Delomatic 4
DM-4 Land/DM-4 Marine



Installation instructions
Part 2, chapter 25

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25. Installation Instructions

The Installation instructions contain general information on how to carry out the installation of the Delomatic 4 system. By observing the advice given in this document, a safe and correct installation of the Delomatic 4 system is ensured.

This document consists of two main parts:

- A **system installation**, which contains general precautions that should be observed during installation
- Information on **how to wire** the individual hardware modules

System installation

The system installation consists of the following five main parts:

- Preinstallation considerations regarding the Delomatic 4 system
- Installation of the RACK in the cabinet
- Installation of the display unit in the cabinet
- Connecting power supply to the RACK and the DU
- Establishing the DM-4 LAN network communication

Before installing the Delomatic 4 system

Before installing the Delomatic 4 system, a number of very important precautions and restrictions must be observed.

Precautions regarding the ambient temperature of the Delomatic 4 system

The ambient temperature (T_{AMB}) has a decisive influence on the min. expected lifetime for the electronic circuits in the RACK and the DU.

AMBIENT TEMPERATURE			MIN. EXPECTED LIFETIME
T_{AMB}	≤	40°C	10 years
T_{AMB}	≤	50°C	5 years
T_{AMB}	≤	60°C	30 months
T_{AMB}	≤	70°C	15 months

It is highly recommended to install the RACK and the DISPLAY UNIT at a cool location in the cabinet in order to achieve the longest lifetime for the Delomatic system.

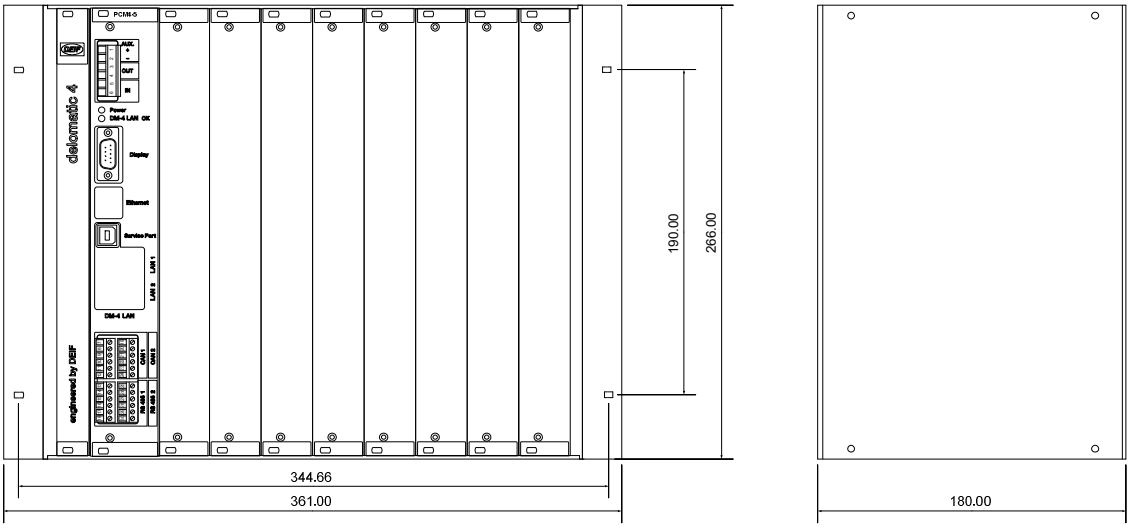
Speed governor interface

For both mechanical and electronic speed governors, it is a demand that the **governor is equipped with a speed droop mode**. The governor must always be in this mode when connected to the Delomatic 4 system set for a droop on 4 %.

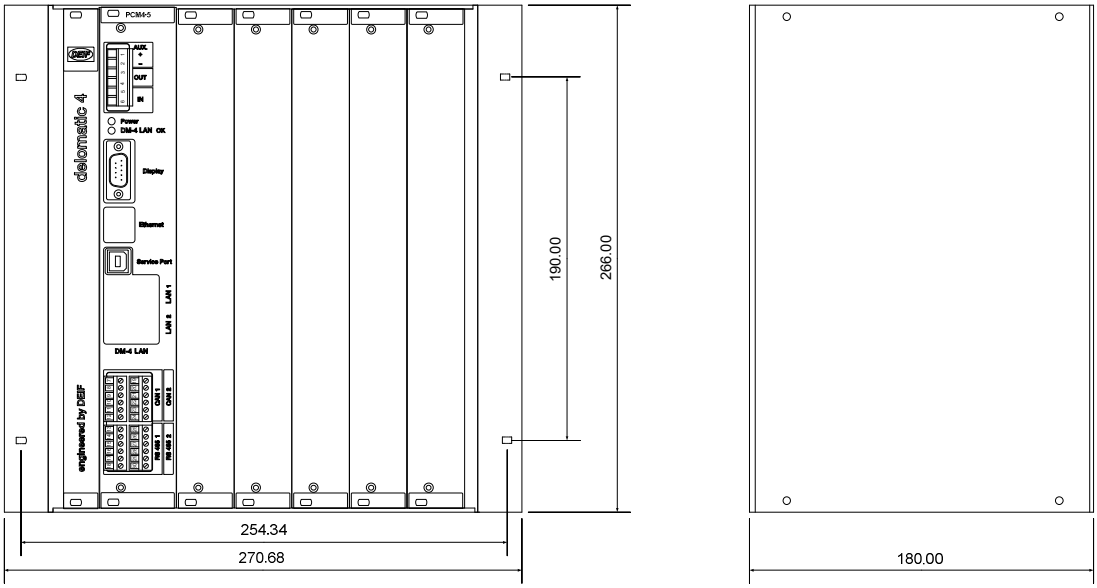
Installing the RACK

The text below contains information necessary in order to carry out the installation of the RACK. The Delomatic 4 rack is available in four different sizes - a TE 24, a TE30, a TE 42 and a TE 60 rack.

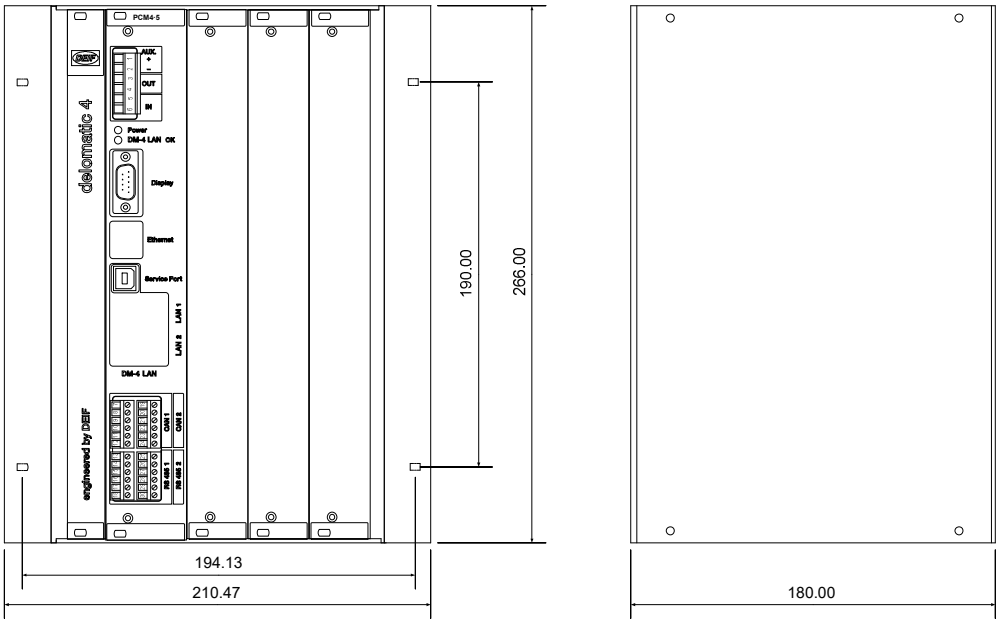
60TE, 8 IO-slots



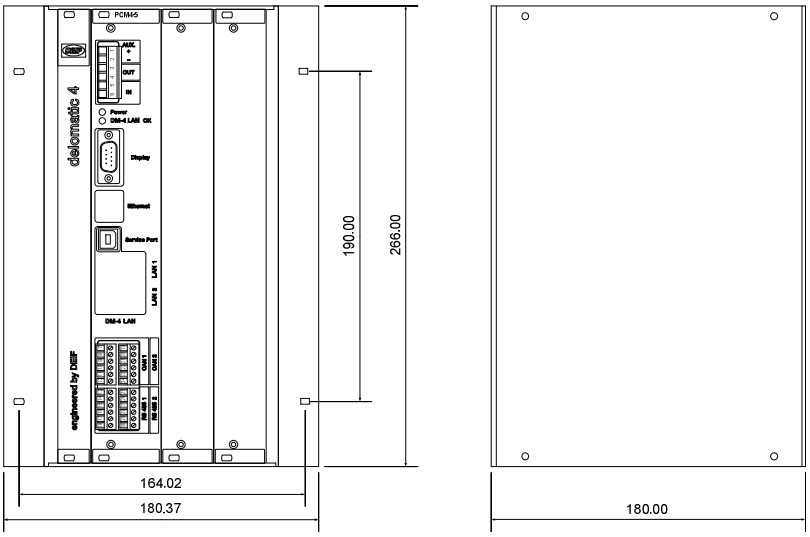
42TE, 5 IO-slots

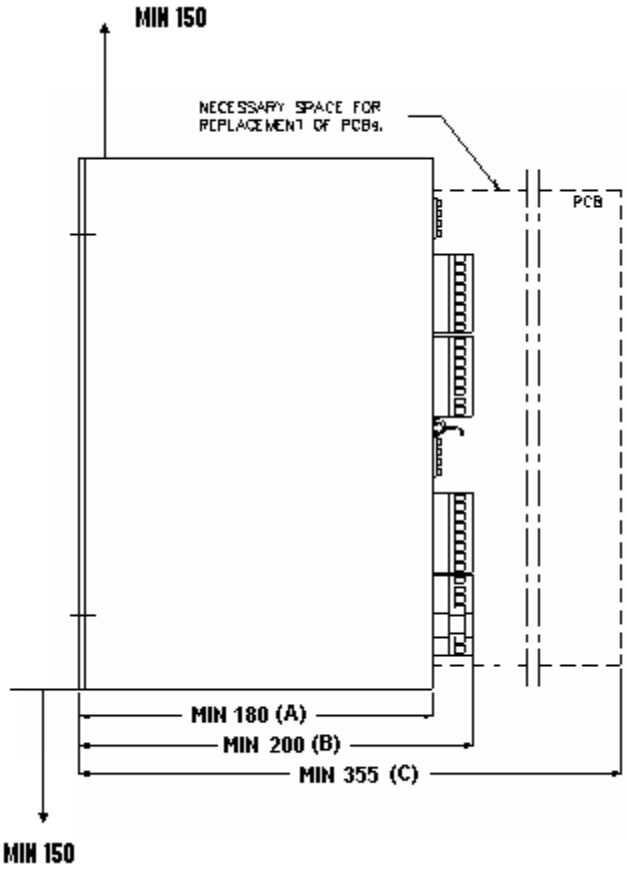


30TE, 3 IO-slots



24TE, 2 IO-slots





Observance of the below-mentioned practical precautions during installation of the rack is necessary in order to avoid problems regarding free space in front of the rack.

During operation, the connectors must be clear of the front door of the cabinet. So the distance from the back of the cabinet to the inside of the closed cabinet door must be larger than the specified "B" measure in the illustration to the left.

Furthermore, the distance from the back of the cabinet to any fixed objects in front of the rack (with an open cabinet door) should as a minimum be the specified "C" measure in the illustration to the left. *This is necessary in order to ensure sufficient working space for replacing and inspection of the* Delomatic 4 *hardware modules.*

Due to air circulation, objects may not be placed within 150 mm from the top and bottom of the RACK.

All measures are shown in mm.

Grounding the RACK

When mounting the RACK, it is very important to make sure that the metal rack frame gets a solid electrical connection with the presumed grounded cabinet. A firmly grounded RACK is important both with a view to operator safety precautions, and also in order to form a complete grounded metal cage, which is part of the approved EMC.

Ensuring the Delomatic 4 system's electromagnetic compatibility (EMC)

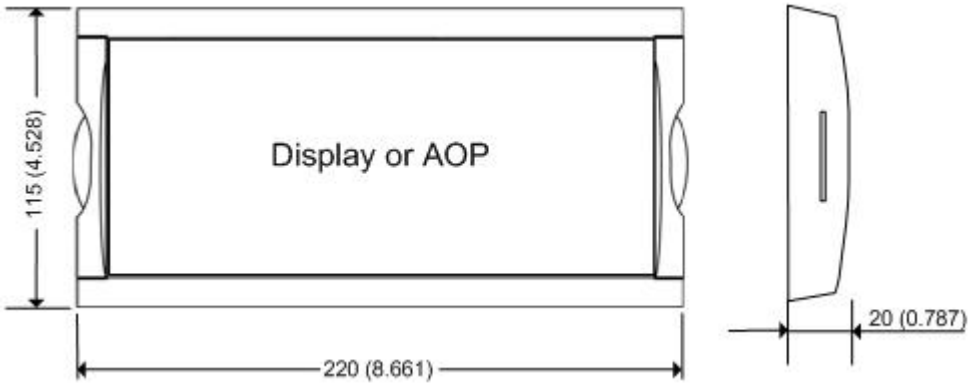
The Delomatic 4 system is CE-marked. In short, this means that the Delomatic 4 system's electrical noise immission and emission have been examined and found to comply with the EN for electromagnetic compatibility (EMC).

A RACK correctly configured with hardware modules and cover plates, thus forming a complete grounded metal cage, is an important part of the approved EMC. In order to ensure an intact EMC, the rack frame and the metal front covers must be in a solid electrical connection.

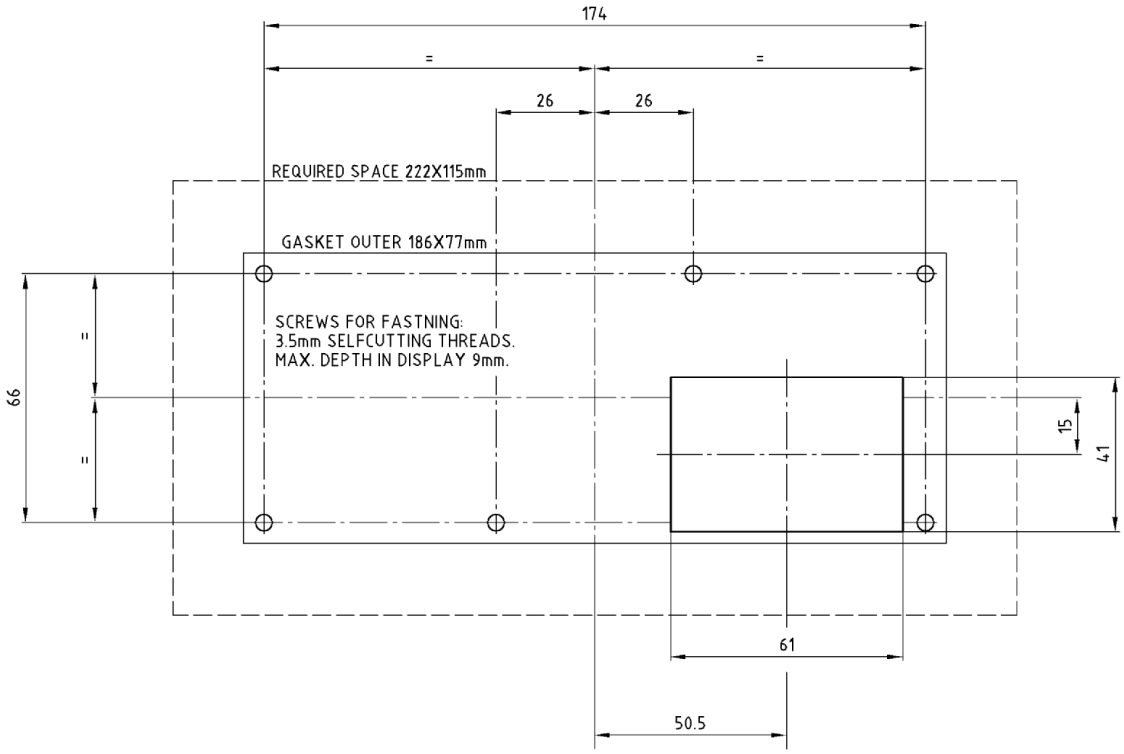
It is thus highly recommended to make sure that all hardware modules are firmly mounted in the rack frame after completing the installation of the RACK. This is done simply by tightening all the screws in the front covers.

Measurements for the display unit and the AOP

The illustrations below indicate the necessary measures in order to carry out a correct installation of the display unit/AOP in the cabinet.



Display size:
H x W x D = 115 (4.528”) x 220 (8.661”) x 20 (0.787’’)



Please note that the drawing shows the cutout seen from the front of the switchboard.

Panel cutout:
H x W = 41 x 61

Display size:
H x W = 115 x 220

Connecting the power supply

The Delomatic 4 system requires 24V DC (-25%/+30% incl. ripple voltage) at all supply terminals.

Please refer to the Delomatic 4 technical specifications, where the power consumption of each Delomatic 4 module is indicated. Based on this information, it is possible to calculate the total power consumption of each RACK.

Each RACK has two different power supply terminals:

- The power supply terminals at the PCM module (switch mode power control module)

and

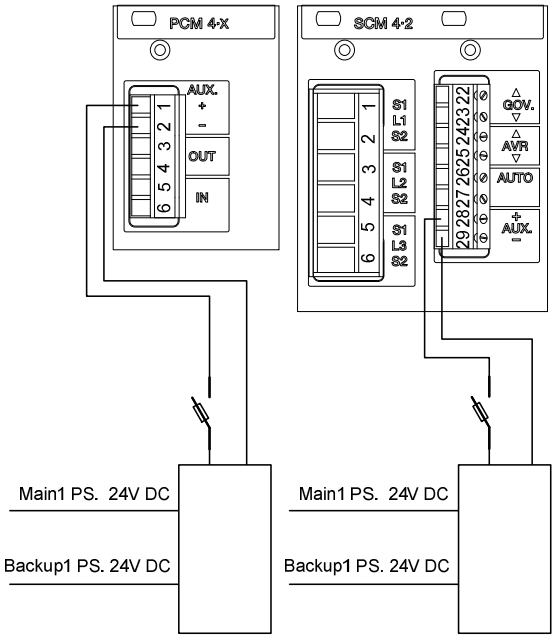
- Power supply terminals at the SCM 4-2 module, terminals no. 28-29 (for speed governor control in SWBD control)

All of the above-mentioned power supply terminals must be connected to the supply voltage in order for the RACK to be able to carry out automatic operation.

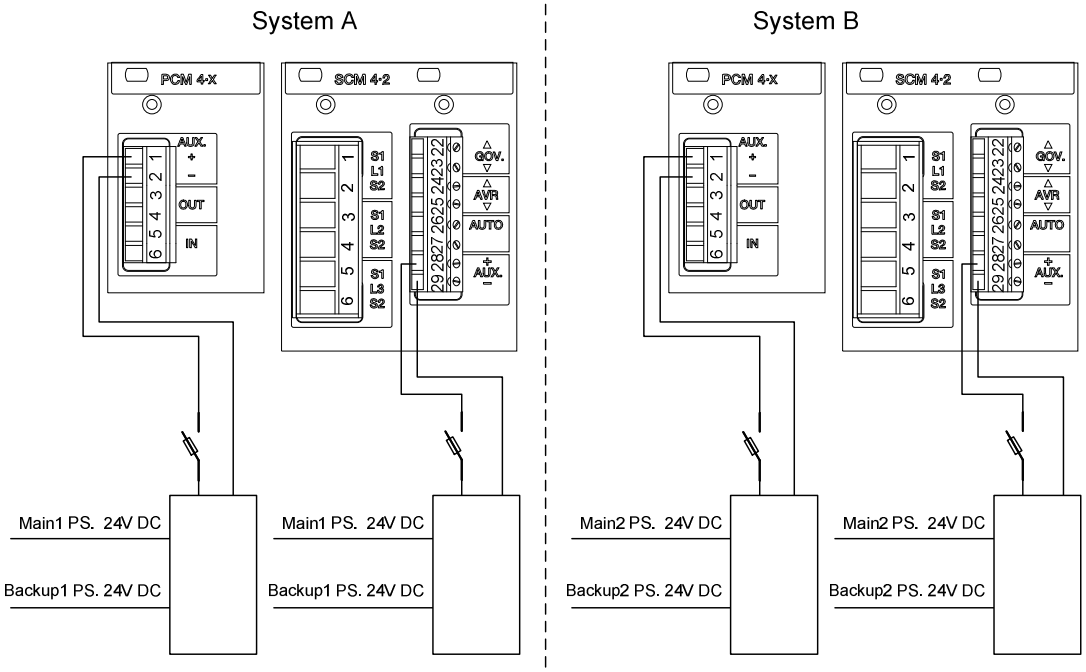
Even though all power supply terminals **must** always be supplied with a suitable power supply to be able to carry out automatic operation, the speed governor control in SWBD control via the SCM 4-2 module only requires supply to the SCM 4-2 module to operate (so that no automatic functions are available).

Suitable power supply is indicated on the drawings below

Standard PMS system



DP PMS system



It is important to have two separate power supplies to Delomatic 4 (a main power supply and a backup power supply). To maintain protection on the generators, it must be secured to have power supply although the main power supply is faulty.

This safe power supply must be split into two fuses, one to supply the PCM and one to supply the SCM 4-2. This is to ensure safe operation of the genset in spite of a broken fuse.

How to wire

This paragraph contains text and illustrations, which provide information on **how to wire** the Delomatic 4 modules, meaning which type of signals are expected etc.

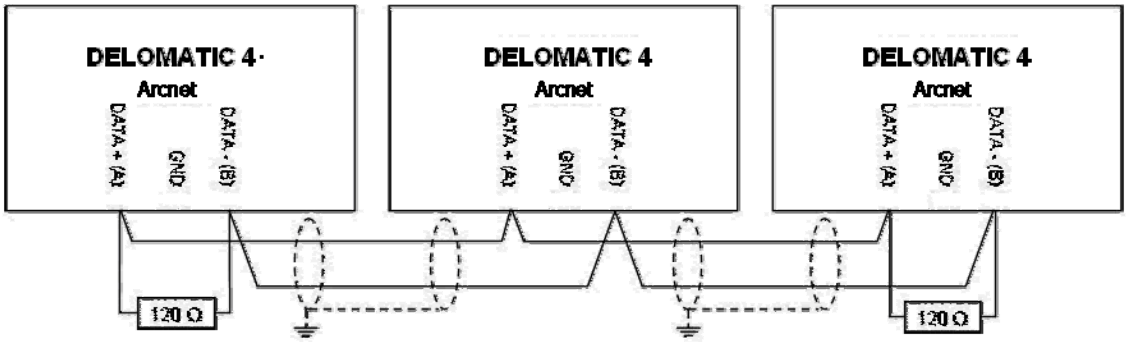
Installing the ARC network on PCM 4.1 cards system

The PCM carries out communication via the LAN (ARC net) to other racks. Maximum Baud rate at the ARC net is 2.5M bit/sec.

The ARC network is a Local Area Network (LAN), which communicates via an RS485 2-wire system.

The optimal installation of the ARC network cables is to locate the communication line separated from other wires. If this is not possible, then install the ARC network as far away from any power or high voltage wires as possible.

It is highly recommended to install the ARC network cables away from high voltage wires, e.g. the busbar cables.



In case of communication problems, the GND terminals on units can be linked together using a third wire.
In case of communication problems, connect the cable shield to earth (only to earth and NOT to ARC net GND).

Please observe! The more units/nodes on the ARC net, the smaller length of the cable can be guaranteed.

Cable length (total):

No. of nodes	Max. cable length
4	243 m
8	213 m
16	152 m

LED: The green LED (LAN OK) is turned on, when there is communication on the ARC net.

Term.	Function	Description
7	DATA + (A)	Data communication between the RACKs
8	GND	
9	DATA - (B)	

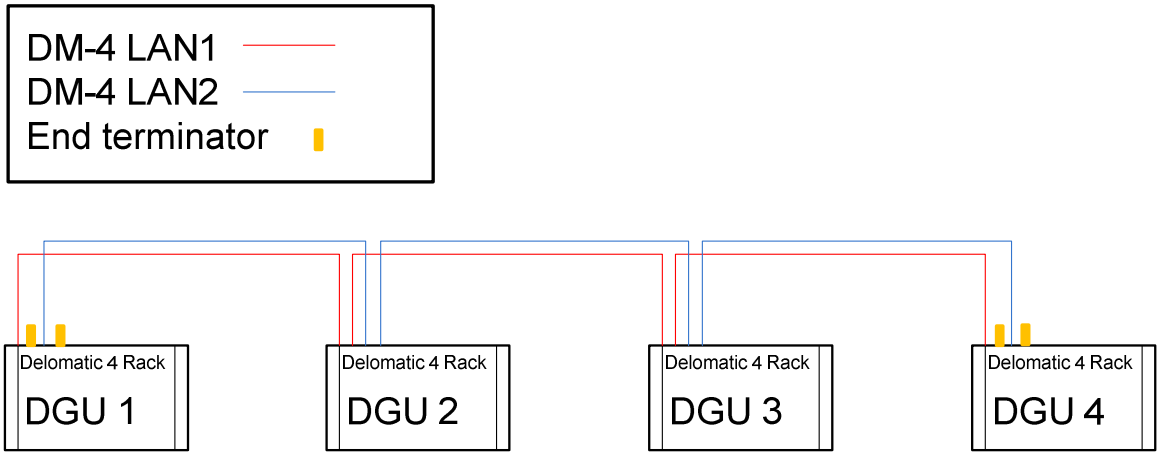
Installing the DM-4 LAN network on PCM 4-5 cards system

The PCM carries out communication via the DM-4 LAN (ARC net) to other racks. The communication line is a high speed network and demands high quality of cables and connections.

The DM-4 LAN is a Local Area Network (LAN), which communicates via an RS485 2-wire system.

The optimal installation of the DM-4 LAN network cables is to locate the communication line separated from other wires. If this is not possible, then install the DM-4 LAN network as far away from any power or high voltage wires as possible.

It is highly recommended to install the DM-4 LAN network cables away from high voltage wires, e.g. the busbar cables.



The PCM 4-5 has the possibility to use two individual DM-4 LAN networks for redundancy. Each network must be terminated at each end by use of an end termination plug as illustrated above.

The DM-4 LAN network cables should be mounted in RJ 45 8P8C modular plug with shield and terminated as a standard straight through Ethernet patch cable.

Please observe! The more units/nodes on the DM-4 LAN, the shorter cable length can be used.

Cable length (total):

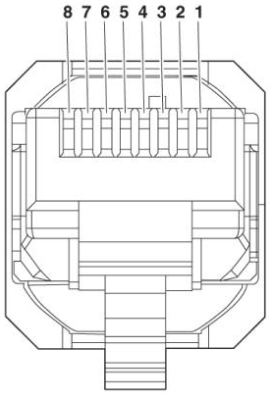
No. of nodes	Max. cable length
4	243 m
8	213 m
16	152 m

This DM-4 LAN cabling is only an example. For the actual one, please refer to the paragraph INTRODUCTION TO THE PRESENT SYSTEM.

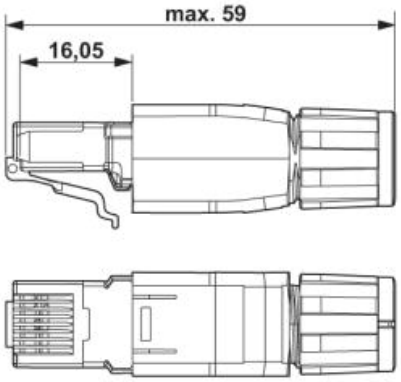
If the redundant network option is implemented, all four plugs on the DM-4 LAN RJ45 connection blocks are to be used.

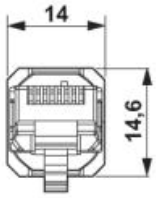
Recommended hardware:

- Plug: RJ 45 8P8C modular plug with shield, gold-plated
- Cable: CAT5e STP Ethernet cable with a characteristic impedance of 100 Ω.



Colour standard T568B	
Pin	**Wire colour**
1	**White/orange**
2	**Orange**
3	**White/green**
4	**Blue**
5	**White/blue**
6	**Green**
7	**White/brown**
8	**Brown**



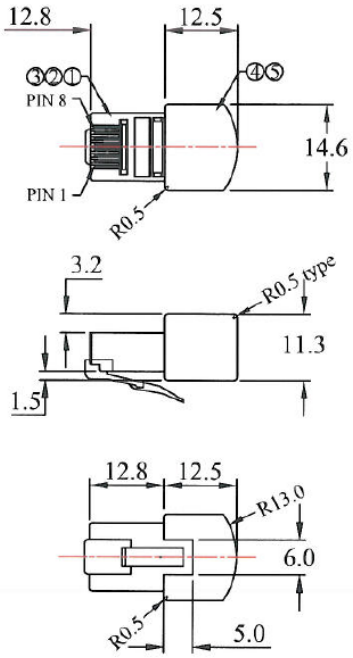


Phoenix contact VS-08-RJ45-5Q/IP20-EC

Remember to connect the shield in both ends.

End terminations plug:

- DEIF part no. 1022000084



WIRE LIST

PIN 7 — PIN 4

PIN 8 — PIN 5

The PCM 4-5 DM-4 LAN internal communication requires special end termination plugs to avoid open lines.

LED: The green LED (LAN OK) is turned on, when there is communication on the ARC net.

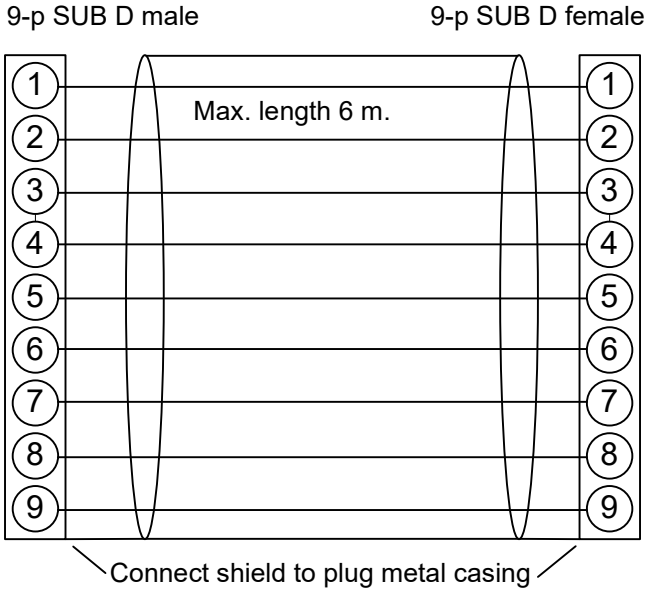
At the DM-4 LAN RJ45 connection blocks there are two LEDs for each plug.

- DM-4 LAN1 green, sending data.
- DM-4 LAN1 orange, receiving data.
- DM-4 LAN2 green, sending data.
- DM-4 LAN2 orange, receiving data.

Installing the display unit

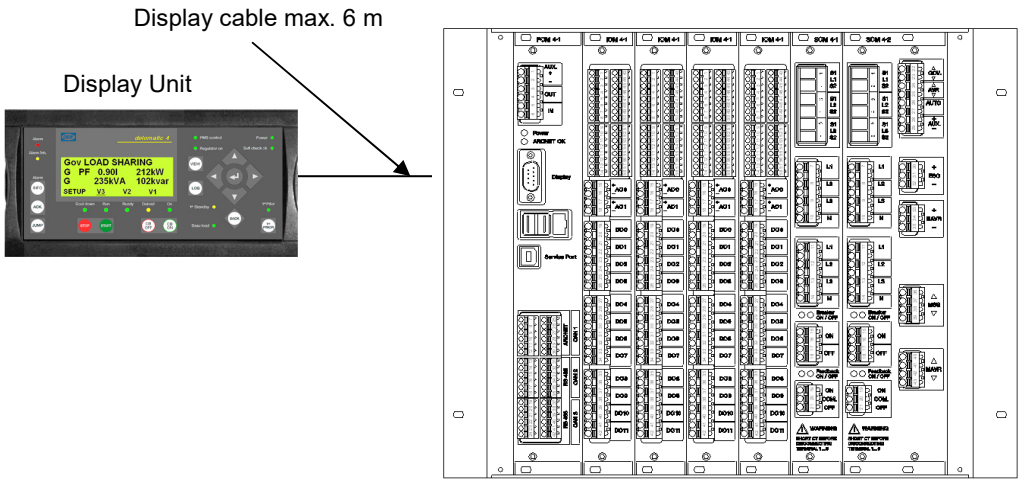
The display unit must be connected to the RACK through a 9 pin male/female display cable. The connection plugs for the display cable are located on the front of the rack's PCM module and the back of the DU.

DEIF monitor cord (cable order no. 3 m - 1022040042, cable order no. 6 m - 1022040043).



Wires min. 0.22 m^2, max. cable length 6 m.
Cable types: Belden 9540, BICC H8146, Brand Rex BE57540 or equivalent.

The maximum length of the display cable between the RACK and the display unit is 6 meters.



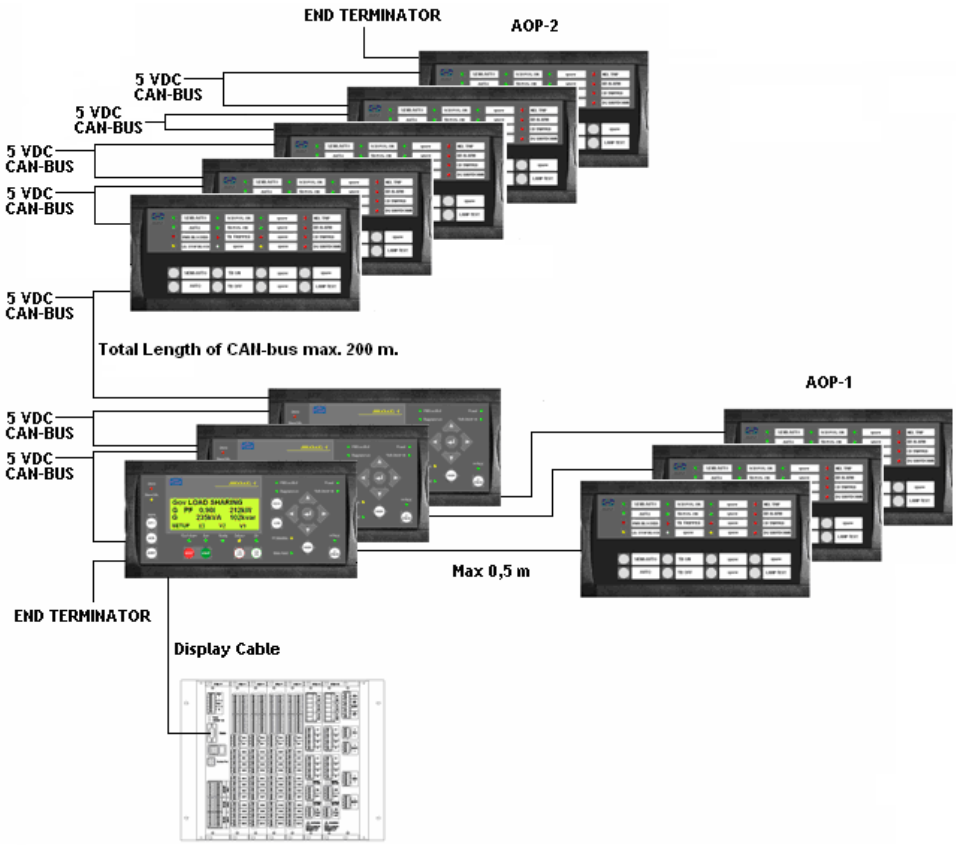
Delomatic 4 rack

A standard computer extension cable can be used (9-pole SUB-D male/female plugs), or a cable can be tailored.

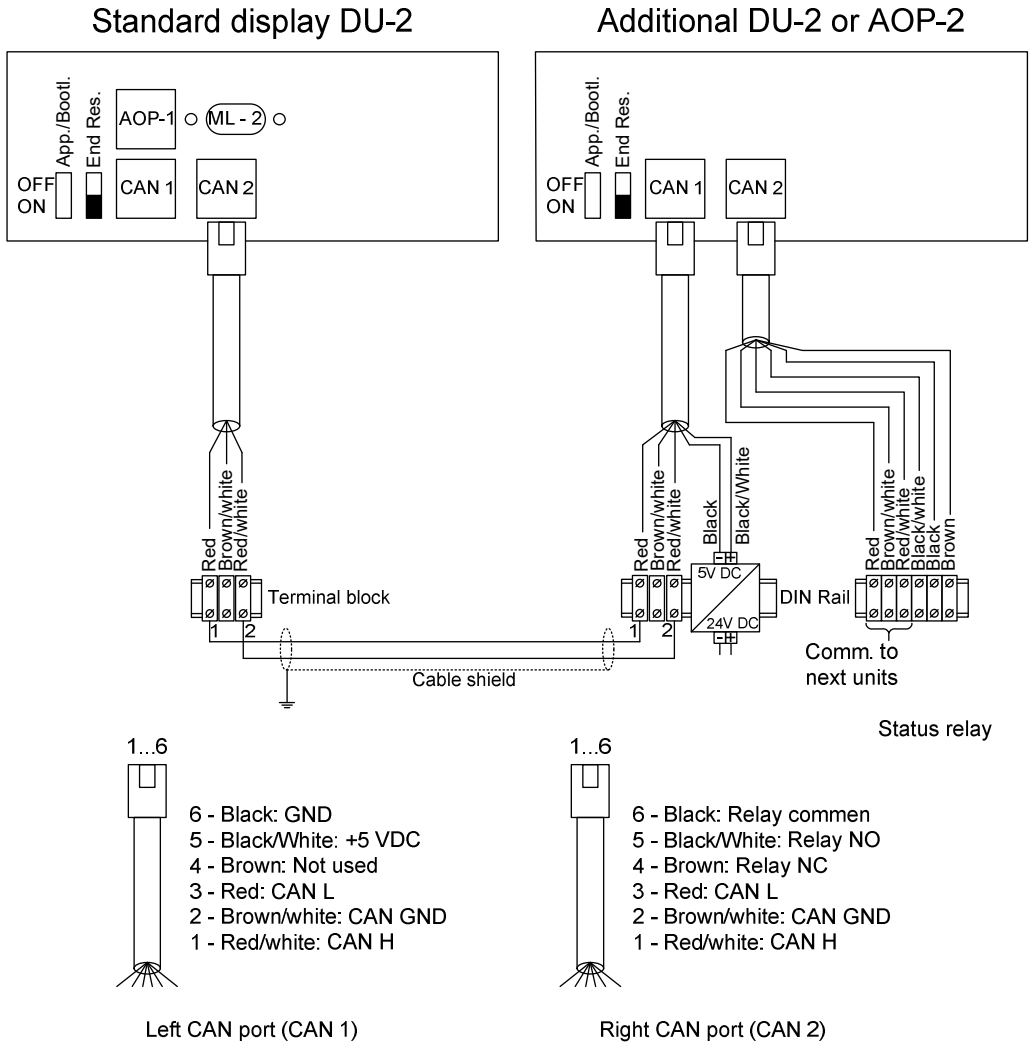
Installing the AOP

AOP-1:
The AOP-1 is connected to the display unit with a display cable. The AOP-1 can be placed anywhere in up to 0.5 m distance from a display unit.

AOP-2:
The AOP-2 is connected to the display unit with a CANbus interface connection. The CANbus connection from the AOP-2 to the main display unit can be placed anywhere in up to 200 m distance from the main display unit. The AOP-2 unit is connected internally via the CANbus.



CANbus cabling (between displays)



Cable order no: 1022040060

Two different types of colour coding have been used on the cable for the AOP-2

6	5	4	3	2	1	Pin no./ cable type
White	Black	Red	Green	Yellow	Blue	Old colour
Black	Black/white	Brown	Red	Brown/white	Red/white	New colour

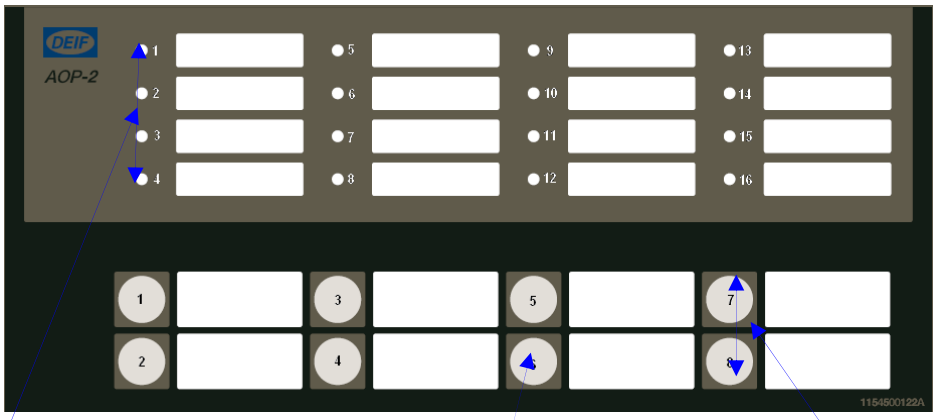
A DC/DC converter for the DC supply voltage and 2x1 m cable with an RJ12 plug in one end and stripped wires in the other end is included in the AOP-2 delivery.

The cable between the terminal blocks should be shielded twisted pair, with reference to CAN L and CAN H. Do NOT connect CAN GND.

Setup of AOP-2 CAN no.

The AOP-2 needs a CAN no. to tell the system which AOP-2 it is on the bus. If there is only one AOP-2, the no. is set to 1. If there are more than 1, they are no. 1, 2, 3…

To setup the CAN no., first press the two buttons to the right for 5 sec. The no. is indicated with a red light in the first left column of LEDs. If LED no.1 is on, it has no. 1, if LED no. 2 is on, it has no. 2 and so on. To scroll up and down, use the two buttons to the right. To choose the selected no., press the enter button; this button is also used to exit the setup. See illustration below to find the different buttons and LEDs.



LED 1-4 indication of CAN No. Enter/exit push-button Push-buttons to enter setup, and change no. of CAN.

Please note:
If two displays have the same ID, LED 1-4 will flash quickly.
Button 6 – Jump into “ID change menu”.

Setup of CAN Master/slave on display unit

The display unit has three ports on the back, one for the monitor cable and two for CANbus. The monitor port is used for connecting the first display unit to the RACK/Delomatic 4 PCM. The two CANbus ports are used for an AOP-2 or a second display unit.

To enter the setup of the three ports, press arrow left, right and up at the same time and enter a screen for CAN ID Change. The setting can be:

0: Only use monitor port
1: Use monitor port and CANbus ports (used with AOP-2s)
2: Only use CANbus ports (Used for second display unit on CANbus)
3: Only use CANbus ports (Used for third display unit on CANbus)
Pres enter to save and exit the setup. See illustration below to find the different buttons.

Arrow left, up and right

The PCM module

The Power supply and Control Module (PCM) supplies the other Delomatic 4 modules with power. The PCM provides a galvanic insulation between the power source and the Delomatic 4 system.

The PCM is equipped with a switch mode power supply, which generates supply voltage for the control part of the PCM and for supply voltages to the other modules.

The total power consumption of the PCM depends on the configuration in the rack, as the modules have different power consumption.

Supply voltage: Start: Min. 15 V.
The power is not turned off at an exact external voltage. It varies with the load.

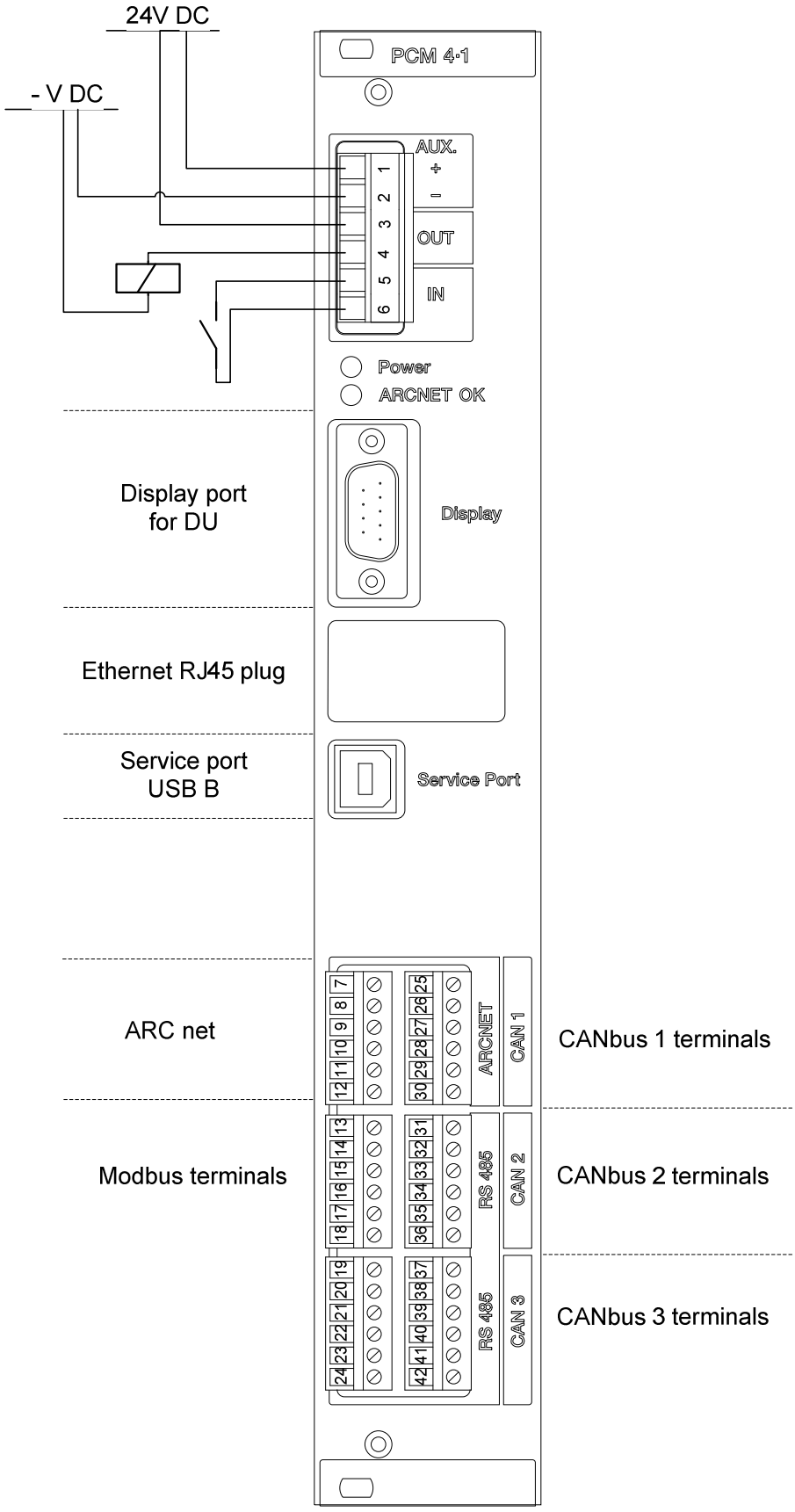
An external fast blowing fuse of 10A is recommended.

Terminals: Plug-able screw connection.

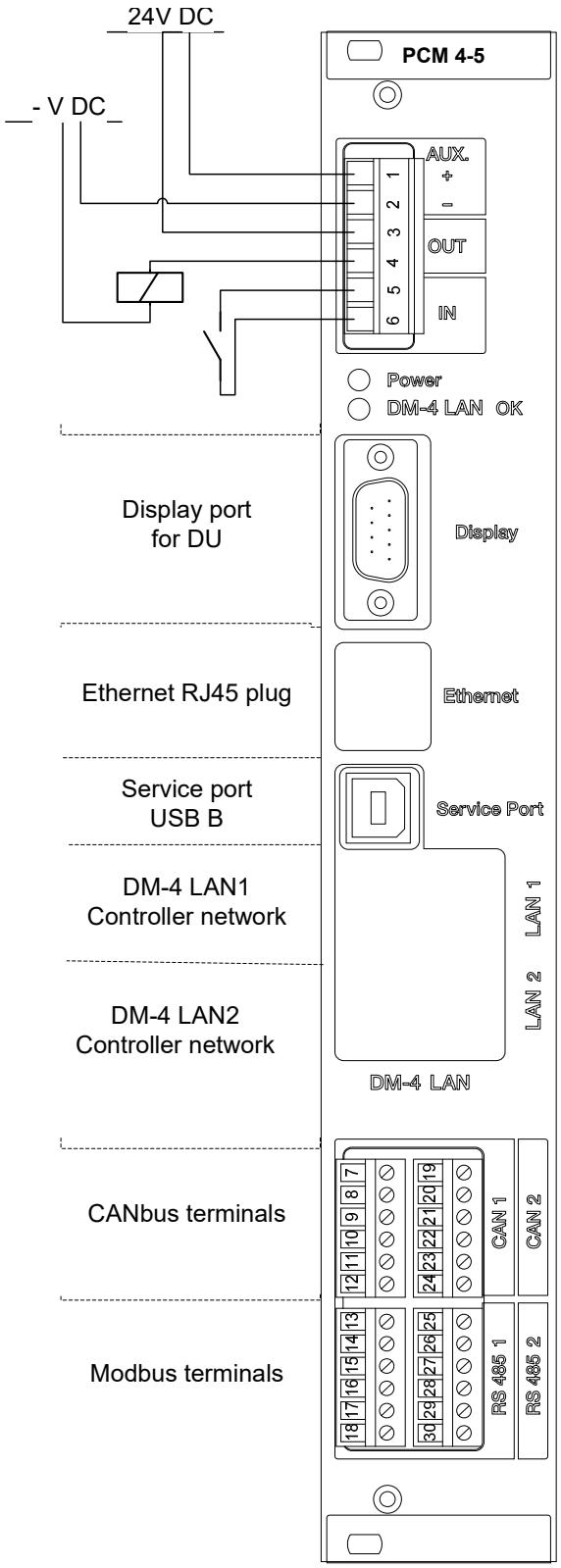
Cabling: 0.2-2.5 mm^2 single/multi-stranded wire.

The PCM has different communication possibilities, which can be used for e.g. engine control and Modbus communication to external systems. An example of the communication configuration is described in the following.

Front view PCM 4-1



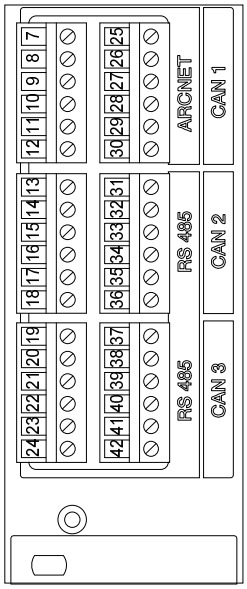
Front view PCM 4-5



Modbus RS485 on PCM 4-1

PCM has RS485 2- or 4-wire, which can be selected with a jumper (see the Service Guide). RS485 is a Modbus RTU port, from which an external system like an HMI panel, PC or alarm system can poll data from Delomatic 4 and write commands to Delomatic 4.

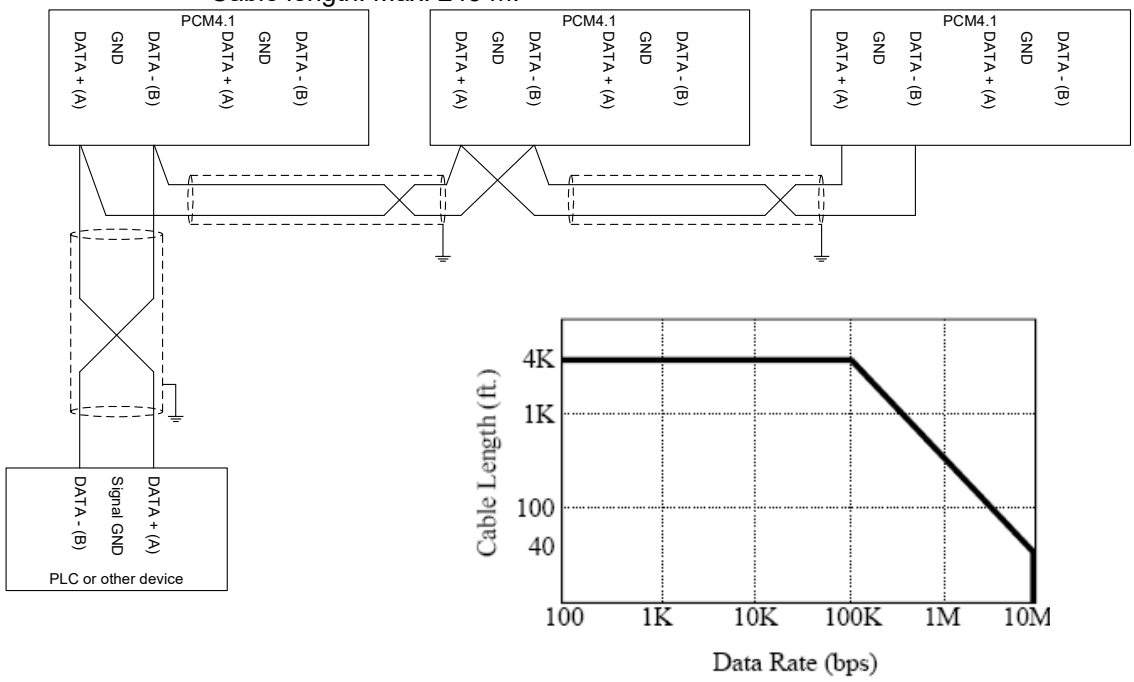
Terminals: plug-able screw connection.



terminal 13 RxA-A (DATA + (A))
terminal 14 signal GND
terminal 15 RxB-B (DATA - (B))
terminal 16 TxA
terminal 17 signal GND
terminal 18 TxB
terminal 19 RxA-A (DATA + (A))
terminal 20 signal GND
terminal 21 RxB-B (DATA - (B))
terminal 22 TxA
terminal 23 signal GND
terminal 24 Tx

Cabling: 2- or 4-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable is used as ground. End terminations of 120 Ω should be used.

Cable length: Max. 243 m.

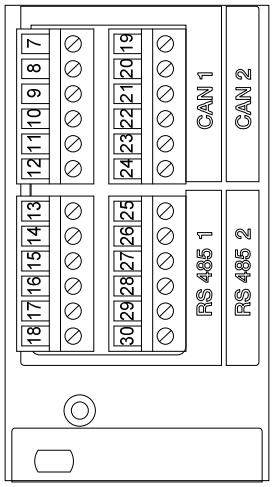


Please notice that GND is not to be connected to ground.

Modbus RS485 on PCM 4-5

PCM 4-5 has two RS485 2-wire ports. RS485 is a Modbus RTU port, from which an external system like an HMI panel, PC or alarm system can poll data from Delomatic 4 and write commands to Delomatic 4.

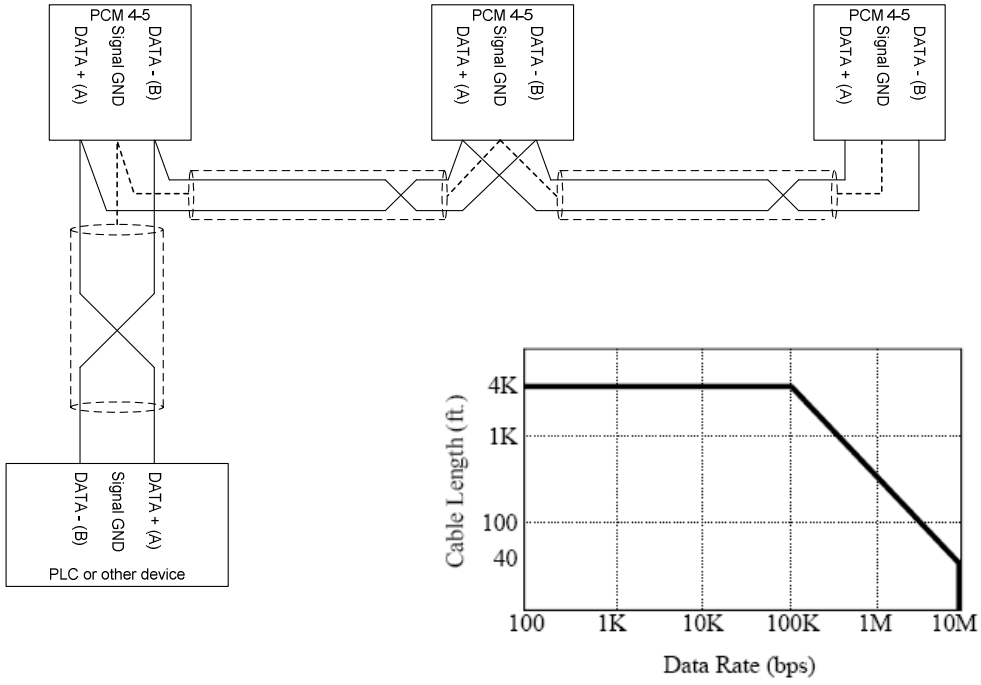
Terminals: plug-able screw connection.



Modbus port 1	Modbus port 2
Port 1 terminal 13 DATA + (A)	Port 2 terminal 25 DATA + (A)
Port 1 terminal 14 Signal GND	Port 2 terminal 26 Signal GND
Port 1 terminal 15 DATA - (B)	Port 2 terminal 27 DATA - (B)

Cabling: 2-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable is used as signal-ground. End terminations of 120 Ω should be used.

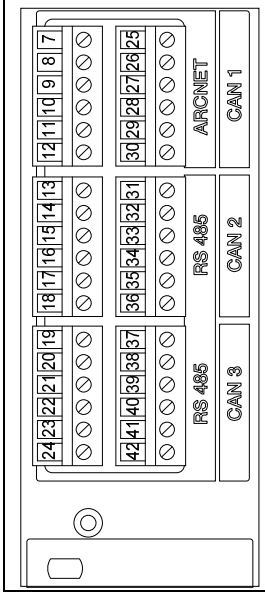
Cable length: max. 243 m.



Please notice that signal GND is not ground, and is not to be connected to ground.

CANbus on PCM 4-1

Terminals: plug-able screw connection



Can 1

Terminal 25: CAN High
Terminal 26: I GND
Terminal 27: CAN Low
Terminal 28: CAN High
Terminal 29: GND
Terminal 30: CAN Low

Can 3

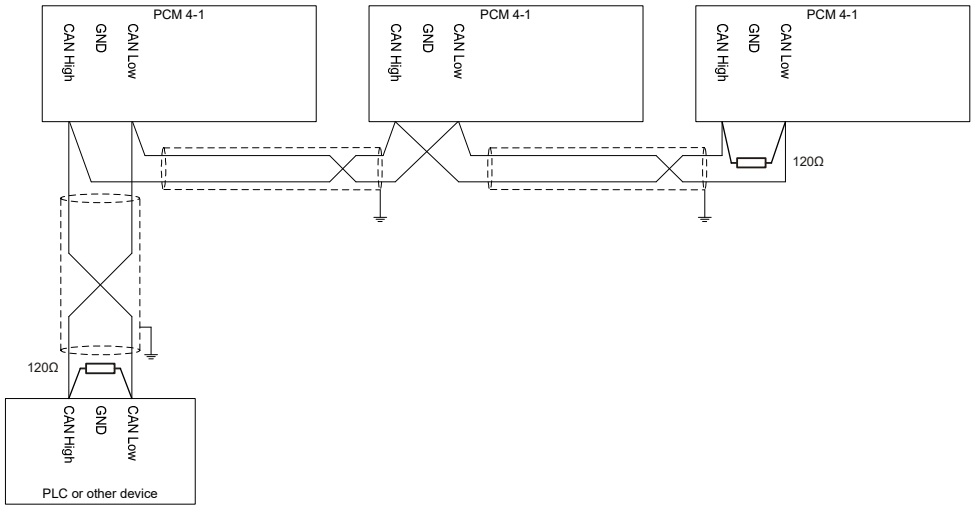
Terminal 37: CAN High
Terminal 38: GND
Terminal 39: CAN Low
Terminal 40: CAN High
Terminal 41: GND
Terminal 42: CAN Low

Can 2

Terminal 31: CAN High
Terminal 32: GND
Terminal 33: CAN Low
Terminal 34: CAN High
Terminal 35: GND
Terminal 36: CAN Low

Cabling:

2-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable is used as ground. End terminations of 120 Ω should be used.

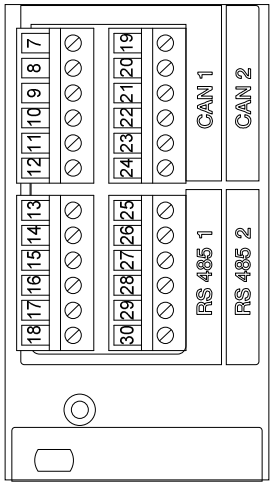


The CAN communication can be connected as shown in the example.

The maximum guaranteed length of the CANbus line is 200 m at 125 Kbit/sec.

Please check what PCM card you have, as there are different installation instructions.

CANbus on PCM 4-5

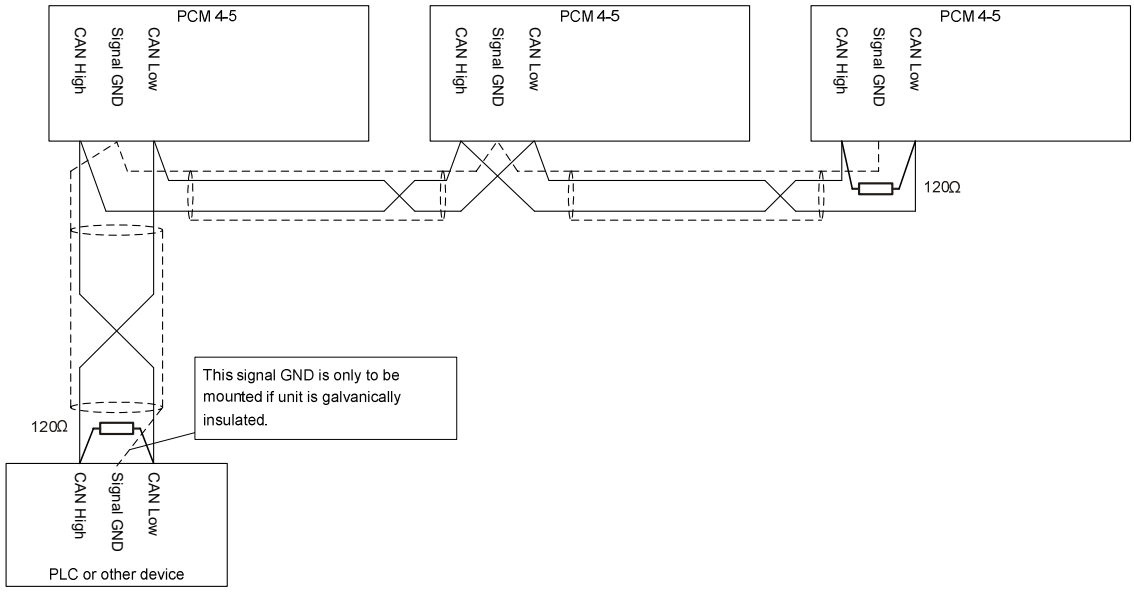


CAN 1		CAN 2	
Terminal 7:	CAN High	Terminal 19:	CAN High
Terminal 8:	signal GND	Terminal 20:	signal GND
Terminal 9:	CAN Low	Terminal 21:	CAN Low
Terminal 10:	CAN High	Terminal 22:	CAN High
Terminal 11:	signal GND	Terminal 23:	signal GND
Terminal 12:	CAN Low	Terminal 24:	CAN Low

Terminals: plug-able screw connection

Cabling:

2-wire twisted pair cable with shield. The cable must have a characteristic impedance of 120 Ω. The shield of the cable is used as ground. End terminations of 120 Ω should be used.



The CAN communication can be connected as shown in the example.

The maximum guaranteed length of the CANbus line is 200 m at 125 Kbit/sec.

Please check what PCM card you have, as there are different installation instructions.

Ethernet

Ethernet at PCM is a standard 10 Mbit/100 MHz connection.

Terminals: Standard RJ45 I/O.

Standard RJ45 cable. Straight-through cable is used when connecting to e.g. a switch. Use a crossover cable if connecting directly to a PC.

The Ethernet is an add-on option, and is not included on a standard PCM card. If included, see functionality in part 1. manual.

Input/output

The PCM is further equipped with one binary input and one relay output.

Input: 1 binary input designed for potential free contacts.
Open/closed: 12 V/7.5 mA.

Relay output: Relay rating: 250V AC/24V DC – 8 A.

Terminals: Plug-able screw connection. 0.2-2.5 mm^2 single/multi-stranded wire.

Display port

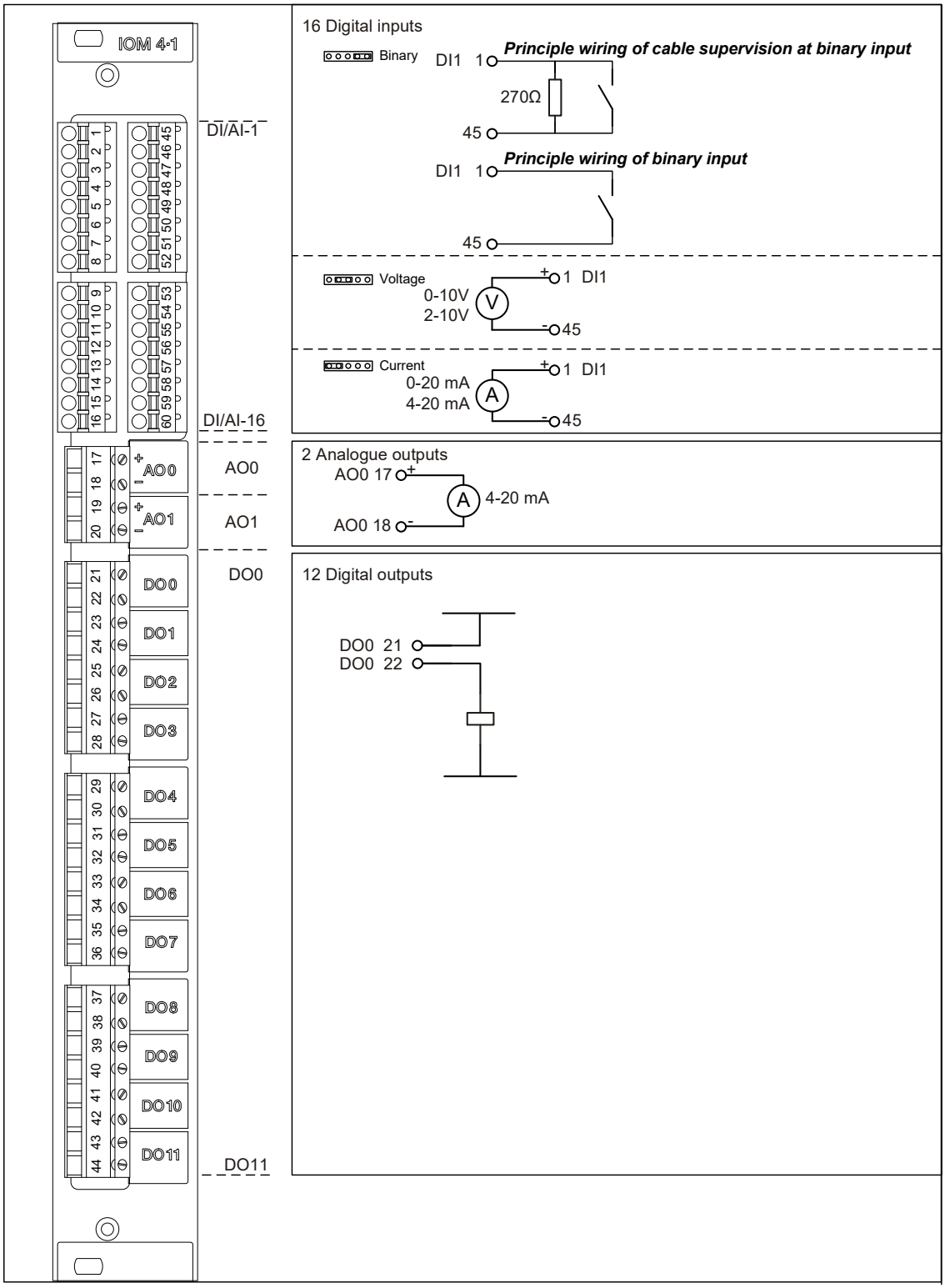
The display port is to connect a Delomatic 4 display unit, from which read-outs and settings can be made.

Terminals: Standard female D-sub-9.

DEIF monitor cord (3 m - 1022040042, 6 m - 1022040043).

See “Installing the display unit” for more info.

The IOM module



Inputs on the IOM module

The IOM has 16 input channels, which can all be configured individually as:

- Binary input
- Analogue current input (0-20 mA/4-20 mA)
- Analogue voltage input (0-10 V/2-10 V)

Please refer to the I/O list for specific information on the configuration of each channel.
Terminals: Plug-able screw connection.
Cabling: 0.2-1.5 mm^2 single/multi-stranded wire.

Binary inputs

Only potential free contacts may be used as **binary** input signals.

Cable supervision

Cable supervision is available as an optional function for the binary input channels.

Cable supervision requires that a shunt resistor (270 Ω ±10%) is mounted across the signal-transmitting device.

Please notice that cable supervision is implemented as default on all analogue inputs, which operate with 20% offset (4...20 mA/2...10V DC).

All the "COM. n" terminals (45-60) are connected to the same potential internally in the IOM 4.1 modules.

All input channels must be connected with the belonging com port. It is not allowed to use one com port for all inputs, even though the com ports are internally connected.

Outputs on the IOM module

The IOM has 12 output channels, which are all relay outputs with the following contact ratings:

Max. AC: 250V – 8 A
DC: 30V – 8 A

The active position may be a closed contact (CC) or an open contact (OC), dependent on the output channel setup in the application programme.

All relay outputs are potential free contacts, and each output is galvanically insulated from the Delomatic 4 system.

If a power supply failure appears, all relay outputs are set to an open contact position (OC).

If the relay outputs are used for control of e.g. relay coils or similarly strong inductive loads, it is recommended to apply a noise reducing component (e.g. a capacitor or a free-wheel diode) across the loads.

The output terminals on the IOM modules may not be connected to more than max. 2.5 mm^2 single or multi-stranded wires/cords.

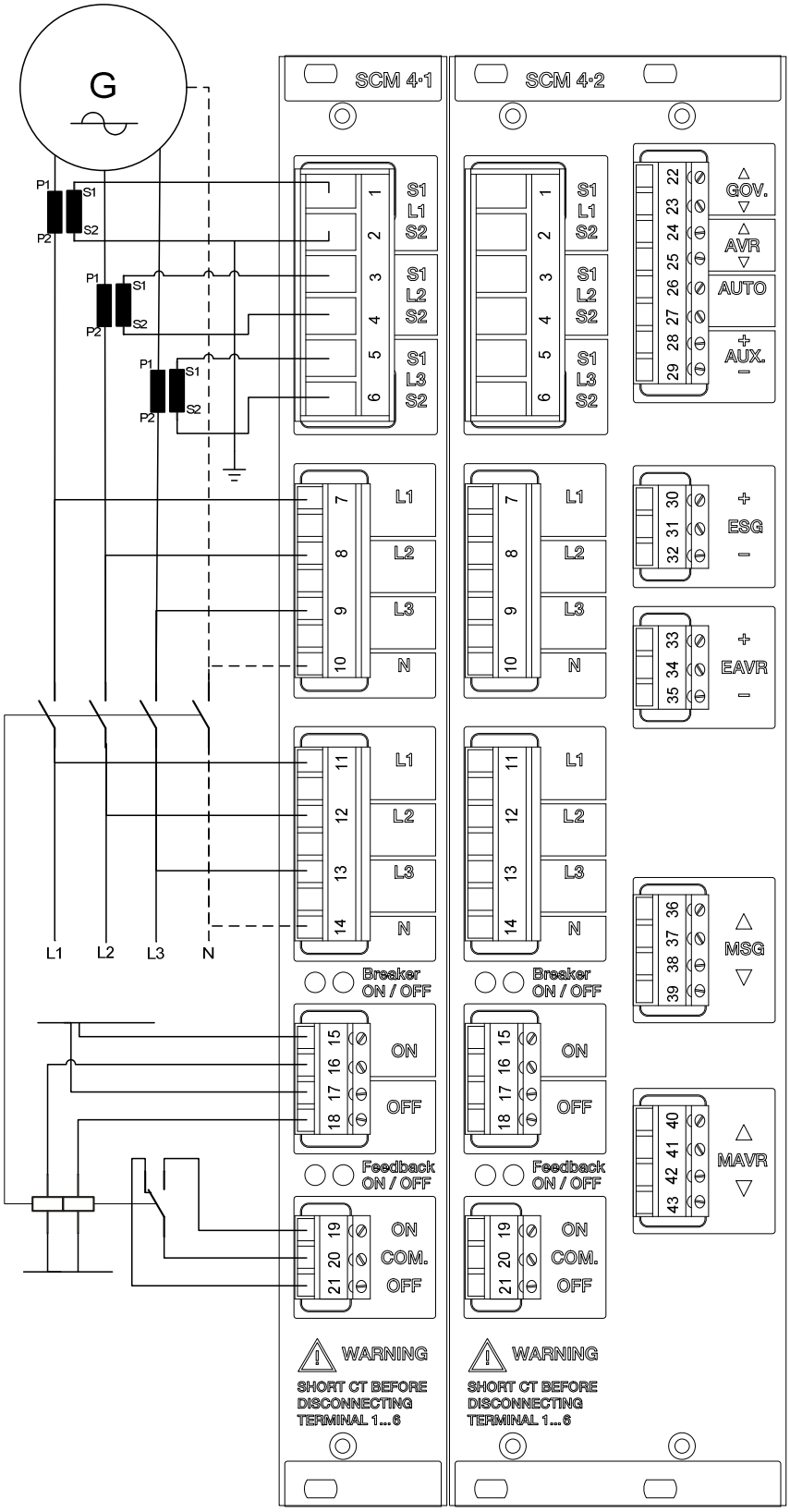
Analogue outputs on the IOM module

The IOM contains two analogue output channels, which can be configured individually as:

- Analogue current output (0-20 mA/4-20 mA)

The analogue output terminals on the IOM modules may not be connected to more than max. 2.5 mm^2 single or multi-stranded wires/cords.

The SCM module/s



The shown wiring is a connection to a 3-wire grid with a neutral conductor (dotted lines).

The SCM module consists of:

- The multi-transducer unit , terminals 1 ... 14
- The GB ON/OFF unit , terminals 15 ... 21
- The synchronising unit , terminals 22 ... 43

Wiring diagram for multi-transducer (AC measuring inputs)

The multi-transducer unit has three measuring input groups:

- A three-phase generator current measuring input
- A three-phase generator voltage measuring input
- A three-phase busbar voltage measuring input

The voltage measuring inputs (both busbar and generator voltage inputs) are able to measure max. 690V AC.

If measurement of voltages higher than this is required, voltage transformers must be applied.

If the SCM is supposed to measure at a 3-wire grid **without neutral conductor**, terminals 10 and 14 are left as open connections **(grounding of the unused "N" terminals may not be done).**

Warning!
Short-circuit the current measuring inputs before disconnection the terminals!

Wiring diagram for the generator breaker ON/OFF control signals

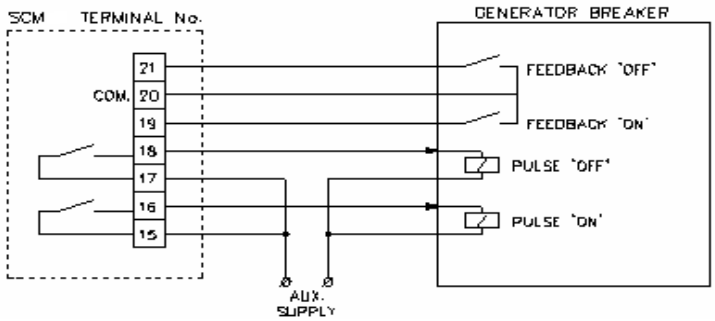
The generator breaker position is supervised by a feedback signal from the generator breaker.

- Two binary inputs for GB position feedback signals

The breaker ON/OFF control signal is carried out via two potential free relay outputs.

- Two relay outputs for GB ON/OFF commands

The breaker control signal terminals on the SCM modules may not be connected to more than max. 2.5 mm^2 single or multi-stranded wires/cords.



Principle wiring between the SCM and the generator breaker

Only potential free contacts may be used for the GB position feedback input signals. The GB ON/OFF commands are potential free relay outputs with the following contact ratings:

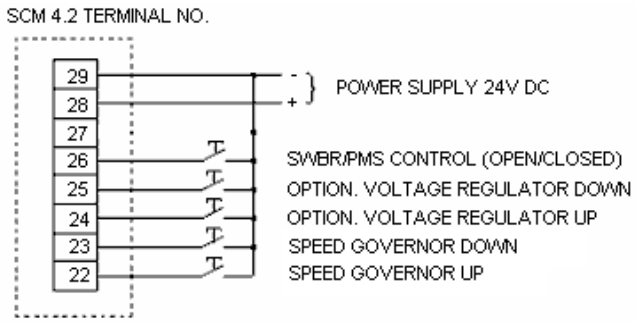
Max.: AC: 250 V – 8 A

Wiring diagram for the synchronising signals

The synchronising unit consists of two parts:

- The control interface, terminals 22 ... 29
- The speed governor interface, terminals 30 ... 43

Selection of SWBD/PMS control for the RACK is made via the control interface. The SWBD control allows manual up/down control of the speed governor via push-buttons in the switchboard.



The control interface incl. selection of SWBD/PMS control

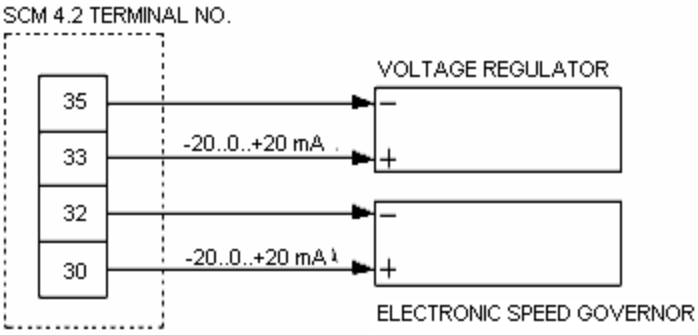
Supply voltage at the SCM module power supply terminals is always required, both in SWBD and in PMS control. To secure the SWBD control, the supply for the SCM module should be fused separately.
SWBD control of the AVR is only available, if the voltage control function (which is an additional function) is implemented in the Delomatic 4 system).

Wiring diagrams for the speed governor outputs

The SCM module has two different types of speed governor interfaces:

- Analogue outputs for interface with electronic speed governors
- Relay outputs for interface with mechanical speed governors

Only speed governors in speed droop mode may be used in co-operation with the Delomatic system.



SCM interface with the speed governors

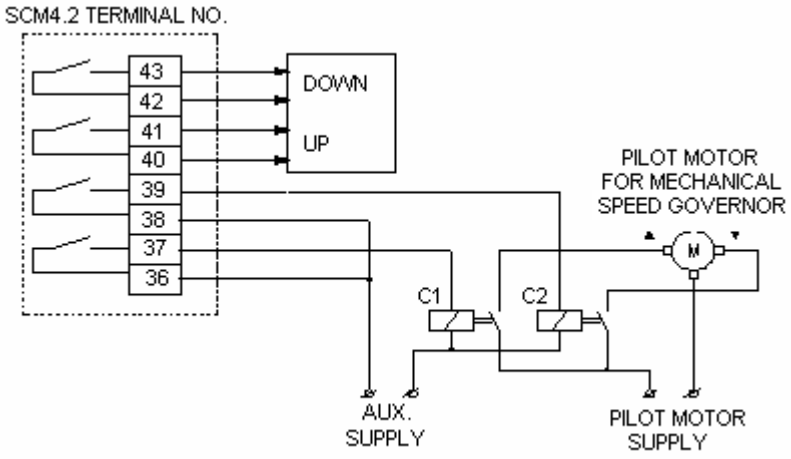
The terminals 30...35 are used for interfacing with an electronic speed governor and analogue output for the AVR.

The analogue output for AVR control is only available, if the additional function for voltage control is implemented in the Delomatic 4 system.

An analogue output (ESG) is available for interfacing with electronic speed governors, if the SCM module is **NOT** equipped with MSG relay outputs.

The analogue outputs range from -20...0...20 mA, max. 5V DC. Voltage output may be achieved by connecting a shunt resistor, -5...0...5V DC ⇔ 250 Ω resistor.

As optional functions, the SCM may be implemented with relay outputs for interfacing with mechanical speed governors (MSG) and mechanically controlled AVRs (MAVR).



Principle wiring of the mechanical speed governors

The terminals 36...43 are only available, if the relay outputs for interfacing with mechanical governors are mounted into the SCM module.

The illustration to the left shows how to connect the mechanical speed governors to the SCM 4-2 module.

If the aux. supply is a DC supply, it is recommended to mount free-wheel diodes in parallel with the relay coils C1 and C2.

If the pilot motor is of AC type, it is recommended to mount a noise-reducing capacitor (0.1 μF X-capacitor or similar) in parallel with the **pilot motor terminals.**

If the pilot motor is of DC type, it is recommended to mount a noise-reducing capacitor (0.1 μF X-capacitor or similar) or a transzorb diode in parallel with the **pilot motor terminals.**