



*Monitoring unit BE 1 for MAN marine Diesel engines*

*Überwachungseinheit BE 1 für MAN-Schiffsdieselmotoren*

*Unidad de control BE 1 para motores marinos Diesel MAN*

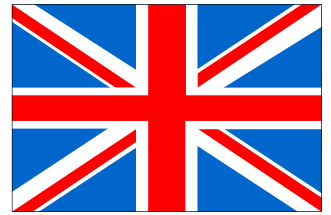
*Unité de surveillance BE 1 pour moteurs Diesel marins MAN*

*Impianto di sorveglianza BE 1 per motori marini Diesel MAN*



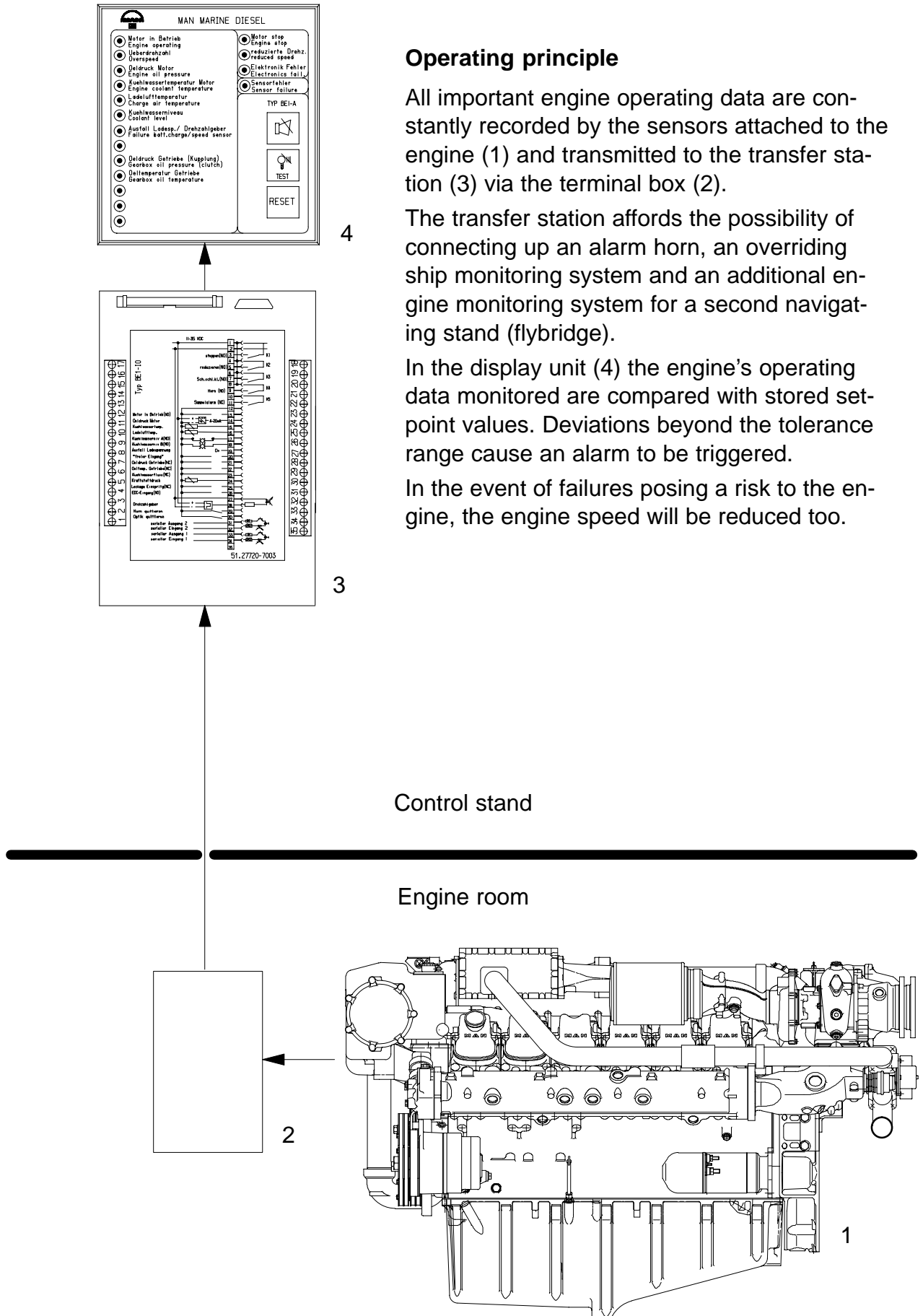


Monitoring unit  
for MAN marine diesel engines





Schematic diagram of data transfer



Operating principle

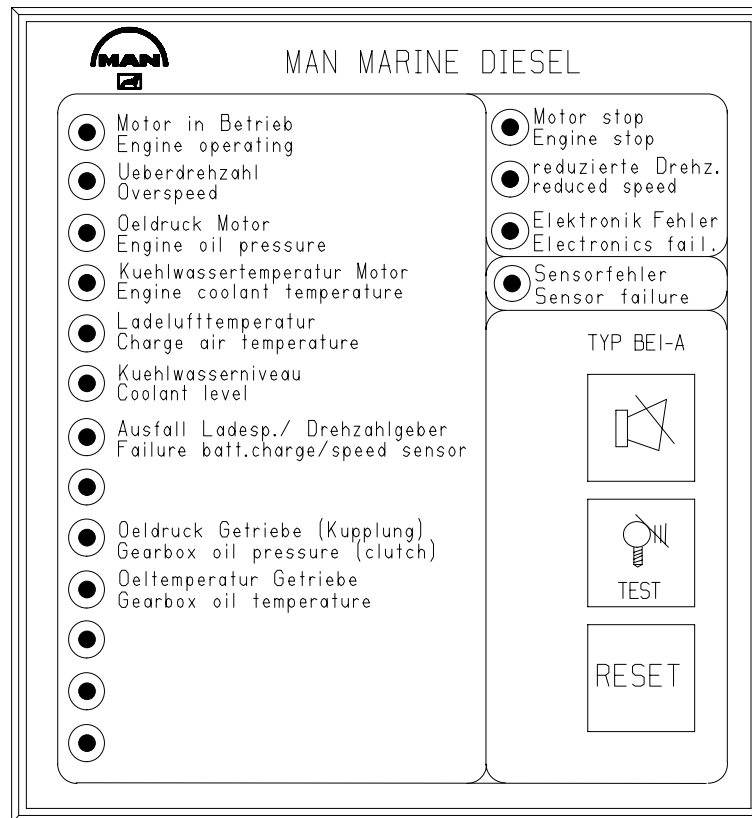
All important engine operating data are constantly recorded by the sensors attached to the engine (1) and transmitted to the transfer station (3) via the terminal box (2).

The transfer station affords the possibility of connecting up an alarm horn, an overriding ship monitoring system and an additional engine monitoring system for a second navigating stand (flybridge).

In the display unit (4) the engine's operating data monitored are compared with stored set-point values. Deviations beyond the tolerance range cause an alarm to be triggered.

In the event of failures posing a risk to the engine, the engine speed will be reduced too.

### Display and operating unit of the engine monitoring system



The basic version of the engine monitoring system monitors the following functions:

- Engine in operation
- Engine speed (overspeed)
- Engine oil pressure (speed-dependent characteristic)
- Coolant temperature
- Charge-air temperature
- Coolant level
- Charging voltage of alternator
- Electronics fault (active only if engine is equipped with electronically controlled diesel injection = EDC)

In addition, it provides the possibility of controlling the following functions:

- Gearbox oil pressure (active only if monitor is fitted to gearbox and is wired)
- Gearbox oil temperature (active only if monitor is fitted to gearbox and is wired)

Brief description of the system:

The engine monitoring system is suitable both for engines with mechanical and for engines with electronically controlled diesel fuel injection.

The sensors for the engine monitoring system are attached to the engine and wired as far as to a central plug. The cable from the engine (flywheel end) to the plug is approx. 3 metres in length.

In gearboxes supplied by MAN the sensors for the gearbox monitoring system are also wired as far as to the central plug.

The terminal box is fitted in the engine room and connected to the aforementioned central plug by means of its 3 m long connecting cable.

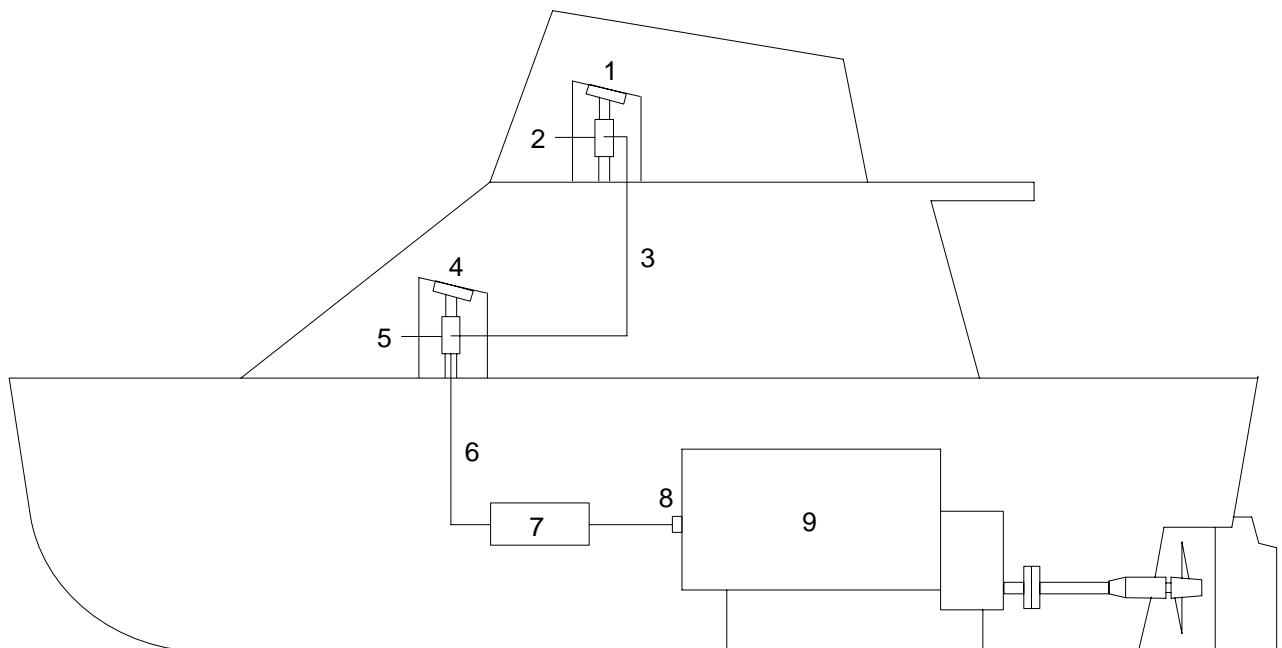
If the gearbox is fitted by the shipyard, the sensors for the gearshifting oil pressure of the clutch and for the gearbox oil temperature may also be connected up to the engine monitoring system (see gearbox monitoring system on page 18)

The terminal box is fitted in the engine room and connected up to the central plug by means of the aforementioned engine cable.

The connecting cable of the monitoring unit in the main navigating stand is connected up to the terminal box.

Available on request, a monitoring unit for the secondary navigating stand is triggered from the monitoring unit in the main navigating stand via serial data transfer.

The check lamps are dimmed automatically via an installed photocell.



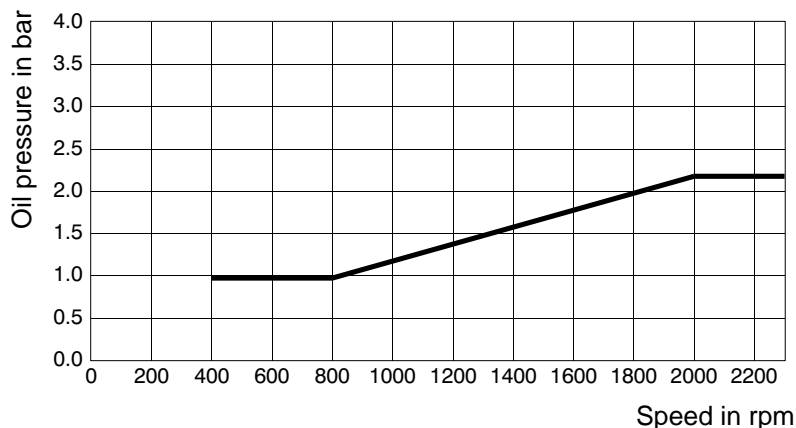
- |  |  |
|--|--|
| 1 Display unit (slave)   | 6 25-pole connecting cable with plugs at both ends |
| 2 Transfer station (slave)   | 7 Terminal box                                     |
| 3 4-pole connecting cable (supplied and installed by the shipyard) | 8 Central plug                                     |
| 4 Display unit (master)  | 9 Engine   |
| 5 Transfer station (master)  |  |

### Variables which are monitored

The following variables are monitored and indicated by check lamps (LEDs):

- Engine running:  
The green LED comes on if:
  - the engine speed is higher than 550 rpm
  - if more than 7.2 V is applied to alternator terminal D+.
- Overspeed:  
Evaluation of the speed signal. The speed is automatically reduced from 2,700 rpm onwards.
- Engine oil pressure:  
Monitoring of a speed–dependent characteristic curve: If the value measured falls below the characteristic curve, the speed will be reduced automatically.

Characteristic: oil pressure – engine speed



- Cooling water temperature:  
Limit value: 95°C. If the value measured exceeds the limit value, the speed will be reduced automatically.
- Charge-air temperature  
Limit value: 70°C. If the value measured exceeds the limit value, the speed will be reduced automatically.
- Cooling water level  
Evaluation of the two level probes in the expansion tank (P + Stb). If both probes are dry, the speed will be reduced automatically.
- Charging voltage of alternator / failure of speed pickup  
The terminal D+ signal and the engine speed signal monitor each other. If one signal fails, an alarm will be triggered.
- Electronic fault (active in EDC–controlled engines only)  
For EDC self-testing, the LED comes on for 3 seconds after the ignition has been switched on. If an EDC fault occurs, the red LED will come on.



In addition, the gearbox can be monitored:

(active only if monitors are installed and wired by the gearbox manufacturer; the connection is established via the engine-mounted gearbox plug)

- Gearbox oil pressure

If the oil pressure supplied to the clutch falls below the permissible value, an alarm will be triggered. The engine speed will not be reduced. If the engine speed is over 1,200 rpm, the monitoring function will become active after 30 sec. If the engine speed is over 1,400 rpm, the monitoring function will become active immediately.

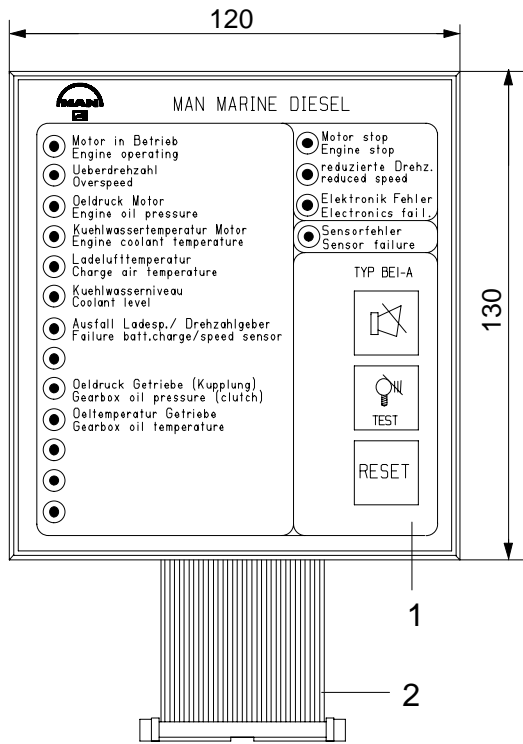
**Reason:** The troling valve for crawling speed releases the full oil pressure at the clutch only from a speed of 1,100 rpm onwards.

- Gearbox oil temperature

In the event of overtemperature an alarm will be triggered. The engine speed will not be reduced.

## The display unit

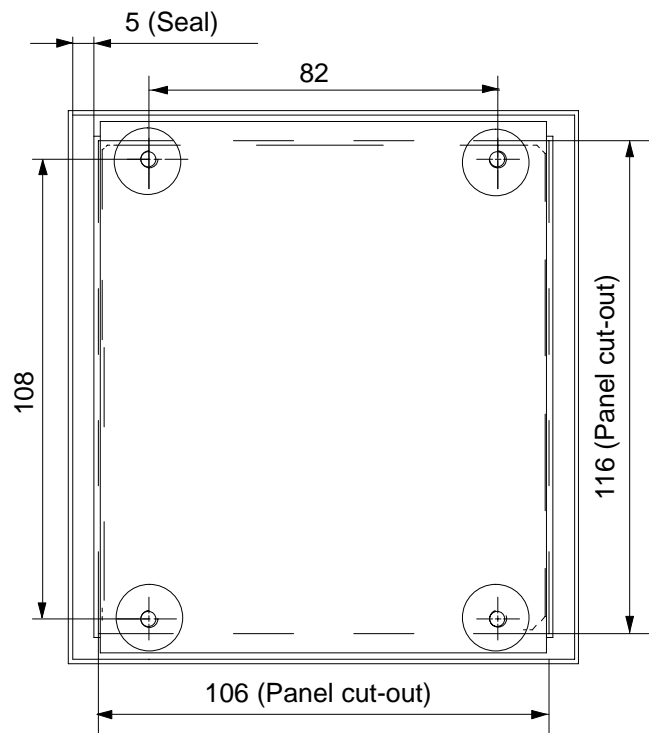
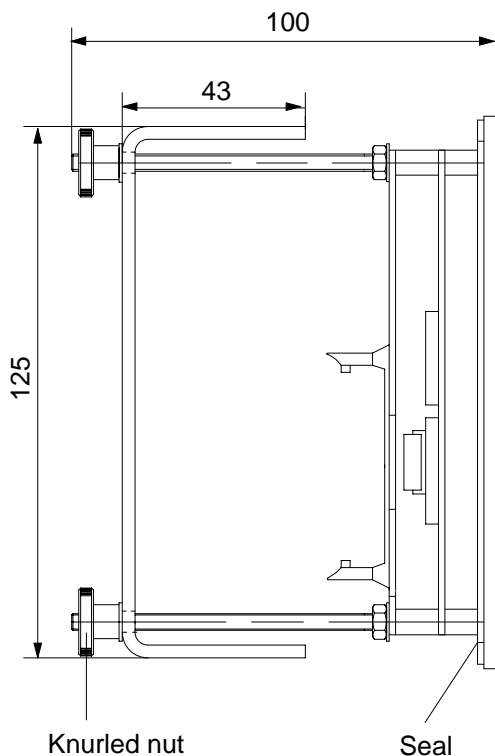
The display unit (1) is installed in the control stand or on the flybridge.



It is connected with the transfer station by means of a ribbon cable (2) that has a length of max. 1.5 metres, so that the display unit must be arranged in the immediate vicinity of the transfer station. Both components are to be arranged in such a way that the ribbon cable will under no circumstances be kinked. A cut-out (width x height = 106 x 116 mm) is to be provided in the instrument panel for the installation of the display unit.

**Caution:**

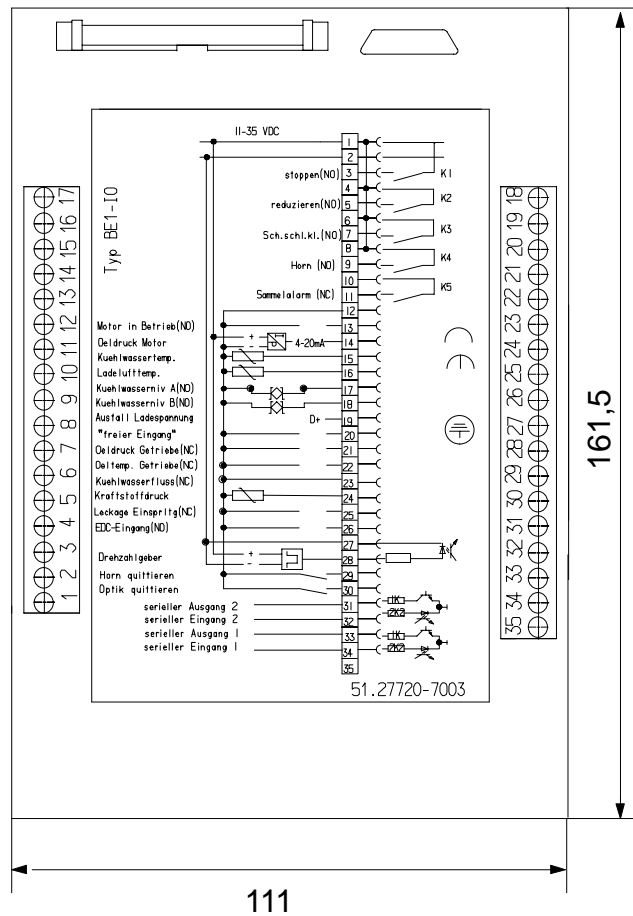
The display and operating units for the main navigating stand and the secondary navigating stand (flybridge) must not be mixed up (see appendix, page 41).



The cut-out in the instrument panel is to be made accurately since the contact face is provided with a rubber seal which must be in full contact to achieve the correct sealing effect (protection class IP 66).

The unit is pressed against the instrument panel from below with the aid of a U-section and is fastened with 4 knurled screws.

## The transfer station



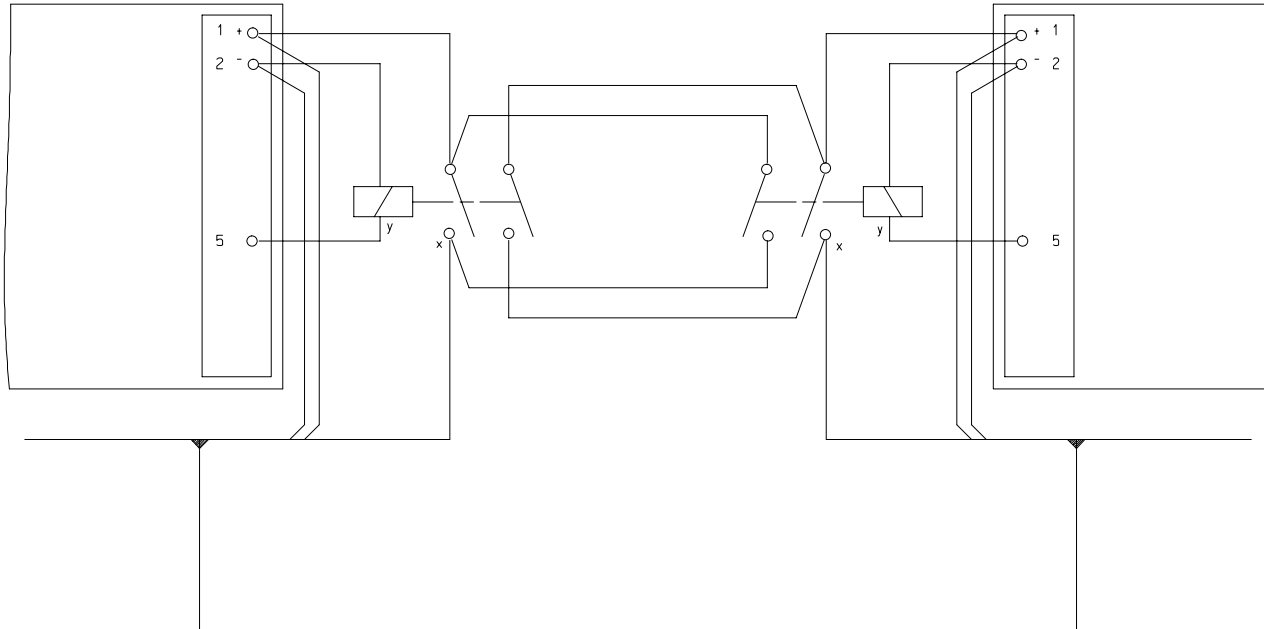
### Installation and fastening:

The transfer station must be installed in a waterproof navigating stand. Type of protection for the transfer station: IP 20 (no anti-water protection). The housing can be mounted on a switch cabinet rail TS 32 or TS 35.

## Reduction of speed of both engines in case of alarm

Transfer station  
Port engine

Transfer station  
Starboard engine



If in fast ships with double engine system the speed of one engine is suddenly reduced because an alarm is triggered whilst the other engine continues to run at unaltered output, the resultant asymmetric thrust may cause the ship to enter into an unstable cruising condition.

For this reason the option has been provided to trigger both engines in the event of a failure.

To simultaneously trigger the reducing valves on double engine systems with separate power supply, it is necessary to connect in the control stand the transfer stations of both engines as per depicted circuit diagram.

A supply voltage (battery voltage = 24 V) is supplied to the terminals 1 and 2.

The line must be disconnected from terminal 5 on the transfer station and connected up to the NO contact (x) of the respective relay (is not part of the extent of delivery).

From the now empty terminal 5 on the transfer station a line is to be laid to relay coil y.

The reducing valve for triggering the injection pump is attached to the engine: 24 V; 0.4 A.

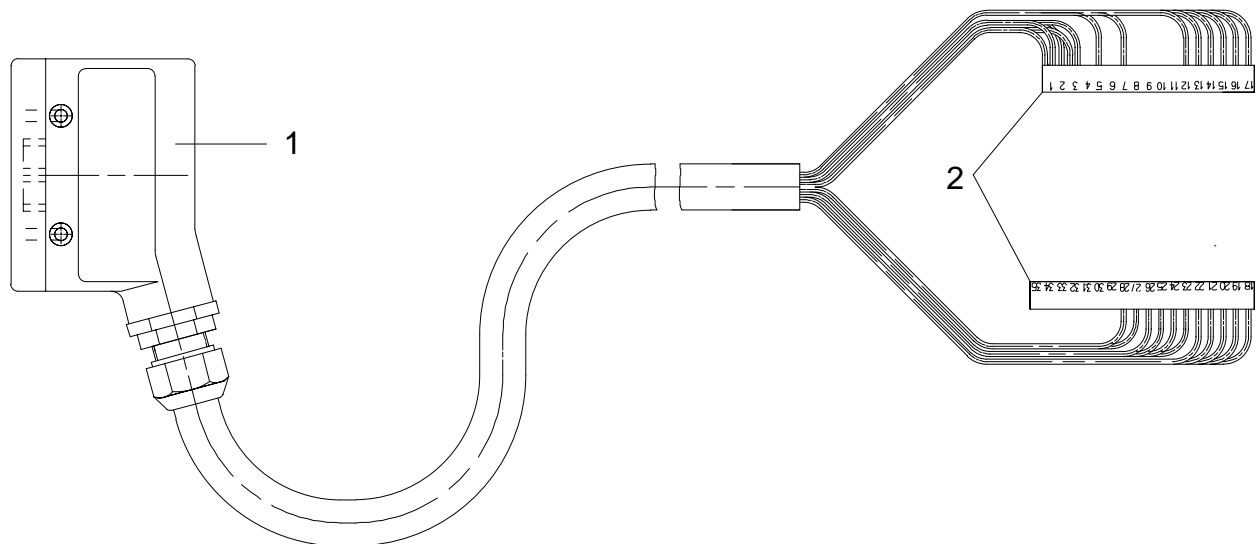
### Additional display unit with transfer station in the second navigating stand (flybridge)

In addition to the main navigating stand a display unit with transfer station may be installed in the second navigating stand (accessories).

The procedure for installing the display unit is identical with that for the main navigating stand. The transfer stations in both navigating stands are then to be interconnected as per the wiring diagram on page 15.

- Voltage supply of the unit in the second navigating stand:  
Connect the terminals 1 and 2 of the transfer station in the main navigating stand with the terminals 1 and 2 of the transfer station in the second navigating stand.
- Serial data transfer to the second navigating stand:  
Terminal 31 of the transfer station in the control stand is to be connected with terminal 32 of the transfer station in the second navigating stand, and terminal 32 of the transfer station in the control stand is to be connected with terminal 31 of the transfer station in the second navigating stand.

### Connecting cable between engine room and main navigating stand



The connecting cable from the engine room to the main navigating stand is part and parcel of MAN's extent of delivery. The length of the cable depends on the actual conditions (ship size, distance between engine terminal box and main navigating stand) and is to be indicated on placing of order.

Cables are available with 10 and 25 metres in length. Cable lengths other than these are available on request. The connecting cable from the engine room to the main navigating stand is to be connected up to the terminal box in the engine room by means of plug (1) and locked into place with two bows.

The other end of the cable with the two terminal strips already wired is to be connected up to the transfer station by means of the terminals 1–17 and the terminals 18–35.

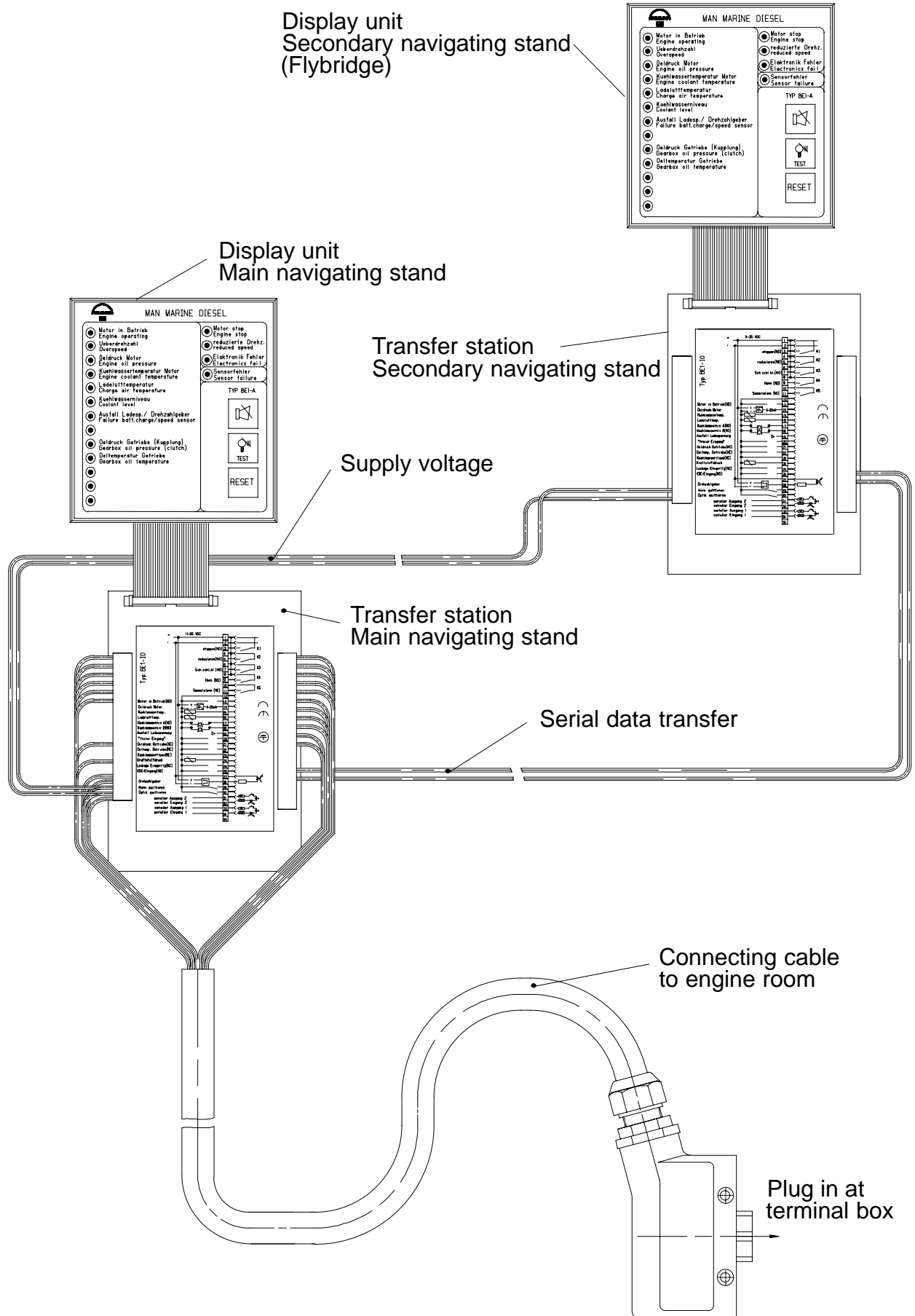
To prevent any malfunction, the cable must be neither kinked nor laid in loops if it has overlength. For this reason the cable length required must be measured exactly before order is placed.



### **External shell cooling**

If an external shell cooling system is fitted, both coolant level probes are to be inserted in the expansion tanks manufactured by the shipyard and to be connected up since otherwise the messages "Cooling water level" and "Sensor fault" will be indicated.

## Wiring diagram for the engine monitoring system (Display units in the main and secondary navigating stands)



### Arrangement and wiring of the engine monitoring system

The adjacent picture shows the arrangement and the basic wiring of an engine monitoring system with display units in the main and secondary navigating stands.

The engine monitoring system for the main navigating stand is merely to be connected up to the supplied connecting cable between the engine room and the main navigating stand (also see page 13). This guarantees an easy and time-saving installation, avoiding faults in the wiring of the engine room and the control stand.

The engine monitoring system for the secondary navigating stand (flybridge) is to be connected up to the monitoring system in the main navigating stand as follows:

- **Supply voltage:** Interconnect terminals 1 and 2 of the terminal strips of both transfer stations (wire cross-section at least 0.75 mm<sup>2</sup>)
- **Serial data transfer:** Interconnect terminals 31 and 32 of the terminal strips of both transfer stations (wire cross-section at least 0.75 mm<sup>2</sup>)

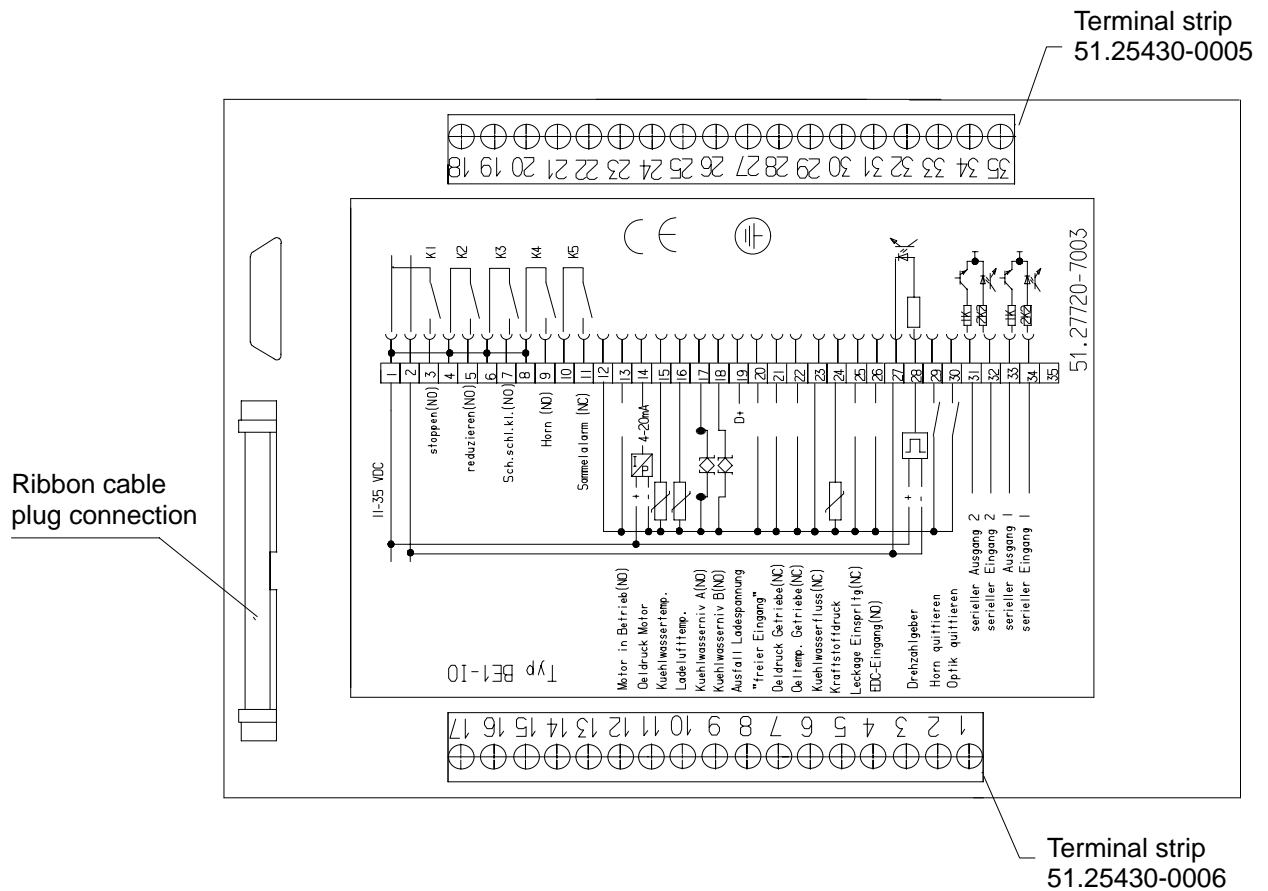
**Caution:**

The display and operating units for the main navigating stand and the secondary navigating stand (flybridge) must not be mixed up.

In the following all components of the engine monitoring system and their installation as well as the options for connecting up additional systems are described.



## Relay outputs of the transfer station



### Connecting up of acoustic and visual warning equipment

Terminal 9 is a relay output (K4, NO = **N**ormally **O**pen contact) for connecting up a horn and / or a warning lamp at the shipyard (permissible relay contact load: 2 A / 50 V). If an alarm is raised the relay contact will close and reopen only after the horn has been confirmed. If an additional alarm is raised, K4 will open for approx. 5 seconds and then close again.

### Connecting up of overriding ship monitoring system

Terminal 11 is a relay output (K5, NC = **N**ormally **C**losed contact) for connecting up an overriding ship monitoring system. (Permissible relay contact load: 2 A / 50 V) If an alarm is triggered, the relay contact will open. It closes again only after the fault has been eliminated. If an additional alarm is raised, K5 will close for approx. 5 seconds and then open again.

### Triggering of a quick-closing flap

The system provides the option of triggering quick-closing flaps. Terminal 7 is a relay output (K3) for triggering a quick-closing flap at overspeed. K3 is a wiping contact.

## Gearbox monitoring

A gearbox monitoring system for the following functions is available on request.

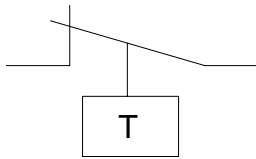
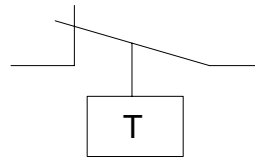
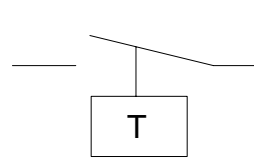
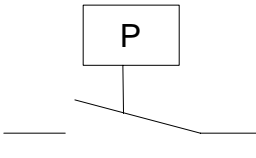
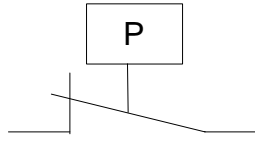
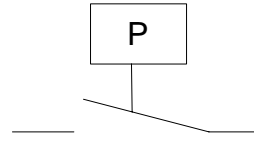
- Gearshifting oil pressure of clutch
- Oil temperature

If the gearbox is delivered by MAN and the customer requires a gearbox monitoring system, the monitors will be connected up ex works.

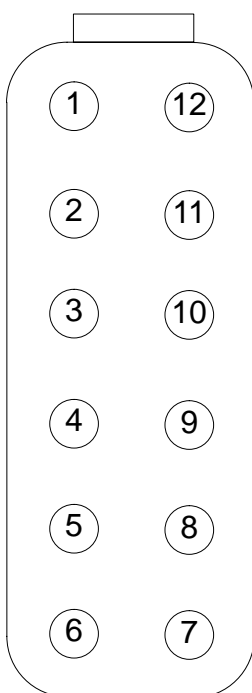
If no gearbox monitoring system is fitted, the cable ends of the cable harness supplied (terminals 4, 8 and 9) will be connected up with one another by MAN.

*Note concerning attachment of gearbox by the shipyard:*

Monitors with the following mode of operation should be mounted on the gearbox:

	Engine off	Engine running, gearbox engaged, no alarm present	Engine running, gearbox engaged, alarm present
Oil temperature: NC: normally closed			
Oil pressure: NO: normally open			

The monitors are to be connected via the "gearbox plug" on the engine flywheel housing with the cable harness of the engine and thus with monitoring system.



### Plugs for electric connection of gearbox

Allocation of connections for the gearbox monitoring system:

- 4 Signal for oil pressure
- 9 Signal for oil temperature
- 8 Negative pole

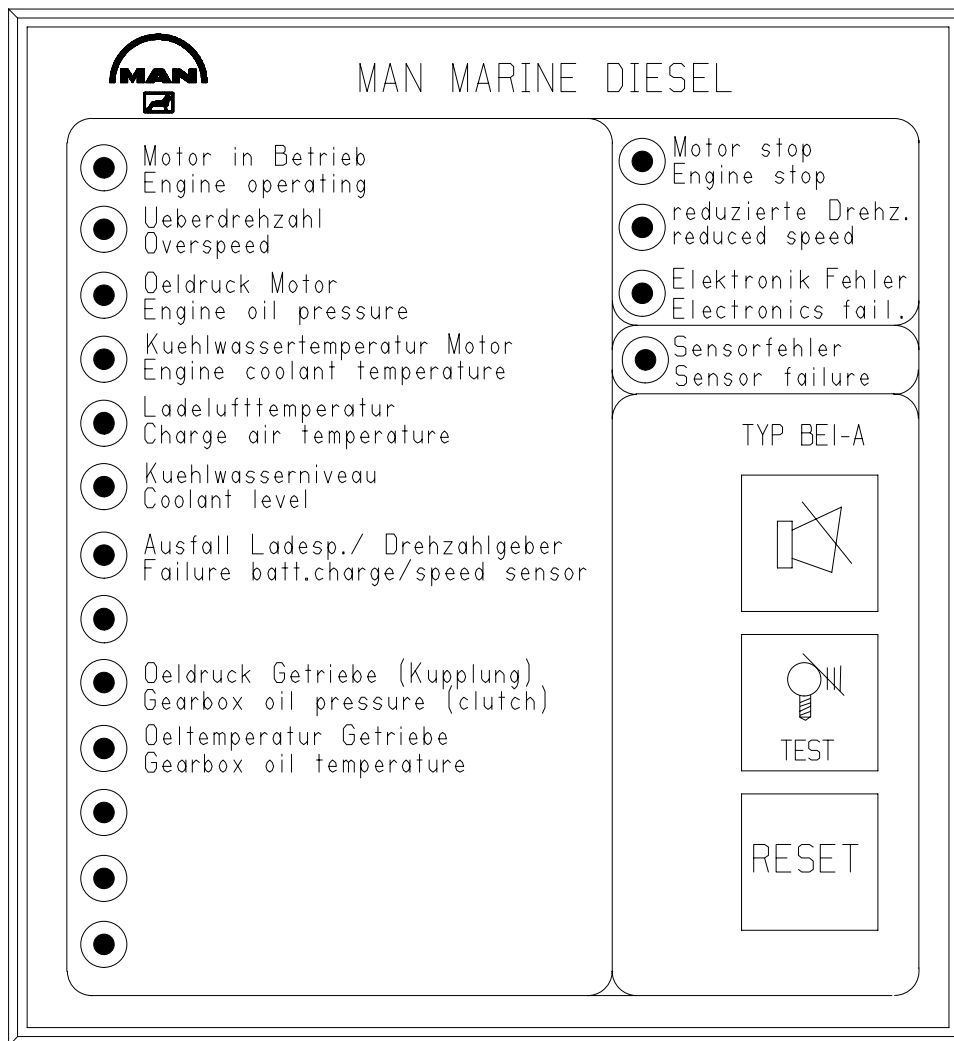
**Function**

The engine monitoring system warns the ship operator if important engine operating values are outside the permissible tolerance range.

The display unit of the engine monitoring system (see picture) is installed in the main navigating stand and, as an option, in the secondary navigating stand (flybridge) too.

The alarm is raised:

- acoustically by means of a horn.
- visually by the flashing of the respective red check lamp (exception: in the event of a fault in the electronic system the respective check lamp is permanently illuminated.)

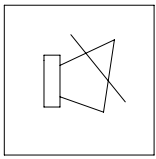


To protect the engine, the speed will be reduced if alarm warnings like engine oil pressure, engine coolant temperature, charge-air temperature and coolant level) is raised. The check lamp "reduced speed" is then illuminated permanently.

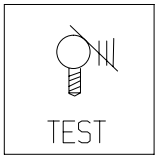
**Note on engines with electronically controlled diesel injection (EDC):**  
 After the ignition has been switched on, the lamp "Fault in the electronic system" will come on momentarily (lamp check). If there is a fault in the electronically controlled diesel injection system (EDC), the lamp "Fault in the electronic system" will be illuminated permanently.

### Operation of the engine monitoring system after an alarm has been triggered

The display unit has the following operating buttons:



Switching off of the alarm horn



Switching off of the flashing signal of the respective check lamp, ie the flashing light changes into permanent light. Before the flashing signal can be switched off, the alarm horn must be switched off.

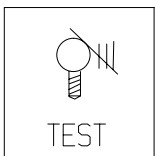


Lifting of the alarm message (the red check lamp will go out).

Precondition for lifting an alarm message:

- Pressing of buttons "Horn off" and "Test" in the order indicated.
- Elimination of the cause of the alarm.
- Short-term reduction of the engine speed below 800 rpm, to again achieve higher engine speeds.

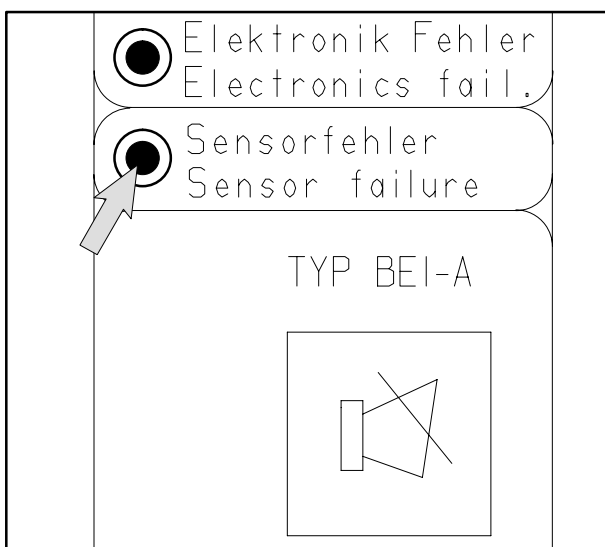
### Functional test of the check lamps



If no alarm is raised, the check lamps may be checked. Upon pressing the button "Test", all check lamps must come on.

### Self-test of system

To achieve optimum operational reliability, the system distinguishes between sensor fault and "real alarm".



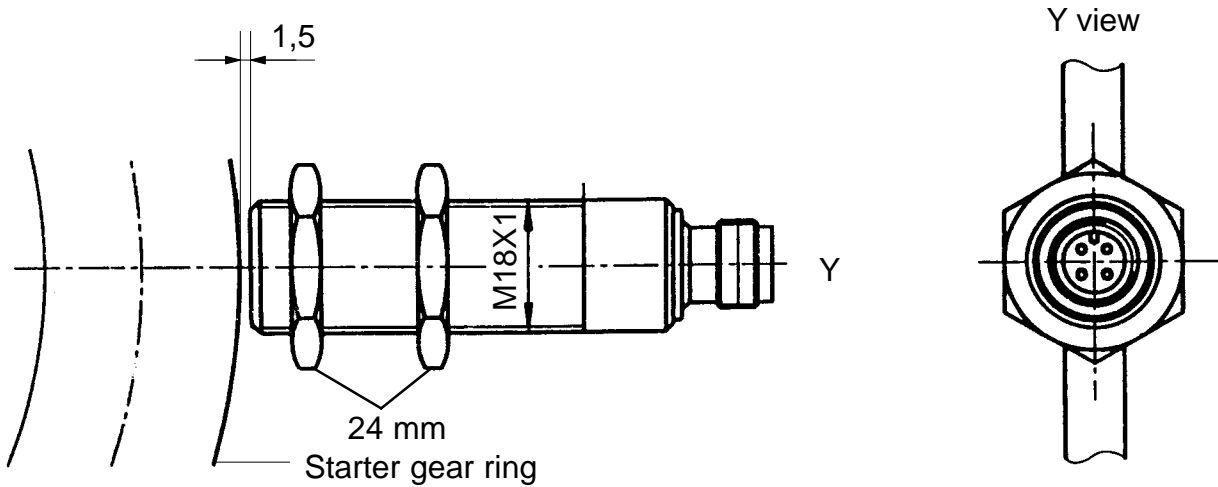
The following sensors are checked for sensor fault and parting of wire:

- Engine speed
- Engine oil pressure
- Coolant temperature
- Charge-air temperature
- Coolant level

If the signal sent by the sensor is a value which does not occur in practice or if the wire connection is interrupted, the check lamp "Sensor fault" and the check lamp of the associated function will start flashing.

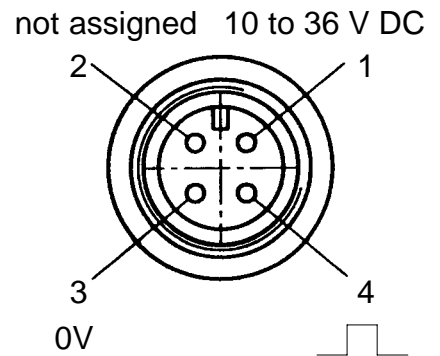
**Speed pickup 51.27120-0010**

The speed pickup is responsible for the messages "Engine running", "Overspeed" and "Charging voltage / speed pickup failure".

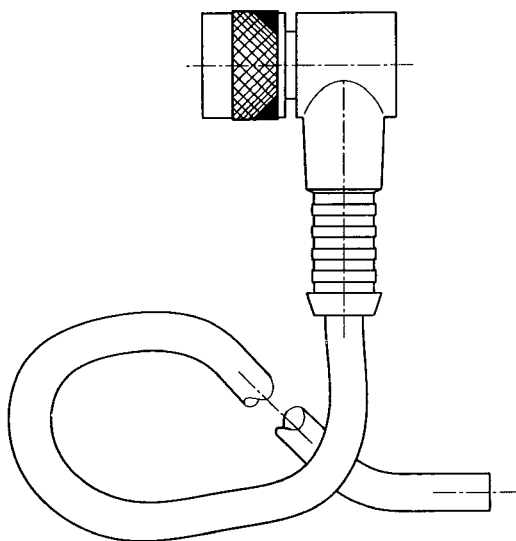


The function of the speed pickup is based on the Hall effect. Owing to the rotation of the starter gear ring, the magnetic flux and, consequently, the Hall voltage are subject to permanent change. This voltage variation is converted into an output voltage with a rectangular characteristic, the frequency of the output voltage being proportional to the speed of the gear ring.

**Contact assignments**

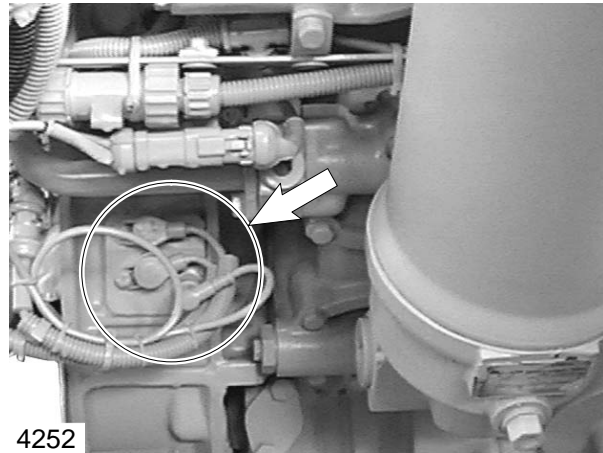


**Plug for speed pickup 51.27112-7002**

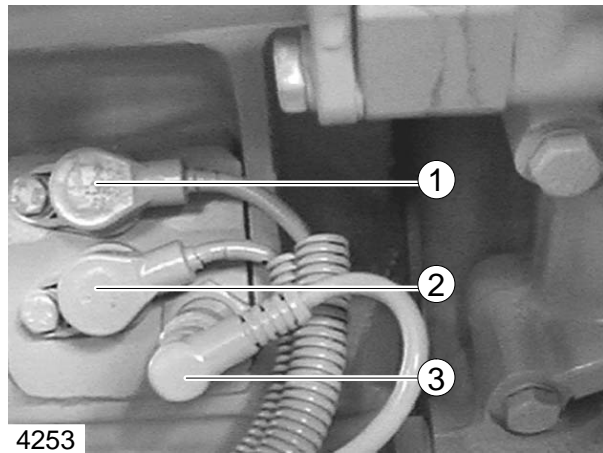


**Arrangement of the speed pickups  
for EDC and the alarm system on the  
engine**

Flywheel housing, right-hand side of engine



- 1 Speed pickup DZG1 for EDC,  
item no. 51.27120-0008, cable no. (1)
- 2 Auxiliary speed pickup HZG1 for EDC,  
item no. 51.27120-0009
- 3 Speed pickup for alarm system,  
item no. 51.27120-0010



**Checking of speed pickup 51.27120-0010**

- Measuring of voltage at transfer station:

The measurement is carried out at  $n = 600$  rpm. There must be a voltage of 10–12 V between terminal 2 (–) and terminal 28 (+).

- Measuring of frequency at transfer station:

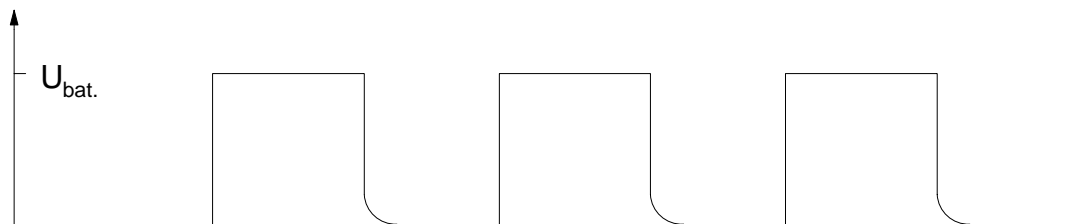
The measurement is carried out between terminal 2 (–) and terminal 28 (+) while engine is running.

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

Key to this formula:

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

- Measuring of signal curve at transfer station, using an oscilloscope (terminals 27 / 28)

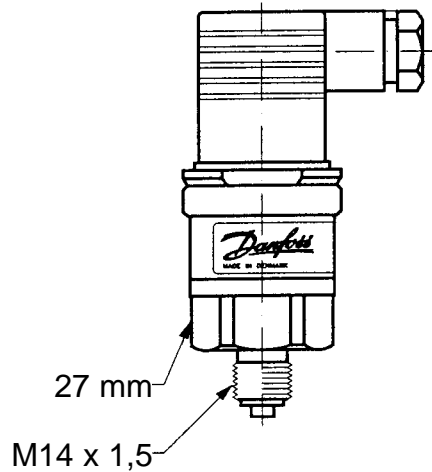


- Functional test

Disconnect plug from speed pickup. After approx. 50 seconds the fault message "Charging voltage / speed pickup failure" must appear on the display unit. The message "Engine running" will remain on, since the monitoring system is checking the charging voltage available and will therefore come to this conclusion.

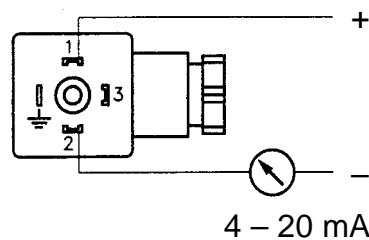
### Oil pressure sensor 51.27421-0126

The oil pressure sensor monitors the engine oil pressure depending on the engine speed. If the speed sensor fails, an alarm will be triggered at an oil pressure of < 1 bar.



Output: 0 – 6 bar  $\triangleq$  4 – 20 mA with linear characteristic.

### Plug DIN 43 650



- 1 Supply +
- 2 Supply –
- 3 Not used
- $\equiv$  connected with pressure transducer housing

### Remarks:

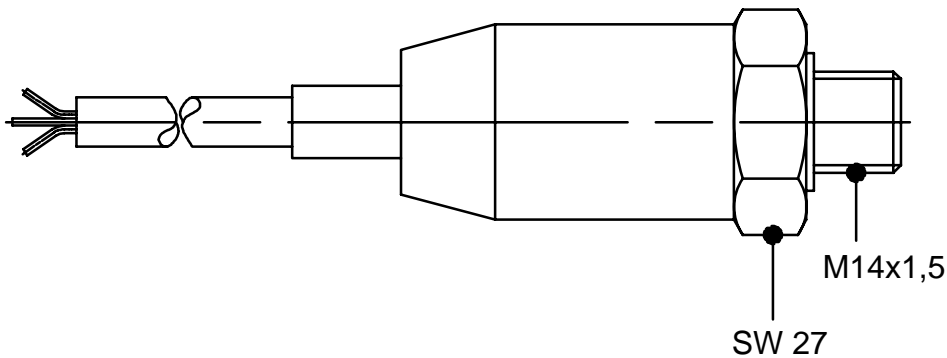
- The oil pressure sensor is part of the transfer station 51.27720-7003 (Master)
- Suitable display units: 51.27720-6023 (Master)

#### **Important:**

Ensure correct allocation of the oil pressure sensors to the respective components of the engine monitoring system; see page 41



### Oil pressure sensor 51.27421-0107



Output: 0 – 10 bar  $\triangleq$  1 – 5 V with linear characteristic  
 Adernbelegung: green: output signal  
 white: earth  
 brown: supply voltage (24V)

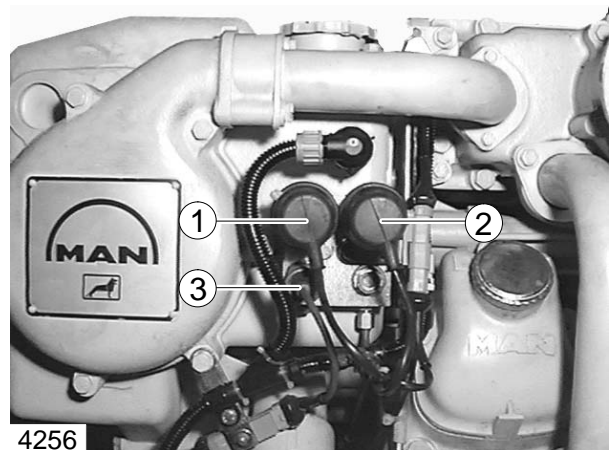
Remarks:

- The oil pressure sensor is part of the transfer station 51.27720-7002 (Master)
- Suitable display units: 51.27720-6004 (Master)

### Arrangement of the oil pressure sensors for the instruments and the alarm system on the engine

Left-hand side of engine between heat exchanger and intercooler

- ① Oil pressure transmitter (M10x1) for engine room instrument panel, item no. 51.76034-0007
- ② Oil pressure transmitter for instruments  
 Single-type (M10x1):  
 item no. 50.76034-0007  
 Double (M18x1.5):  
 item no. 50.27421-0033
- ③ Oil pressure transmitter for alarm system, item no. 51.27421-0107 or -0126

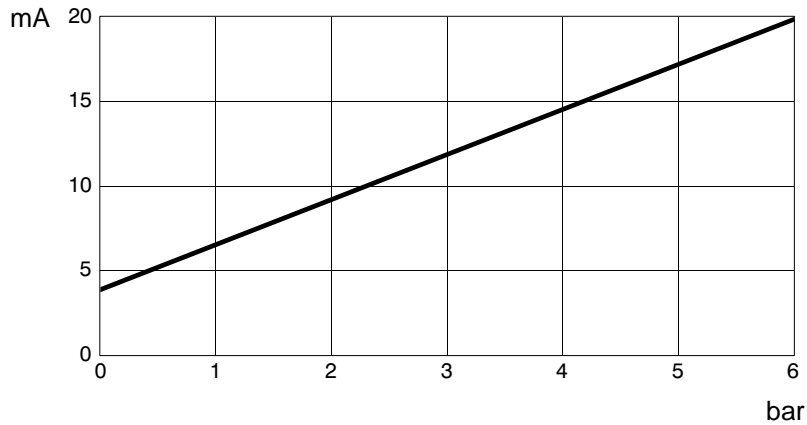


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### Checking

#### Checking of oil pressure sensor 51.27720-0126

- Disconnect wire from terminal 14 of the transfer station, connect up ammeter with measuring range mA (negative terminal to terminal 14, positive terminal to wire).
- Switch on ignition, a value of 4 mA must be indicated while the engine is stationary.

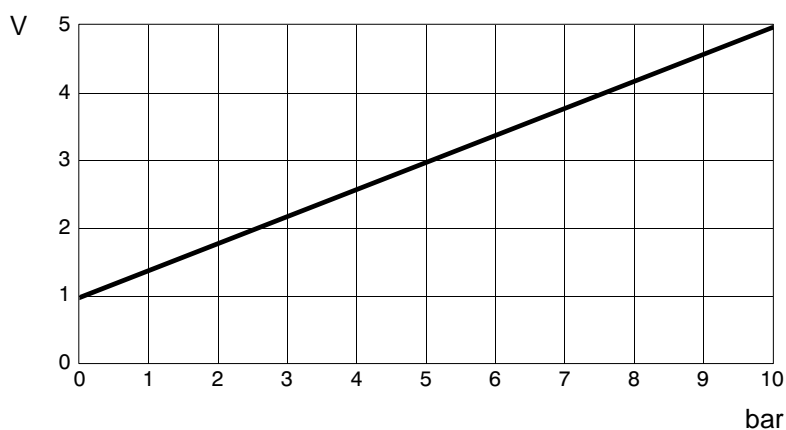


#### Checking of function:

Disconnect plug from oil pressure sensor. The sensor fault message "Oil pressure " must appear on the display unit.

#### Checking of oil pressure sensor 51.27720-0107

- Connect up voltage meter between terminal 14 (+) and terminal 12 (-) of the transfer station
- Switch on ignition

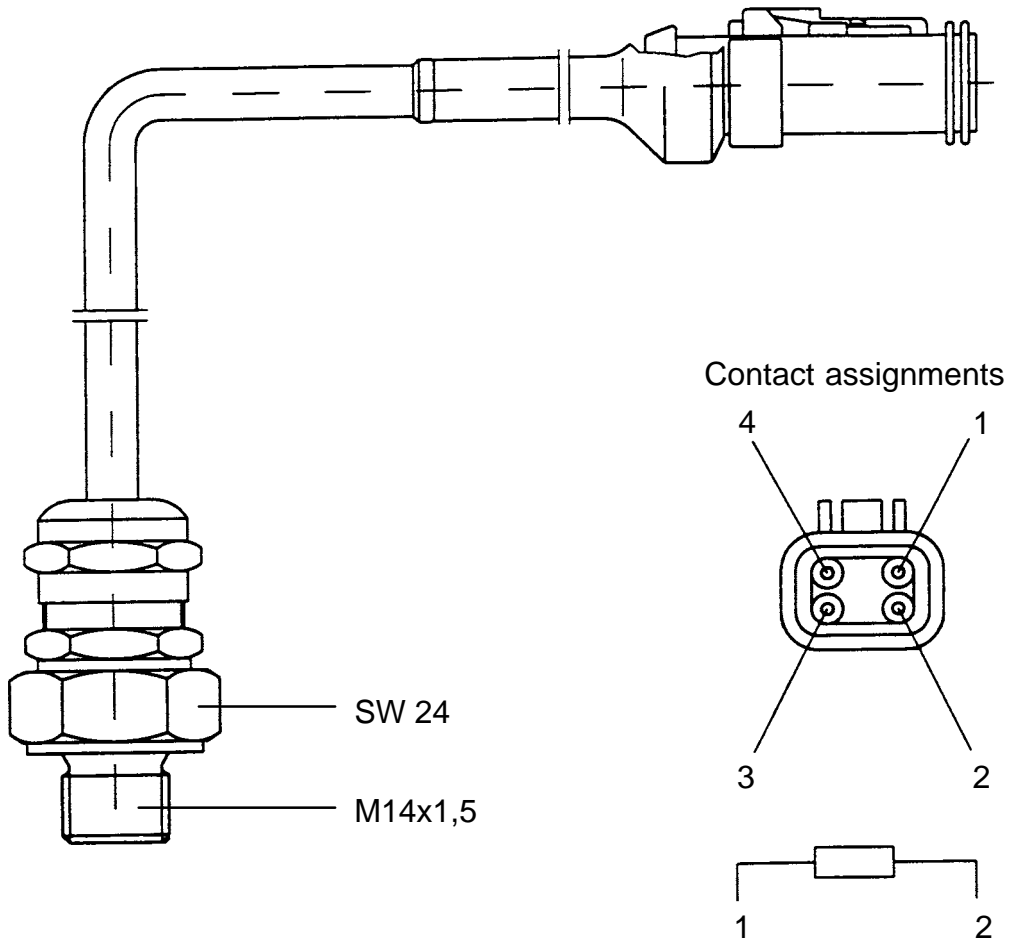


#### Checking of function:

Disconnect plug from oil pressure sensor. The sensor fault message "Oil pressure" must appear on the display unit.

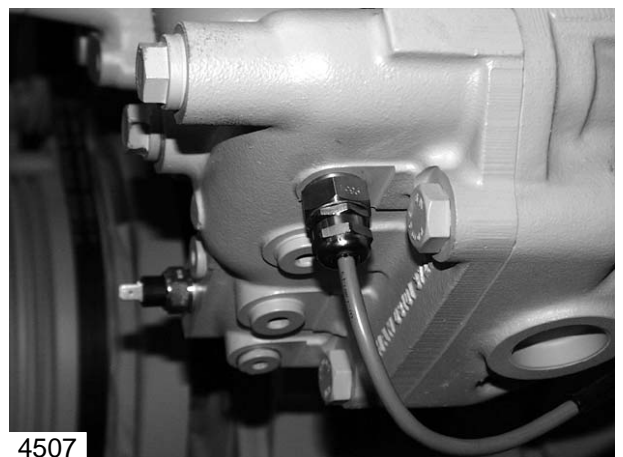
**Coolant temperature sensor 51.27421-0150 (PT 1000)**

The coolant temperature sensor monitors the coolant temperature at the engine outlet.



**Arrangement of the coolant temperature sensor for the alarm system on the engine (new version)**

Left-hand side of engine  
 Front cover of the liquid-cooled exhaust pipe  
 Item no. 50.27421-0150  
 Width across flats: 24 mm



### Checking

Checking of coolant temperature sensor 51.27421-0150

Disconnect wire from terminal 15 of the transfer station and measure the resistance between the disconnected wire and terminal 12 (–) of the transfer station, using an ohm-meter

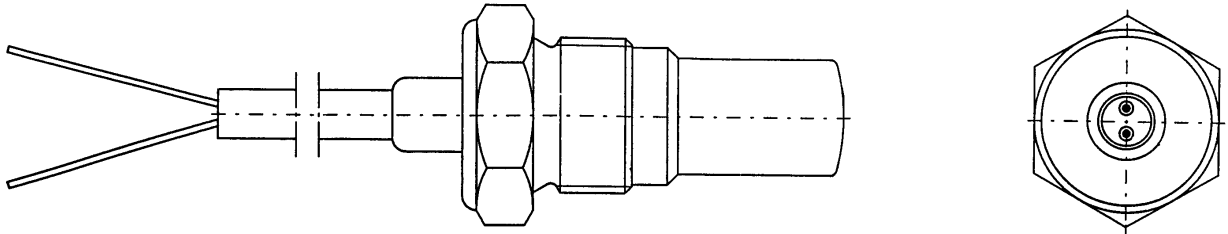
Resistance of the coolant temperature sensor as a function of the temperature (Ω)										
°C	0	1	2	3	4	5	6	7	8	9
0	1000	1003	1007	1012	1016	1019	1023	1027	1031	1035
10	1039	1042	1046	1050	1054	1058	1062	1066	1070	1074
20	1078	1082	1086	1090	1094	1097	1101	1105	1109	1112
30	1117	1121	1125	1128	1132	1136	1139	1144	1148	1151
40	1155	1159	1163	1167	1171	1174	1179	1182	1186	1190
50	1194	1198	1202	1206	1209	1213	1217	1221	1225	1228
60	1232	1236	1240	1244	1247	1252	1255	1259	1263	1266
70	1271	1275	1278	1282	1286	1290	1294	1298	1301	1305
80	1309	1313	1317	1320	1324	1328	1332	1336	1339	1343
90	1347	1351	1355	1358	1362	1366	1370	1373	1377	1381
100	1385	1388	1393	1396	1400	1404	1408	1412	1415	1419
110	1423	1427	1430	1434	1438	1442	1445	1449	1453	1456
120	1461	1454	1463	1472	1476	1479	1483	1487	1490	1494
130	1498	1502	1506	1510	1513	1517	1521	1525	1528	1532
140	1536	1540	1543	1547	1551	1555	1558	1562	1566	1569

Checking of function:

Disconnect plug from coolant temperature sensor. The sensor fault message "Coolant temperature" must appear on the display unit.

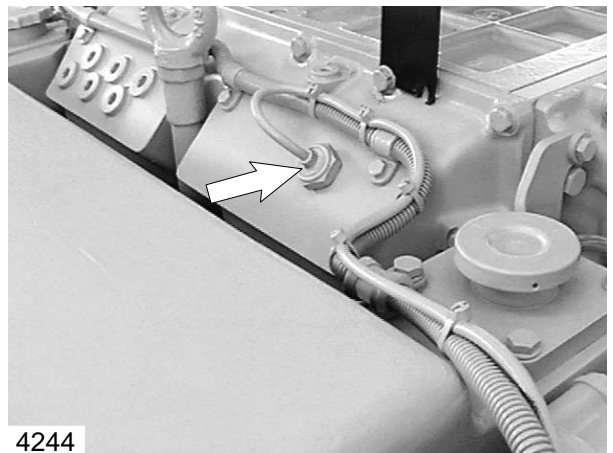
**Charge-air temperature sensor 51.27421-0103 (Ni 1000)**

The charge-air temperature sensor monitors the charge-air temperature when the engine speed exceeds 1,400 rpm.



**Arrangement of the charge-air temperature sensor for the alarm system on the engine**

Charge-air elbow  
(downstream of the intercooler),  
left-hand side of engine



### Checking

Checking of charge-air temperature sensor 51.27421-0103

Disconnect wire from terminal 16 of the transfer station and measure the resistance between the disconnected wire and terminal 12 (–) of the transfer station, using an ohm-meter.

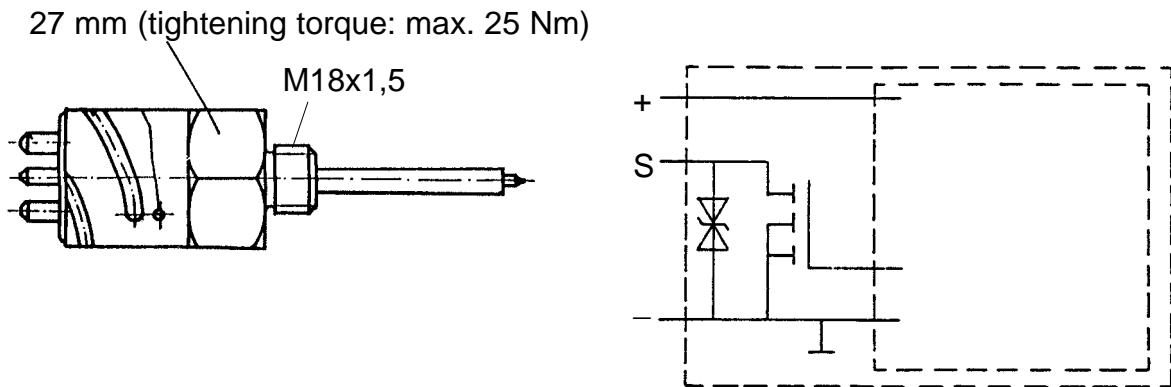
Resistance of the charge-air temperature sensor as a function of the temperature (Ω)										
°C	0	1	2	3	4	5	6	7	8	9
0	1000	1005	1011	1017	1022	1028	1033	1039	1044	1050
10	1056	1061	1067	1072	1078	1084	1089	1095	1101	1107
20	1112	1118	1124	1130	1135	1141	1147	1153	1159	1165
30	1171	1176	1182	1188	1194	1200	1206	1212	1218	1224
40	1230	1236	1242	1248	1254	1260	1267	1273	1279	1285
50	1291	1297	1303	1310	1316	1322	1328	1335	1341	1347
60	1335	1360	1366	1372	1379	1385	1392	1396	1404	1411
70	1417	1424	1430	1437	1443	1450	1456	1463	1469	1476
80	1483	1489	1496	1502	1509	1516	1522	1529	1536	1543
90	1549	1556	1563	1570	1577	1583	1590	1597	1604	1611
100	1618	1625	1632	1639	1646	1653	1660	1667	1674	1681
110	1688	1695	1702	1709	1716	1724	1731	1738	1745	1753
120	1760	1767	1774	1782	1789	1796	1804	1811	1819	1826
130	1833	1841	1848	1856	1863	1871	1879	1886	1894	1901
140	1909	1917	1924	1932	1940	1948	1955	1963	1971	1979
150	1987	1994	2002	2010	2018	2026	2034	2042	2050	2058

Checking of function:

Disconnect plug from charge-air temperature sensor. The sensor fault message "Charge–air temperature" must appear on the display unit.

**Coolant level probe 51.27421-0116**

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



Two probes are fitted to the expansion tank. An alarm is triggered if both probes are out of the fluid for at least 7 seconds.

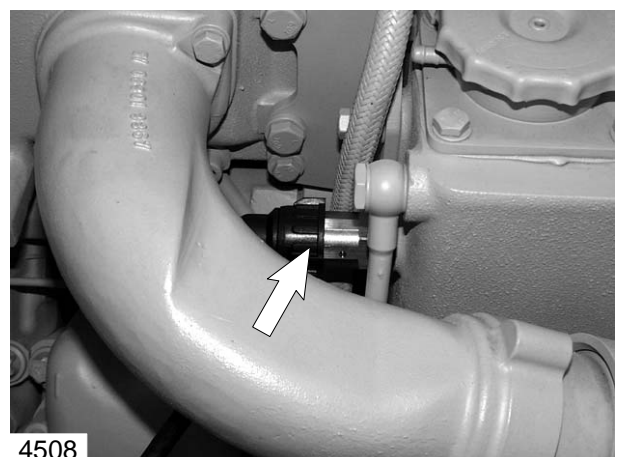
**Operating principle**

The coolant level probe is a capacitive probe. If the coolant level falls below the level to be monitored, a negative potential will be sent to signal output "S".

To detect wire ruptures, a 7.5 V suppresser diode is installed in the probe between "S" and " -".

**Arrangement of the coolant level probe on the engine**

On both sides the of the expansion tank.



### Checking with probe installed:

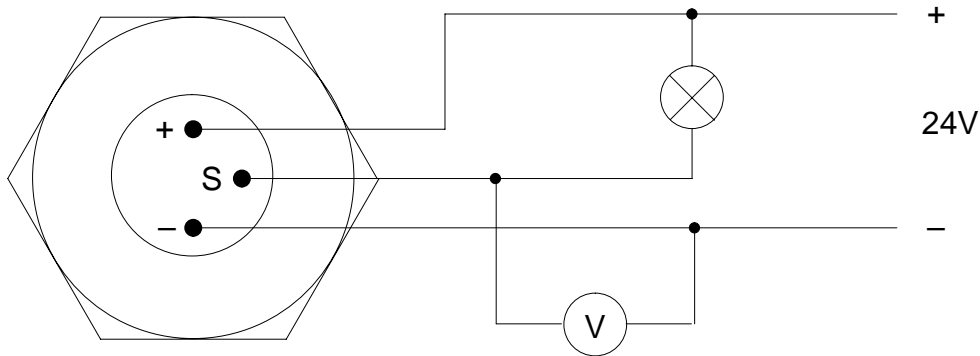
Ignition is switched on, coolant level in expansion tank is adequate

	Probe in order / function in order	Probe defective or cable rupture
Coolant level probe is connected up	No fault message	Alarm "Coolant level" and "Sensor fault" or "Coolant level" only
Disconnect coolant-level-probe plug	Fault message "Coolant level" and "Sensor fault"	
Voltage measurement on operating unit 1 IO (transfer unit) between: Terminal 12 ("–") / terminal 17 probe 1 Terminal 12 ("–") / terminal 18 probe 2	$U < 7V$ every 30 seconds $U = 7,5 - 8V$	$U < 7V$ every 30 seconds: $U > 8V$

### Checking with probe not installed:

Supply probe with 24 V as shown in the picture and connect up voltmeter / test lamp (24 V, max. 3 W).

Important: "S" must not be directly connected to "+".



	Probe in order / Probe dry	Probe in order / Probe wet
Voltage measurement between "S" and "–" on the probe	Take probe out of water, after 7 seconds $U < 7V$	Immerse probe in water, after 2 seconds $U = 7,5V$
Test lamp	Bright light	Dim light



## Charging voltage / speed pickup

### Fault message: failure of "Charging voltage / speed pickup"

If the charging voltage of the alternator or the signal from the speed pickup is defective, the fault message "Charging voltage / speed pickup" will appear on the display unit.

### Possibility of differentiating between a failure of the charging voltage and a failure of the speed pickup

#### a) Failure of charging voltage

After the engine has been started the green check lamp "Engine running" on the display unit comes on, while simultaneously the fault message "Charging voltage / speed pickup" is displayed.

If the engine speed is increased to over 1,800 rpm, the alternator will excite itself and the fault message "Charging voltage / speed pickup" will go out.

#### b) Failure of speed pickup

After the engine has been started the green check lamp "Engine running" on the display unit comes on. After approx. 50 seconds the fault message "Charging voltage / speed pickup" will be displayed.

## Checking

#### a) Checking of charging voltage:

Carry out measurement between terminal 19 (+) and 2 (-) of the transfer station, using a voltmeter.

Set-point values:

- Engine not running, ignition off: 0 V
- Engine not running, ignition on: approx. 2 V
- Engine running, ignition on: up to 28,3 V

#### b) Checking of speed pickup

See page 23

#### c) Functional test:

Charging voltage: disconnect terminal 19 from transfer station and pull off wire. The fault message "Charging voltage / speed pickup" must appear on the display unit.

### Gearbox oil pressure

The sensor (NC = **N**ormally **C**losed) is attached by the gearbox manufacturer and is part and parcel of the extent of delivery of the gearbox.

The quantity monitored is the gearshift oil pressure supplied to the clutch. If an alarm is triggered, the engine speed will not be reduced.

Types of alarm:

- 0 to 1200 1/min: not active
- 1200 to 1400 1/min: active after 30 seconds
- over 1400 1/min: immediately active

Reason: The trolling device reduces the clutch oil pressure (with which the clutch discs are pressed against each other).

Connection is established via the engine-mounted gearbox plug.

### Checking

#### a) Checking of sensor

Disconnect wire from terminal 21 of the transfer station and measure the resistance between wire and terminal 12 using an ohmmeter. The result must be nearly  $\infty$ , since the sensor is closed in normal operating condition (NC = **N**ormally **C**losed, when the gearbox is engaged completely).

#### b) Functional test

Disconnect plug from sensor. The alarm message "Gearbox oil pressure" must appear on the display unit as soon as the engine speed raises above 1400 rpm.

### Gearbox oil temperature

The sensor (NC = **N**ormally **C**losed) is attached by the gearbox manufacturer and is part and parcel of the extent of delivery of the gearbox.

The quantity to be monitored is the gearbox oil temperature. If an alarm is triggered, the engine speed will not be reduced. Connection is established via the engine-mounted gearbox plug.

### Checking

#### a) Checking of sensor

Disconnect wire from terminal 22 of the transfer station and measure the resistance between wire and terminal 12, using an ohmmeter. The result must be nearly 0 ohm, since the sensor is closed in normal operating condition (NC = **N**ormally **C**losed).

#### b) Functional test

Disconnect plug from sensor. The alarm message "Gearbox temperature" must appear on the display unit.

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### **Fault message "Electronics fault"**

This message indicates that an EDC fault has occurred and is not active in mechanically controlled engines.

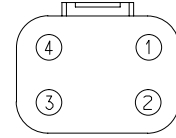
### **Checking**

When the ignition is switched on, the message "Electronics fault" will come on for two seconds.

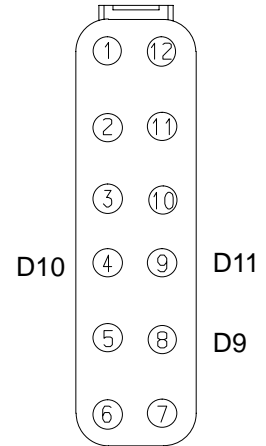
If an EDC fault is being simulated by disconnecting any EDC sensor (except those for the charge-air and fuel temperature), the "Electronics fault" message will come on permanently. This message must also appear on the EDC operating unit in the terminal box (the connection between the EDC operating unit and the EDC control unit is fitted).

Plugs of monitoring unit BE1 for mechanical controlled engines

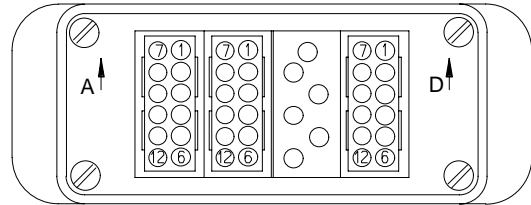
Plug X4, X5  
(front view)



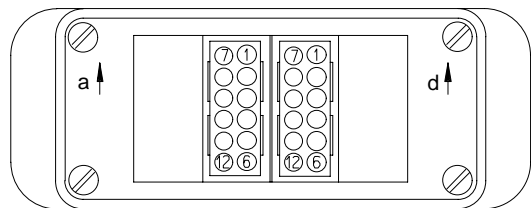
Gearbox plug X3  
(front view)



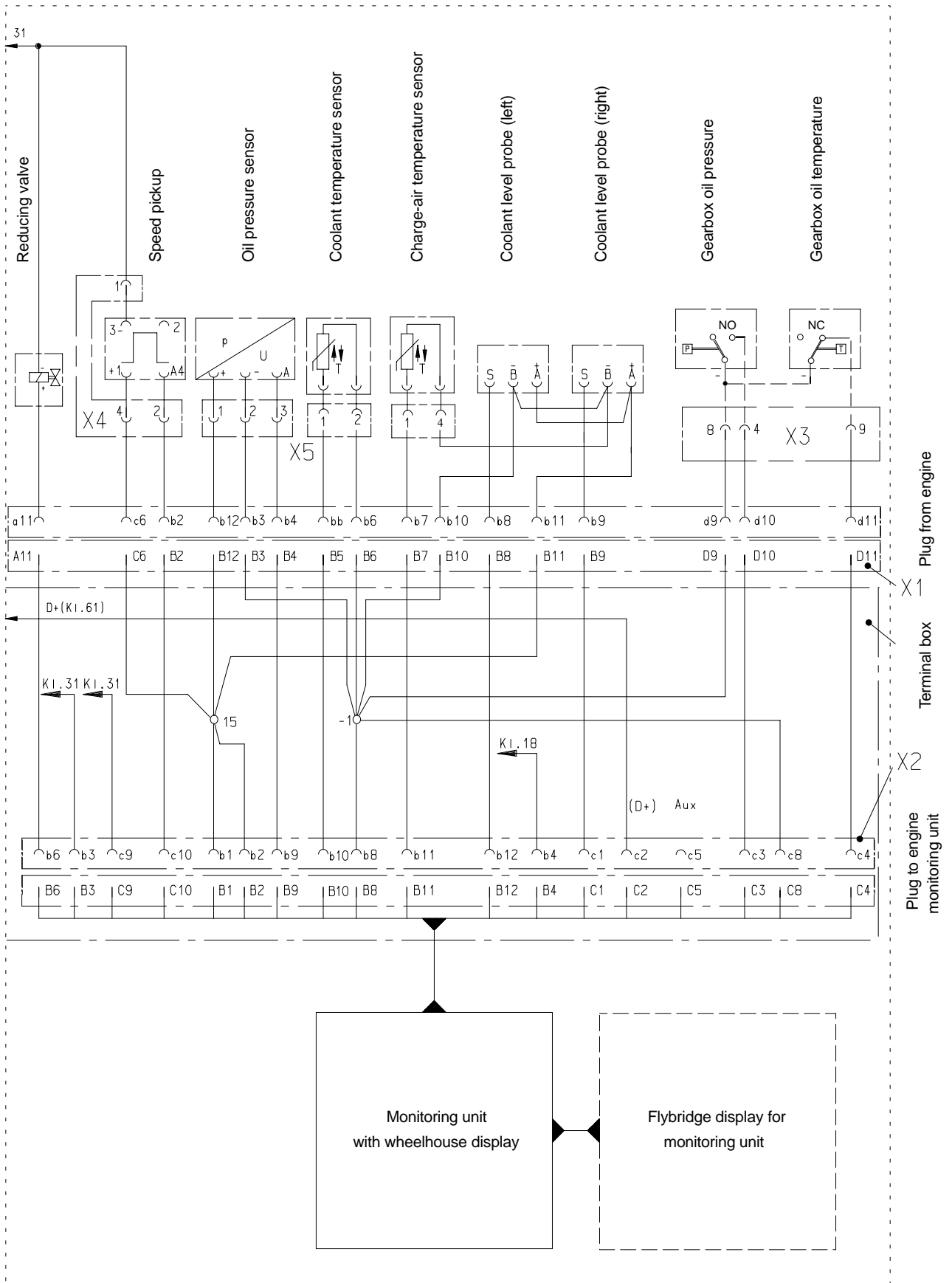
Plug socket X1 at terminal box  
(front view)



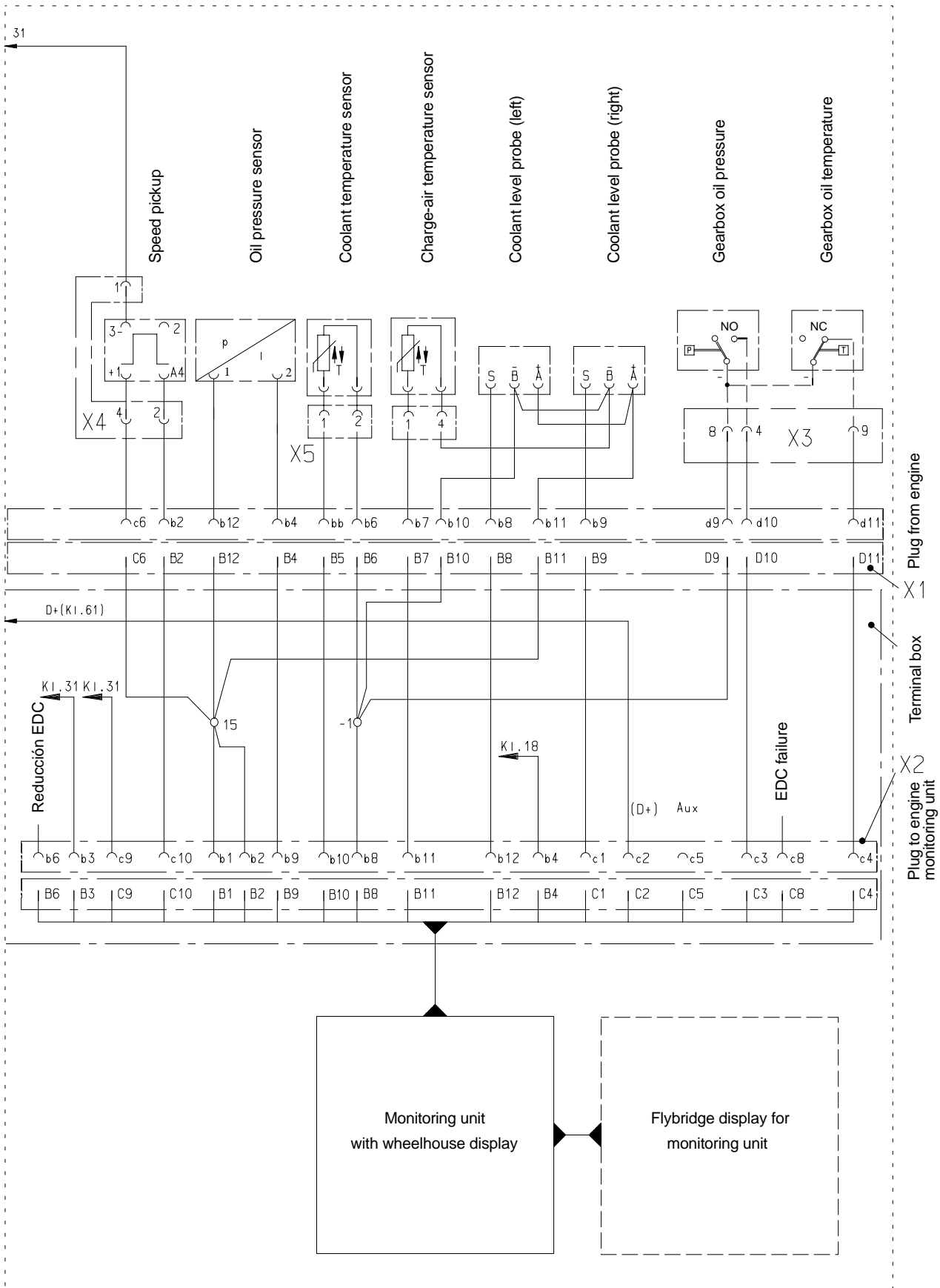
Plug socket X2 at terminal box  
(front view)



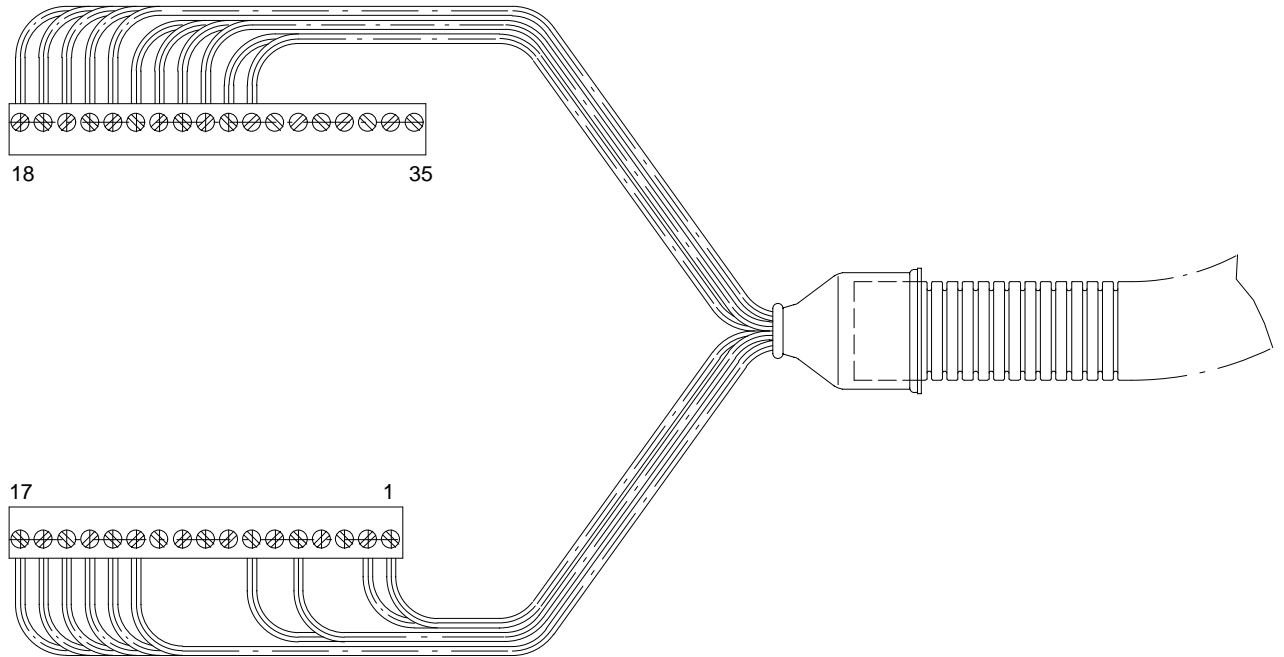
**Plugs of monitoring unit BE1 for mechanical controlled engines with oil pressure sensor 1-5 V**



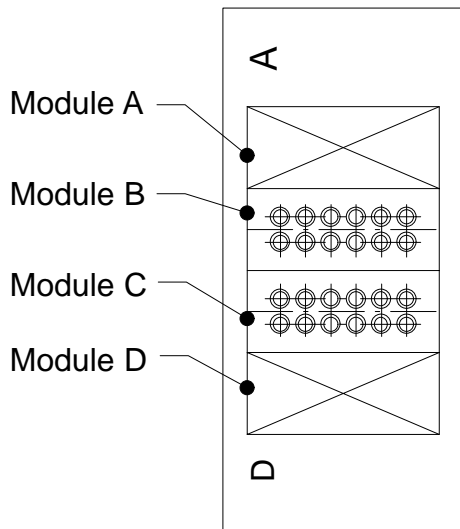
## Plugs of monitoring unit BE1 for EDC engines with oil pressure sensor 4-20 mA



**Connecting cable from terminal box to operating unit BE 1-I0**



**Plug of connecting cable from terminal box to operating unit BE 1-I0**



**Plug assignment on connecting cable from terminal box to operating unit BE 1-10**

Terminal no. on operating unit BE 1	Plug assignment Module				Function, measuring point, sensor
	A	B	C	D	
1		1			Positive (+) voltage
2		3			negative (-) voltage
3					Engine stop
4					
5		6			Reduce engine
6					
7		7			Quick-closing flap
8					
9					Horn
10					
11					Collective alarm
12		8			"Negative"
13					clear
14		9			Engine oil pressure
15		10			Cooling-water temperature
16		11			Charge-air temperature
17		12			Cooling-water level
18			1		Cooling-water level
19			2		Alternator D+
20					clear
21			3		Gearbox oil pressure
22			4		Gearbox oil temperature
23			5		Flow of cooling water
24			6		Fuel pressure
25			7		Leakage injection lines
26			8		EDC control unit
27			9		Speed pickup
28			10		Speed pickup
29					Confirm horn
30					Confirm optical indicator
31					Serial output 2
32					Serial input 2
33					Serial output 1
34					Serial input 1
35					



### Combination of oil pressure sensor, transfer station and display unit

Oil pressure sensor	Transfer station Master	Transfer station Slave	Display station Master	Display station Slave	Eprom Master	Eprom Slave
	51.27720-	51.27720-	51.27720-	51.27720-	51.27720-	51.27720-
1–5 V 0–10 bar	7002	7002 or 7003	6004	6005	0019N	0020
4–20 mA 0–6 bar	7003	7002 or 7003	6023	6020	0033	0024

Terminal strip for connection to transfer station (1 – 17) 51.25430-0006

Terminal strip for connection to transfer station (18 – 35) 51.25430-0005

### Relay functions

Measuring point	Relay	Delay On / Off
Engine running	–	–
Overspeed	K2, K3, K4, K5	0,5s
Engine oil pressure	K2, K4, K5	10s
Engine coolant temperature	K2, K4, K5	10s
Charge-air temperature	K2, K4, K5	3s
Coolant level	K2, K4, K5	10s
Failure of charging voltage	K2, K4, K5	–
Failure of speed pickup	K4, K5	–
Gearbox oil pressure	K4, K5	5s
Gearbox oil temperature	K4, K5	3s
Electronic fault	–	–

Relay	Function	Perm. relay contact load
K1	Stop engine	8A starting current (2s) 4A continuous current
K2	Reduce engine speed	2A / 50V
K3	Quick-closing flap	2A / 50V
K4	Horn	2A / 50V
K5	Collective alarm	2A / 50V

Relay functions

Relay designation	K1	K2	K3	K4	K5
First-up signal	X	X	X		
New-value signal				X	X
Contact normally open	X	X	X	X	
Contact normally closed					X
Wiping contact (5s)			X		
Permanent contact	X	X		X	X
Open-circuit monitoring	X				

**Permanent contact:** Relay switches only after the alarm has been lifted.

**New-value signal:** If an additional alarm is raised the relay will be switched back for approx. 5 secs (K4 will open for 5 secs, K5 will close for 5 secs) and will then return to alarm position (K4 will close, K5 will open).

Reason: Optical and acoustic recognition if another fault occurs (in addition to the one already triggered).





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