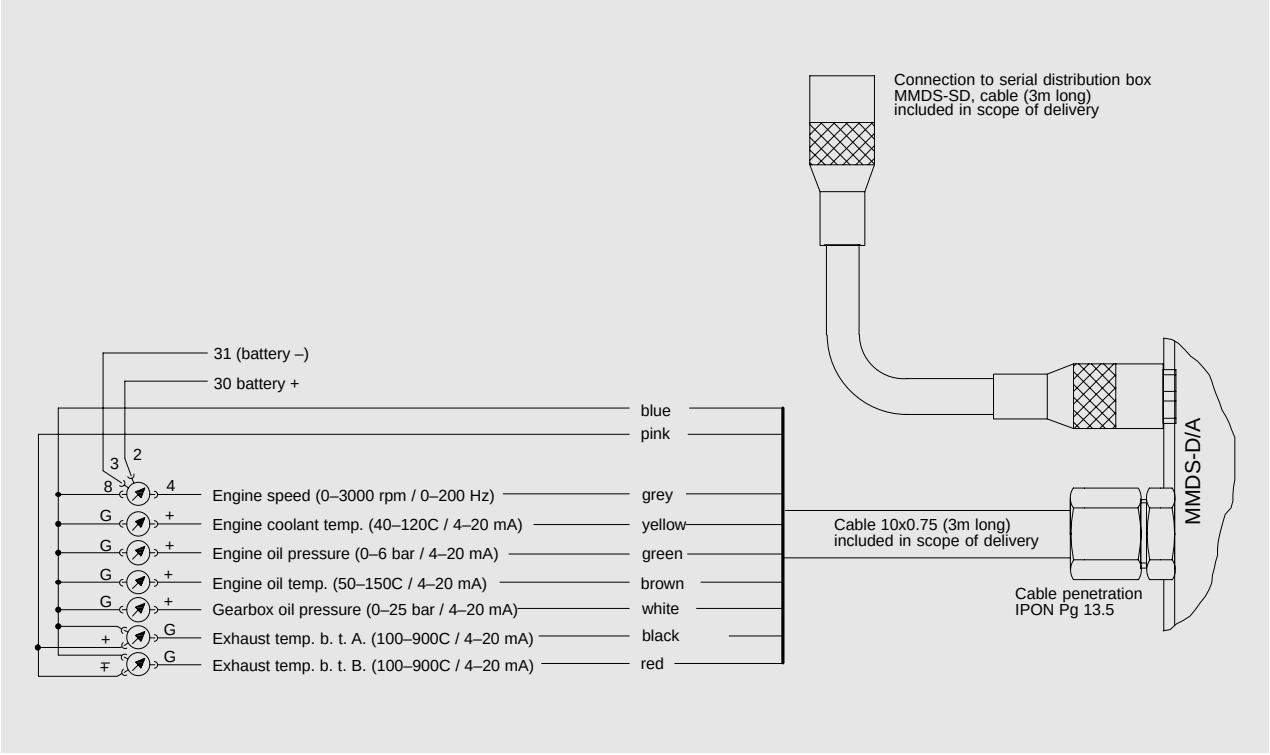
Connecting analog instruments

The following instrument dials can be connected to the digital-analog (D/A) converter:

– VDO-Ocean line, 4–20 mA input
– VDO-Ocean line tachometer with frequency input 0–200 Hz

These can be ordered from MAN and are featured on the following pages.
Instruments are connected at the shipyard.

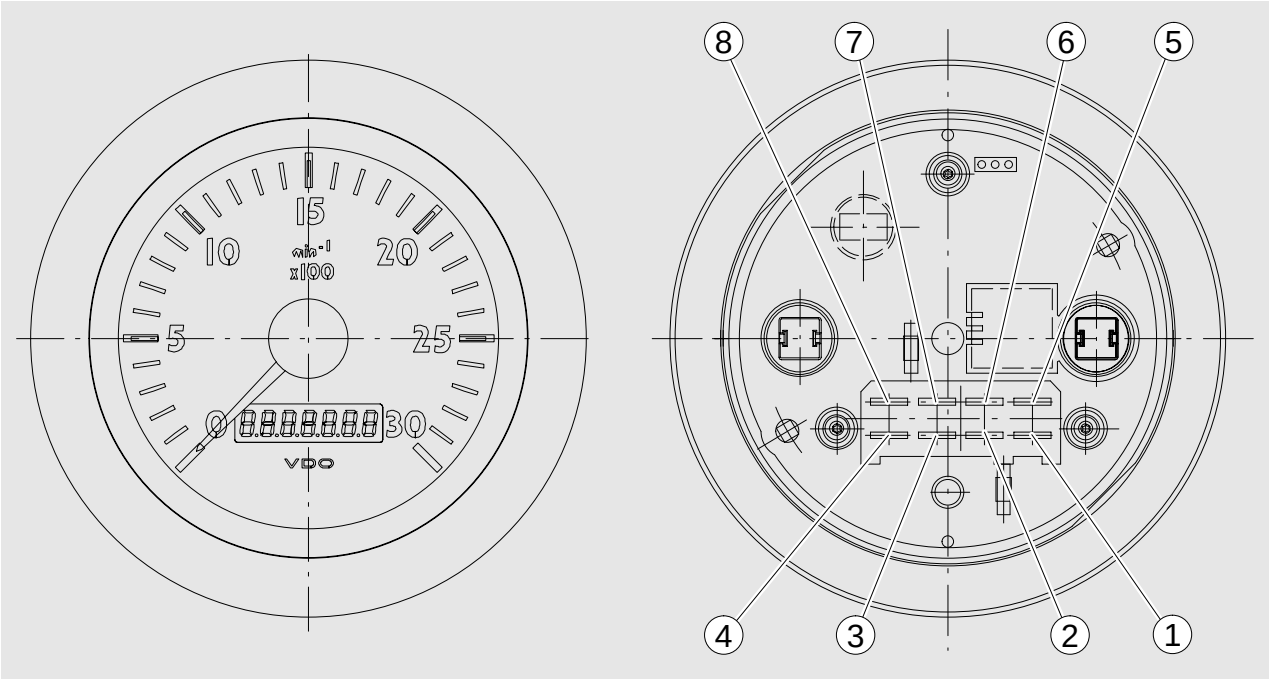
Connection diagram:



Tachometer with operating hours meter: 51.27102–6001

Characteristic data of tachometer with integrated digital operating hours meter:

– Diameter: 85 mm
– Display range: 0–3000 rpm
– Input: frequency set to 4 pulses/revolution



① Lighting
② Battery +
③ Battery –
④ Signal +
(connection to D/A converter, frequency)
⑤ Lighting
⑧ Signal –

Connections 2 (+) and 3 (–) must be supplied with continuous voltage so that the instrument needle returns to 0 with “ignition OFF”.

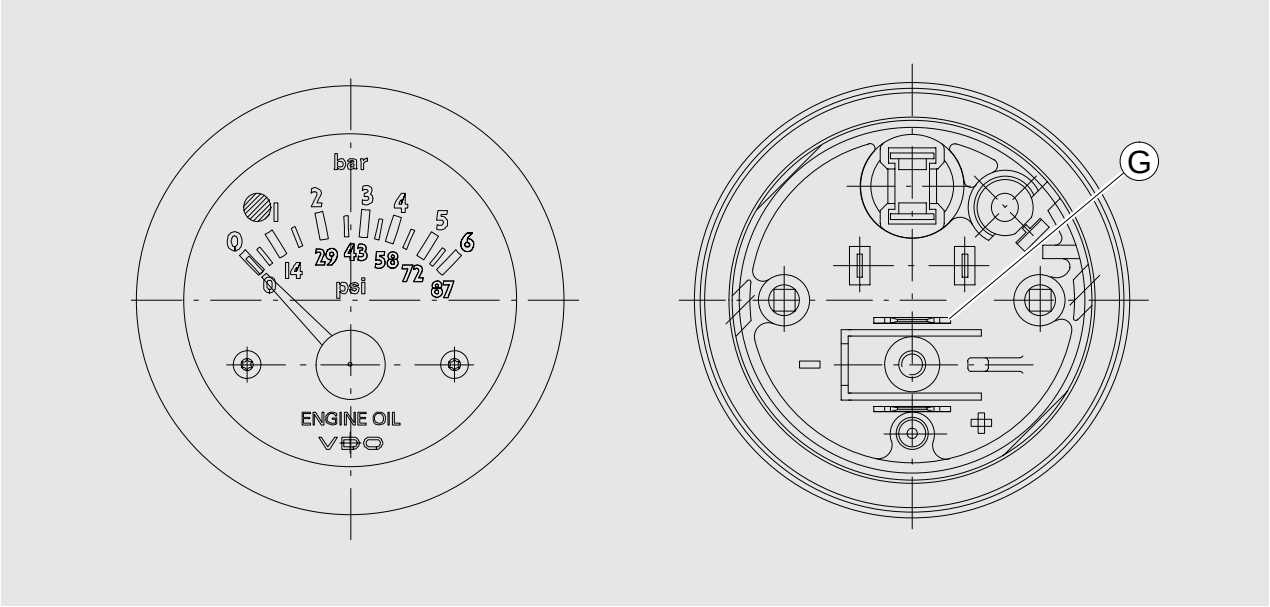
Test

For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
A supply voltage of 24 V at terminals 2 and 3 must be available.
Using a frequency meter at terminals “8” and “4” of the tachometer, measure the frequency in the 0–200 Hz range, corresponding to 0–3000 rpm.
If the corresponding frequency is not available, the D/A converter may be faulty or the meter may be incorrectly connected.
If the frequency is available and the instrument indicates no value or an implausible value, the instrument dial is faulty or incorrectly preset.
For correct adjustment, refer to the adjustment instructions in the tachometer’s original packaging.

Indicating instrument for engine oil pressure: 51.27410–6002

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 0–6 bar/0–87 psi
– Input: 4–20mA



Test

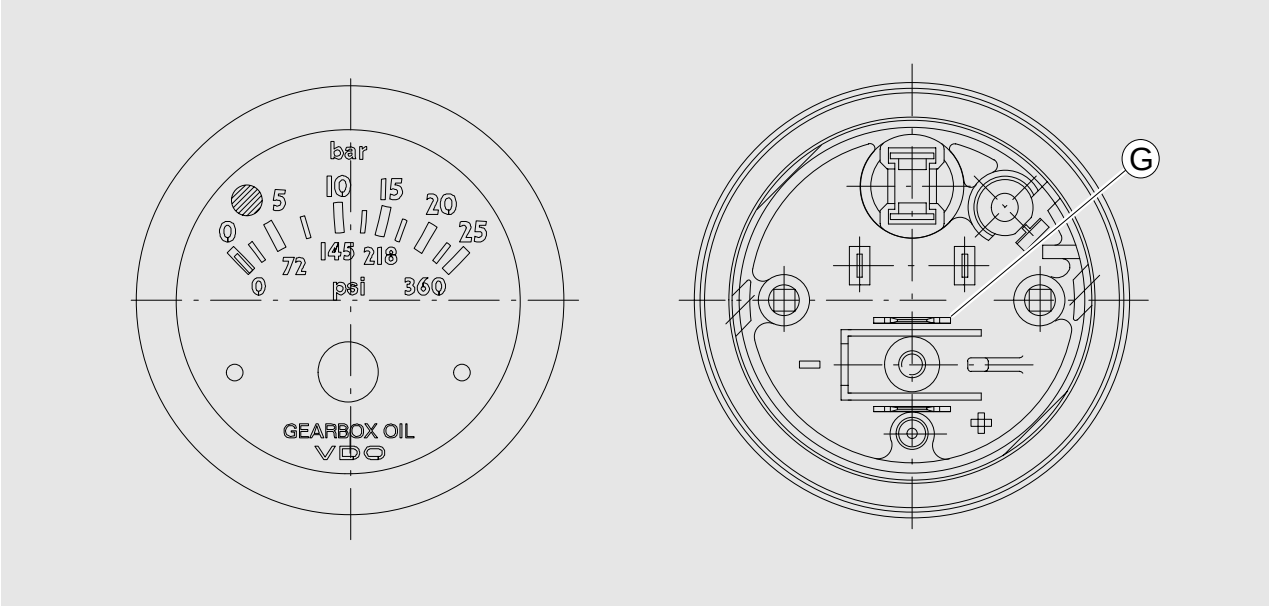
For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
Disconnect plug connection “G” from the instrument dial and connect an ammeter in the milliampere measuring range in series.

– If the corresponding current is not available, the D/A converter is faulty, the plug connection is loosely or incorrectly connected or the instrument is faulty.
– The instrument is faulty if the correct current is flowing and the instrument indicates no value.
  Replace the instrument with the adjacent instrument (except the tachometer).
  If the adjacent instrument indicates a value, the first instrument is faulty. If the new instrument also indicates no value, the fault is in the D/A converter.

Indicating instrument for gearbox oil pressure: 51.27410–6003

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 0–25 bar/0–360 psi
– Input: 4–20mA



Test

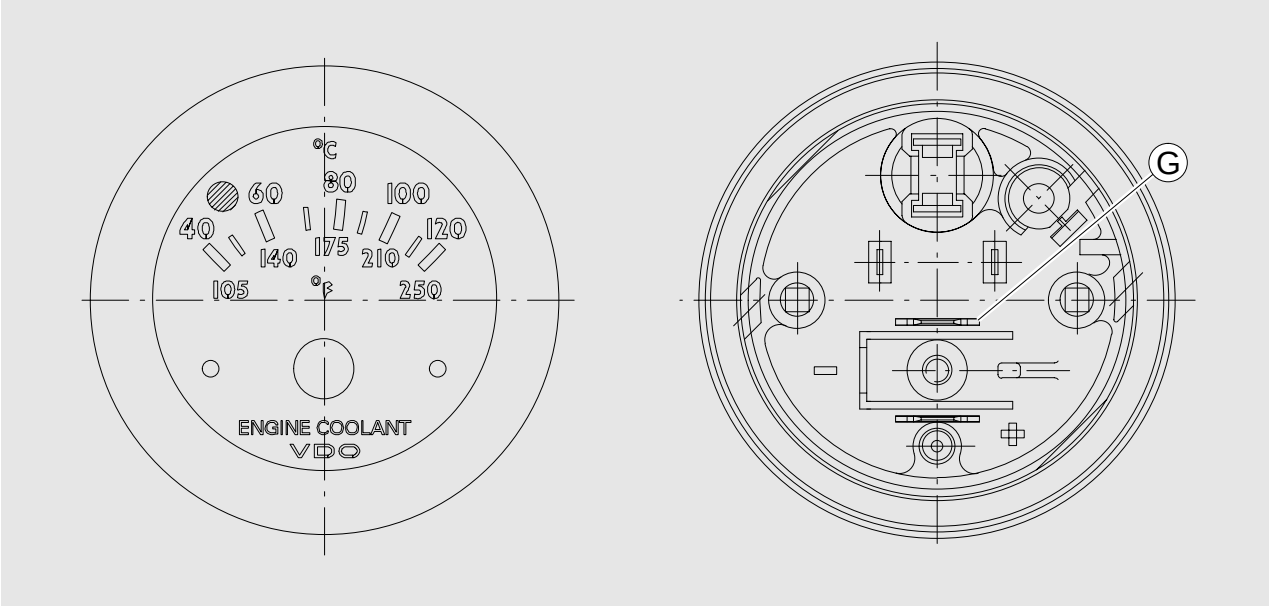
For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
Disconnect plug connection “G” from the instrument dial and connect an ammeter in the milliampere measuring range in series.

– If the corresponding current is not available, the D/A converter is faulty, the plug connection is loosely or incorrectly connected or the instrument is faulty.
– The instrument is faulty if the correct current is flowing and the instrument indicates no value.
  Replace the instrument with the adjacent instrument (except the tachometer).
  If the adjacent instrument indicates a value, the first instrument is faulty. If the new instrument also indicates no value, the fault is in the D/A converter.

Indicating instrument for coolant temperature: 51.27401–6005

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 40–120°C/105–250°F
– Input: 4–20mA



Test

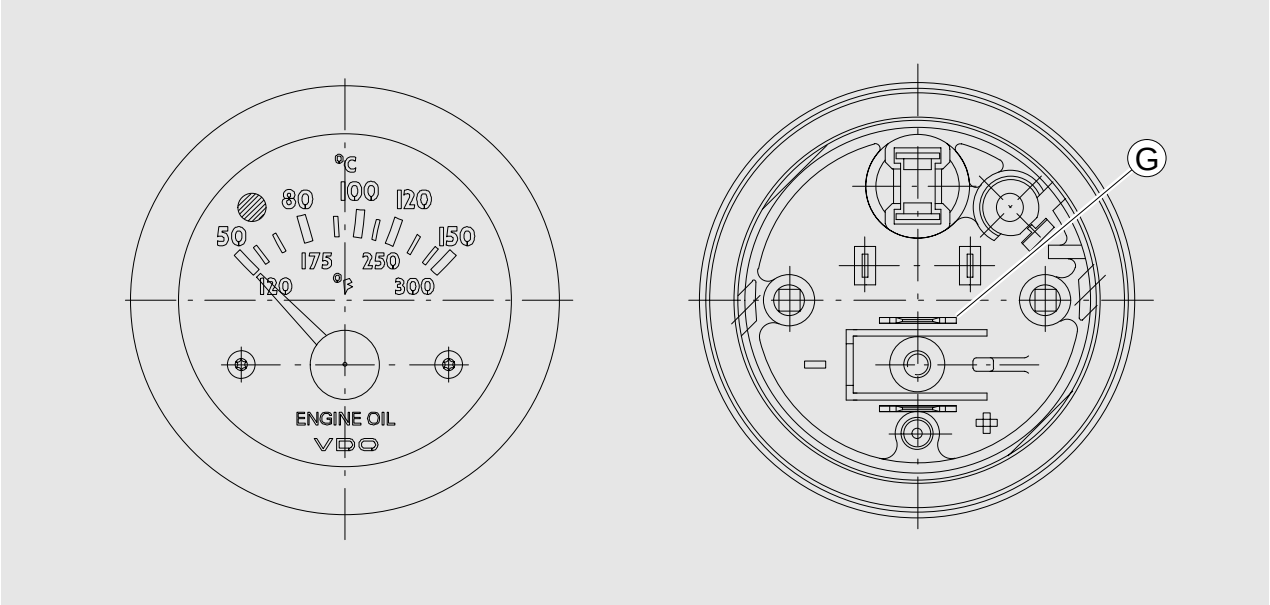
For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
Disconnect plug connection “G” from the instrument dial and connect an ammeter in the milliampere measuring range in series.

– If the corresponding current is not available, the D/A converter is faulty, the plug connection is loosely or incorrectly connected or the instrument is faulty.
– The instrument is faulty if the correct current is flowing and the instrument indicates no value.
  Replace the instrument with the adjacent instrument (except the tachometer).
  If the adjacent instrument indicates a value, the first instrument is faulty. If the new instrument also indicates no value, the fault is in the D/A converter.

Indicating instrument for engine oil temperature: 51.27401–6006

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 50–150°C/120–300°F
– Input: 4–20mA



Test

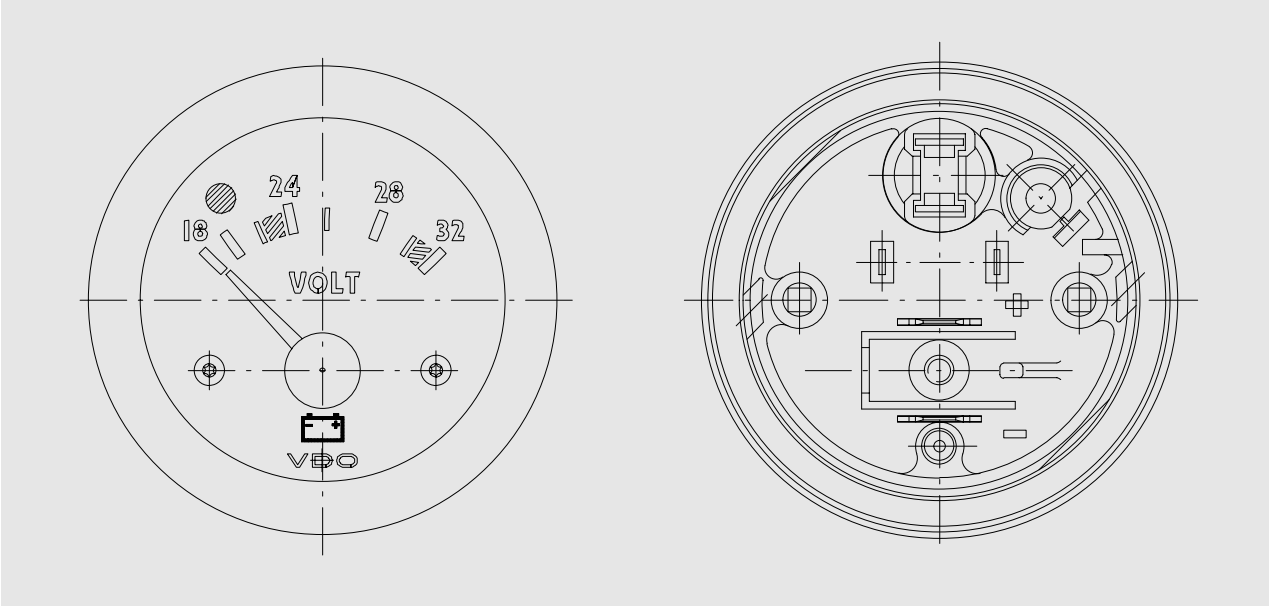
For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
Disconnect plug connection “G” from the instrument dial and connect an ammeter in the milliampere measuring range in series.

– If the corresponding current is not available, the D/A converter is faulty, the plug connection is loosely or incorrectly connected or the instrument is faulty.
– The instrument is faulty if the correct current is flowing and the instrument indicates no value.
  Replace the instrument with the adjacent instrument (except the tachometer).
  If the adjacent instrument indicates a value, the first instrument is faulty. If the new instrument also indicates no value, the fault is in the D/A converter.

Indicating instrument for battery voltage (voltage gauge): 51.27302–6001

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 18–32 volts
– Input: battery voltage



Test

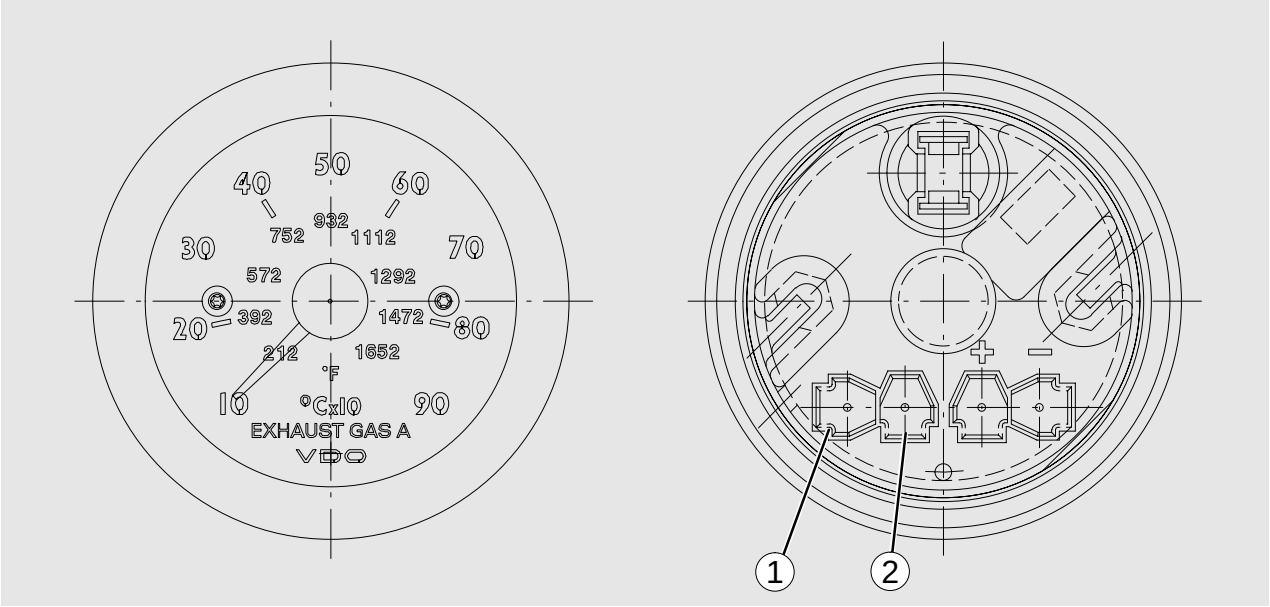
Connect a voltmeter in parallel to the voltage gauge. If voltage is available and the instrument dial indicates no value, the instrument is faulty.

Indicating instrument for exhaust-gas temperature: 51.27401–6002

Instrument characteristic data:

– Diameter: 52 mm
– Display range: 100–900°C/212–1652°F
– Input: 4–20mA

A series resistor (which is supplied) is required for a rated voltage of 24 volts.
This series resistor is not required for a rated voltage of 12 volts.



Test

For the relevant test, it is assumed that the corresponding sensor on the engine is in proper working order. This is to be read off at the engine room instrument or at the MMDS-LC.
Disconnect plug connection ② from the instrument dial and connect an ammeter in the milliampere measuring range in series.

– If the corresponding current is not available, the D/A converter is faulty, the plug connection is loosely or incorrectly connected or the instrument is faulty.
– The instrument is faulty if the correct current is flowing and the instrument indicates no value.
  Replace the instrument with the adjacent instrument (except the tachometer).
  If the adjacent instrument indicates a value, the first instrument is faulty. If the new instrument also indicates no value, the fault is in the D/A converter.

Note:
– Connection ② corresponds to connection “G” for exchanging
  (e.g. with oil pressure indicating instrument).
– Indicating instrument requires voltage supply.

Function description of MMDS-LC display unit

The MMDS-LC display unit (51.27720–7015) offers the following functions:

- Visualization of analog engine data
- Indication of engine alarms, optical and acoustic
- Indication of sensor failures, optical and acoustic
- Processing of 11 further binary ship alarms or the possibility of displaying them (generators, bilges, nautical alarms, intrusion, fire...)

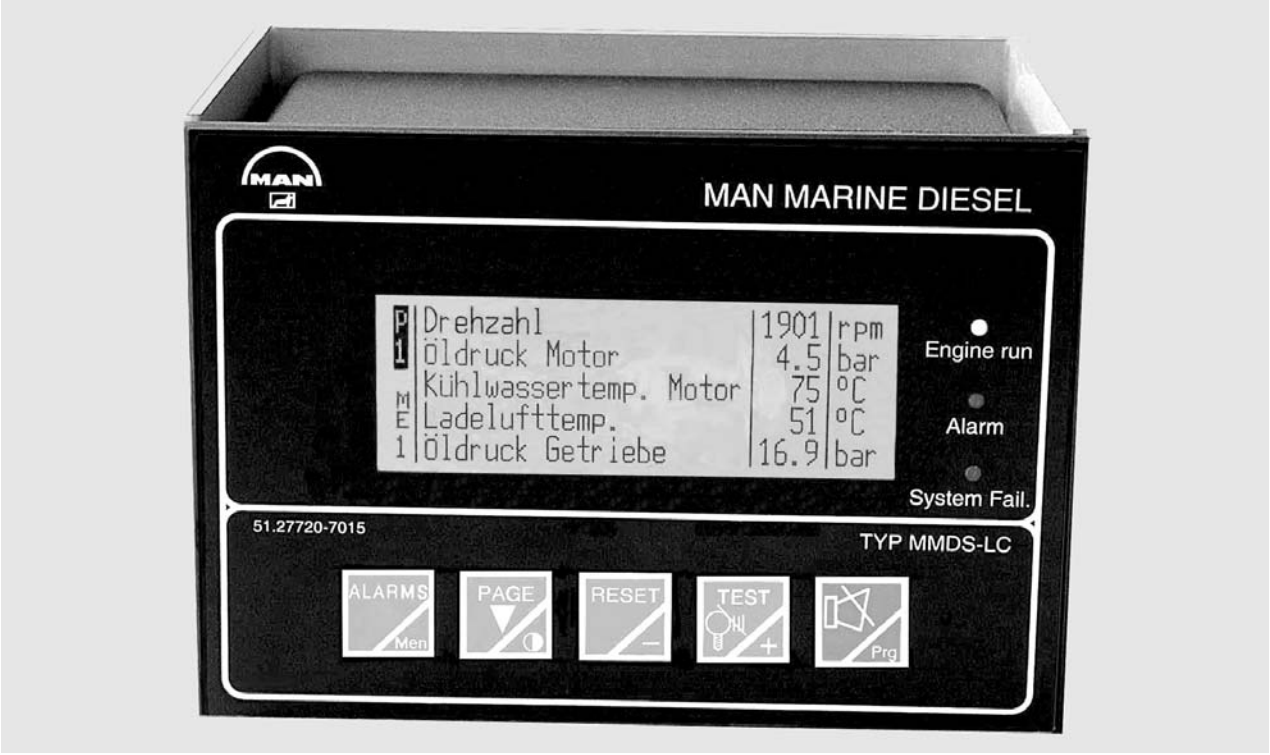
All the engine and gearbox parameters are input at the factory in the following languages: German, English, French, Italian and Spanish.

Likewise texts can be entered in the above–mentioned languages for the freely usable binary inputs. The desired language can be called up using the buttons.

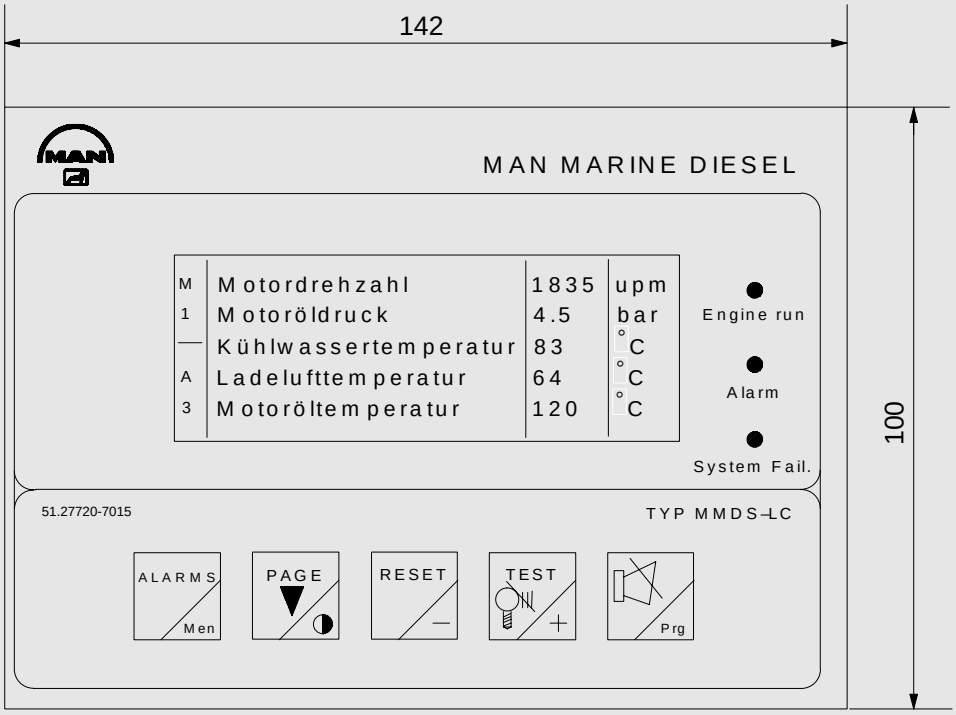
The MMDS-LC unit is connected via a serial bus system to the MMDS central monitoring and diagnostic unit in the engine terminal box. The connection is established by means of the MMDS–SD serial distribution box with the aid of a plug–in connecting cable. All the analog and binary engine and gearbox data are received via this equipment.

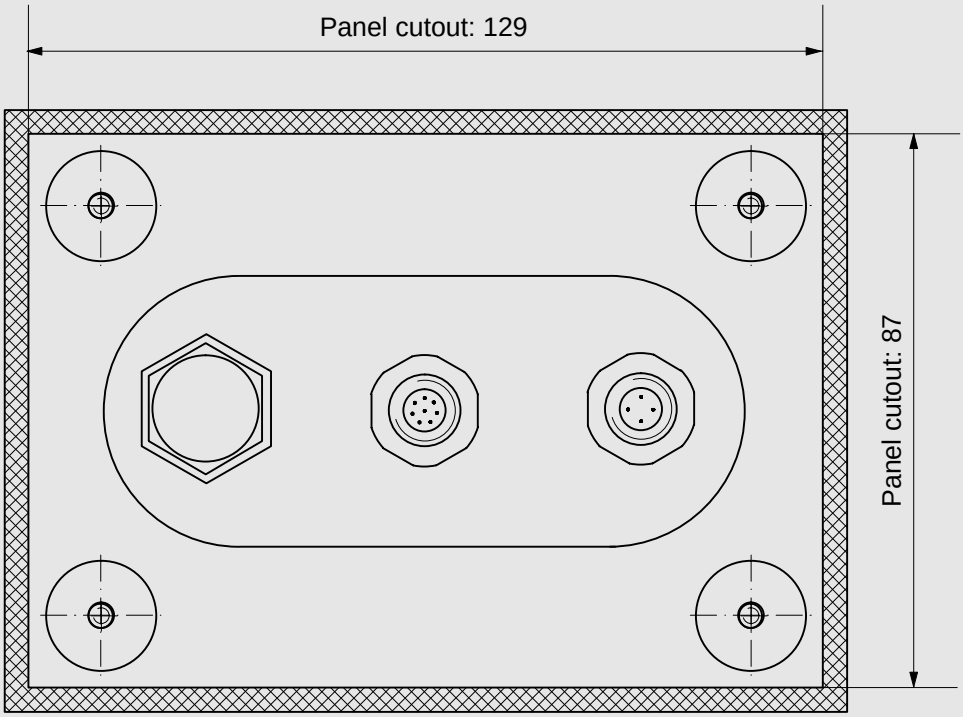
The unit is supplied with power from the engine battery while the engine ignition is on.
In order to be able to record the general ship alarms and displays even while the engine is switched off, the MMDS–SD serial distribution box offers the option of an additional incoming supply voltage. A relay changeover in the distribution box ensures that the monitor is powered by this second incoming supply while the engine ignition is off.

The built–in buzzer is activated when an alarm occurs. This also activates horn and group alarm relays in the MMDS–SD serial distribution box which can be used as required (luminous call system, telephone system for unmanned ship etc.).



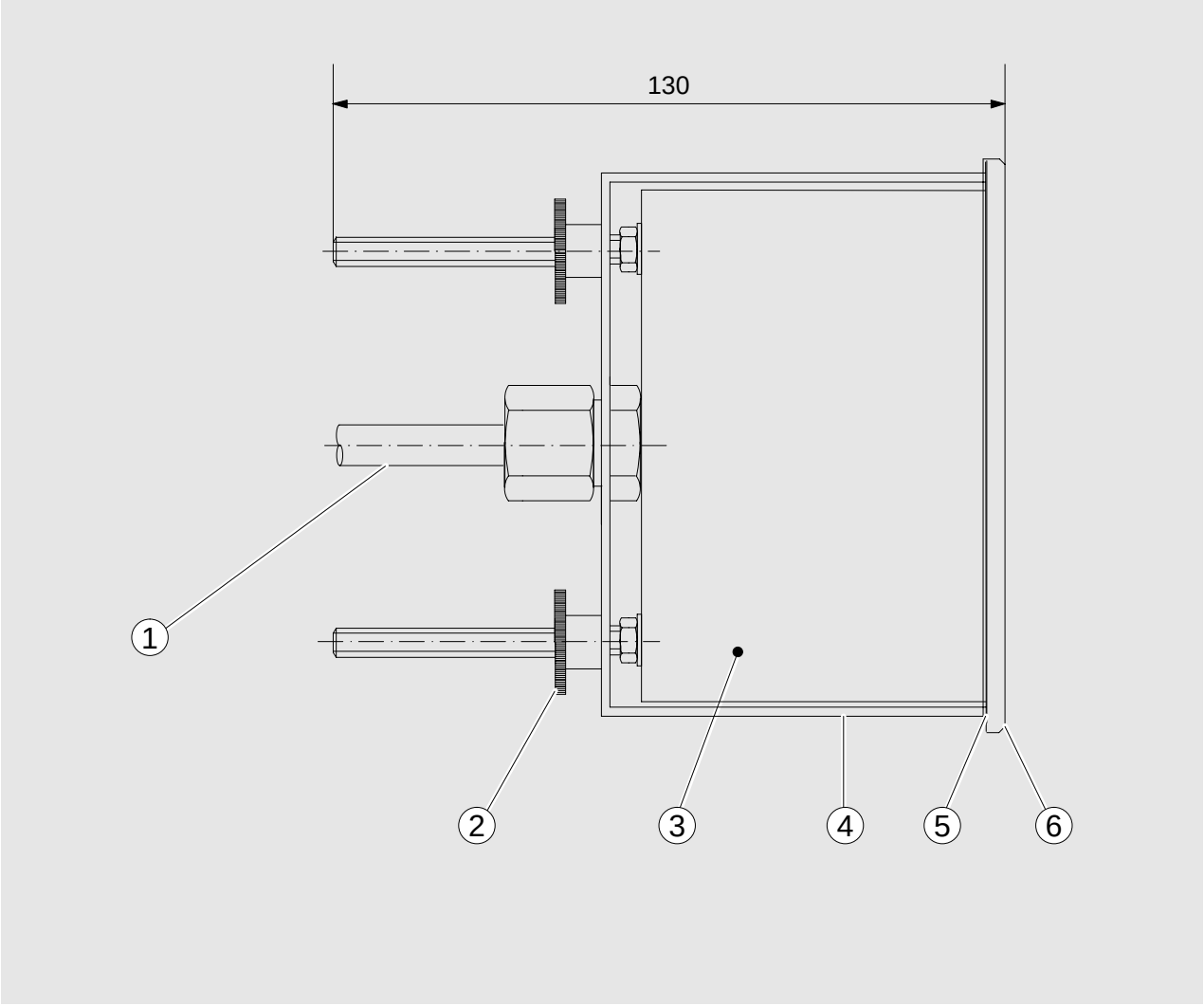
The display unit has an LCD display with graphics capabilities and dimensions of 84mm x 31mm. 5 lines each featuring 32 characters and a character height of 5.2 mm can be displayed. The display is backlit and also makes use of the incidental light. This ensures clear legibility under all lighting conditions.
All the important engine data can be called up by “scrolling” with the “PAGE” button. Currently active alarms or displays can be shown with the “ALARMS” button.


142
MAN MARINE DIESEL
M Motordrehzahl 1835 upm
1 Motoröldruck 4.5 bar
Kühlwassertemperatur 83 °C
A Ladelufttemperatur 64 °C
3 Motoröltemperatur 120 °C
Engine run
Alarm
System Fail.
100
51.27720-7015
TYP MMDS-LC
ALARMS
Men
PAGE
RESET
TEST
Prg


Panel cutout: 129
Panel cutout: 87

Design of MMDS-LC display unit

The MMDS-LC display unit is designed for installation in a control panel.
The front panel made from black anodized aluminium (AlMg1) is coated with a watertight and UV-resistant plastic film.
A flat gasket is fitted in the contact area between the unit and the console. This design achieves degree of protection IP66 for the front of the unit.
At the back of the unit, a housing shell made from AlMg1 encloses the electronics. It is pressed against the same gasket. The plug connections and the PG13.5 cable penetration achieve degree of protection IP54.
A stable U-shaped aluminium bracket, which is placed over 4 threaded bolts and pressed against the console panel by knurled nuts, provides a sound installation.



① 5m cable, 12-core, cross–section 12x0.75mm^2 for connecting general ship indications
② M4 knurled nut
③ Housing shell
④ Mounting bracket
⑤ Flat gasket
⑥ Front panel

Installation of MMDS-LC display unit

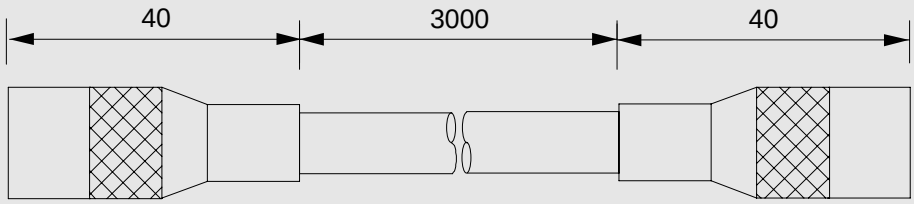
General notes

The MMDS-LC display unit can be installed e.g. in the bridge console of a ship.
A suitable installation location must have the following properties:

– A panel cutout of 129mm x 87mm is required for installing the monitor. A larger cutout must be avoided as otherwise the sealing surface between the unit and the console panel would be too small.
– The console surface must be flat in the area of the gasket contact. Once installed, the unit is secured with a U-shaped bracket and 4 knurled nuts.
– Protection against direct sunlight, if possible. The LCD display used for MMDS-LC is indeed provided with special UV protection; however, intensive sunlight will reduce the unit's service life.

A cable included in the scope of delivery provides the connection between MMDS-LC and the MMDS-LC serial distribution box.

Cable with plug for connection between MMDS-LC and MMDS-SD serial ditribution box



51.25449–0022

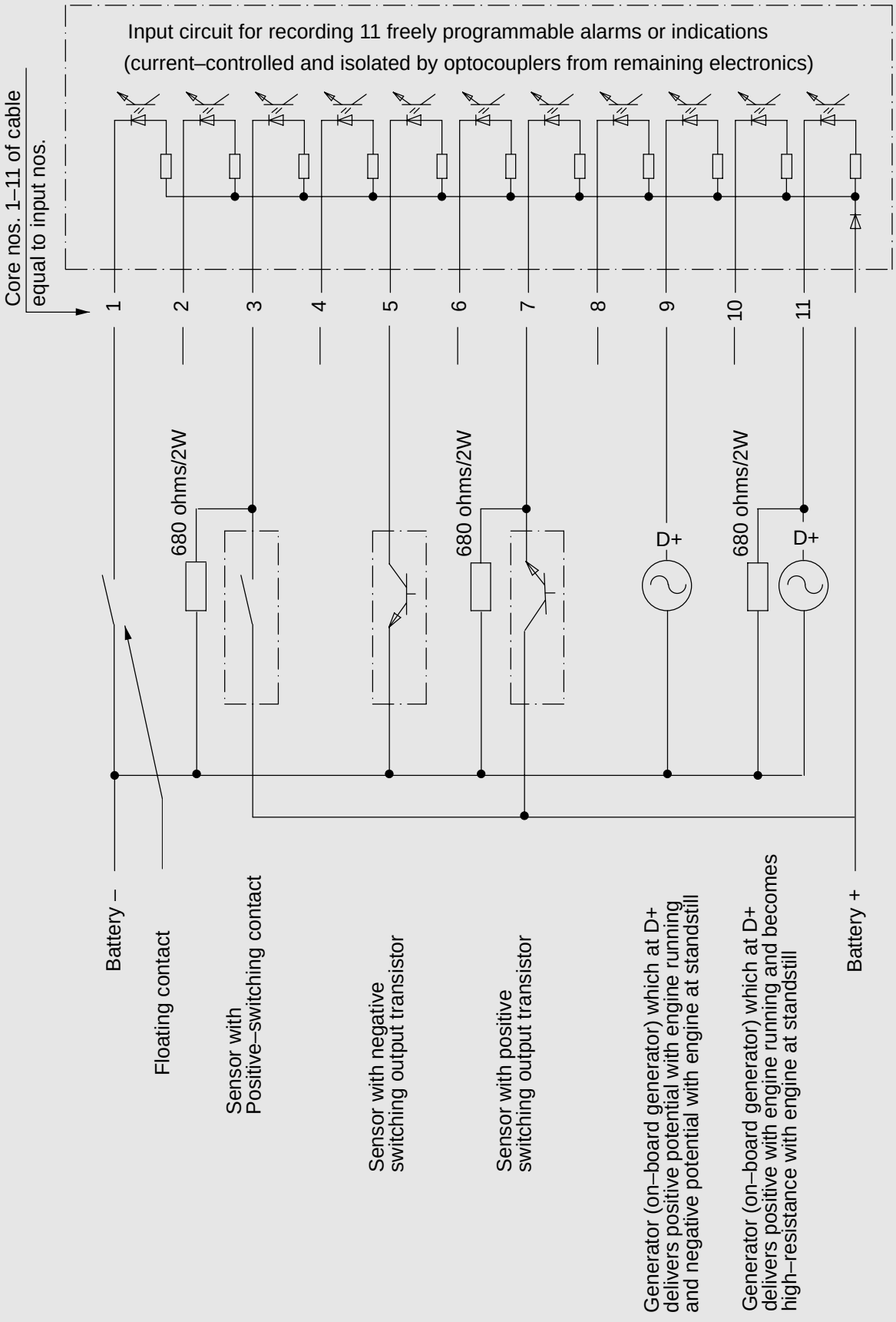
Connection of general ship indications

A 5m long 12x0.75mm^2 cable is brought out through a cable penetration (PG13.5) located on the housing shell at the back.
Its core nos. 1 to 11 correspond to the input numbers and are connected to the binary sensors (contacts, proximity switches, transistor outputs, level sensors etc.).
Battery positive must be connected to the joint core 12. The second connection of each sensor must be connected to battery negative (see connection diagram on Page 59).

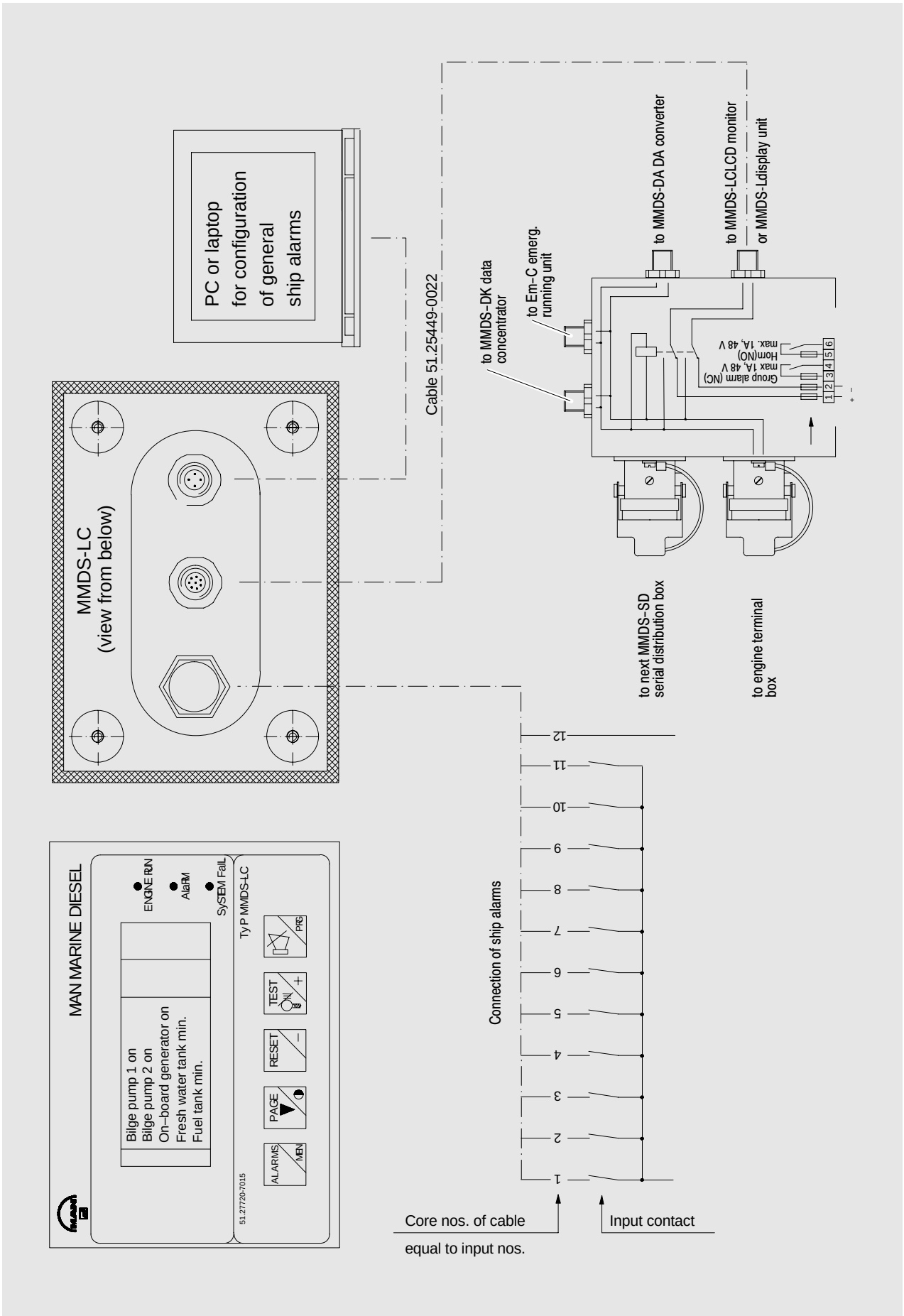
The inputs are isolated by optocouplers from the electronics. It is thus possible to record the general ship indications without conductive connection to the supply voltage. Optocouplers are current–controlled and thus insensitive to potential transfers, as can easily occur on ships.

If several MMDS-LCs for one engine are installed on a ship, the engine indications are displayed on all the units. The general ship indications however only ever appear at the point where they are connected.

Example of different input assignments / connection of ship alarms:



Connection diagram:



Technical data

Display:	192 x 64 pixels, 84 mm x 31mm, illuminated, transflective technology
Dimensions:	142 mm wide x 100 mm high x 130 mm installation depth
Voltage supply:	11 to 35 VDC
Current consumption:	approx. 0.3 A
Perm. operating temperature:	0 to 70°C
Inputs:	11 x binary via optocoupler
Outputs:	2 x floating relay contact 35VDC/1A (horn and group alarm)
Serial interfaces:	1 x TTY current loop, bidirectional
Panel cutout:	129 mm x 87 mm
Max. console panel thickness:	30 mm
Weight:	0.9 kg
Protection:	– front IP66 – back IP54

Notes on maintenance

The service life of the LCD display is reduced by UV light. Direct sunlight must therefore be avoided. If this is not possible due to local conditions, the unit should at least be fitted with a UV–resistant cover when the ship is unmanned.
To prevent the ingress of water, check that the screwed plug connectors and knurled nuts are tightly secured.

Displaying monitor pages

The engine data supplied by the MMDS are spread over 4 monitor pages. The current engine speed is displayed in the top line on every page.
The most important engine data are featured on the first page, such as engine oil pressure, coolant temperature, charge–air temperature and gearbox oil pressure. Further engine and gearbox data, such as exhaust–gas temperatures and additional information, are featured on the subsequent pages:

Page 1		Actual value (example)	
P1	Engine speed	2100	rpm
	Engine oil pressure	4.3	bar
	Engine coolant temp.	82	°C
	Charge-air temp.	41	°C
	Gearbox oil pressure	19	bar

Page 2		Actual value (example)	
P2	Engine speed	2100	rpm
	Cool. press. expans. tank	830	mbar
	Cool. press. water pump	3.9	bar
	Engine oil temp.	103	°C
	Battery voltage	27.1	V

Page 3		Actual value (example)	
P3	Engine speed	2100	rpm
	Intake depression	30	mbar
	Boost pressure	1.86	bar
	Exhaust–gas temp. T.A	629	°C
	Exhaust–gas temp. T.B	613	°C

Page 4		Actual value (example)	
P3	Engine speed	2100	rpm
	Fuel consumption	162	l/h
	Engine load	79	%

The pages are switched through with the **“PAGE”** button. Each time the button is pressed brings up the next page higher in numerical sequence. Page 4 is followed by Page 1 again.
An alarm table is provided to indicate current alarms and displays. This is called up with the **“ALARMS**” button. If there is no alarm, the text **“No message”** appears on the screen.

A1	> No message <		

When an alarm occurs, the unit switches automatically to the alarm table. A new entry appears in the top line in each case. Any messages that are already present are shifted one line down.
The identification and the current time are inserted in a column to the right. A display (message without alarm) is entered in the alarm table but there is no automatic switch to the alarm table.

There are the following different identifications:

- **Displays:** **no identification**
- **Warnings (pre–alarms):** **WA**
- **Master alarms:** **AL**
- **Sensor failure alarms:** **SE**

Example:

	Message text	ID	Time
A1	Fuel pressure	WA	14:14
	Charge–air temp.	SE	13:57
	Bilge pump ON		11:00
	Injection line leak	AL	08:37

If there are more than 5 alarms (e.g. during commissioning at the shipyard), the alarms can be displayed in groups of five (A2 to An) by further pressing the **“ALARMS”** button (see also Page 66)
All alarms are always displayed in reverse sequence to that in which they occurred. The alarm that occurred last therefore appears in the first line of the alarm table. The red **“Alarm”** LED to the right of the display lights up as long as at least one alarm is active.

Alarms

The built–in buzzer is activated and the ”Alarm” LED flashes provided an engine alarm from the MMDS central unit or a configured alarm occurs.
At the same time the monitor switches automatically to the alarm table. The new alarm is entered in the first line as a flashing message. The alarms that would occur erroneously with the engine at a standstill but with the ignition switched on (e.g. insufficient oil pressure) are suppressed until the green “Engine run” LED lights up. This occurs approx. 8s after firing speed is reached.

In the MMDS-SD serial distribution box, the horn relay (NO) closes and the group alarm relay (NC) drops out. If an alarm was already active beforehand, the group alarm relay outputs a repeat pulse (group alarm repeat).
It picks up for approx. 3s and then drops out again. In this way, it is e.g. possible with each new alarm to activate a luminous call system or leave a telephone message if the ship is unmanned.

After actuation of acoustic acknowledgement (Horn ackn button), the integrated buzzer switches off and the horn relay in the MMDS-SD serial distribution box drops out. With optical acknowledgement (Optic ackn button), the flashing text and the “Alarm” LED switch to permanent display. The alarm text in the monitor also disappears when the fault is rectified. The “Alarm” LED goes out provided another alarm is not present.

The “RESET” button must also be pressed in the event of alarms which have resulted in automatic engine shutdown or slowdown by the MMDS central unit. This function is enabled for a shutdown alarm only when the engine is at a standstill and for a shutdown alarm below a speed of 800 rpm.

Alarm acknowledgement and “RESET” are transmitted to the serial bus and from there to all the other monitoring units. There they effect the same function. This always applies to the MMDS monitoring and diagnostic system. It also affects the following units if fitted:

- MMDS-L monitoring unit
- MMDS-EP engine room panel
- If necessary, further MMDS-LC monitors

Operating parameters and analog alarms:

LCD display Page 1:
– Engine speed
– Engine oil pressure
– Engine coolant temperature
– Charge–air temperature
– Gearbox oil pressure (does not result in alarm, see Page 30)

LCD display Page 2:
– Engine speed
– Coolant pressure expansion tank
– Coolant pressure water pump
– Engine oil temperature
– Battery voltage

LCD display Page 3:
– Engine speed
– Intake depression
– Boost pressure
– Exhaust–gas temperature T.A.
– Exhaust–gas temperature T.B. (V-engines only)

LCD display Page 4 (EDC engines only):
– Engine speed
– Fuel consumption
– Engine load

Binary alarms:

– Coolant level
– Engine speed sensor
– Gearbox oil temp. (only active if sensor fitted on gearbox, see Page 30)
– Battery charge
– EDC failure
– System failure
– Overspeed
– Fuel filter (option)
– Throttle lever signal
– Ambient temperature
– Fuel temp.
– Injection line leak (option)
– Stop circuit wire break (mechanically controlled engines only)
– Remote slowdown (only if ”terminal box– terminal box” connecting cable is connected)
– Gearbox oil pressure (only active if sensor fitted on gearbox, see Page 30)

Horn test

When the “Horn acknowledge” button is pressed for approx. 5s, the integrated buzzer sounds and the horn relay in the MMDS–SD serial distribution box closes.

System failure

The unit has a red LED with the designation System Failure in the front panel. This LED is activated in the following two cases:

– Failure of the serial data from the MMDS safety, alarm and diagnostic system in the engine terminal box. In this case, the “Alarm” LED also flashes and the text “System failure” appears in the alarm table.
– Malfunction of the LCD monitor itself. In this case, no further message appears.

Button functions

The front panel incorporates 5 buttons which are used to execute various functions such as page switching, contrast adjustment, alarm acknowledgement and menu control.
The buttons are assigned the following functions in particular:

HORN ACKN:

Standard function: Acoustic acknowledgement or deactivation of the internal horn.
In addition, the horn relay in the serial distribution box drops out. All other monitoring units in the system are acknowledged via the serial bus.

Test function: Holding down the button for at least 5s activates the integrated buzzer. In addition, the horn relay in the MMDS-SD serial distribution box closes.

Menu function: Accept currently selected setting (Prg=Program).

OPTIC ACKN / TEST:

Standard function: Optical acknowledgement, i.e. all the flashing alarm texts in the currently visible alarm table switch to constant display provided the horn was acknowledged beforehand.
The red Alarm LED integrated in the front panel is likewise switched from flashing to continuously lit. All other monitoring units in the system are acknowledged via the serial bus.

Test function (if no alarm is currently present, or all the occurred alarms were optically acknowledged beforehand): Lamp test, i.e. the three LEDs in the front panel are activated for as long as the button is pressed.

Special function: See explanation of “PAGE” button.

Menu function: Move selection pointer to right or increase input value.

RESET:

Standard function when a slowdown or shutdown alarm has occurred: A “Reset” signal is transmitted via the serial bus to the MMDS central unit (engine terminal box).
If the corresponding criteria (see “Alarms” on Page 63) are satisfied, the cause of the alarm has been eliminated and there has been an acknowledgement, the occurred slowdown or shutdown alarm can thus be reset in the central unit.

Special function: See explanation of “PAGE” button.

Menu function: Move selection pointer to left or increase input value.

PAGE:

Standard function: Switch to the next display table higher for analog engine data.
The page number is designated P1 to P4 in the top left corner. Page 4 is followed by Page 1 again. If this button is pressed while the alarm table is being displayed, the monitor switches back to the page from which the alarm table was originally called up.

Special function: Button enables adjustment of the LCD contrast with simultaneous pressing of the (+) and (–) buttons.

ALARMS:

Standard function: Calls up the alarm table. The last five occurred and still active alarms or displays are shown. The identification A1 appears at top left in the monitor.
If more than five messages are currently active, five further messages can be displayed by pressing the button again. The page number is designated A1 ... Ax in the top left corner. If after this button is pressed the display jumps to the first alarm table or the display remains unchanged, this means that no further messages are active.

Special function: Holding down the button for at least 5 seconds activates the integrated configuration menu, where it is possible to set the language, units, date and time. This button is also used to enable PC communication for programming general ship alarms (see “Menu functions” and “Programming general ship alarms” on Page 69).

Menu function: This button also has an Escape function (Esc) within the menu. In each case, the user goes back one menu level, or from the main menu to the normal display function.

Menu functions

The user accesses the configuration menu by holding down the “ALARMS” button. The buttons are now assigned the meanings described under “Menu function” (see Page 67).
The new allocation is highlighted continuously in black in the lower line:

Escape	Move selection pointer	Accept setting
esc (Men)	**move(+/–)**	**enter(Prg)**

Menu prompting is now implemented in English and cannot be changed.
The user first goes into the main menu, where the language and units for measuring point designations and measured values can be selected.
Further subfunctions for time setting (set-time) as well as service functions incl. PC communication (service) are also available here.
Each current selection procedure can be cancelled with the Escape button (Men). However all other settings made beforehand are not affected by this.

Displaying language and units

Once the menu has been called up, the current settings are highlighted in black. A flashing selection pointer marks the language currently set (e.g. English):

English	German	French	Italian	Spanish
> (US/GB) <	(D)	(F)	(I)	(E)

The selection pointer can be moved with the Move function (+/–). The Enter function (Prg) is used to mark and highlight in black the relevant language.
The selection pointer then jumps to the unit currently set for temperatures (e.g. °F):

Display in degrees Celsius	Display in degrees Fahrenheit
(°C)	**> (°F) <**

The selection is again made with the Move function (+/–) followed by acceptance with the Enter function (Prg). The selection is marked and highlighted in black and the selection pointer jumps to the unit currently set for pressures (e.g. bar).

Display in BAR	Display in PS
> (BAR) <	(PS)

After this selection and acceptance, all the language and unit settings are completed and marked and highlighted in black accordingly.

The selection pointer jumps to the penultimate line to the "**exit**" position:

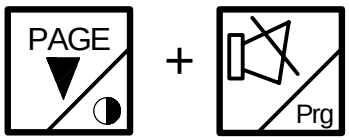
> exit <	back	set-time	service

If this is confirmed with the Enter function (Prg) or cancelled at this point with the Escape function (Men), the user returns with the currently marked status to the normal display function. If an input mistake has been made, the input can be repeated with the "**back**" function.
The selection pointer jumps back to the start position (language selection).

Night design (inverse display)

The LC display can be switched over to night design, a so–called inverse display. The background is dark while the digits are brightly lit:

Button combination: Contrast and simultaneously Horn off



Back to normal display: same button combination

Setting time

The selection pointer must first be brought to the penultimate line. For this purpose, the current language and unit setting is confirmed each time with the Enter button (Prg). The pointer can now be positioned with the Move buttons (+/–) to "**set–time**".

exit	back	**>set-time<**	service

The function is called up with the Enter button (Prg).

A new page is called up and the current time (time / date) displayed. The selection pointer jumps to hour.

set time		hour / minute / second
time	(H:M:S)	**>13<** : 29 : 56

		day / month / year
date	(D.M.Y)	27 . 06 . 00

If no changes are to be made, the operation can be cancelled with the Escape function (Men).
Otherwise the setting is made with the Move buttons (+/–) and the Enter button (Prg) in the sequence: hour, minute, second, day, month and year.
A correct time or date input is confirmed with the Enter button (Prg) and the selection pointer jumps to the next value. The last figure is the year, after which the selection pointer jumps to the penultimate line to the **"exit"** position; the time setting is now completed.

> exit <	back	get-mmds-time

The user returns to the main menu by confirming with the Enter function (Prg) or with the Escape button (Men). If an input mistake has been made, the input can be repeated with the "**back**" function.

An additional function makes it possible to download the system time of the MMDS central unit into the display module.
For this purpose, the selection pointer is positioned to **"get-mmds-time"** and confirmed with Enter (Prg). Provided the central unit is active (engine ignition ON), the date and time are overwritten and the following message appears briefly in the display:

>>> LOAD MMDS-SYSTEM-TIME <<<

If the central unit is deactivated (engine ignition OFF), nothing is altered and the following message appears:

>>> NO MMDS-TIME RECEIVED <<<

The selection pointer jumps back to the penultimate line to the **"exit"** position.

PC communication / programming general ship alarms

If the general ship alarms are to be programmed from the PC, it will be necessary to activate this function **beforehand**.
For this purpose, the selection pointer must first be brought to the penultimate line. The current language and unit setting is confirmed several times with the Enter button (Prg). The pointer can then be positioned with the Move buttons (+/–) to **“service”**.

exit	back	set-time	**>service<**

The service submenu is now called up with the Enter button (Prg). The pointer is positioned at **“pc-com”**.

Service	**> pc-com<**
	mmds-analog-monitor
	exit

Activation is effected by calling up the function **“pc-com”**, the following display appears:

>>> PC-COMMUNICATION <<<	
wait	esc(Men)

The system is now ready to receive new configuration data from the PC, communication with the PC is activated.
Once this operation is completed, the user returns with the Escape function (Men) to the normal display function.

Service function

An additional function helps the service technician to view all the analog channels of the MMDS central unit. This is of particular interest if during a commissioning procedure additional sensors are to be connected and no further aids for visualization are available.
The selection pointer must first be moved to the penultimate line to access the service menu. The current language and unit setting is confirmed each time with the Enter button (Prg) and the pointer is then positioned with the Move buttons (+/–) to **“service”**:

exit	back	set-time	**>service<**

The service submenu is selected and the selection pointer moved to **“mmds-analog-monitor”**:

Service	pc-com
	mmds-analog-monitor
	exit

After being called up with the Enter button (Prg), the display switches and indicates the current measured values of all 26 analog channels of the MMDS central unit simultaneously on one page with the following allocation:

MMDS-Analog 1–26

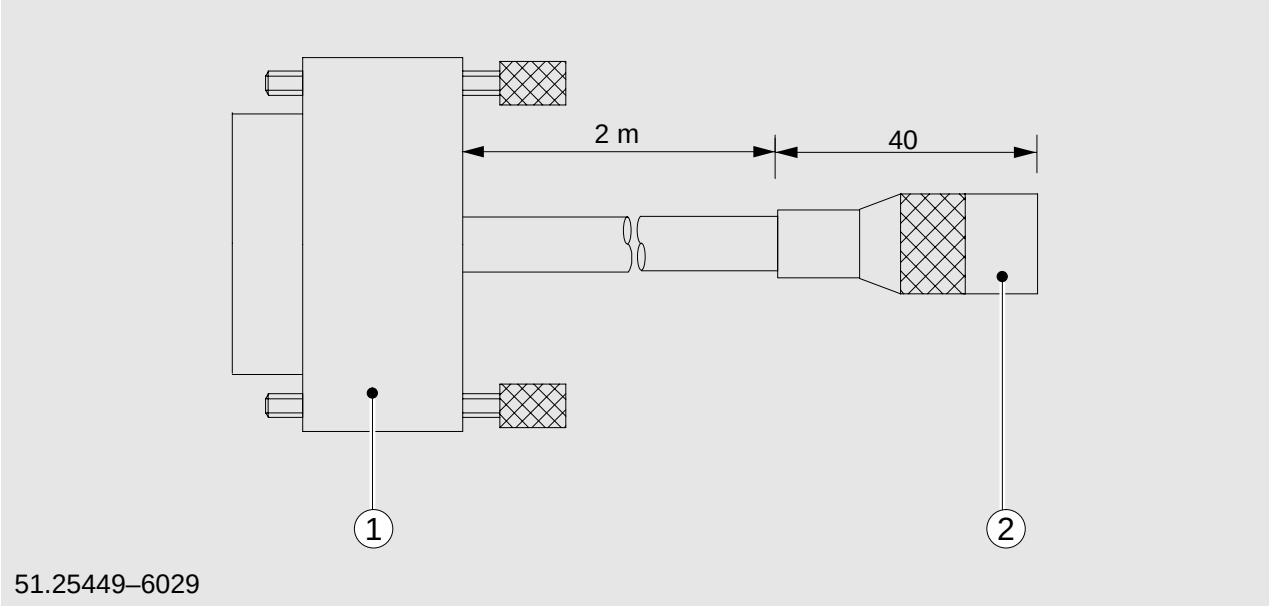
1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26				

The 26 analog channels are defined as follows:

Input no.	Designation
1	Exhaust-gas temperature before turbocharger, side A
2	Exhaust-gas temperature before turbocharger, side B
3	Exhaust-gas temperature after turbo
4	Sea water flow
5	Pressure after sea water pump
6	Fuel pressure
7	Throttle lever
8	Engine oil pressure
9	Gearbox oil pressure
10	Coolant in expansion tank
11	Coolant pressure after water pump
12	Intake depression
13	Sea water temperature before engine
14	Sea water temperature after engine
15	Engine oil temperature
16	
17	Exhaust backpressure
18	Ambient temperature
19	Operating voltage
20	Boost pressure
21	Load/control rod travel
22	Coolant temperature
23	Charge–air temperature
24	Engine speed
25	Fuel temperature
26	Relative load

The MMDS-LC display unit is equipped with an RS232C serial interface which is brought out at the rear of the housing via a 4-pin connecting jack.
A special adapter cable for serial communication is included in the scope of delivery.
The 4-pin screwed plug connection is connected to the display and the 9-pin SUB-D jack is connected to a free serial port (COM1...COM4) of the PC.

Adapter cable with plug for connection between MMDS-LC and a laptop or PC



51.25449–6029

① SUB-D jack, 9-pin ② Plug, 4-pin

The MMDS–LC monitor to be programmed is then switched on. Power can be supplied from either the engine battery (ignition ON) or an external source (via MMDS-SD).
Before the configuration software is now called up, the programming must be activated by way of the designated menu function (see Page 69).

The configuration can be created for each input by means of menu–driven PC software.
The following parameters can be selected:

– Measuring point texts for each input in 5 languages (limited to 21 characters)
– Input acts as alarm or display
– ON delay (0 to 99 s)
– OFF delay (0 to 99 s)
– Contact normally closed (NC) or normally open (NO)
– Alarm suppression by input (core no.)
– Alarm suppression with engine at standstill (in conjunction with MMDS central unit)

CD-ROM for programming ship alarms: item number 51.99585–4030 (German and English)

Basic settings on delivery

When the unit is delivered, the general ship alarms are preconfigured as follows:

– Measuring point texts for the 11 inputs (X01.. X11 corresponding to the core numbers)
– All inputs as ALARM
– All inputs normally open (NO)
– All suppressions deactivated
– ON and OFF delays: 3 seconds

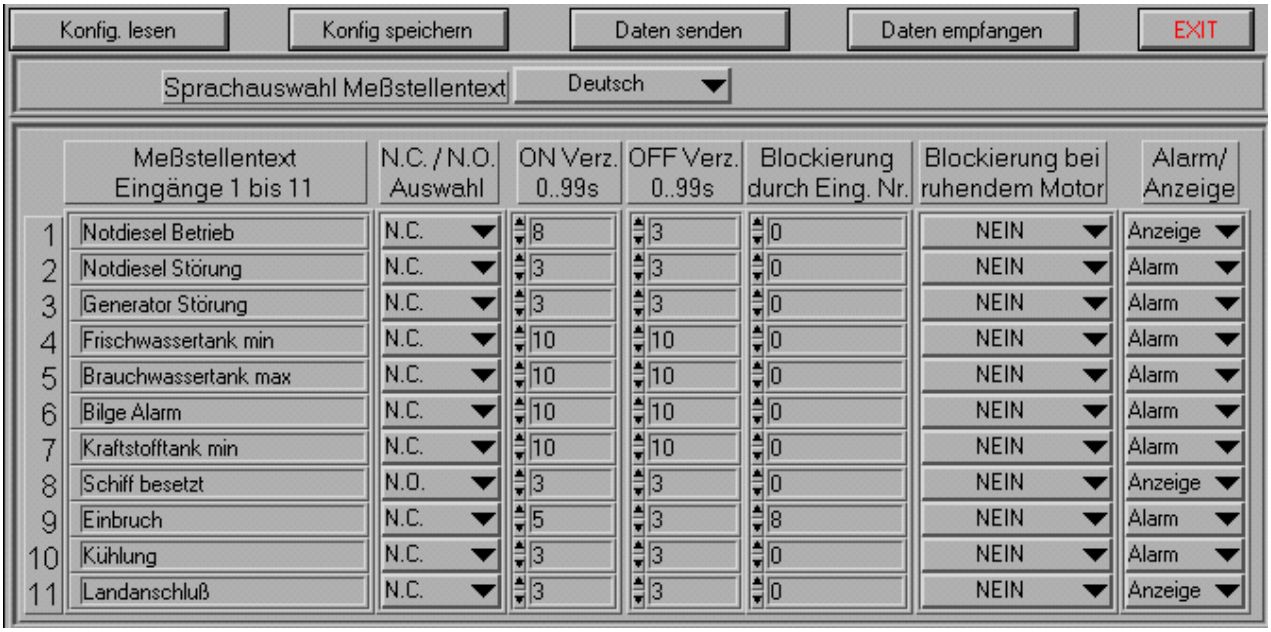
Installing PC configuration program

Begin by inserting the CD containing the MMDS-LC configuration software in the drive. Then switch via the EXPLORER into the subdirectory with the desired language (e.g. English).
Here call up the SETUP program and follow the installation instructions. After installation is complete, the configuration program can be called up via the Windows start menu.

Calling up PC configuration program

The program detects an activated and enabled unit automatically.
If the MMDS-LC is not switched on or the interface is not functioning, the program responds with the question as to whether the user is to work without the display.
If this option is selected, the control elements for transmitting and receiving data are no longer available. However data can still be read from and saved to the hard disk.
This provides the option of creating a new configuration without an MMDS-LC unit being connected.
After installation, the configuration software is called up via the Start menu. The “Start window” (Fig. 1) appears on the screen. The alarm and blocking states shown here are entered as an example and in this respect are only intended to explain the option of programming:

Fig. 1: Start window



	Meßstellentext Eingänge 1 bis 11	N.C. / N.O. Auswahl	ON Verz. 0..99s	OFF Verz. 0..99s	Blockierung durch Eing. Nr.	Blockierung bei ruhendem Motor	Alarm/ Anzeige
1	Notdiesel Betrieb	N.C.	8	3	0	NEIN	Anzeige
2	Notdiesel Störung	N.C.	3	3	0	NEIN	Alarm
3	Generator Störung	N.C.	3	3	0	NEIN	Alarm
4	Frischwassertank min	N.C.	10	10	0	NEIN	Alarm
5	Brauchwassertank max	N.C.	10	10	0	NEIN	Alarm
6	Bilge Alarm	N.C.	10	10	0	NEIN	Alarm
7	Kraftstofftank min	N.C.	10	10	0	NEIN	Alarm
8	Schiff besetzt	N.O.	3	3	0	NEIN	Anzeige
9	Einbruch	N.C.	5	3	8	NEIN	Alarm
10	Kühlung	N.C.	3	3	0	NEIN	Alarm
11	Landanschluß	N.C.	3	3	0	NEIN	Anzeige

Four buttons are set out in the top bar of the Start window. They can be used to read already existing display configurations from the hard disk and to save newly created configurations. In addition, the data can be transmitted from the PC to the display and data can be read from the display.

Two selection menus are set out in the line underneath (Fig. 2). These menus are activated by clicking with the mouse and permit configuration of the display.
Thus activating the ”Read Config.” button brings up a file selection window in which existing data records can be accessed.
Activating the ”Send Data” or ”Receive Data” button opens a dialog window for transmitting the data to the MMDS-LC.

Fig. 2: Main control elements

Clicking on the language selection button brings up a selection menu as shown in Fig. 3:

Fig. 3: Language selection

This menu can be used to carry out the programming of the alarm texts in different languages.

For example, programming could be displayed as follows: Fig. 4a for German-speaking areas and Fig. 4b for English–speaking areas.

Fig. 4a: German

	Meßstellentext Eingänge 1 bis 11
1	Notdiesel Betrieb
2	Notdiesel Störung
3	Generator Störung
4	Frischwassertank min
5	Brauchwassertank max
6	Bilge Alarm
7	Kraftstofftank min
8	Schiff besetzt
9	Einbruch
10	Kühlung
11	Landanschluß

Fig. 4b: English

	Meßstellentext Eingänge 1 bis 11
1	Emerg. engine running
2	Emerg. engine fail
3	Generator fail
4	Fresh water tank min
5	Grey water tank max
6	Bilge alarm
7	Fuel oil tank min
8	ship attended
9	Burglary
10	Fridge
11	harbour power supply

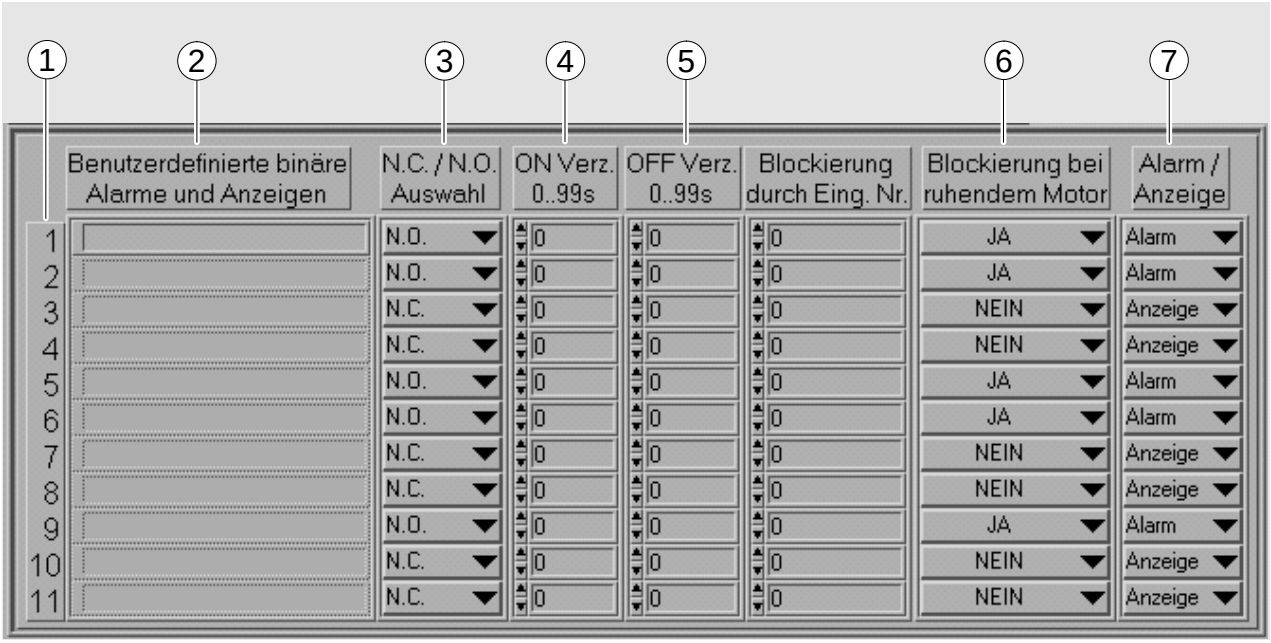
The programming thus performed is assigned to the relevant language displayed after transmission to the display.

The alarms / displays can be configured by way of the buttons and input fields to the right of the measuring point texts. It is thus possible to set whether a contact is normally closed or open, which ON and OFF delays have a contact (e.g. bilge level) and the input by which a suppression is carried out.
It is also possible to input here whether an alarm is still triggered when the engine is at a standstill and whether the input is a display or an alarm.

An input can be suppressed by any other input. For this purpose e.g. ”Door contact 3 open” could be entered in the text field under number 1.
In order for this to be suppressed by the 5th input (Intruder alarm system off), the number 5 must be entered in the first line in the “Blocking by input no.” field.
A ”0” is entered in this field if the entry is not suppressed.

Once all the settings have been made, they can be transmitted to the MMDS-LC LCD monitor and saved to the hard disk. It is thus possible to transmit the same programming to various units without having to make a new entry every time.
The user should make note of the file name on the unit so that he can access the file quickly e.g. in the event of any queries.

Fig. 5: Programmable alarm parameters



① Serial nos. Core nos. of 12–pin cable
② Measuring point designation
③ Switch is normally closed / open
④ ON delay
⑤ OFF delay
⑥ Dependent on engine running / standstill
⑦ Alarm or display

System requirements

There are only system requirements with regard to processor speed. A Pentium PC with min. 133 MHz and free hard disk memory of 10 MB will suffice.
Windows NT 4.0 SP3 and higher, Windows 95 (98) or Windows 2000 can be used as the operating system.

Function of MMDS-L display unit

The MMDS-L display and alarm monitor system (51.27720–7008) is a component of the equipment range developed by MAN for monitoring and diagnosing diesel engines.

The unit serves to indicate engine alarms and displays in optical and acoustic form.

It is connected via a serial bus system to the MMDS central monitoring and diagnostic unit in the engine terminal box. The connection is established by means of the MMDS-SD serial distribution box with the aid of a plug–in connecting cable.

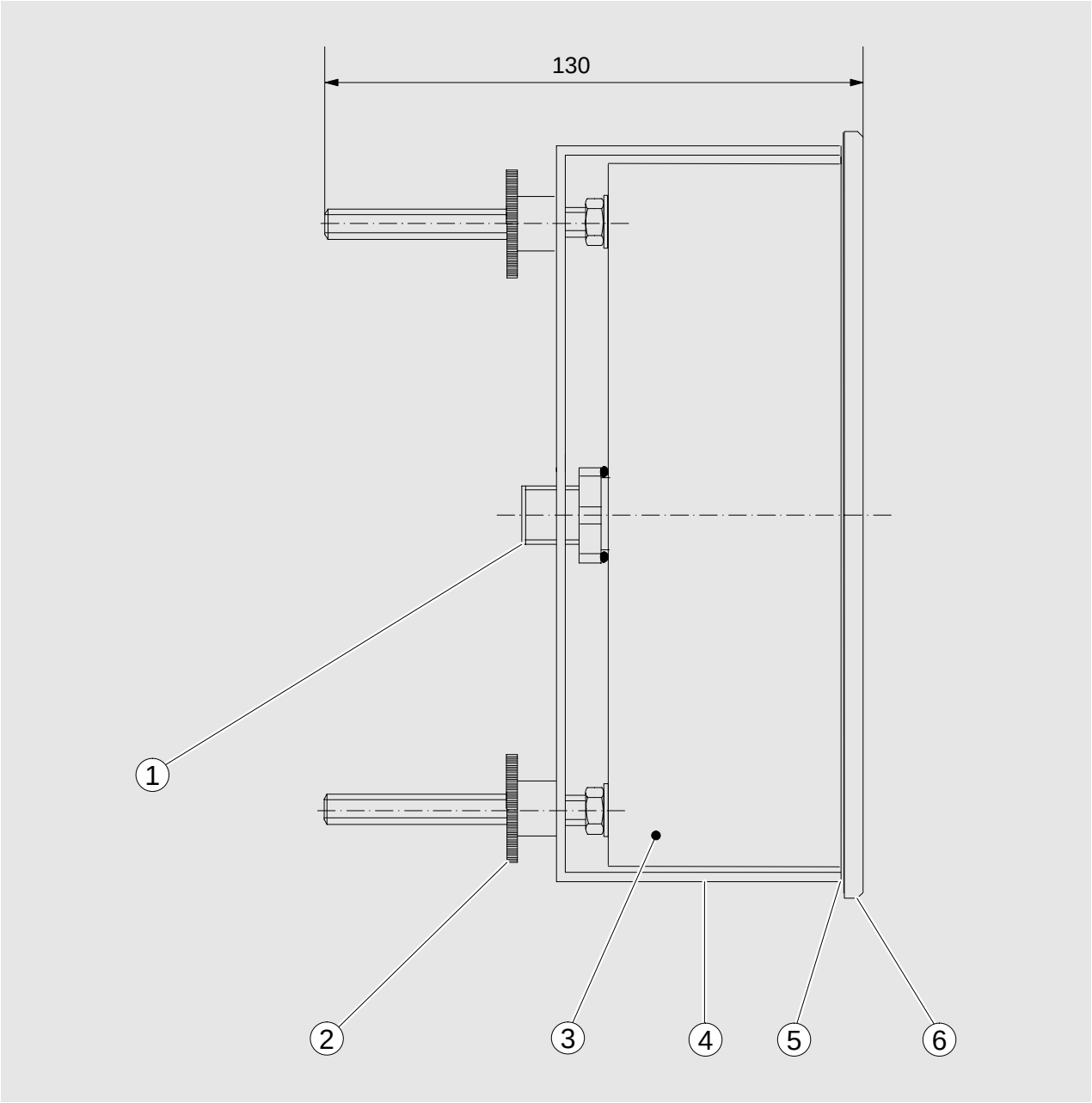
The unit is supplied with power from the engine battery while the engine ignition is on.

The integrated buzzer is activated in the event of an alarm. This also activates horn and group alarm relays in the MMDS-SD serial distribution box which can be used as required (luminous call system, telephone system for unmanned ship etc.).

MMDS-L display system

Design of MMDS-L display unit

The MMDS-L display unit is designed for installation in a control panel.
The front panel made from black anodized aluminium (AlMg1) is coated with a watertight and UV-resistant plastic film.
A flat gasket is fitted in the contact area between the unit and the console. This design achieves degree of protection IP66 for the front of the unit.
At the back of the unit, a housing shell made from AlMg1 encloses the electronics. It is pressed against the same gasket and thus achieves degree of protection IP 54 from the back.
A stable U-shaped aluminium bracket, which is placed over 4 threaded bolts and pressed against the console panel by knurled nuts, provides a sound installation.



① Socket
② M4 knurled nut
③ Housing shell
④ Mounting bracket
⑤ Flat gasket
⑥ Front panel

Installation of MMDS-L display unit

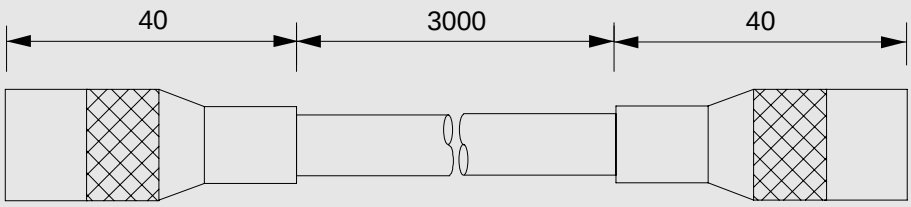
General notes

The MMDS-L display unit can be installed e.g. on the flybridge of a ship.
A suitable installation location must have the following properties:

– A panel cutout of 116 mm x 106 mm is required for installing the monitor. A larger cutout must be avoided as otherwise the sealing surface between the unit and the console panel would be too small.
– The console surface must be flat in the area of the gasket contact. Once installed, the unit is secured with a U-shaped bracket and 4 knurled nuts.

A cable included in the scope of delivery provides the connection between MMDS-L and the serial distribution box.

Cable with plug for connection between MMDS-L and MMDS-SD serial distribution box



51.25449–0022

Alarms

The integrated buzzer is activated if an engine alarm is issued from the MMDS central unit.

In the event of a pre-alarm, only the LED of the associated measuring point flashes. In the event of a master alarm, the ”Alarm” status LED is also activated.
If the alarm is a shutdown or slowdown alarm, the corresponding status LED “Engine slow down” or “Engine stop” also lights up.

In the MMDS-SD serial distribution box, the horn relay (NO) closes and the group alarm relay (NC) drops out.
If an alarm was already active beforehand, the group alarm relay outputs a repeat pulse (group alarm repeat).
It picks up for approx. 3s and then drops out again. In this way, it is e.g. possible with each new alarm to activate a luminous call system or leave a telephone message if the ship is unmanned.

After actuation of acoustic acknowledgement (Horn ackn button), the integrated buzzer switches off and the horn relay in the MMDS-SD serial distribution box drops out. With optical acknowledgement (Optic ackn), **the flashing LED switches to being continuously lit. The LED goes out after the fault has been rectified.**

The ”RESET” button must also be pressed in the event of alarms which have resulted in automatic engine shutdown or slowdown by the MMDS central unit. This function is enabled for a shutdown alarm only when the engine is at a standstill and for a shutdown alarm below a speed of 800 rpm.

Alarm acknowledgement and “RESET” are transmitted to the serial bus and from there to all the other monitoring units. There they effect the same function. This always applies to the MMDS monitoring and diagnostic system. It also affects the following units if fitted:

- MMDS-LC LCD monitor
- MMDS-EP engine room panel
- If necessary, further MMDS-L units

Dimming

All the alarm LEDs are automatically dimmed depending on the ambient luminosity. This function is performed by a photoelement integrated in the front panel.

Horn test

When the Horn acknowledge button is pressed for approx. 5s, the integrated buzzer sounds and the horn relay in the MMDS–SD serial distribution box closes.

System failure

There are 2 different failure states, which are indicated by the failure LED flashing or being continuously lit:

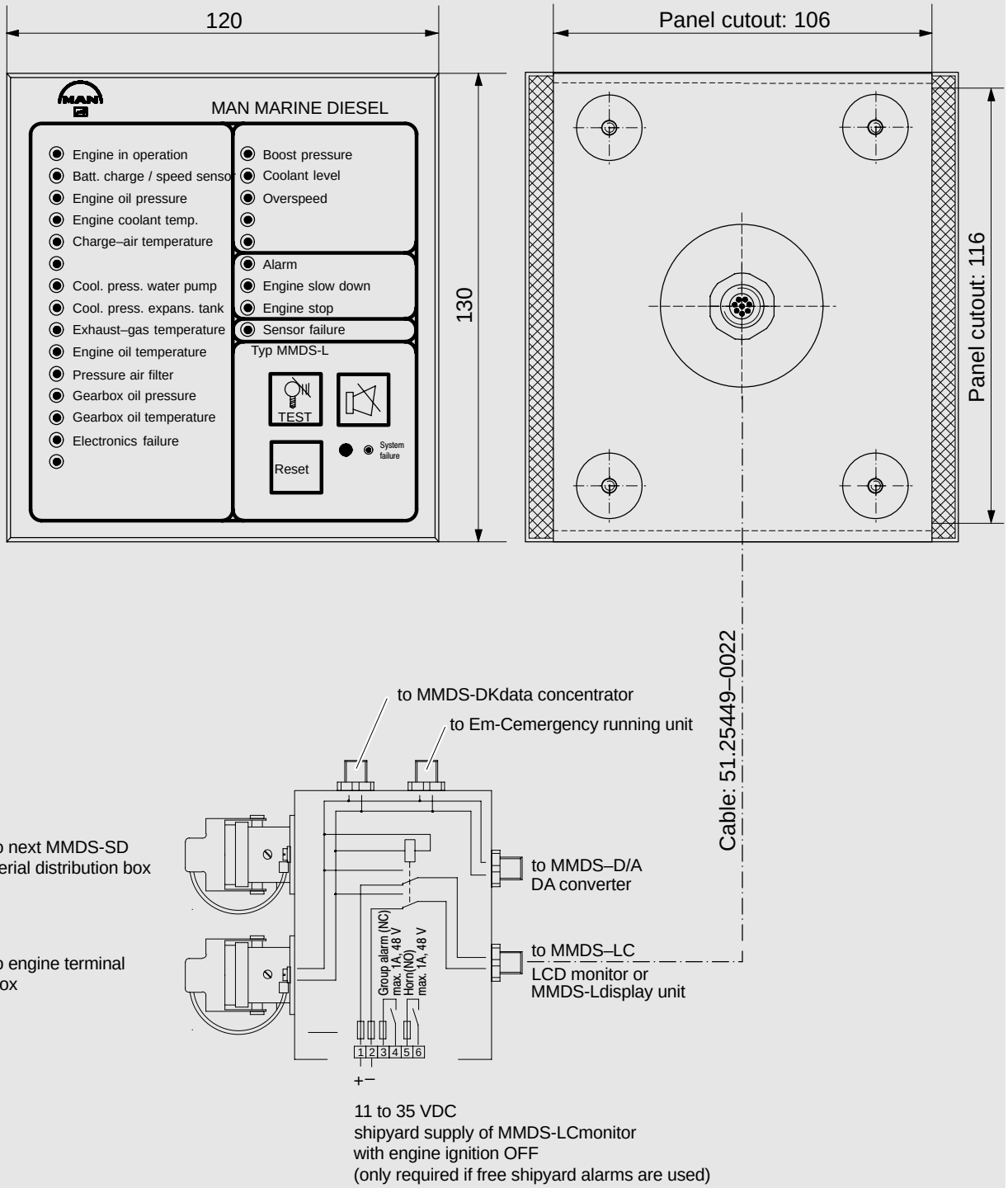
– A flashing system failure LED signifies a communication fault, i.e. the data bus is open–circuited or malfunctioning. In this case, the plug connections on the MMDS-L and the MMDS-SD serial distribution box must be checked for correct seating.
– A continuously lit system failure LED indicates an internal fault. The unit is faulty if this status persists after it is switched off and on again.

Technical data

Dimensions:	120 mm wide x 130 mm high x 130 mm installation depth
Voltage supply:	11 to 35 VDC
Current consumption:	approx. 0.2 A
Perm. operating temperature:	0 to 70°C
Outputs:	2 x floating relay contact 35VDC/1A (horn and group alarm)
Serial interfaces:	1 x TTY current loop, bidirectional
Panel cutout:	116 mm x 106 mm
Max. console panel thickness:	30 mm
Weight:	0.7 kg
Protection:	– front IP66 – back IP54

Notes on maintenance

To prevent the ingress of water, check that the screwed plug connectors and knurled nuts are tightly secured.


120
Panel cutout: 106
MAN MARINE DIESEL
Engine in operation
Batt. charge / speed senso
Engine oil pressure
Engine coolant temp.
Charge–air temperature
Cool. press. water pump
Cool. press. expans. tank
Exhaust–gas temperature
Engine oil temperature
Pressure air filter
Gearbox oil pressure
Gearbox oil temperature
Electronics failure
Boost pressure
Coolant level
Overspeed
Alarm
Engine slow down
Engine stop
Sensor failure
Typ MMDS-L
TEST
Reset
System failure
130
Panel cutout: 116
Cable: 51.25449–0022
to MMDS-DKdata concentrator
to Em-Cemergency running unit
to next MMDS-SD serial distribution box
to engine terminal box
to MMDS–D/A DA converter
to MMDS–LC
LCD monitor or MMDS-Ldisplay unit
Group alarm (NC) max. 1A, 48 V
Horn(NO) max. 1A, 48 V
1 2 3 4 5 6
+ –
11 to 35 VDC
shipyard supply of MMDS-LCmonitor
with engine ignition OFF
(only required if free shipyard alarms are used)

Function of serial distribution box 51.27720–7007

The MMDS diagnostic, alarm and safety system, located in the engine terminal box, offers the possibility of communicating with other units via a serial bus. These units include in particular:

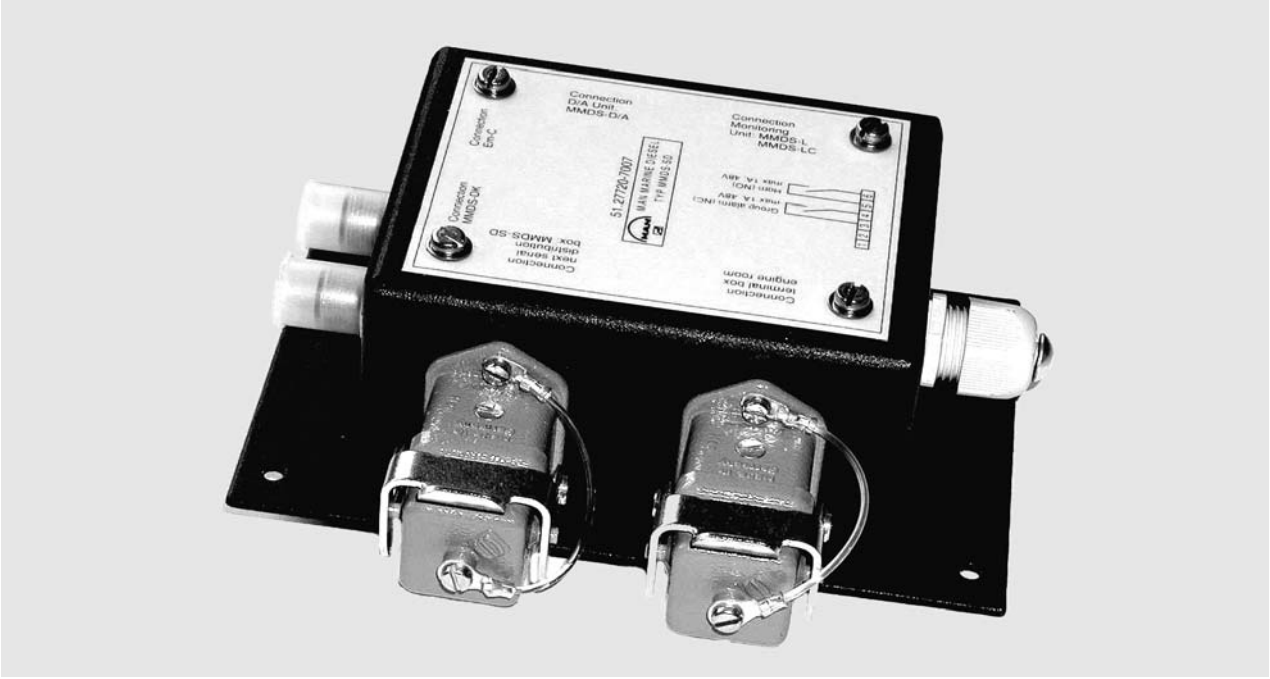
- MMDS-LC LCD monitor
- MMDS-L display unit
- MMDS-D/A unit for activating instruments
- MMDS-DK data concentrator with PC connection

An MMDS-SD serial distribution box is needed to be able to integrate the above-mentioned units or an emergency running unit in the system.
The unit connections are established by cables with plug connections included in the scope of delivery. This ensures a simple and economic installation while avoiding cabling errors.
The connections for the MMDS-LC LCD monitor and the MMDS-L are the same. One of the units mentioned can be connected to a distribution box.

An MMDS-SD serial distribution box is usually installed on the bridge. Here the seven–pin cable from the engine terminal box is plugged into the unit.
A second plug connection of the same type offers the option of connecting a further distribution box, which is located e.g. on the open bridge. This feature offers the option of an unlimited number of distribution boxes. The plant is therefore open for accommodating further devices (cabins, crew-mess etc.).

Connection of horn and group alarm relays

The distribution boxes have horn and group alarm relays for connection at the shipyard. These relays are controlled by the MMDS-LC LCD monitor or the MMDS-L display unit.
The horn relay closes when an alarm occurs and opens when the alarm is acoustically acknowledged.
The group alarm relay opens in the event of an alarm. If an alarm occurs when one or more are already present, the relay closes for approx. 2s and then opens again (group alarm repeat). The group alarm relay likewise opens when the engine ignition is switched off provided there is no further power supply at terminals 1 and 2 of the serial distribution box.



MMDS-LC LCD monitor voltage supply with engine ignition OFF

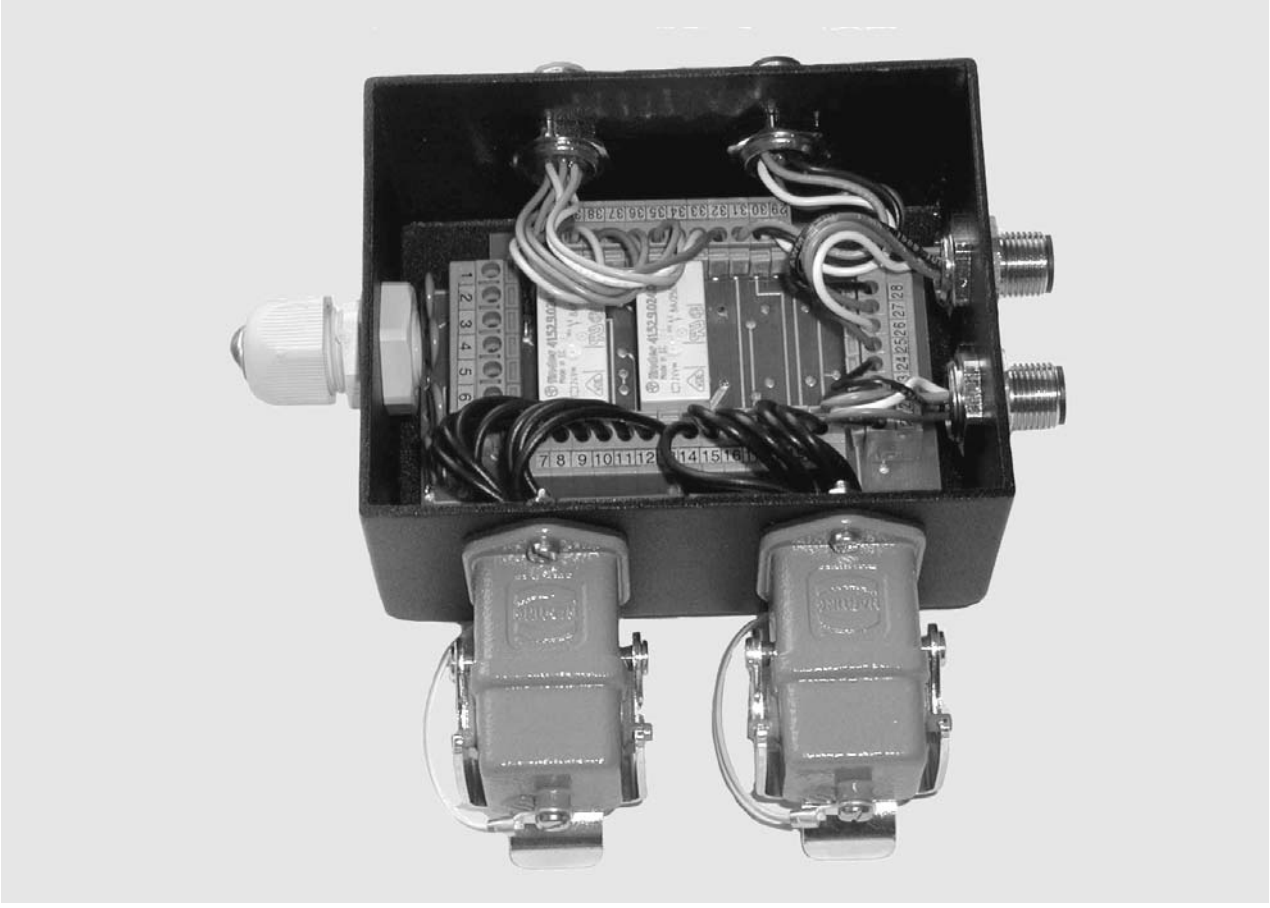
With the exception of the MMDS-LC LCD monitor, all the units mentioned here serve exclusively to process engine data in some form or to display such data. As a result, their power supply is coupled to the engine ignition.

The LCD monitor however offers the additional option of processing 11 general ship indications (alarms or displays). Their function must be independent from the engine ignition.
The serial distribution box therefore offers the possibility of connecting an additional supply voltage to the LCD monitor, which continues to power the monitor even when the engine ignition is switched off.
A changeover device in the serial distribution box ensures that the additional supply and the engine battery remain isolated provided they are not already connected elsewhere.

Design

The MMDS–SD serial distribution box consists of among others a black painted aluminium housing with baseplate and cover. Inbetween there is a flat gasket, which prevents the ingress of water at this point.
The plugs for connecting the units are located on the outside. The housing interior contains a printed circuit board, which carries the necessary terminal strips with spring terminals for the plugs and the shipyard connections.
The board also carries the relay for horn control, the group alarm relay and the changeover device for the LCD monitor power supply.
Four semiconductor fuses (PTC), which reset themselves automatically after a fault, protect the shipyard connections against excess current and short–circuiting.

View with housing cover removed



Installation of MMDS-SD serial distribution box

– Installation location:
  The MMDS-SD serial distribution box is screwed to a level surface. This can be e.g. the mounting plate of a control cabinet or the bridge console, or simply a suitable wall. The device achieves degree of protection IP54, which must be borne in mind when the installation location is chosen.
– Connection:
  Before the cables are connected, the protective caps of the housing plugs must be removed. This also applies to the pin which is located in the cable penetration (Pg 9) to improve the degree of protection. This pin is also removed if the shipyard connections are to be used.
  To be able to reach the associated terminal strip, it is necessary to remove the four cylinder head bolts and the housing cover.
  The unused plug connections must retain their factory-fitted protective caps factory. In addition, the pin in the cable penetration may only be removed if a cable is inserted here as well.

Commissioning

The distribution box is commissioned with the other units belonging to the system. The user must check beforehand once again that all the plug connections are correctly fitted and not mixed up.

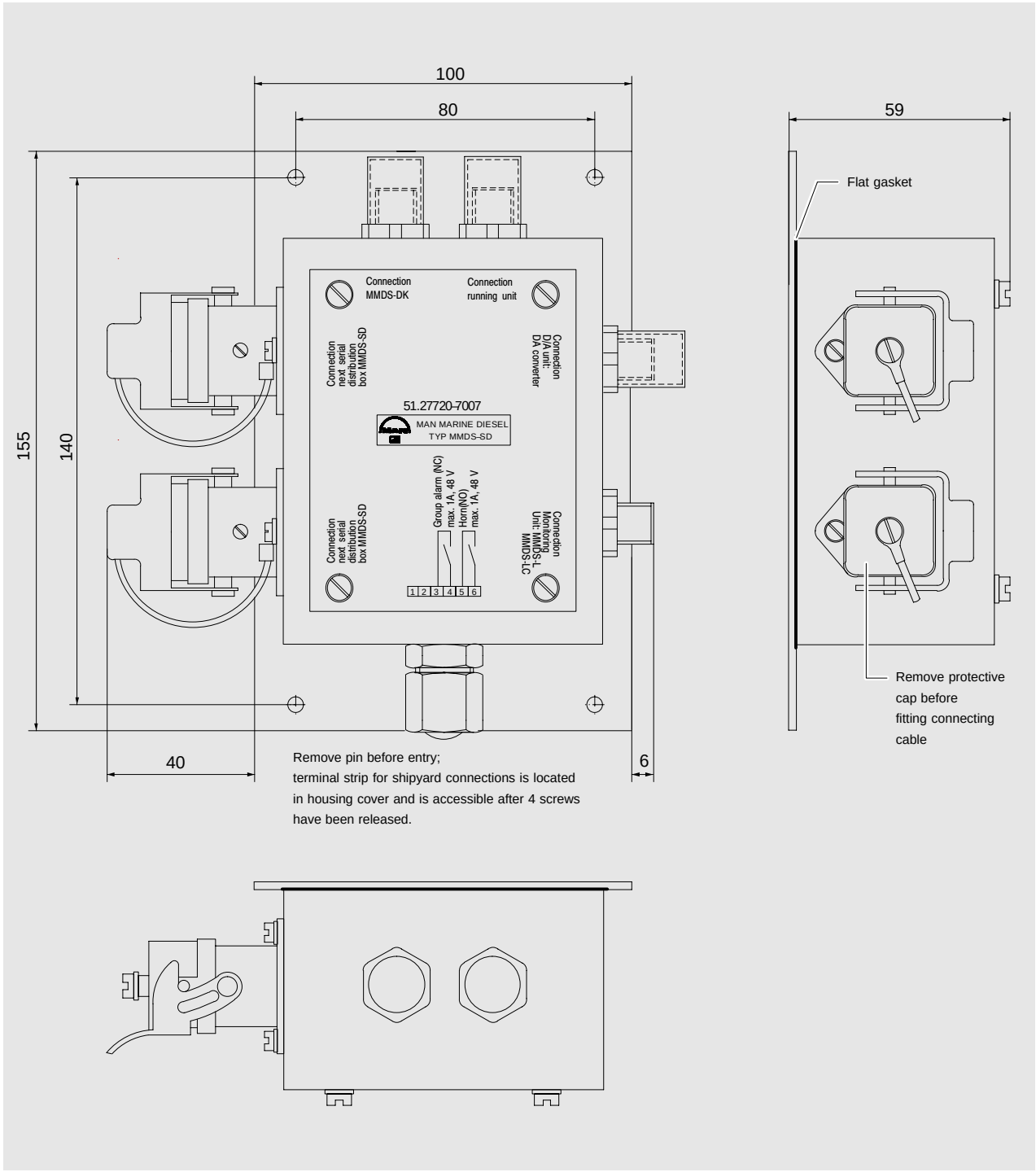
Maintenance

In order to guarantee degree of protection IP54, make sure the bolts for securing the housing cover and the cable penetration are firmly tightened. Otherwise moisture could get into the housing, which could result in destruction of the unit or shorten its service life. Apart from this, the serial distribution box is maintenance-free.

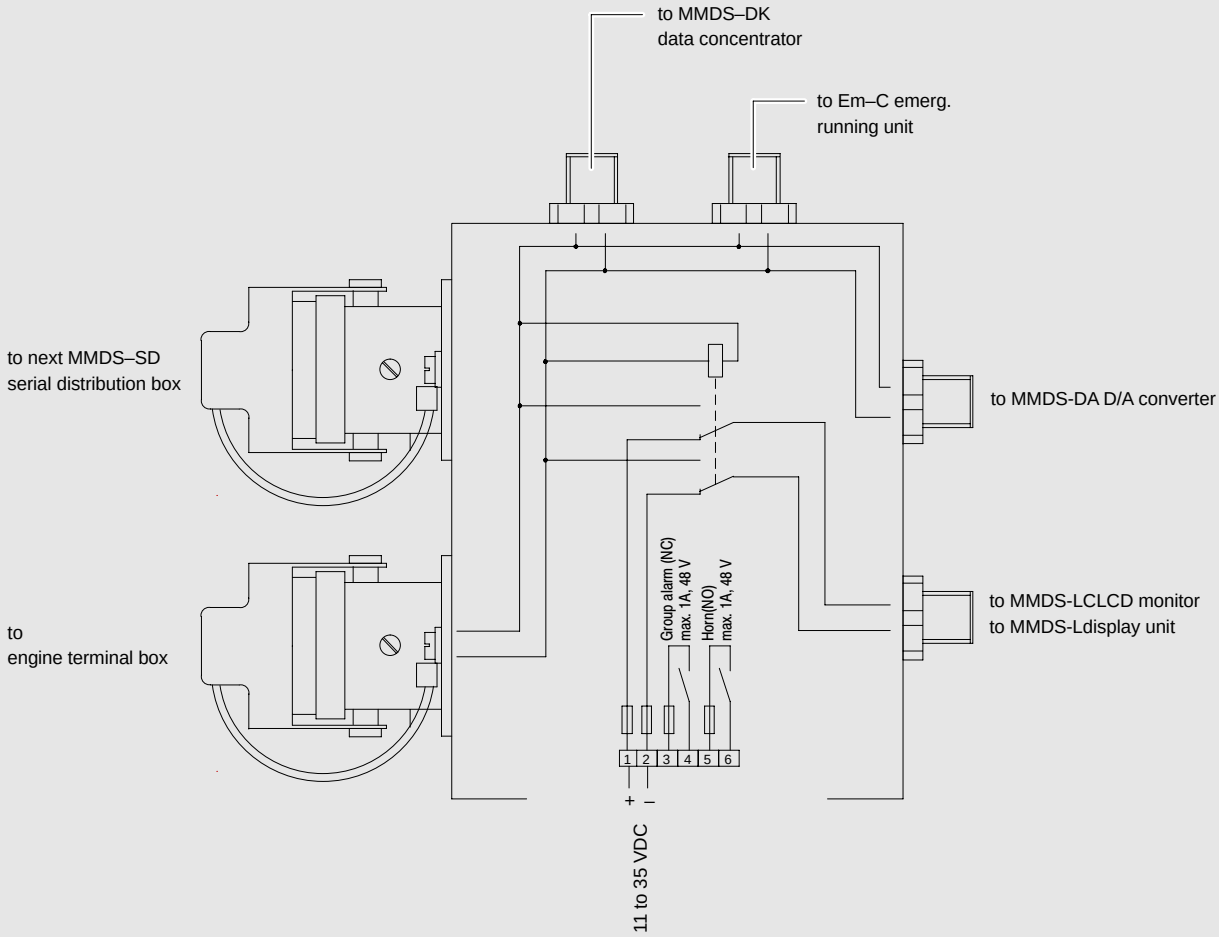
Technical data

Perm. ambient temperature:	0 to 70°C
Perm. rel. air humidity:	99%
Protection:	IP 54
Weight:	0.6 kg
Perm. load capability of relay contacts:	1A, 48 V
Cable penetration for shipyard connections:	Pg 9

Dimensions



Connection diagram



Shipyard supply of MMDS-LCmonitor
with engine ignition OFF
(only required if free shipyard alarms are used)

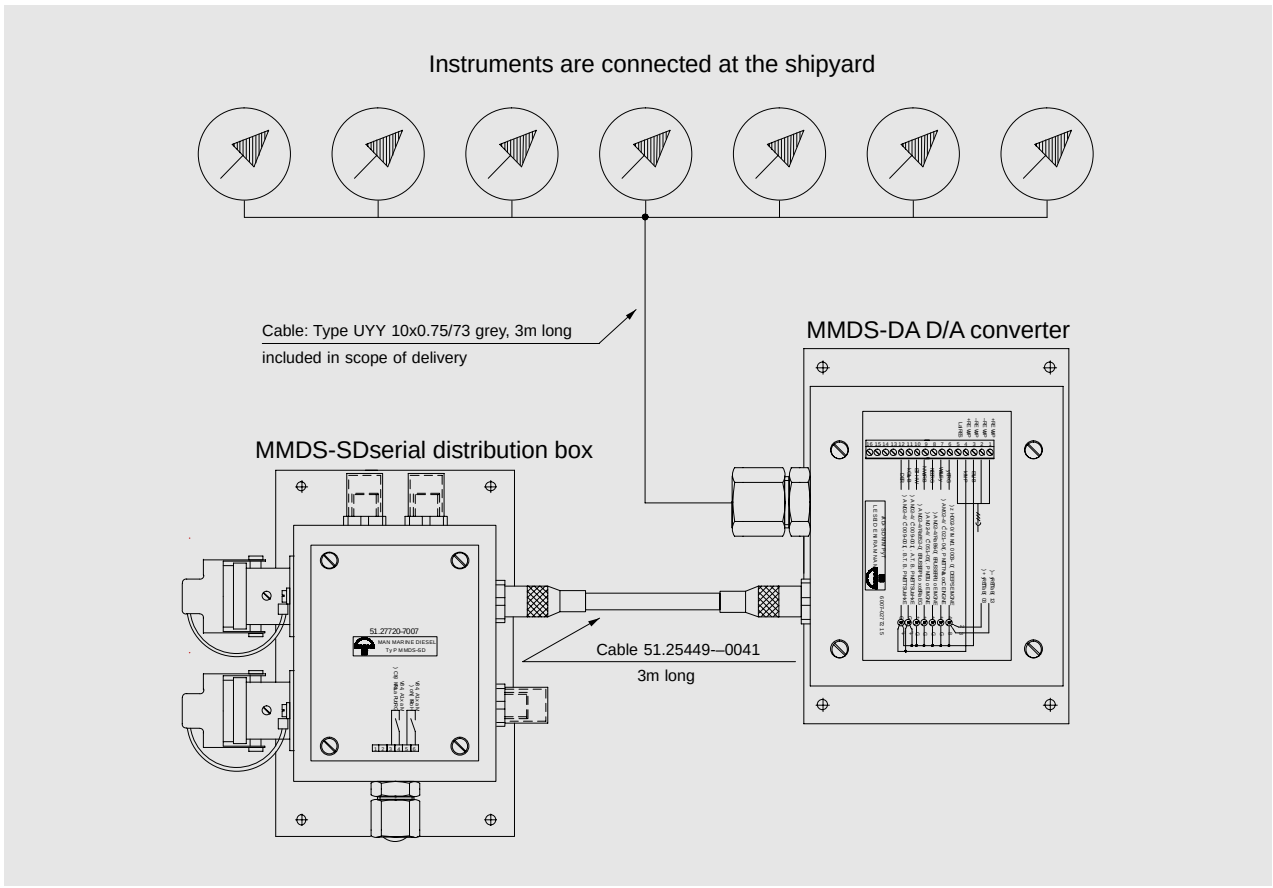
Function of MMDS-DA digital/analog converter 51.27720–7006

The MMDS diagnostic, alarm and safety system, located in the engine terminal box, records all the important engine and gearbox data.
These data are processed and made available to other devices via a serial bus. These devices include the MMDS-DA D/A converter (instrument driver).
This converter receives the data relevant to it and converts them into the following signals, with which the instruments are then activated:

Serial from engine terminal box (MMDS)	Output signal	Scale of instrument
Exhaust-gas temperature before turbocharger, side A	4–20mA	0–900°C
Exhaust-gas temperature before turbocharger, side B	4–20mA	0–900°C
Gearbox oil pressure	4–20mA	0–25 bar
Engine oil temperature	4–20mA	50–150°C
Engine oil pressure	4–20mA	0–6 bar
Engine coolant temperature	4–20mA	40–120°C
Engine speed	0–200 Hz	0–3000 rpm

When compared with a conventional solution, this technology reduces the required number of sensors or measuring transducers and reduces the wiring to three strands/cores (including power supply).
Various instrument drivers can be connected in parallel to the bus (bridge, open bridge etc.).

Connection diagram



Device design and installation

The MMDS-DA instrument driver is a microprocessor-controlled device.
The electronics are accommodated in a black painted aluminium housing with baseplate and cover. A flat gasket is fitted inbetween in order to achieve degree of protection IP 54.
For connecting the instruments, the device has a 3 m long cable, which has been connected to the internal terminal strip at the factory. The housing is thus ready for installation and can be screwed to a level surface (e.g. console plate, wall).

The power supply and the connection to the data bus is effected by a cable fitted with plugs (included in the scope of delivery) and connected between the MMDS-DA instrument driver and the MMDS–SD serial distribution box.

Commissioning

The device is commissioned with the entire plant. Before turning on the supply voltage (engine ignition), please check that all connections have been properly established.
Particular care should be taken to ensure that the supply voltage does not come into contact with the outputs for activating the instruments due to connection errors as this may destroy the device.

After switching on the plant and with the engine running, first check the indicated instrument values for clear differences to the values to be expected. If the plant is equipped with an MMDS-LC LCD monitor, it is useful to compare the values displayed here with those of the instruments. They must be identical, bearing in mind the tolerances. This does not in fact serve as proof of the accuracy of the indicated values since the same sensors are used for both devices, but it is a necessary condition.

Troubleshooting must be performed if the values are not identical. An obvious cause is that instruments have been mixed up during installation.

As is already known, the D/A converter obtains its information from the MMDS diagnostic, alarm and safety system via the bus system. The data are transmitted at intervals of approx. 0.5 s. Thus the instrument values can only be updated in this time base. Appropriate software is integrated in the D/A converter to prevent the instruments from “jumping” as far as possible.

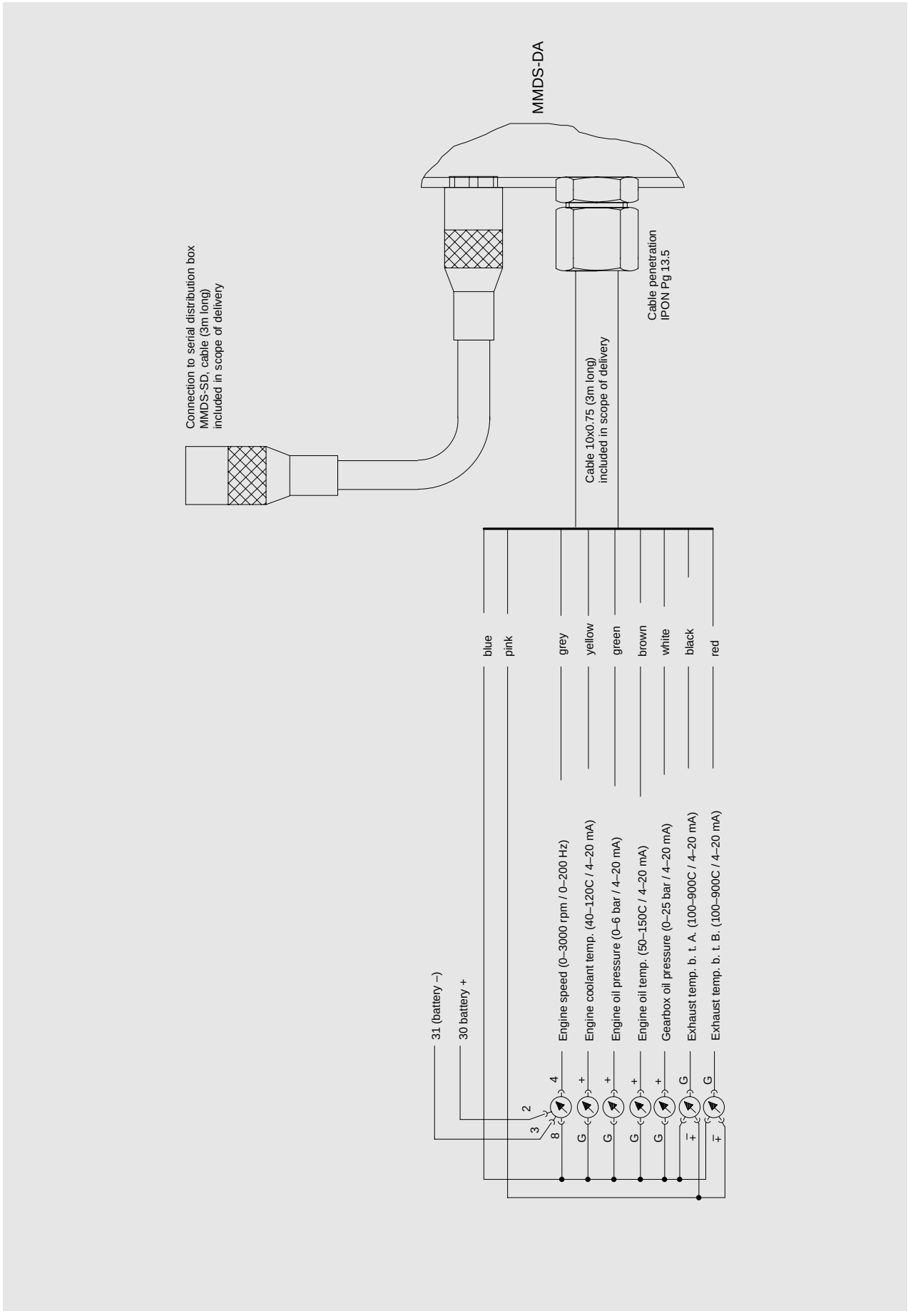
Maintenance

It is important to make sure the screws for securing the housing cover and the cable penetration are not loose as otherwise degree of protection IP54 will not be guaranteed. Apart from this, the device is maintenance–free.

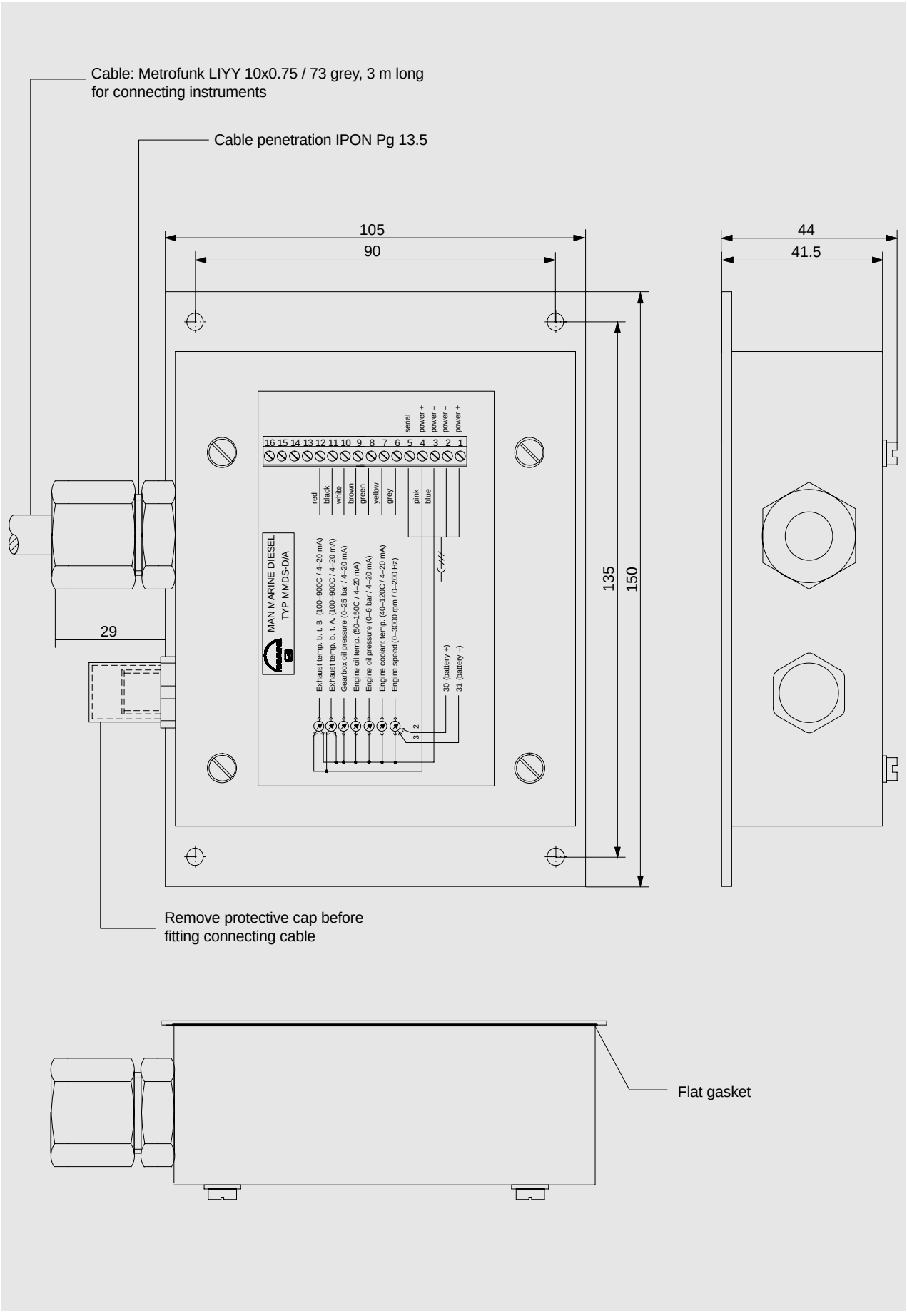
MMDS-DA technical data

Power supply:	11–35 VDC
Current consumption:	0.2 A (when all current outputs deliver 20 mA)
Serial interfaces:	1 x TTY current loop
Outputs:	7 x 4–20 mA, 1 x 0–200 Hz
Max. load for current outputs:	400 ohms
Min. load for frequency output:	1.5 kohms
Perm. ambient temperature:	0–70°C
Perm. relative air humidity:	99%
Protection:	IP 54
Weight:	0.8 kg (without cable)
Cable penetration for shipyard connections:	Pg 9

MMDS-DA connection diagram



MMDS-DA dimensions



Installation of engine room panel

The engine room panel is designed for direct connection to the terminal box in the engine room by means of X7 plugs.
The connecting cable is attached to the MMDS-EP and is 5 m in length.
The engine room panel must be screwed to a level surface. An operating temperature of up to 70°C is permitted.

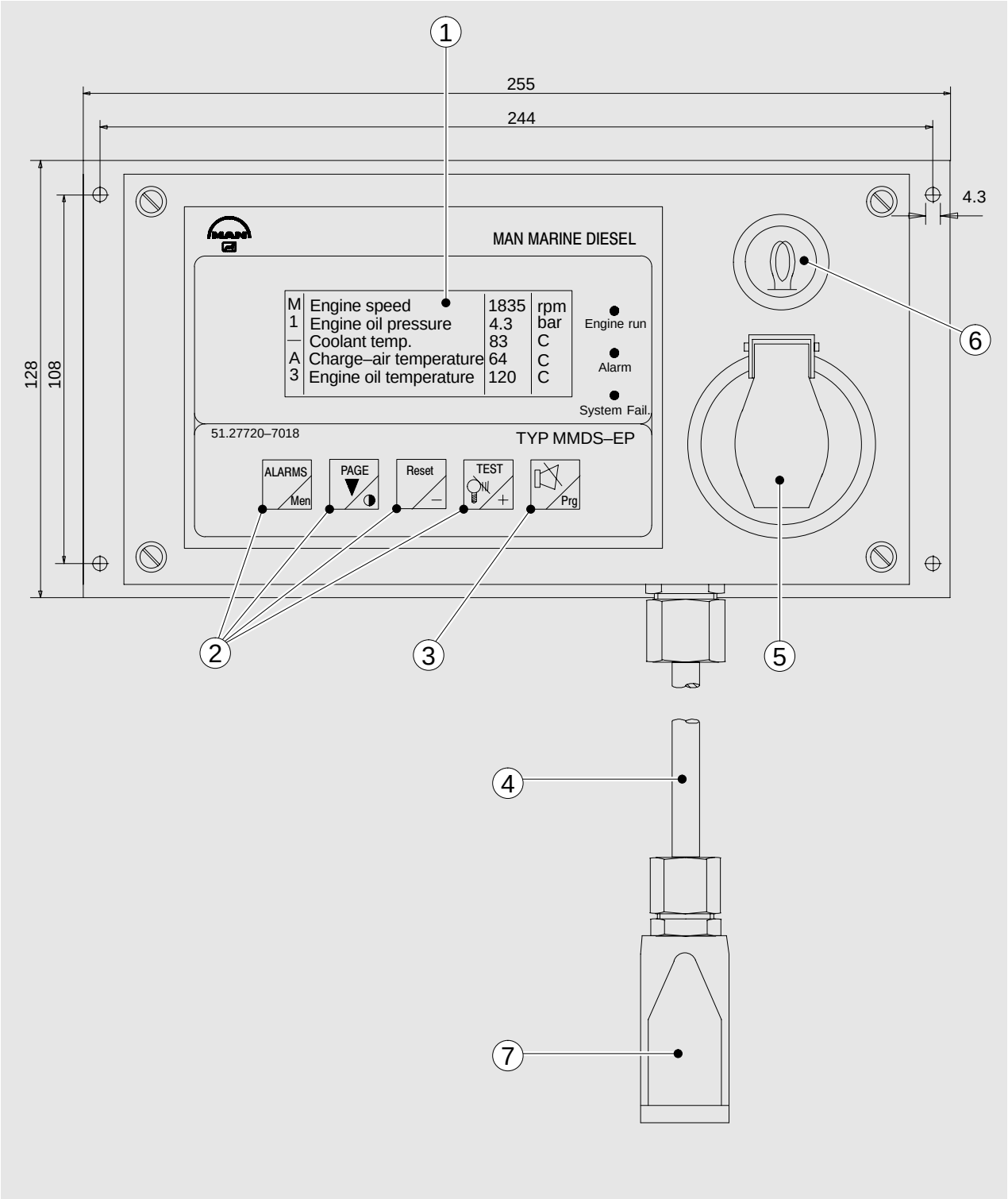
Notes on engine room panel operation

The functions of the engine room panel are identical to those of the MMDS-LC, but in this case it is not possible to program in 11 additional alarms.

In addition, the engine room panel is equipped with:

– an ignition lock for starting and shutting down the engine
– an indicator lamp for the preheating system (if installed); this lamp goes out when preheating is completed and the engine can be started.

In all other respects, the device is operated in identical fashion to the MMDS-LC.



① LCD display
② Buttons, green
③ Button, red
④ Cable, 5 m long
⑤ Ignition lock cap
⑥ Indicator lamp, yellow for preheating (optional for V-engines)

⑦ Pin assignment:
Pin 1: S87 MMDS
Pin 2: S86 MMDS
Pin 3: Terminal 31
Pin 4: Coding pin
Pin 5: Terminal L
Pin 6: Terminal 50g
Pin 7: Terminal 15
Pin 8: Terminal 30

Engine room panel technical data

LCD display with adjustable contrast and 5 selectable languages:

- German
- English
- French
- Italian
- Spanish

LCD display with selectable physical units:

- bar / psi
- degrees Celsius / degrees Fahrenheit

Equipment for commissioning

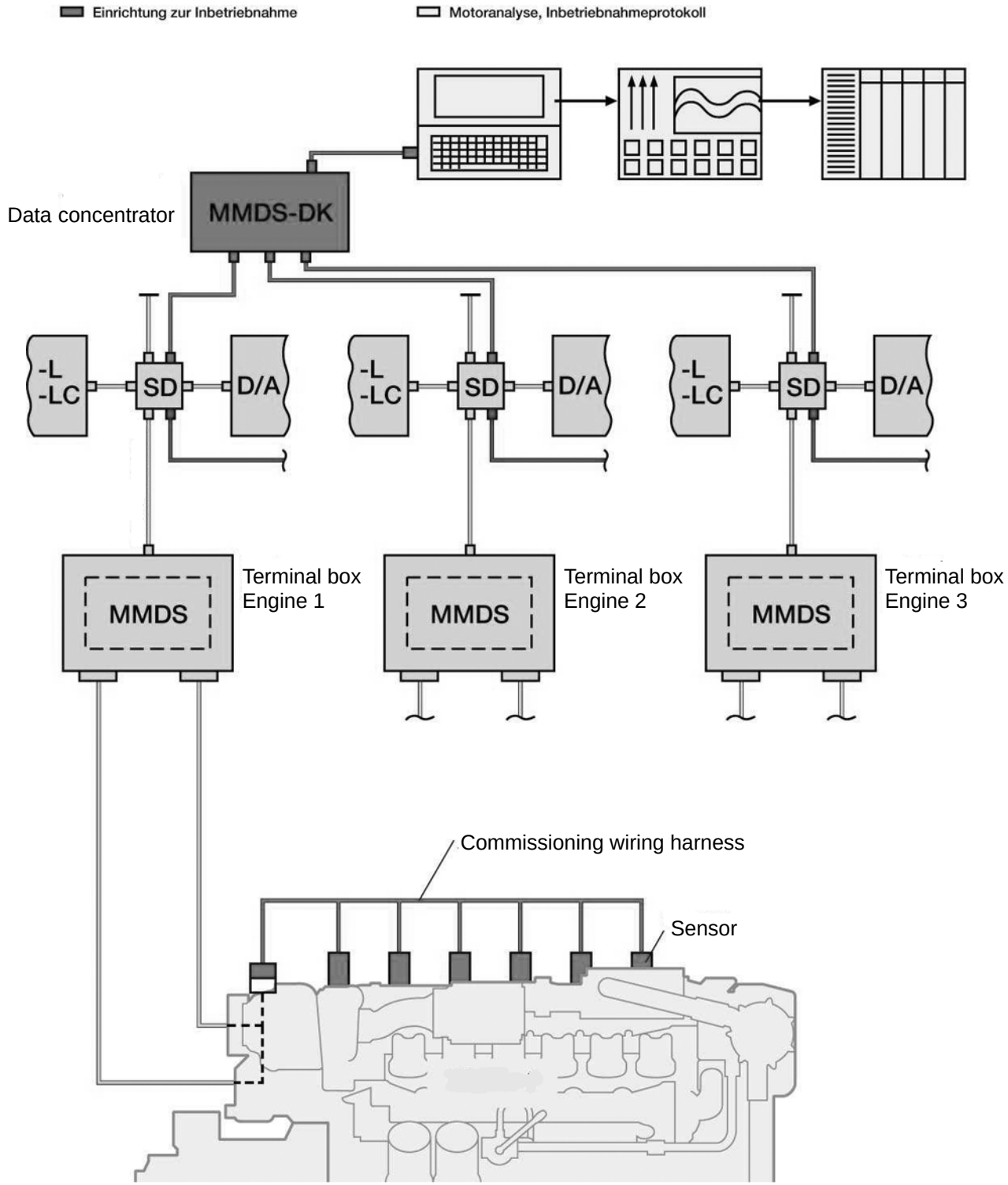
The setup is designed to commission up to 3 engines at the same time with a single laptop (min. 266 MHz). The following equipment is required for this purpose:

– Commissioning wiring harness 51.25400–6056 with various sensors
– Data concentrator 51.27720–7017
– Connecting cable, data concentrator-laptop 51.25449–6029
– Connecting cable, serial distribution box-data concentrator 51.25449–0041
– CD with commissioning software 51.99585–4000
– Program description 51.27720–8006

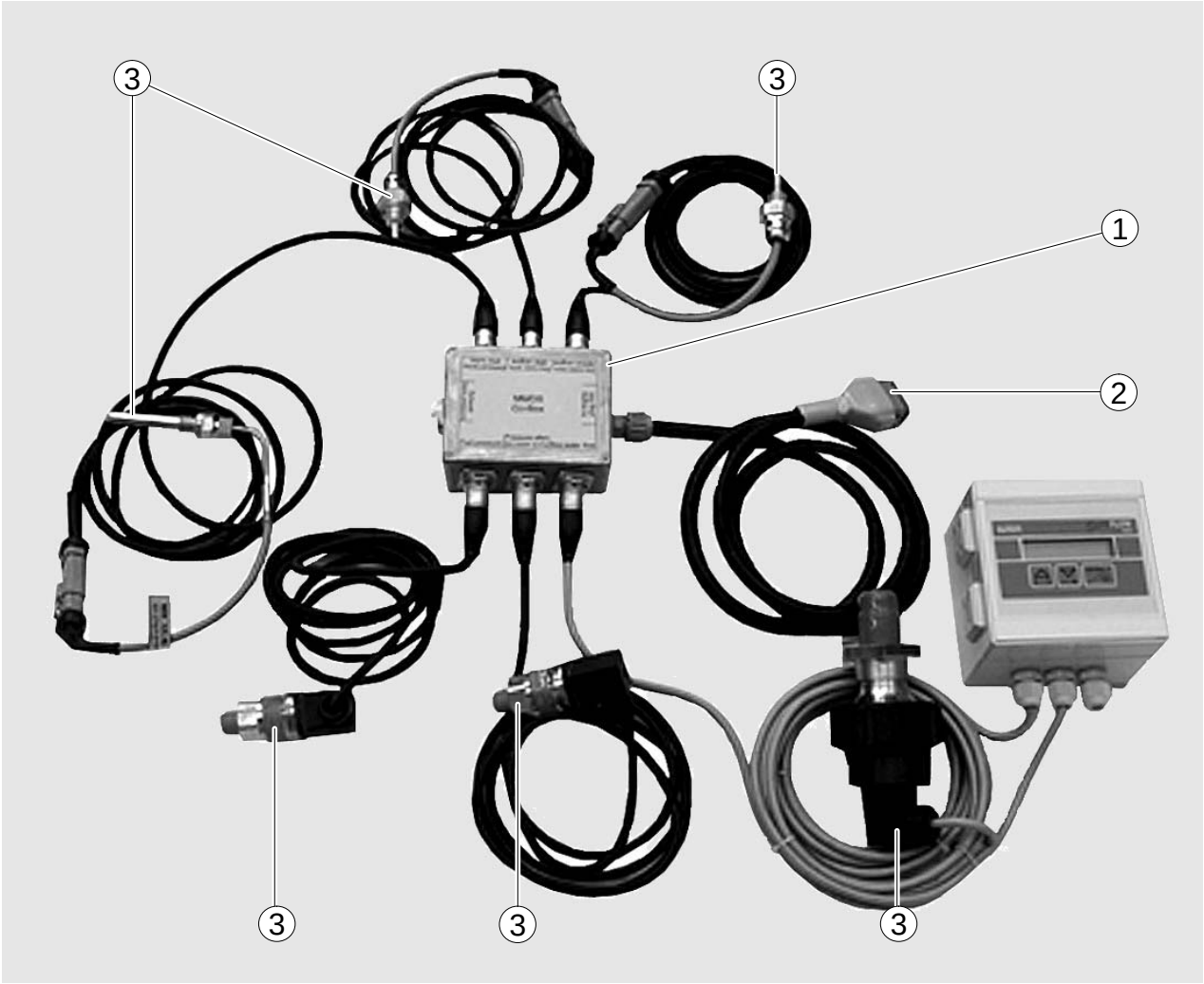
The following sensors are screwed in during commissioning:

– Exhaust backpressure: 51.27421–0124 (–0.5 – +0.5 bar/4–20 mA)
– Fuel pressure: 51.27421–0126 (0–6 bar/4–20 mA)
– Sea water flow: 51.27421–.... (still in development)
– Exhaust–gas temperature after turbocharger: 51.27421–0158 (NiCrNi)
– Pressure after sea water pump: 51.27421–0125 (0–2.5 bar/4–20 mA)
– Sea water temperature before engine: 51.27421–0150 (PT1000)
– Sea water temperature after engine: 51.27421–0150 (PT1000)

Commissioning diagram



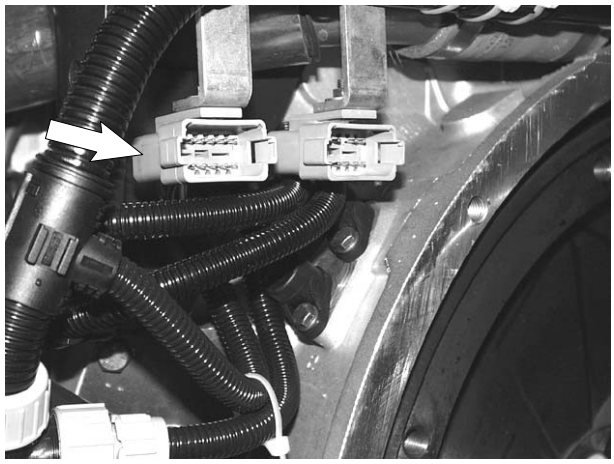
Commissioning wiring harness: 51.25400–6056



① Commissioning box (MMDS-**Co**) for connecting all sensors
② Mating plug to X30 on engine
③ Commissioning sensors

Fig. 1

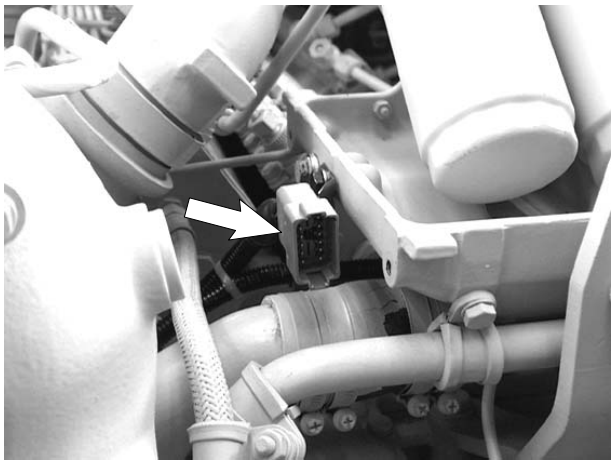
X30 commissioning plugs on in-line engine



1

Fig. 2

X30 commissioning plugs on V-engine



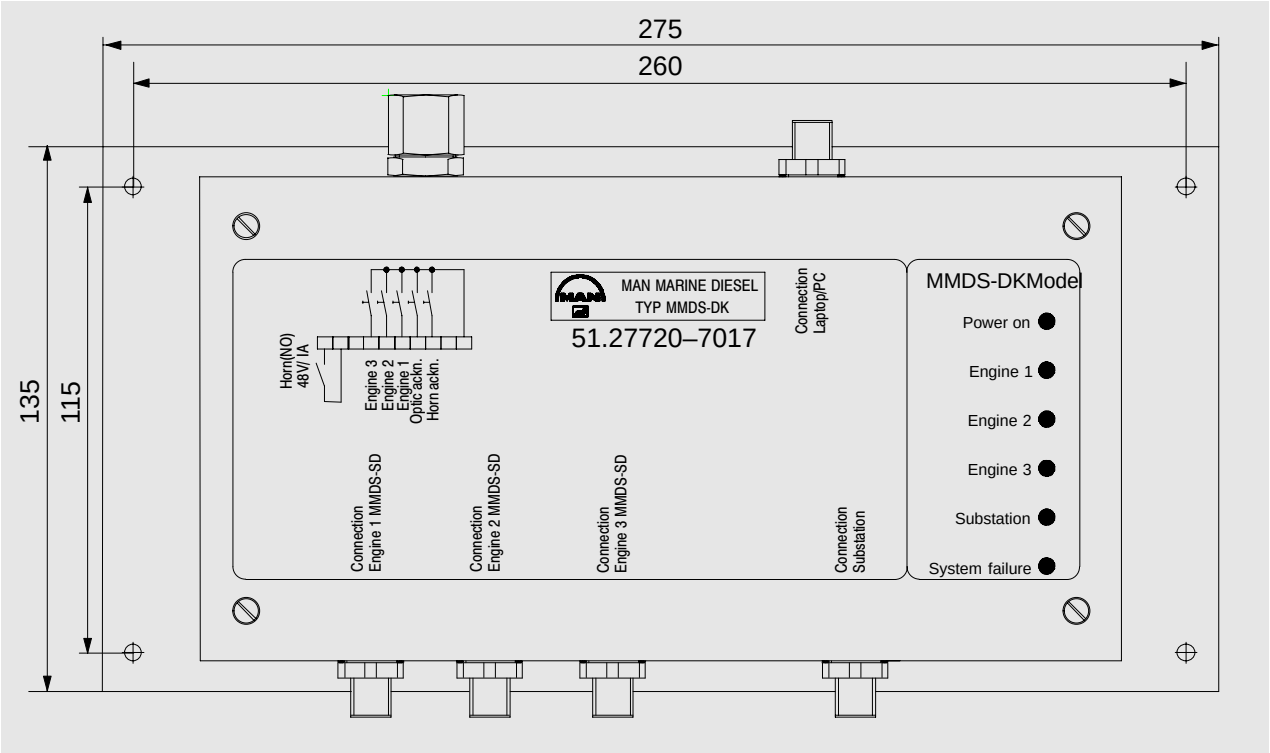
2

Wiring and connecting equipment for commissioning

- Screw the sensors into the engine and connect to the commissioning box
- Connect the commissioning box to the X30 service plug

The commissioning sensors are thus connected to the diagnostic unit but are not monitored for sensor failure.

Data concentrator: 51.27720–7017



The data concentrator (DK) is connected to the serial distribution box with the cable 51.25449–0041.
Connection to DK: “Connection Engine MMDS-SD”

The DK collects the data of up to 3 engines, converts them into a PC–readable form and outputs them on the laptop.
Connection to data concentrator: “Connection Laptop/PC”
Connecting cable to laptop: 51.25449–6029

Engine 1:	Connect to port engine
Engine 2:	Connect to middle engine (on 3–engine plant)
Engine 3:	Connect to starboard engine

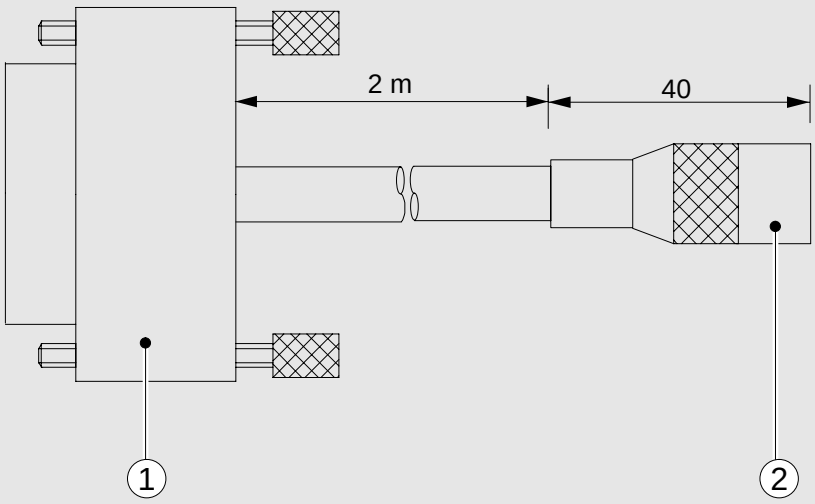
This assignment must be observed as otherwise the assignment in the commissioning record is wrong.

Engine 1 must always be connected because the data concentrator electronics is supplied with power from here.

The following inputs / connections cannot be used as yet on the data concentrator as they are not printed on the circuit board:

– Connection: “Connection Substation”
– Connection for buttons at switch inputs to terminal 1–10

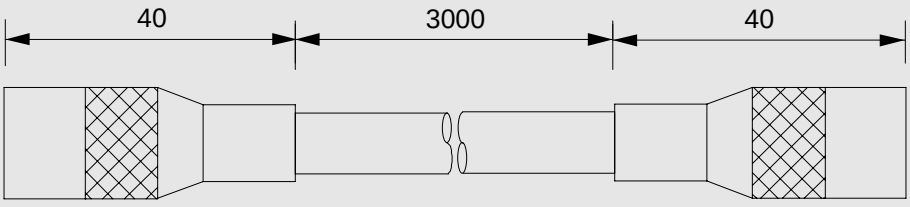
Connecting cable, data concentrator-laptop: 51.25449–6029



① SUB-D jack, 9-pin

② Plug, 4-pin

Connecting cable, serial distribution box-data concentrator: 51.25441–0041



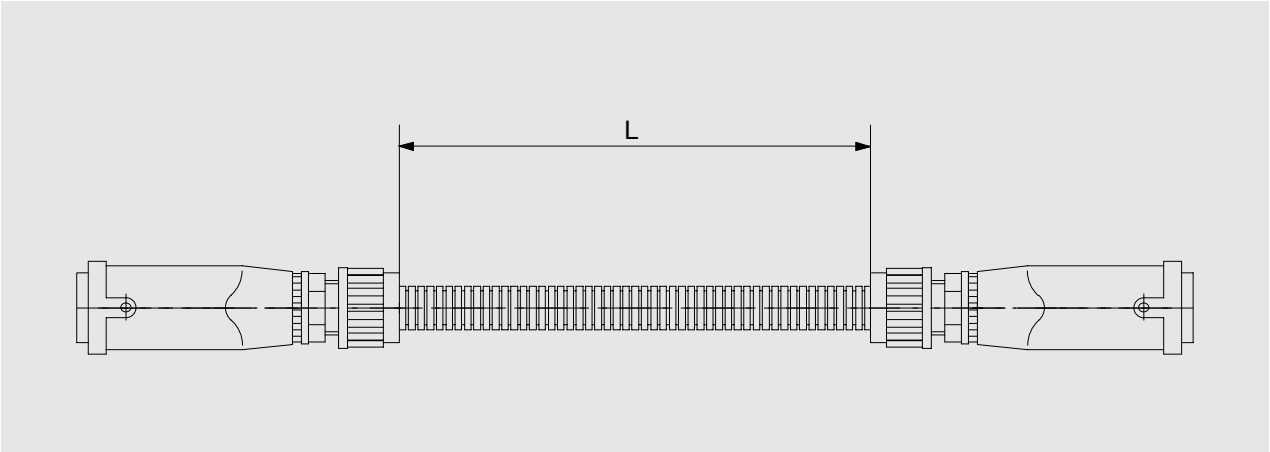
CD-ROM with diagnostic and commissioning software: 51.99585–4000

The software automatically completes the measurement section of the commissioning record during commissioning.

Commissioning software languages: German, English, Italian, French, Spanish

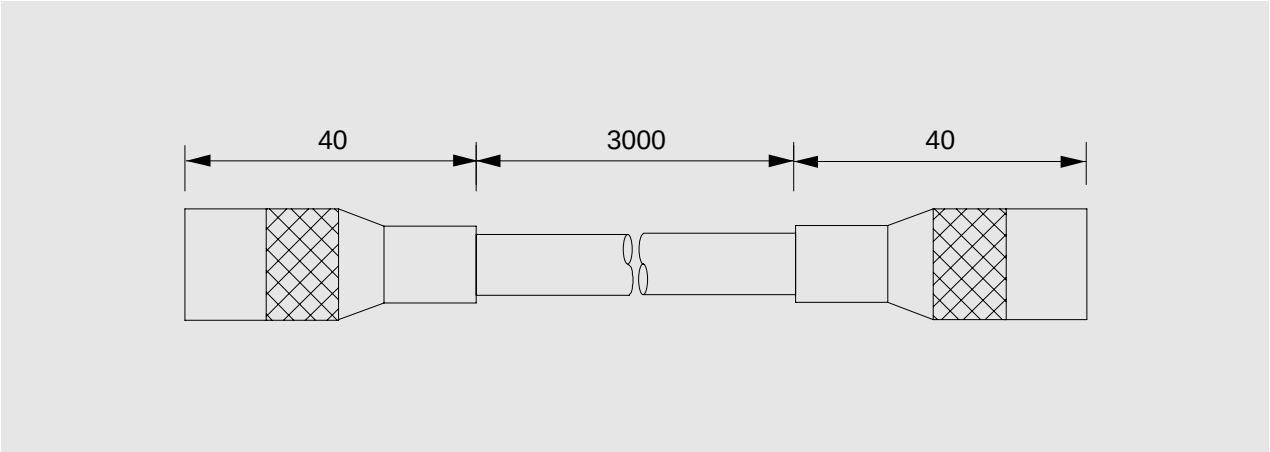
Diagnostic software languages: German, English

Connecting cable, engine room – serial distribution box

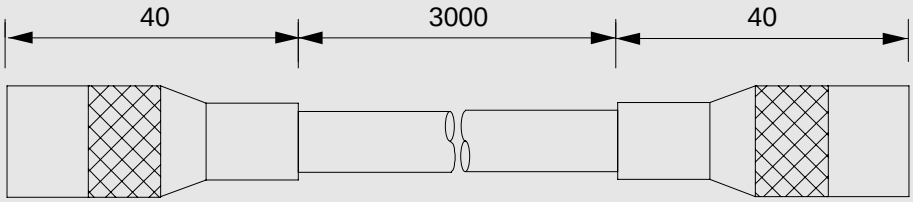


Length L	Item no.
7 m	51.25449–6014
10 m	51.25449–6015
15 m	51.25449–6016
20 m	51.25449–6017
25 m	51.25449–6018

Connecting cable, serial distribution box – D/A converter (4-pin): 51.25441–0041



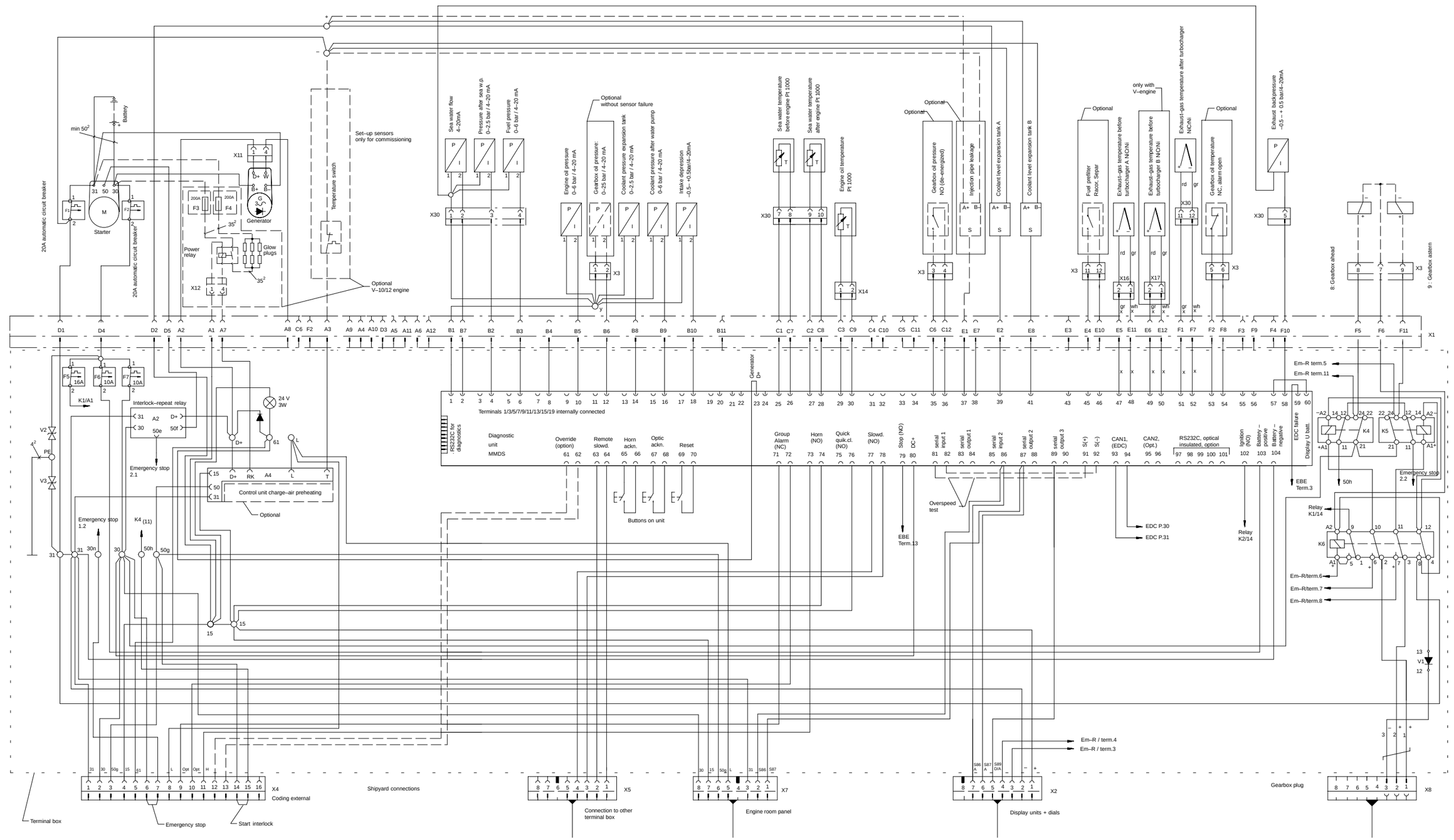
Connecting cable, serial distribution box – MMDS-LC or MMDS-L display unit (8-pin): 51.25441–0022



Connecting cable, terminal box – terminal box

Length L	Item no.
2 m	51.25449–6027
5 m	51.25449–6028

Circuit diagram for EDC and MMDS



F5: Fuse EDC
F6: Fuse MMDS
F7: Fuse gearbox activation and engine electrics

Circuit diagram for EDC engine with MMDS

V2/V3: Diode 1.5 KE 39 CA

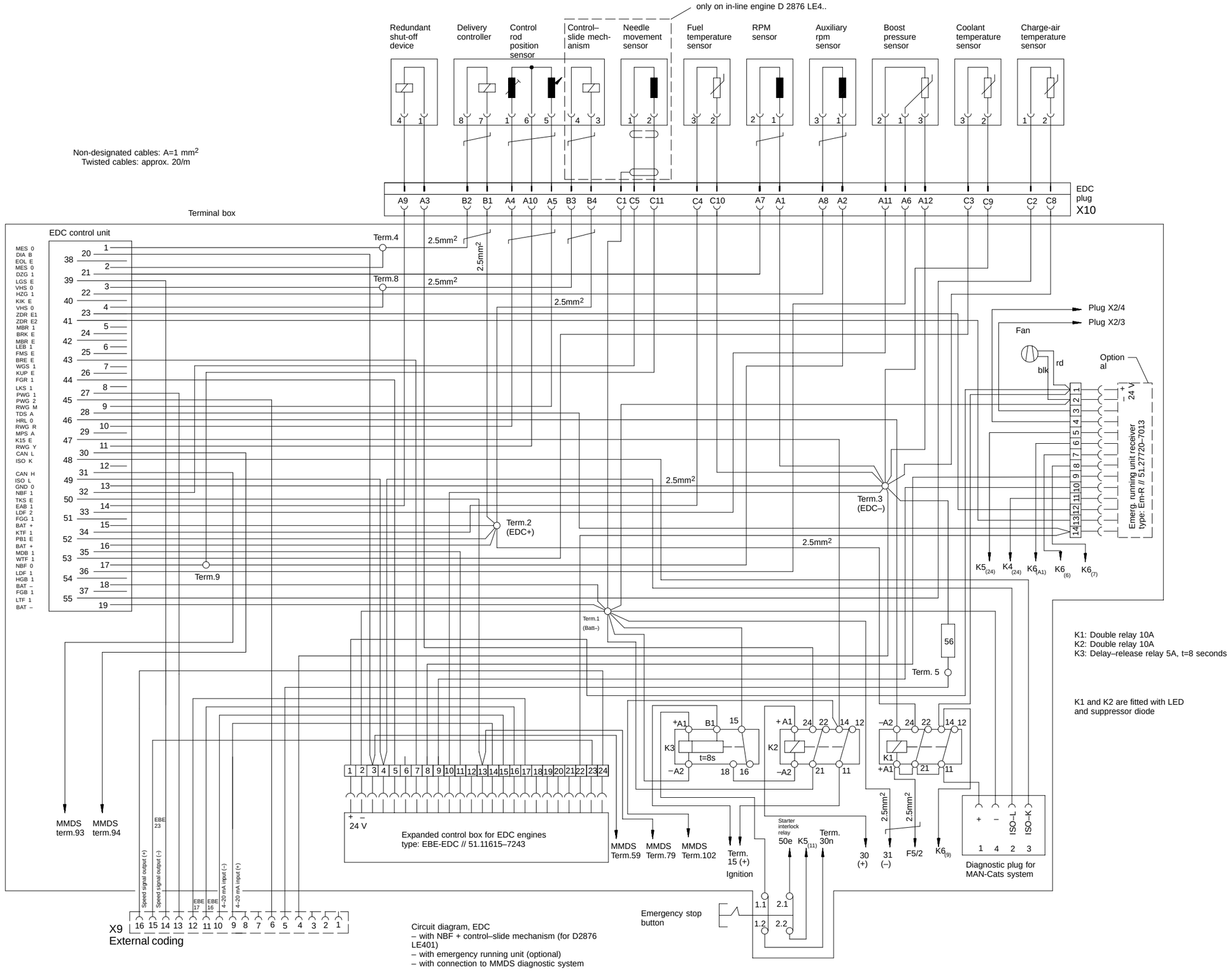
x: Thermocable type K

y: Contact point on starter

K4/K5: Double relay 10A
K6: Relay Finder type: 55.34
(relay with 4-contacts)
K4, K5, K6, equipped with LED and suppr. diode

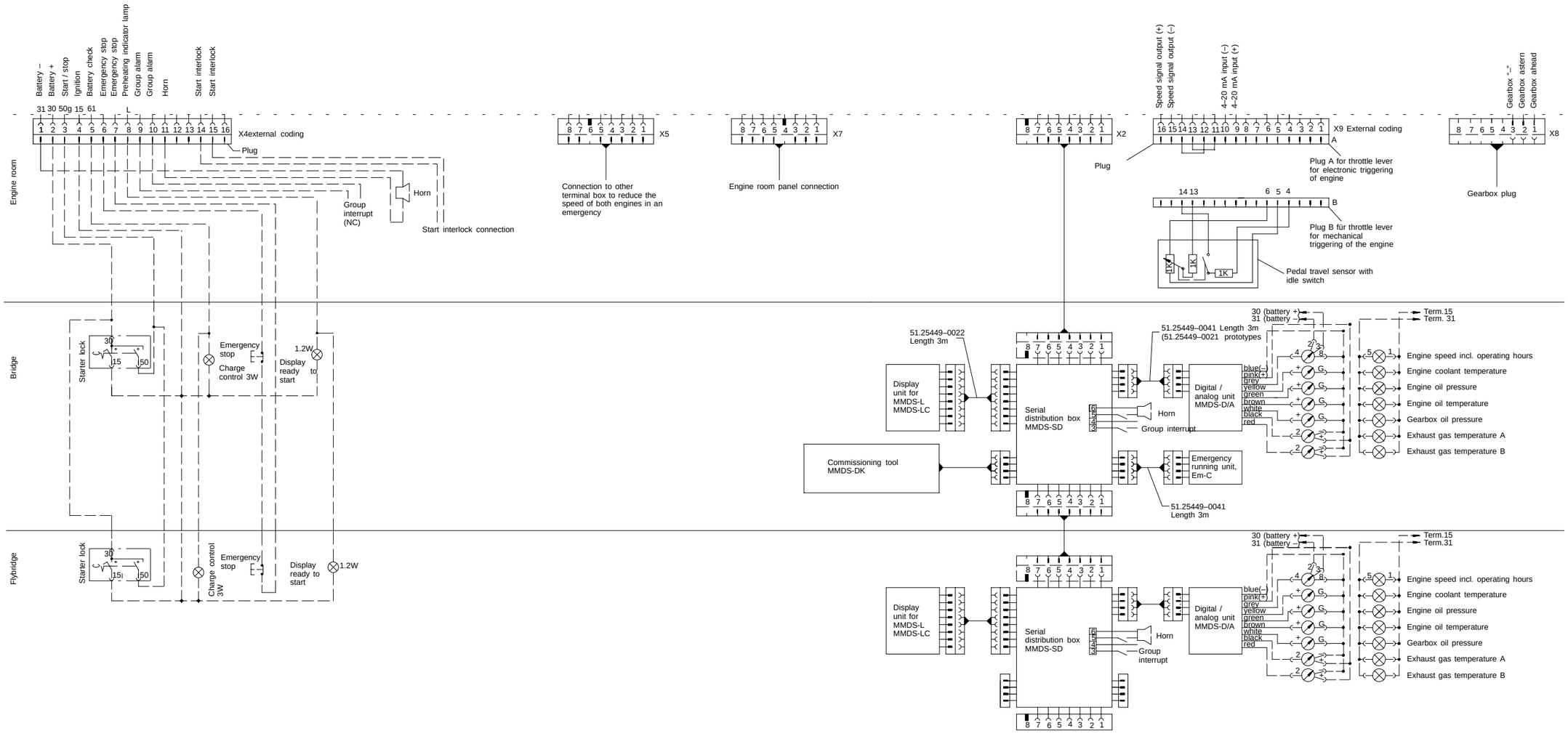
8054

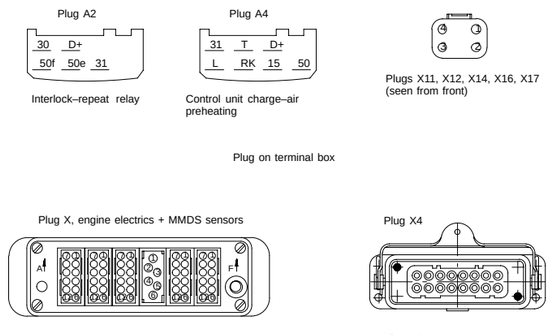
EDC Diagram



8054

Connection diagram



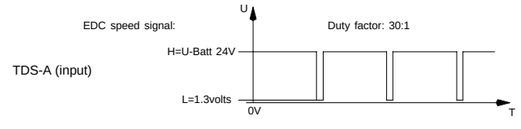


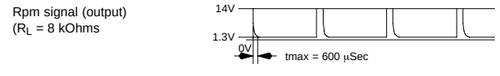
Gearbox plug X3

Assignment	X1			X1	Assignment
4–20 mA "+"	B1	1	12	E10	Fuel prefilter (Racor, Separ)
Gearbox oil pressure display	B6	2	11	E4	Fuel prefilter (Racor, Separ)
Gearbox oil pressure contact	C6	3	10		free
Gearbox oil pressure contact	C12	4	9	F11	Gearbox astern
Engine Gearbox contact	F2	5	8	F5	Gearbox ahead
Gearbox oil pressure contact	F8	6	7	F6	Gearbox "–"

Service plug X30

Assignment	X1			X1	Assignment
4–20 mA "+"	B1	1	12	F7	Exhaust gas temperature after turbine
Sea water flow	B7	2	11	F1	Exhaust gas temperature after turbine
Pressure after sea water pump	B2	3	10	C8	Sea water temperature after engine
Fuel pressure	B3	4	9	C2	Sea water temperature after engine
Exhaust backpressure	F10	5	8	C7	Sea water temperature before engine
free		6	7	C1	Sea water temperature before engine

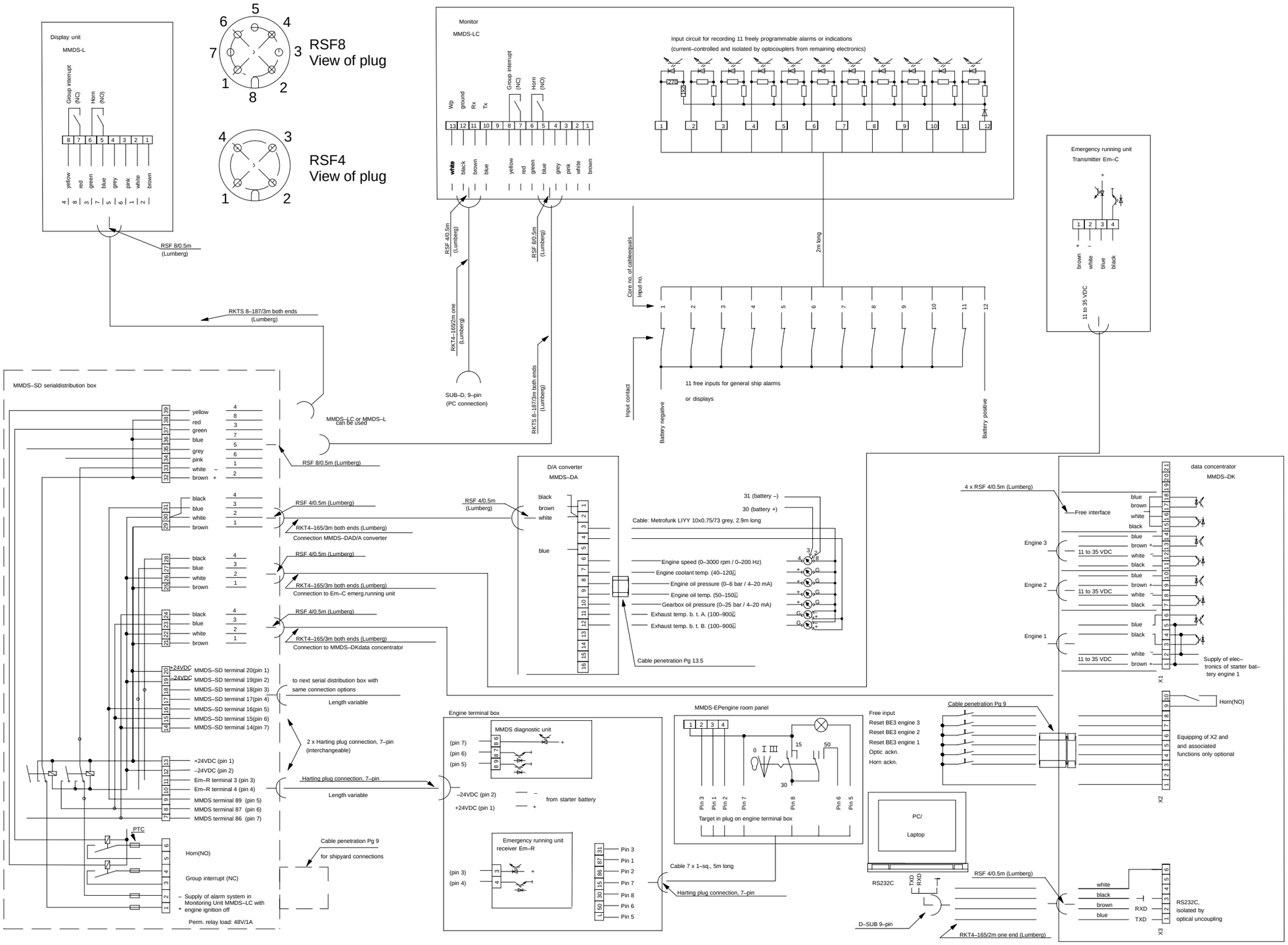




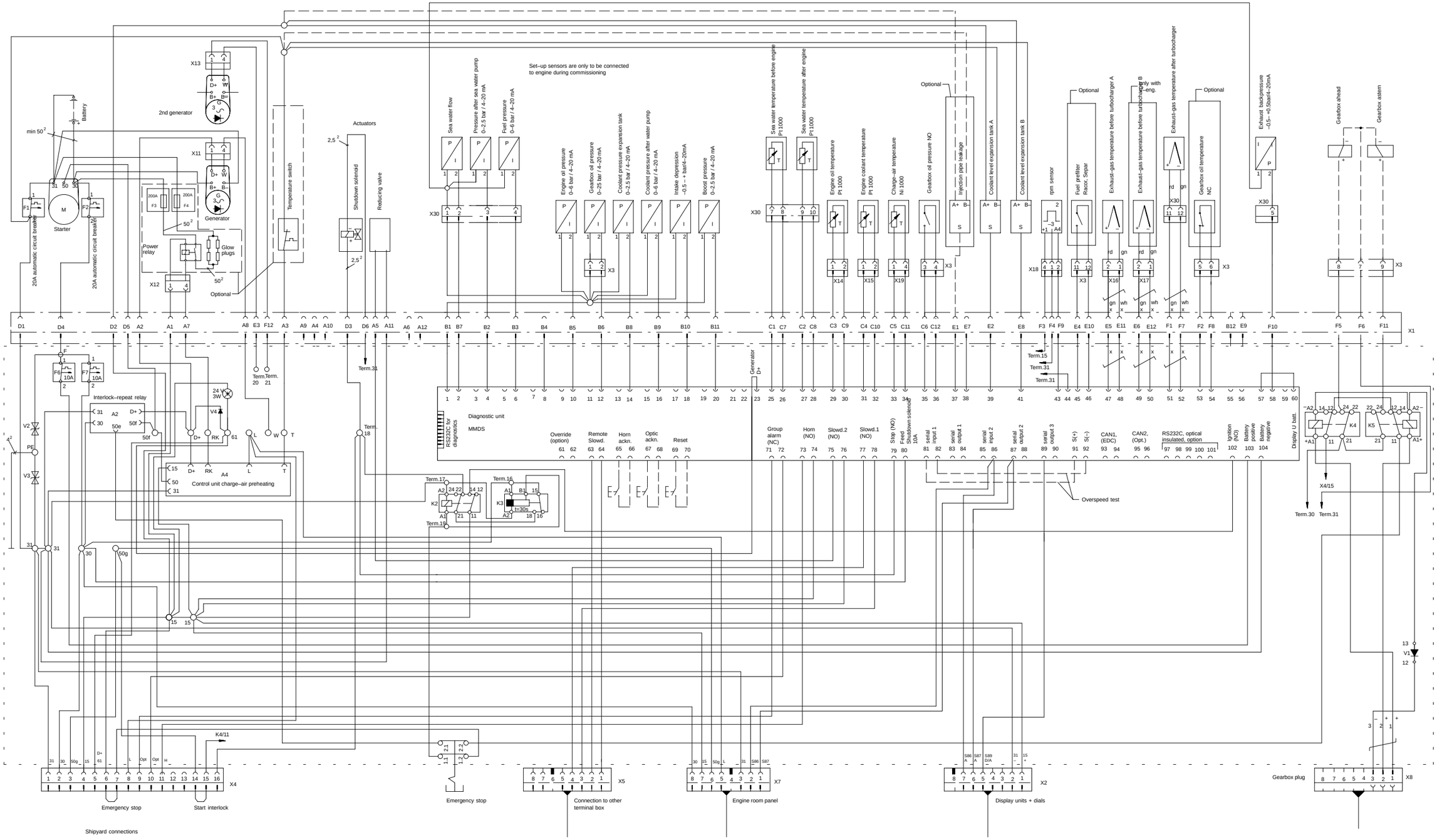
All non–designated cables 1 mm²

Wiring done by shipyard

8054


Display unit
MMDS-L
Group interrupt (NC)
Horn (NO)
yellow
red
green
blue
grey
pink
white
brown
RSF 8/0.5m (Lumberg)
RSF8
View of plug
RSF4
View of plug
Monitor
MMDS-LC
Wp
ground
Rx
Tx
Group interrupt (NC)
Horn (NO)
Input circuit for recording 11 freely programmable alarms or indications
(current–controlled and isolated by optocouplers from remaining electronics)
270
100
RSF 4/0.5m (Lumberg)
RSF 8/0.5m (Lumberg)
RKT4–165/2m one end (Lumberg)
SUB–D, 9–pin
(PC connection)
RKTS 8–187/3m both ends (Lumberg)
Core no. of cable
Input no.
2m long
Input contact
Battery negative
11 free inputs for general ship alarms
or displays
Battery positive
Emergency running unit
Transmitter Em–C
11 to 35 VDC
RKTS 8–187/3m both ends (Lumberg)
MMDS–SD serialdistribution box
MMDS–LC or MMDS–L can be used
RSF 8/0.5m (Lumberg)
RSF 4/0.5m (Lumberg)
RKT4–165/3m both ends (Lumberg)
Connection MMDS–DAD/A converter
Connection to Em–C emerg.running unit
Connection to MMDS–DKdata concentrator
+24VDC MMDS–SD terminal 20(pin 1)
–24VDC MMDS–SD terminal 19(pin 2)
MMDS–SD terminal 18(pin 3)
MMDS–SD terminal 17(pin 4)
MMDS–SD terminal 16(pin 5)
MMDS–SD terminal 15(pin 6)
MMDS–SD terminal 14(pin 7)
to next serial distribution box with same connection options
Length variable
2 x Harting plug connection, 7–pin (interchangeable)
+24VDC (pin 1)
–24VDC (pin 2)
Em–R terminal 3 (pin 3)
Em–R terminal 4 (pin 4)
MMDS terminal 89 (pin 5)
MMDS terminal 87 (pin 6)
MMDS terminal 86 (pin 7)
Harting plug connection, 7–pin
Length variable
PTC
Horn(NO)
Group interrupt (NC)
– Supply of alarm system in Monitoring Unit MMDS–LC with engine ignition off
+
Perm. relay load: 48V/1A
Cable penetration Pg 9
for shipyard connections
D/A converter
MMDS–DA
RSF 4/0.5m (Lumberg)
Cable penetration Pg 13.5
Cable: Metrofunk LIYY 10x0.75/73 grey, 2.9m long
31 (battery –)
30 (battery +)
Engine speed (0–3000 rpm / 0–200 Hz)
Engine coolant temp. (40–120°C)
Engine oil pressure (0–6 bar / 4–20 mA)
Engine oil temp. (50–150°C)
Gearbox oil pressure (0–25 bar / 4–20 mA)
Exhaust temp. b. t. A. (100–900°C)
Exhaust temp. b. t. B. (100–900°C)
Engine terminal box
MMDS diagnostic unit
(pin 7)
(pin 6)
(pin 5)
–24VDC (pin 2)
+24VDC (pin 1)
from starter battery
Emergency running unit receiver Em–R
(pin 3)
(pin 4)
Pin 3
Pin 1
Pin 2
Pin 7
Pin 8
Pin 6
Pin 5
MMDS-EPengine room panel
Target in plug on engine terminal box
Cable 7 x 1–sq., 5m long
Harting plug connection, 7–pin
Free input
Reset BE3 engine 3
Reset BE3 engine 2
Reset BE3 engine 1
Optic ackn.
Horn ackn.
Cable penetration Pg 9
PC/
Laptop
RS232C
TXD
RXD
D–SUB 9–pin
RSF 4/0.5m (Lumberg)
RKT4–165/2m one end (Lumberg)
data concentrator
MMDS–DK
4 x RSF 4/0.5m (Lumberg)
Free interface
Engine 3
Engine 2
Engine 1
11 to 35 VDC
Supply of elec–tronics of starter bat–tery engine 1
X1
Horn(NO)
Equipping of X2 and and associated functions only optional
X2
RS232C, isolated by optical uncoupling
X3

Circuit diagram for marine engines with mechanical controllers and MMDS



F6: Fuse MMDS
F7: Fuse shipyard connections

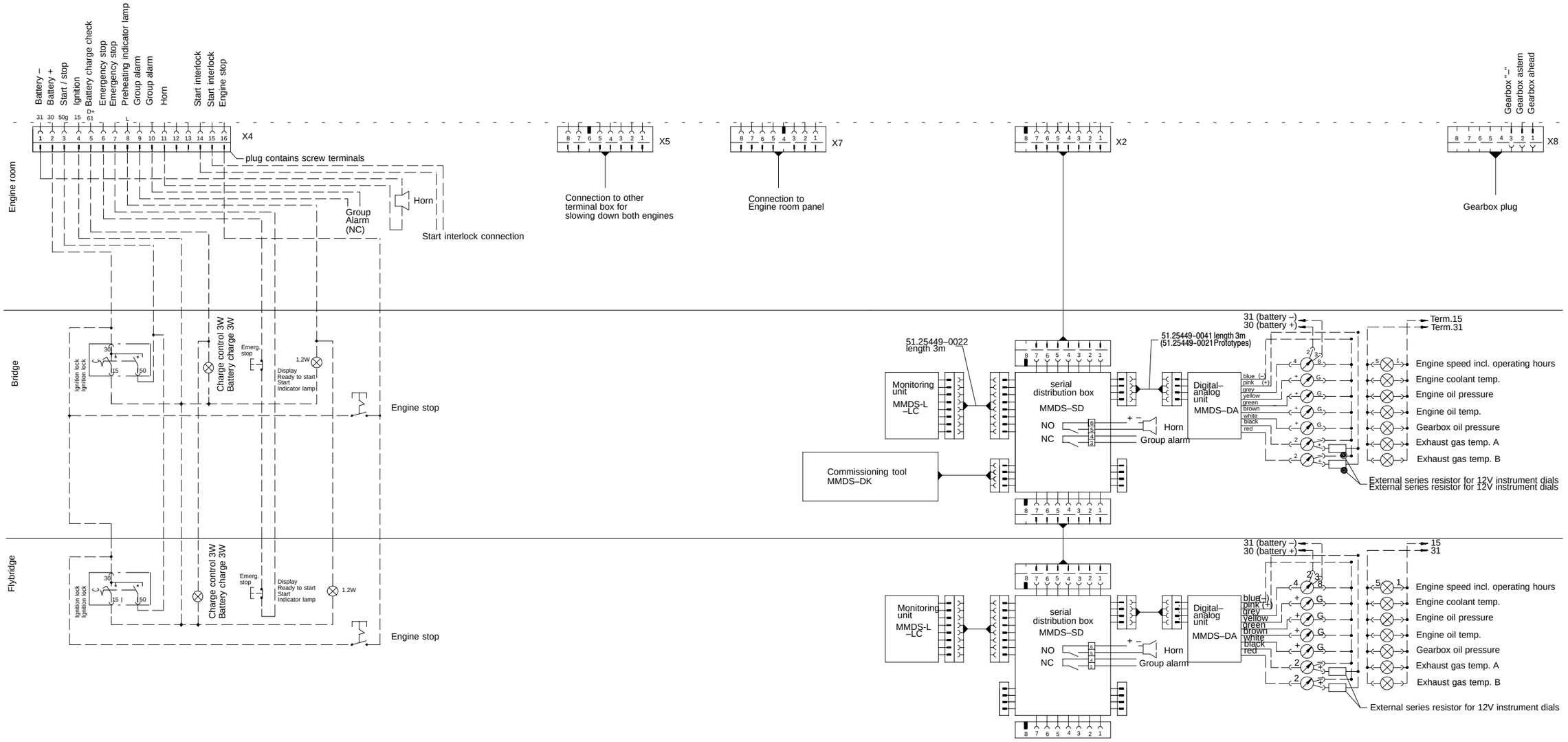
Circuit diagram for mechanically controlled engine with MMDS

V2/V3: Diode 1.5 KE 39 CA
V1/V4: integrated in terminal

K2/K4/K5: Double relay 2x10A
K3: Delay–release relay 5A
K2, K4, K5, equipped with LED and suppr. diode

8054

Circuit Diagram for Marine Engines with Mechanical Controllers and MMDS



Plug A2
Plug A2

30 D+
50f 50e 31

Start repeat relay
Starting interlock relay

Plug A4
Plug A4

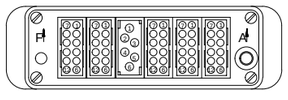
31 T D+
L RK 15 50

Control unit charge–air preheating
Control unit charge–air preheating

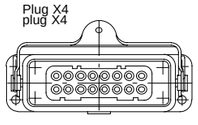
Plugs X11–X17
(viewed from front)
Plugs X11–X17
(viewed from front)

Plug on terminal box
plugs at the engine terminal box

Plug X1
Engine electrics + MMDS sensors
Plug X1
Engine wiring + sensors for MMDS



Plug X4
plug X4



Plug X8
plug X8

Plugs X2, X5, X7
Plugs X2, X5, X7

Gearbox plug X3

Connection	Assignment	X1		X1	Assignment	Connection
external fuel filter (Racor, Separ)	Fuel prefilter (Racor, Separ)	E10	12 1	B1	4 –20 mA "+"	4 –20 mA "+"
external fuel filter (Racor, Separ)	Fuel prefilter (Racor, Separ)	E4	11 2	B6	Gearbox oil pressure Display	Gearbox oil pressure/monitoring
free	free		10 3	C6	Gearbox oil pressure Contact	Gearbox oil pressure contact
Gear astern	Gearbox astern	F11	9 4	C12	Gearbox oil pressure Contact	Gearbox oil pressure contact
Gear ahead	Gearbox ahead	F5	8 5	F2	Gearbox oil temp., Contact	Gearbox oil temp. contact
Gear "–"	Gearbox "–"	F6	7 6	F8	Gearbox oil temp., Contact	Gearbox oil temp. contact

Service plug X30

Connection	Assignment	X1		X1	Assignment	Connection
exhaust gas temp. after turbine	Exhaust–gas temp. after turbine	F7	12 1	B1	4 –20 mA "+"	4 –20 mA "+"
exhaust gas temp. after turbine	Exhaust–gas temp. after turbine	F1	11 2	B7	Sea water flow	Sea water flow
sea water temp. after Engine	Sea water temp. after Engine	C8	10 3	B2	Pressure after sea water pump	press. after sea water pump
sea water temp. after Engine	Sea water temp. after Engine	C2	9 4	B3	Fuel pressure	Fuel pressure
sea water temp. before Engine	Sea water temp. before Engine	C7	8 5	F10	Exhaust backpressure	exhaust back press.
sea water temp. before Engine	Sea water temp. before Engine	C1	7 6		free	free

All non–designated cables 1 mm²

Wiring done by shipyard

8054

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