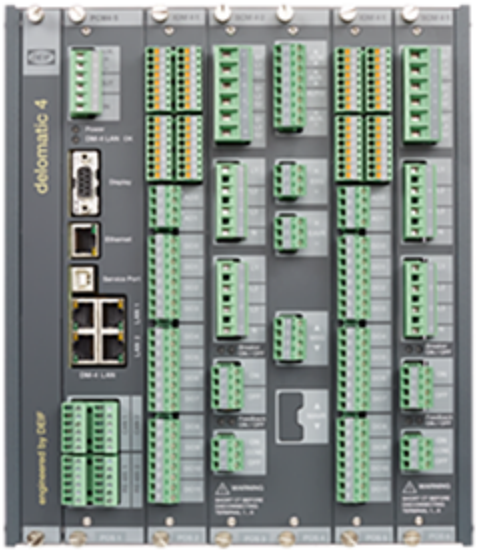
DATA SHEET

Delomatic 4

DM-4 Marine and Offshore



Delomatic 4, DM-4 Marine & Offshore
DATA SHEET



Application

- Power management control and protection of complex marine and offshore applications including diesel, gas and turbine generators, as well as tie breakers and shore connections
- Highly flexible HW and SW – engineered to specification
- Each case handled as a unique project
- Access to our highly qualified know-how to obtain the optimal system solution
- Developed for high reliability and robustness including approvals from all major marine classification societies

Setup

- Modular I/Os (according to need)
- Combi I/O module for standard I/O (analogue I/O, digital I/O) (IOM-41)
- Multi-transducer included (SCM-41)
- Only 4 module types needed to set up a complex control system
- Double euro format (6HE) rack in 4 standard sizes of 24, 30, 42 and 60TE

Features

Local:

- Start/Stop engine
- Synchronising
- Speed control/active load share
- AVR control/reactive load share
- Advanced generator protection
- Heavy consumer control
- Load shedding
- Generator breaker control and protection
- Tie breaker control and protection
- Programmable parameter, timer and alarms
- Log of 150 alarms
- Engine communication CAN J1939

General:

- Overall power management
- Overall mode handling
- Load-dependent start/stop
- Load group control
- Modbus RTU RS485 com (for external ctrl.)
- Free PC utility software (USB interface to PC)

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Application

The Delomatic 4 Marine & Offshore controller (DM-4 Marine & Offshore) is the basic unit in a highly flexible power management system. It covers the special demands of power production plants regarding reliability, robustness, flexibility, and remote accessibility in an optimal way.

Based on an existing generator control system approved for marine applications and used in thousands of ships and land-based power stations over the last 20 years, DM-4 Marine & Offshore matches the special demands of harsh environments and far-away-locations faced in the off-shore and land-based decentralised power generation.

The range where the DM-4 Marine & Offshore will fit your demand is wide, but among others can be mentioned:

- Diesel electric propulsion (With DP 2 and 3)
- Supply vessel with 2 SGs and 2 or more DGs
- Systems with SG as both generator and motor
- Two or more BB systems with control of TBs
- Combinations of the above
- Offshore platforms and rigs including turbines

Typically, a combination of many different operation modes are included in the same system.

General design

The system has been designed to carry out **generator control, supervision and protection** functions of up to 15 generators integrated in one system. Furthermore, the DM-4 Marine & Offshore is able to control tie breakers, shore connection breakers etc.

The system performs a wide range of power management features, such as load-dependent start/stop, programmable start priority, load group control, load shedding, control/supervision of bus couplers and tie breakers.

Each DGU contains all necessary 3-phase measuring circuits and presents all values and alarms on the LCD display.

In addition to the display unit, an additional operator panel (AOP) with 8 push-buttons and 16 LEDs can be added. AOP-1 is delivered as standard for the master DGU but is not limited to the master DGU only. AOP-1 is connected to the display unit with a 0.5 m cable. Using a CANbus connection, an extra AOP (AOP-2) can be connected (max. 200 m from DU). Up to 5 AOPs can be connected to the CANbus line. The AOP delivers status information from the system and includes plant mode control.

DM-4 LAN
Internal communication between DGUs for system calculations, load sharing etc. is performed through a DM-4 LAN.

The PCM 4-5 uses a dual network philosophy for redundancy. Dual DM-4 LAN feature must be ordered as option.

For PCM 4-1, the DM-4 LAN is configured by a single common twisted pair connection.

The total length of the DM-4 LAN depends among others on the number of DGUs on the individual network. In this case, please contact DEIF.

Both the PCM 4-1 and PCM 4-5 can be used together with a conversion to/from fibre in case of longer distances. In this case, please contact DEIF.

Communication to an external alarm and monitoring system can be performed via RS485 Modbus RTU, Modbus TCP/IP or by CANopen.

DEIF Generator Unit (DGU)

DM-4 Marine & Offshore's HW modules are placed in the DGU rack. 4 different rack sizes are available, depending on the need for IOs and synchronising modules (please refer to the illustrations at the end of the data sheet).

Example of 30TE Rack

System HW modules

As a quite unique feature, the entire DM-4 Marine & Offshore system is composed of only four different hardware modules. All application solutions are based on these four modules:

PCM 4-1 (8TE) (Only for spare parts and replacements):
Carries the rack system power supply, system main CPU and I/O router in distributed configurations and various external interfaces (3 x CAN, 1 x RS485, DM-4 LAN, USB service port).

PCM 4-5 (8TE):
Carries the rack system power supply, system main CPU and I/O router in distributed configurations and various external interfaces (2 x CAN, 2 x RS485, 1 x Ethernet, DM-4 LAN, USB service port).

IOM 4-1 (6 TE):
Universal I/O module for:
16 input channels (selectable as binary or analogue by a jumper)
12 relay outputs
2 analogue outputs (0(4)…20 mA)

SCM 4-1 (6 TE):
Multi-transducer for a high precision 3-phase electrical measurement (class 0.5)
Integrated synchroniser/breaker control

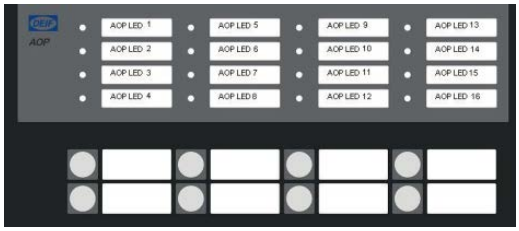
SCM 4-2 (12 TE):
Multi-transducer for a high precision 3-phase electrical measurement (class 0.5)
Integrated synchroniser/breaker control
Controller board for GOV and AVR (binary or analogue)

Display possibilities

The display unit (DU) is separate and can be mounted in the switchboard via the display cable. Up to three displays can be connected to each DGU, enabling the user interface to be placed at different locations. The additional operator panels (AOP-1/AOP-2) can be connected to the DU for additional functions and indications. One AOP-1 and up to five AOP-2s can be connected to each DU.

Display Unit (DU)

Additional Operator Panel (AOP-1/AOP-2)



Power Management

In principle, all DGUs in the system have the same SW. By the node switch on the PCM-4.X, the individual DGUs are able to identify relevant parts of the SW. Therefore, the DM-4 Marine & Offshore is able to function as a distributed Power Management System in which each DGU can perform individual functions.

With this setup, the individual HW modules can be used as spare parts for other DGUs, and hereby it is possible to keep the essential units running in emergency situations.

This system's flexibility is also illustrated in the possibility to control up to 4 synchronizing modules from each DGU. As an example, this means that one DGU can control 1 GB, 2 TB's and 1 SC, if a very compact solution if requested.

Please note that only 1 GB is controlled from each DGU. This is due to SW design and because we recommend only one GB in each SWBD section (as well as due to class requirements).

Utility Software, USW

USW-supported functions (free at www.deif.com):

- USB direct access to PCM
- Connect via TCP/IP (only PCM 4-5)
- Download of software
- Parameter setup
- Monitoring of all modules in the DGU
- Alarm monitoring
- Clock synchronisation
- Trending
- Installation done with a setup wizard

GOV and AVR control

The governor control ensures:

- Frequency control
- Active load sharing (symmetric or asymmetric)

The AVR control ensures:

- Voltage control
- Reactive load sharing

Customised functions

The flexible IO platform in combination with the integrated measurement of all electrical values gives a unique possibility to develop "customised functions".

Examples could be:

- Advanced load reduction/shedding algorithms
- Fuel-optimised load sharing
- Propulsion/thruster interface
- Advanced customised operation modes

Order information

Because of the widespread flexibility of DM-4 Marine & Offshore, DEIF must be contacted directly to order this system. In this way, we will make sure that our customers gain full advantage of DM-4 Marine & Offshore's flexibility.

Our project managers will typically request a single line diagram of the generators and breakers to be controlled and a short description of control philosophy in order to customise the solution perfectly.

Based on the given information, DEIF will make a quotation for your engineered-to-fit control system.

Protection functions

In the below table, the standard protection functions are listed.

- Generators (diesel/shaft/turbine etc.)
- Tie/shore breaker protection and supervision (depending on current inputs to the SCM module)

All protection functions have definite time characteristics.

Protection function	ANSI no.*	Levels
Speed supervision device	(15)	1 step
Overexcitation	(24)	2 steps
Synchronous check device	(25)	1 step
Generator undervoltage	(27)	1 step
Busbar undervoltage	(27 B)	2 steps
Generator overload	(32)	2 steps
Generator reverse power	(32_R)	2 steps
Loss of excitation	(40)	2 steps
Current unbalance	(46)	1 steps
Phase sequence voltage	(47)	1 step
Circuit breaker failure	(50BF)	1 step
Generator overcurrent	(50)	4 steps
Voltage-dependent overcurrent	(51V)	1 curve
Generator overvoltage	(59)	2 steps
Busbar overvoltage	(59 B)	2 steps
Voltage unbalance	(60)	1 steps
Blocking (engine start/synchronisation)	(68)	1 step
Generator overfrequency	(81)	2 steps
Generator underfrequency	(81)	2 steps
Busbar overfrequency	(81 B)	2 steps
Busbar underfrequency	(81 B)	2 steps
Locking-out relays, electronic	(86)	Several
Speed, frequency and active load control device	(90)	
Volt and reactive load control device	(90)	
Tripping relay	(94)	
Advanced generator protection: - Engine, governor or fuel failure - Generator or AVR failure	(95)	

***** (ANSI# as per IEEE Std. C37.2-1996 (R2001) in parenthesis).

Advanced generator protection (optional)

By means of the fast communication between the PMS units and load share deviation calculation, a failure in a diesel engine, governor or blocked fuel filter can be found, and the faulty genset can be disconnected from busbar before causing to much disturbance, and in worst case perform a blackout.

Fast load reduction (optional)

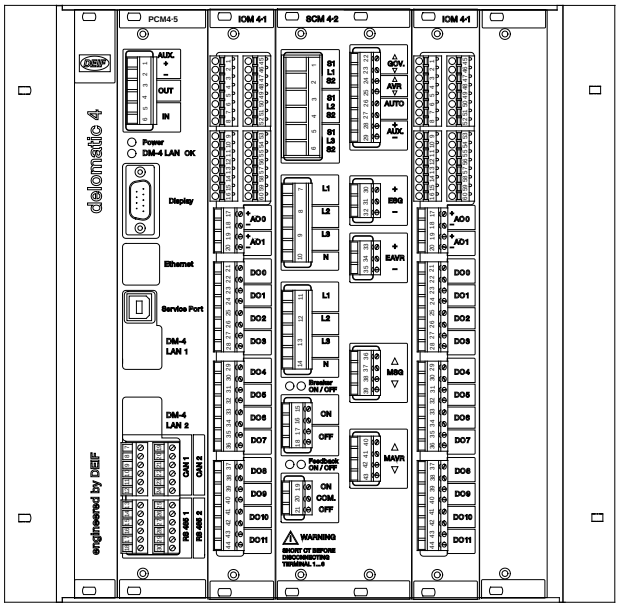
The fast load share deviation calculations are also basis for sending signals to thrusters and other equipment to reduce load immediately to avoid overload of generators.

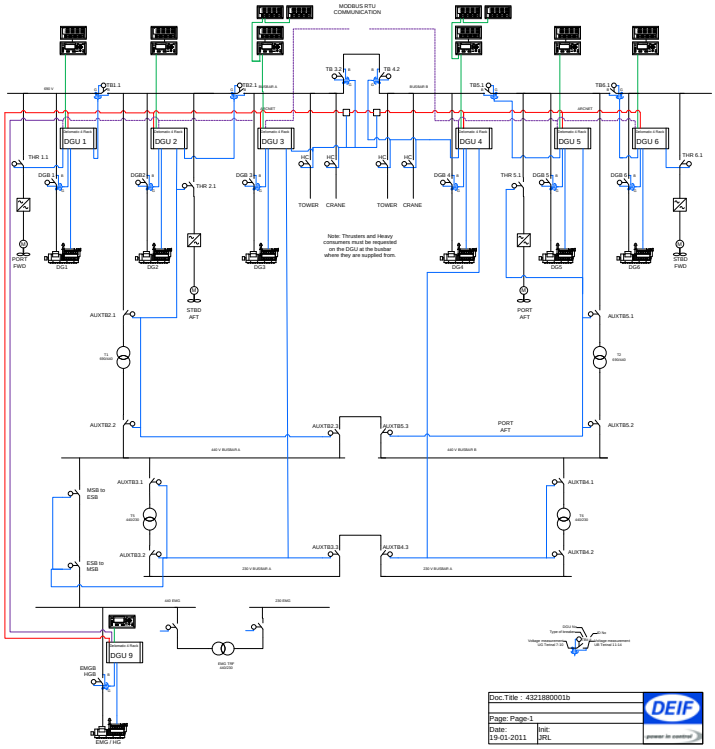
Special tailor-made protection functions may be available on request.

Application illustrations

All applications are based on individually configured DGUs. This means that the actual HW modules can easily differ between each of the DGUs. Below, a typical DGU configuration is illustrated together with an application example.

42TE, 5 IO-slots





Example from a project containing control of diesel gensets, emergency genset and tie breakers. All can be controlled as a common plant, either from the local displays and AOPs, or from an external SCADA solution.

Technical specifications

DGU rack system

Operating temp.: -25…70°C (-13...158° F)

Vibration class: DNV A+C,
3.0… 13.2 Hz 2.0 mm_{pp}
13.2… 100 HZ 0.7 g
3.0… 13.2 Hz 6.0 mm_{pp}
13.2… 50.0 HZ 2.1 g

Protection class: IP 20

Climate: 97% RH to IEC 60068-2-30 Db

Mounting: Base mounting

EMC/CE: To EN 61000-6-1/2/3/4,
SS4631503 (PL4)

Material: Plastic headers according to UL94-V0, Al housing, steel front plates

Connectors: Self-secure
spring cage 6/8/20 Arms
Screw terminals 20 Arms

Weight: Depends on configuration
Min.: 3.2 kg
Max.: 8.3 kg

PCM module (4.1)

Aux. supply: 24V DC (-25%, +30%)
Max. 6 A
Battery voltage measurement accuracy:
±0.8 V within 8 to 32V DC,
±0.5 V within 8 to 32V DC @ 20°C

CAN: 3 independent bus lines
125…250 kbps
Terminals for route-through of bus lines

RS485: 1 interface up to 56 kbps,
RS485 2 or 4 wire
Multi-drop or point-to-point

Safety: To EN 61010-1
Overvoltage category III
600V AC
Pollution degree 2

PCM module (4-5)

Aux. supply: 24V DC (-25%, +30%)
Max. 6 A
Battery voltage measurement accuracy:
±0.8 V within 8 to 32V DC,
±0.5 V within 8 to 32V DC @ 20°C

CAN: 2 independent bus lines
125…250 kbps
Terminals for route-through of bus lines

RS485: Port 1: Interface up to 38.4 kbps,
RS485 2 wire
Multi-drop or point-to-point

Port 2: Interface up to 115 kbps,
RS485 2 wire
Multi-drop or point-to-point

Safety: To EN 61010-1
Overvoltage category III
600V AC
Pollution degree 2

Additional Vibration: Vibration response test.
10…58.1 Hz 0.15 mm_{pp}
58.1… 150 Hz 1 g

Vibration endurance test.
10…150 Hz 2 g

Vibration seismic test.
3…8.15 Hz 15 mm_{pp}
8.15 …35 Hz 2 g

WEB-arm module

Modbus TCP/IP
Utility software connection over TCP/IP

SCM module

	Safety: To EN 61010-1 Overvoltage category III 600V AC Pollution degree 2
Meas. range (Un):	100…690 Vrms direct (phase-phase) Other range with voltage transformer Burden max. 0.5 A per phase Overload max. 2*Un for 10 s External fuse max. 2 A slow-blow
Meas range (In):	Current transformer ../1 Arms or ../-5 Arms Burden max. 0.4 VA per phase Overload 10 Aeff continuously <75 A for 10 s < 300 A for 1 s
Galvanic separation:	2.5 kV isolation between voltage measurement inputs and all other potentials
Frequency of grid:	30…70 Hz
Accuracy:	Class 0.5 according to IEC 688
Harmonics:	Up to 500 Hz are measured

16 input channels
The IOM 4-1 contains 16 input channels which may be individually configured as a current input (0...20 mA), a voltage input (0..10 V) or as a binary input (CC/OC). Live zero (offset) of the analogue inputs (e.g. 2..10 V or 4..20 mA) are available through the application programme. The input channel configuration (analogue/binary) must correspond to the input definitions in the application programme (in the PCM).

The status on the binary input is detected by an active voltage level detector circuit in the IOM 4-1, which may be connected to a potentially free contact only.

All “COM” terminals are in all three configurations connected to the internal ground. Cable supervision is optional for channels configured as binary input.

Measurement:
Accuracy: Class 1 (to IEC 688)

Resolution: 10 bit (0.1% of full scale)

Impedance: mA - input: 50 Ω
V - input: 15 kΩ

Binary input:
Max. resistance for ON detection: 100 Ω

Resistance for cable supervision: 270 Ω +/-10%

12 relay output channels
The IOM 4-1 contains 12 relay outputs with programmable active position. The active position may be a closed contact (CC) or an open contact (OC), dependent on the output channel setup in the application programme (in the PCM). The relay position is a closed contact with an energised coil.

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

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

Contact ratings: Max. 250V AC/24V DC, 8 A

2 analogue output channels
The IOM 4·1 contains 2 analogue outputs (0..20 mA), both galvanically separated. Live zero (offset) of the analogue outputs (e.g. 4..20 mA) are available through the application programme (in the PCM).

If a power supply or system failure appears both analogue output channels are set to zero output (0 mA).

Output: 0 .. 20 mA

Load: Max. 500 Ω

Accuracy: Class 0.5 (to IEC 688)

Resolution: 10 bit (0.1% of full scale)

Galvanic separation:

Between analogue outputs and other circuits:

500V AC – 50 Hz - 1 min.

Between two analogue outputs:

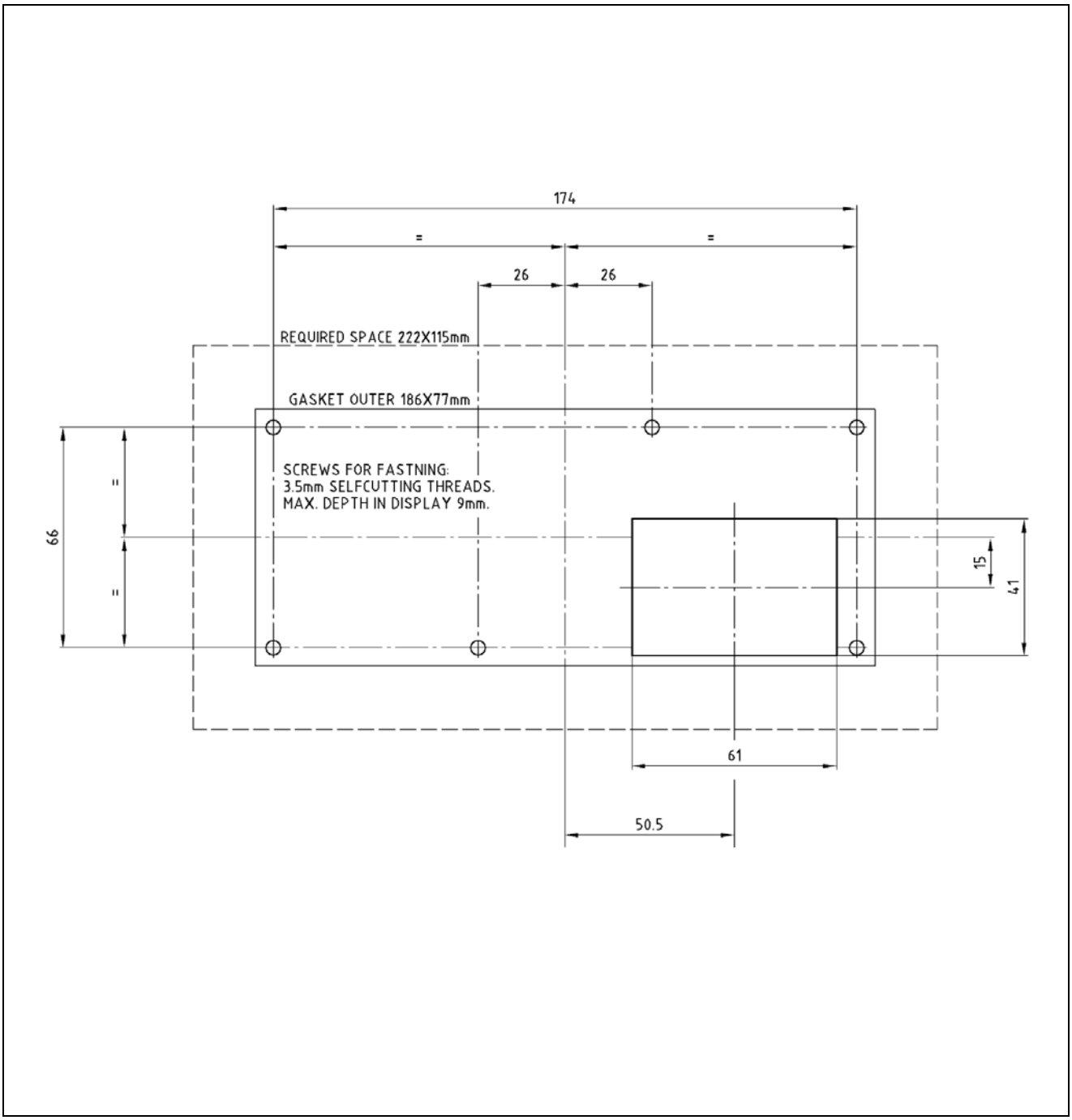
500V AC – 50 Hz - 1 min.

Between analogue outputs and earth (chassis):

500V AC – 50 Hz - 1 min.

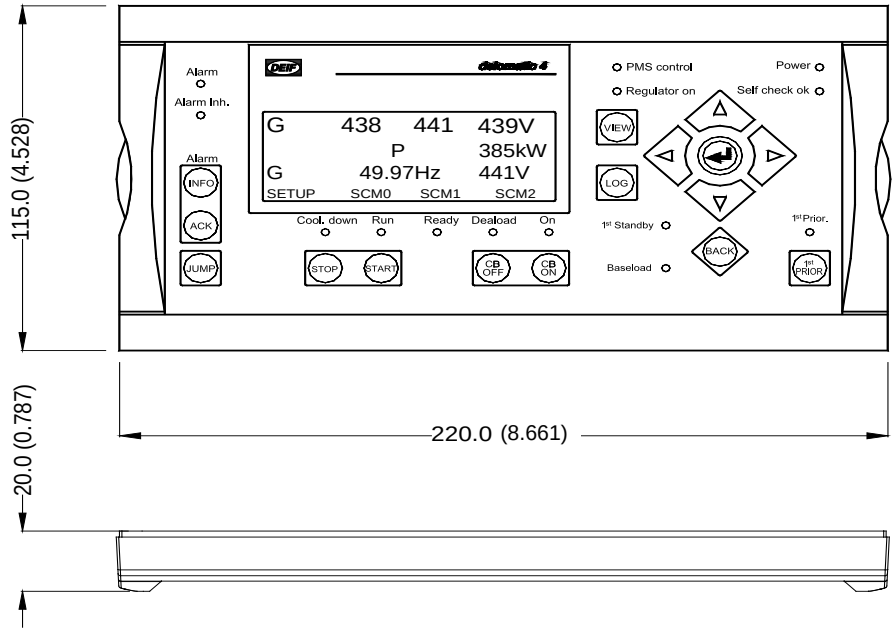
Safety: To EN 61010-1
Overvoltage category III
600V AC
Pollution degree 2

Panel cutout for display unit and AOP (mm)



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

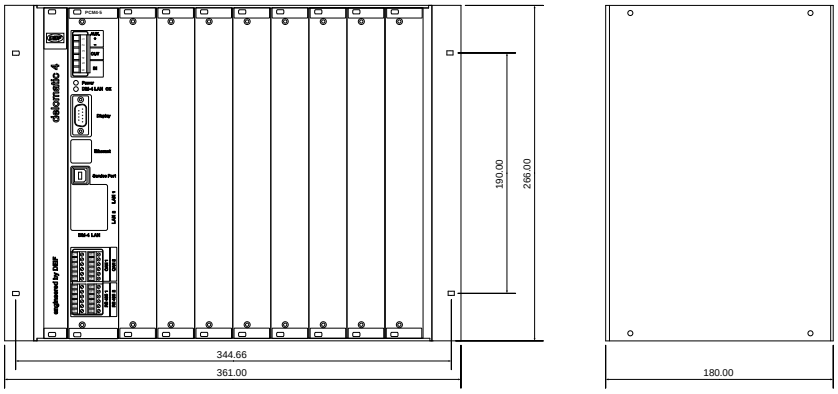
Unit dimensions of display unit and AOP in mm (inches)



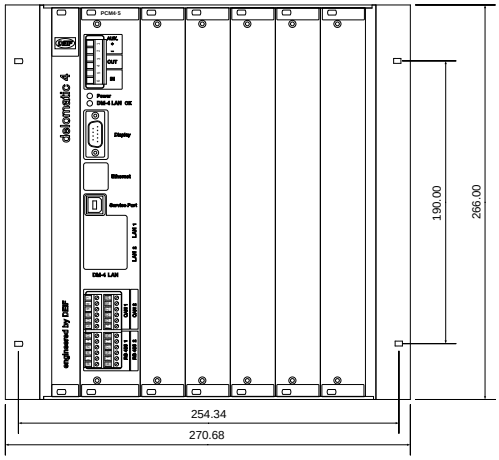
Display size: H x W x D = 115 (4.528”) x 220 (8.661”) x 20 (0.787”)

Unit dimensions of rack system in mm (inches)

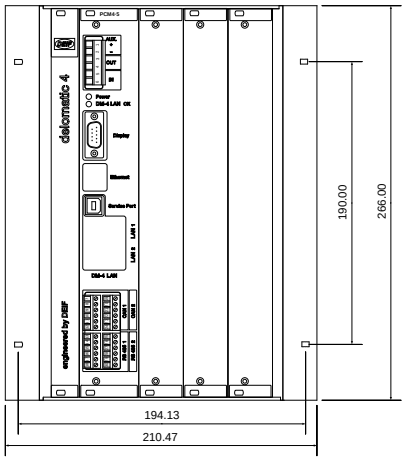
60TE, 8 IO-slots



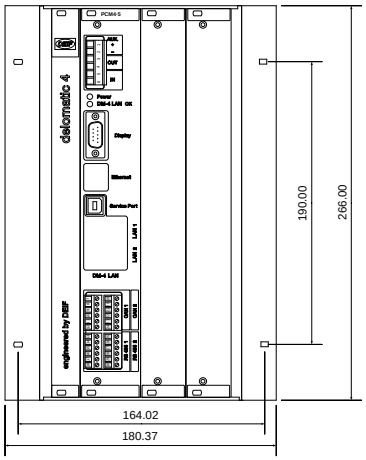
42TE, 5 IO-slots



30TE, 3 IO-slots



24TE, 2 IO-slots



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