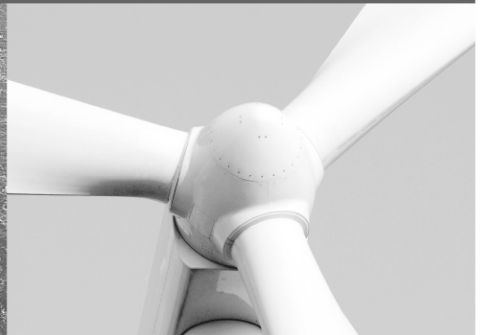




-power in control



DATA SHEET



DELOMATIC 400 GAS

- Full gas engine control and monitoring
- Integrated emission control (air/gas mix control)
- Integrated combined heat and power control
- Integrated speed governor
- Full generator control and monitoring
- Mains failure protections integrated
- Local/remote PC monitoring via TCP/IP



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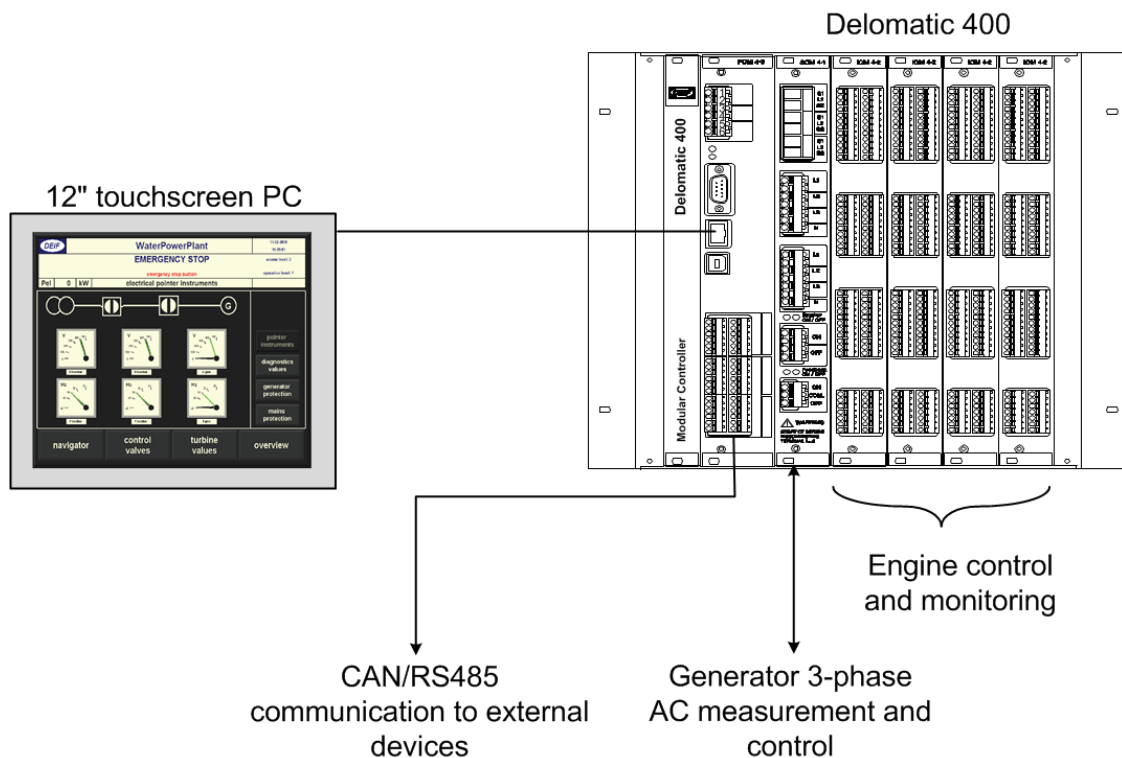
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1. Application information

1.1 General information

1.1.1 Hardware

The DELOMATIC 400 delivery from DEIF consists of:



1.1.2 Application

The controller Delomatic 400 is designed as a modular process controller. It covers the special demands of gas engine driven/hydro turbine energy 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 25 years, Delomatic 400 matches the special demands of harsh environments and far-away-locations faced in the off-shore and land-based decentralised energy generation.

The control system is designed for unmanned operation. The user interface provides full information to the user and allows an efficient diagnosis and a fast reestablishment of the operation locally as well as remotely.

The Delomatic 400 can communicate with external devices such as ignition systems, anti-knocking systems, gas mix control systems and so on.

1.1.3 Properties

The system Delomatic 400 covers the following functions as a standard:

Measurements:

- Generator voltages three-phase L1, L2, L3, N
- Mains voltages three-phase L1, L2, L3, N
- Currents L1, L2, L3
- Active power per phase/total
- Reactive power per phase/total
- Active and reactive energy counter
- Operating hours
- Circuit breaker operations counter
- Temperatures and pressures
- Measurement values of the plant

Common protection and control functions:

- Mains protection
 - o Vector jump
 - o df/dt (R.O.C.O.F.)
 - o Voltage
 - o Frequency
- Support of a hardware safety chain with reset function
- Electrical protections generator over- and undervoltage, over- and underfrequency, current asymmetry, overload, reverse power, minimum power, overcurrent, thermal overcurrent, overexcitation, loss of excitation
- Overspeed
- Wire-break proof supervision of the breaker position
- Emergency stop
- Configurable inputs for fault messages (e.g. for digital auxiliary contacts)
- Prerun and postrun of auxiliaries
- Operation of motorised circuit breakers
- Analogue power setpoint
- Voltage adjustment and CosPhi control
- Synchronisation with voltage adjustment and time supervision
- Speed governor with acceleration control function (no external governor needed)
- Power ramp function for smooth start and stop

For gas engine:

- Supervision of lube oil pressure
- Supervision of coolant temperature
- Supervision of pressure and temperature of the gas line
- Gas leak check
- Open-time supervision of the gas valves
- Supervision of the exhaust temperature after turbocharger
- Exhaust back pressure supervision
- Water level limiter for coolant, emergency cooler, and heating circuit
- Run time supervision of air flaps
- Run time supervision of exhaust bypass
- Tooth-on-tooth supervision of the starter
- Level supervision in external lube-oil tanks (fresh oil min, waste oil max)
- Fully automated engine start/stop
- Heating up control
- Postrun of the engine
- Load reduction function due to receiver temperature, throttle position, room air temperature, and exhaust temperatures
- Peak shaving
- Heat-controlled operation (heat demand-controlled power output)
- CH₄-value-controlled operation
- Gas level- or gas pressure-controlled operation
- Control of engine cooling circuit, emergency cooling circuit, and heating circuit
- Control of gas mixture
- Control of the exhaust bypass flaps
- Control of the room temperature
- Control of air flaps

- Emission control (Select between lambda sensor, intake manifold (receiver) pressure/temperature and combustion chamber temperature)
- Engine preheating
- Demand signal to a compressor
- Second gas type selectable

Typical Scope of Delivery:

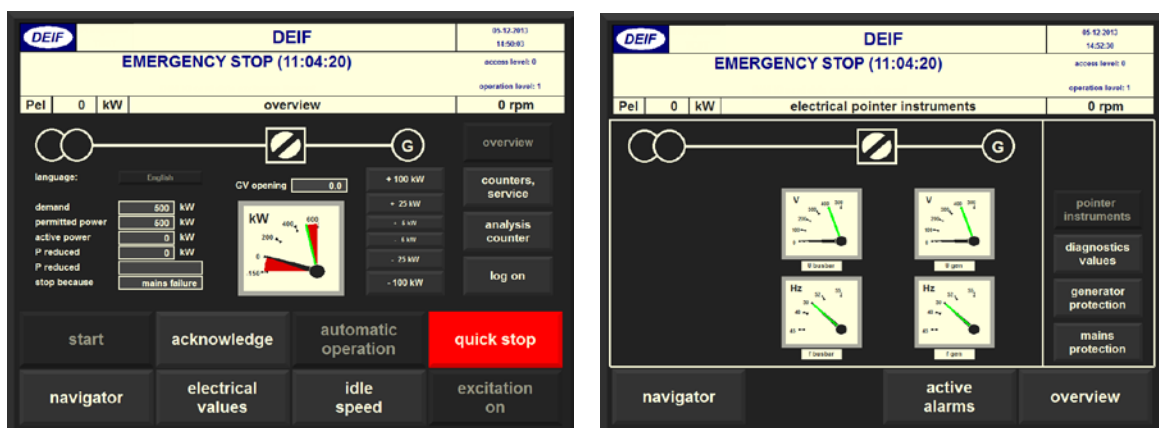
- Delomatic 400 hardware
- Touch panel PC if desired
- Example wiring diagram
- I/O list
- List of error messages
- Commissioning check list
- Handbook

1.2 User interface

1.2.1 General description

- Display of all measurements as graphics and in numbers
- Visualisation of the states of the protections
- Trending function
- Logbooks with more than 200 entries with time stamps each
- Adjustment of parameters
- Multi-user function with standard hardware as touch screens, laptop computers for direct access (USB, TCP/IP)
- Remote access (TCP/IP)
- "Living" P&I diagrams on the screen show changes and states of components in graphics
- Operation of the plant
- Maintenance calls after operating hours, adjustable

1.2.2 Examples



1.3 System components with specifications


1.3.1 General description

The whole Delomatic 400 system consists of only three hardware modules. Each module contains its own processor and therefore it works independently of the other modules. Communication between the modules is carried out via the rack backplane.

All three modules will be delivered in a standard industry rack. Available standard sizes:

- 24 TE for 2 modules + power supply/processor module.
- 42 TE for up to 4 modules + power supply/processor module.
- 60 TE for up to 8 modules + power supply/processor module.

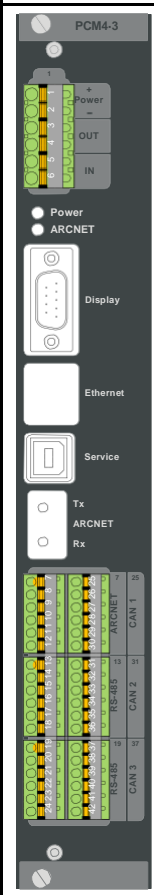
1.3.2 Rack

Technical specifications	
	
Operating temperature	-25...70°C to IEC 60068-2-1, IEC 60068-2-2 & IEC 60255-1
Storage temperature	-40...85°C to IEC 60255-1
Reference temperature	15...30°C
Climate	55°C 97 % RH condensing to IEC 60068-2-30 Db
Vibration	<p>DNV class A+C & IEC 60068-2-6 Fc</p> <p>3.0...13.2 Hz 2.0 mpp 13.2...100 Hz 0.7 g</p> <p>3.0...13.2 Hz 6.0 mpp 13.2...50 Hz 2.1 g</p> <p>Vibration response test. To IEC 60255-21-1 Class2 10...58.1 Hz 0.15 mpp 58.1... 150 Hz 1 g</p> <p>Vibration endurance test. To IEC 60255-21-1 Class2 10...150 hz 2 g</p> <p>Vibration seismic test. To IEC 60255-21-3 Class2 3...8.15 Hz 15 mpp 8.15 ...35 Hz 2 g</p>
Repetitive shock (Bump)	20 g 16 ms. To IEC 60255-21-2 Class2
Shock	<p>Shock test. To IEC 60068-2-27Ea 50 g 11ms. Half sine</p> <p>Shock response test. To IEC 60255-21-2 Class2 10 g 11ms. Half sine</p> <p>Shock withstand test. To IEC 60255-21-2 Class2 30 g 11 ms. Half sine</p>

EMC/CE	To EN 61000-6-2, EN 61000-6-4 & IEC 60255-26
Protection class	IP 20 To IEC/EN 60529
Material	Plastic headers acc. UL94-V0, Alu-case, steel cover plates
Safety	To EN 61010-1 overvoltage category III, 690 V _{ac} , pollution degree 2

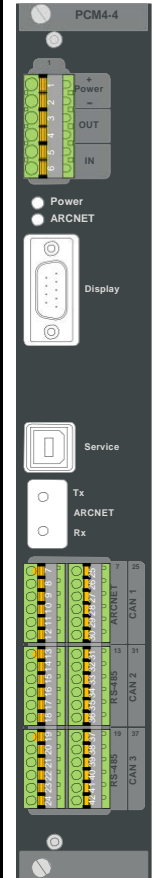
1.3.3 PCM 4.3 module specifications

The PCM 4.3 is the power supply and main control module of the Delomatic 400 system with a module width of 8TE. It is mounted leftmost in the rack. It supplies all other modules in the rack and controls the data exchange on the backplane. Furthermore, it contains the control unit with the application software and communication interfaces.

Power and control module		
	Power supply	Power IN 18...36 V _{dc} , max 6 A
	Output	Digital relay output (NO)/24 V _{dc} 8 A
	Input	Digital input designed for potential-free contacts. Open/Close 5 V/7.5 mA
	Interface	3 x CAN: Independent CANbus lines 125/250 kbps 1 x RS422/485 port: 4,800 – 57,600 Baud 1 x ARCNET port either electrical or optical connection: 2.5 Mbit 1 x Ethernet port: 10/100 Mbit
	Service	USB service interface (DEIF personnel only) 256,000 Baud
	Processor	180 MHz
	Operative system	Linux 2.6
	Storage	64 MB SD RAM 32 Kb non-volatile RAM 16 MB FLASH shared for programme memory and data storage
	Size	8TE (40.64 mm)

1.3.4 PCM 4-4 module specifications

The PCM 4-4 module is typically used as a controller for an extension rack, should one rack be insufficient. The main and extension PCM modules communicate via ARC-Net.

Distributed I/O and field bus controller		
	Power supply	Power IN 18...36 V _{dc} , max 6 A
	Output	Digital relay output (NO) 250 V _{ac} /24 V _{dc} 8 A
	Input	Digital input designed for potential-free contacts. Open/Close 5 V/7.5 mA
	Interface	3 x CAN: Independent CAN bus lines 125/250 kbps 1 x RS422/485 port: 9,600 – 57,600 Baud 1 x ARCNET port either electrical or optical connection: 4,800 – 57,600 Baud 1 x Display port (TTL): 4,800 – 57,600 baud
	Service	USB service interface 256,000 Baud
	Storage	2 MB RAM 32 Kb non-volatile RAM 1 MB FLASH
	Size	8TE (40.64 mm)

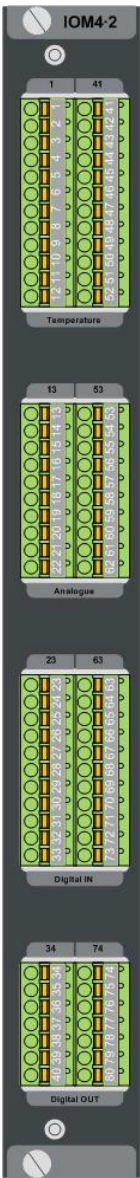
1.3.5 IOM 4-2 module specifications

IOM 4-2 is a highly flexible IO module which holds the most commonly used IO signals. IOM 4-2 is designed for rough environment and all inputs and outputs are protected by optical insulation from other potentials.

40 channel multi-function I/O module with analogue inputs, temperature inputs, digital inputs, frequency counter inputs, analogue outputs and digital outputs			
	12 digital inputs	Input	9...36 V _{dc} or -9...-36 V _{dc} with reference to common.
		Impedance	App. 2.4 kΩ
		Insulation	Optically insulated from other potentials 550 V _{ac}
	4 frequency/digital inputs	Input	9...36 V _{dc}
		Impedance	App. 2.4 kΩ
		Insulation	Each input is optically insulated from other potentials with 550 V _{ac}
		Frequency	0 ... 20 kHz. (Internal frequency divider for frequency >1 KHz)
		Duty cycle	>40 % at 1...20 kHz; >20 % at 500 Hz
		Resolution	0.8 μsec. (1.25 MHz sampling rate.)
	10 digital outputs	Supply	External supply 9...36 V _{dc} .
		Voltage	Voltage drop <1 V according to external supply
		Current	0...200 mA source or sink for each output
		Insulation	Optically insulated from other potentials 550 V _{ac}
Protection		Current limited for short-circuit protection or thermal overload. In case of a short circuit or a thermal overload of the output stages, a signal is generated to the PCM main controller, so the application can take a controlled action.	

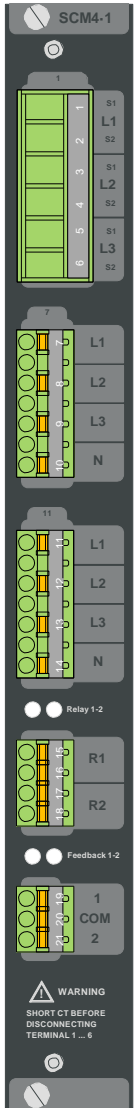
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40 channel multi-function I/O module with analogue inputs, temperature inputs, digital inputs, frequency counter inputs, analogue outputs and digital outputs

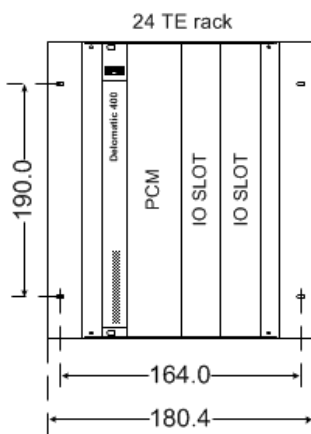
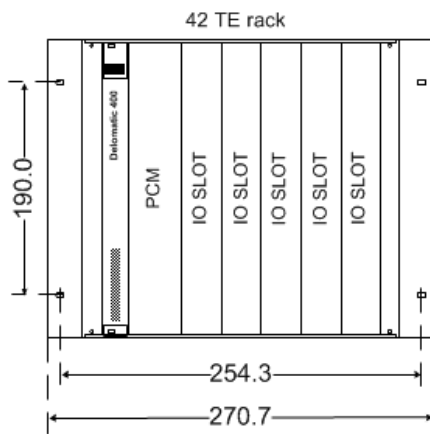
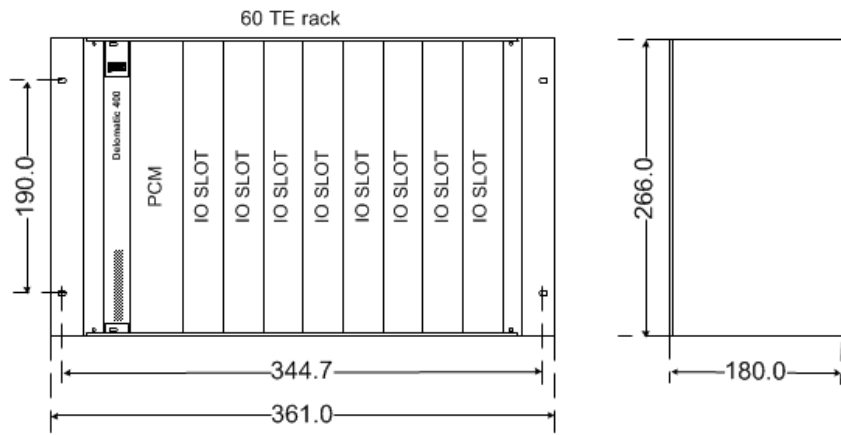
	6 temperature inputs	Sensor type	Pt100, Pt1000 or NiCr-Ni thermocouple sensor
		Range	-50 to 200°C for PT sensors; -50 to 1000°C for NiCr-Ni sensors
		Wire	2-, 3- or 4-wire connection for PT sensors
		Cable error	Open input and short circuit is detected. (Only open for NiCr-Ni sensors)
		Resolution	0.1°K
		Accuracy (4-wire)	0.5°K at reference temperature. 2.0°K at operational temperature.
		Accuracy (2 or 3-wire)	1.0°K at reference temperature. 2.5°K at operational temperature (2-wire only when cables are shorter than 1 m).
		Accuracy (NiCr-Ni sensor)	5.0°K at reference temperature. 20.0°K at operational temperature.
	Insulation	Same potential as analogue inputs and analogue outputs. Optically insulated from other potentials 550 V _{ac} .	
	4 analogue inputs	Input type	-20 mA...20 mA or -10 V...10 V
		Impedance	App. 50 Ω (mA input)/10 kΩ (V input)
		Resolution	16 bit
		Accuracy	0.5 % of full range input (40 mA/20 V) at reference temperature. 1.0 % of full range input (40 mA/20 V) at operational temperature.
		Insulation	Same potential as analogue outputs and temperature inputs. Optically insulated from other potentials 550 V _{ac} .
4 analogue outputs	Output	-20 mA...20 mA	
	Load	0...500 Ω	
	Resolution	12 bit	
	Accuracy	0.5 % of full range output (40 mA) at reference temperature. 1.0 % of full range output (40 mA) at operational temperature.	
	Insulation	Same potential as analogue inputs and temperature inputs. Optically insulated from other potentials 550 V _{ac} .	
	Size	6TE (30.48 mm)	

1.3.6 SCM 4-1 module specifications

The SCM 4-1 module is a class 0.5 AC measurement and protection module which can be fully configured from the main application. All measurements are available for the main application each period. Two relay outputs are controlled, one is a sync check relay, the other a trip relay controlled by the protection functions to secure a fast and reliable disconnection of a generator in case of electrical failures.

3-phase grid and generator voltage and current measurement (Class 0.5) with configurable grid protection features like vector jump ($\Delta\phi$) detection		
	Inputs	2 x direct three-phase voltage inputs (L1, L2, L3, N) 40...70 Hz max 690Vrms direct. Other range by use of voltage transformer/100 or/110 V _{ac} . Load max 0.5 mA or 0.3 VA per phase. Overload: <130 % of Un continuously <200 % of Un for 10 s. External fuse max 2 A slow-blow 1 x three-phase current input (L1, L2, L3) 40...70 Hz current transformer secondary 1 Arms or 5 Arms. Load max 0.4 VA per phase. Overload: 20 Arms continuously, <75 A for 10 s, <300 A for 1 s
	Outputs	2 x digital relay outputs (normally open(NO) for sync check, normally closed (NC) for protections) 230 V _{ac} , max. 8 A
	Certification class	0.5 measurement of voltage, frequency, current, power, reactive power, phase angle Configurable grid protection functions
	Harmonics	Up to 500 Hz measured
	Galvanic separation	3.25 kV isolation between voltage measurement inputs individually and between voltage measurement inputs and all other potentials. 2.2 kV isolation between relay outputs and all other potentials 550 V isolation between digital inputs (feedback supervision) and all other potentials
	Safety	To EN 61010-1 overvoltage category III, 690 V _{ac} , pollution degree 2
	Accuracy	Acc. to IEC 60688 0.5 % at reference temperatures 1.0 % at operational temperatures
Size	6TE (30.48 mm)	

2. Base mounting racks



3. General information

3.1 Disclaimer

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