- Active power per phase/total
- Reactive power per phase/total
- Active and reactive energy counter
- Operating hours
- Circuit breaker operations counter
- Temperatures and pressures at the engine
- Measurement values of the plant

Protection functions:
- Mains protection
- Vector jump
- df/dt (R.O.C.O.F.)
- 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
- 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
- Emergency stop
- 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.)
- Configurable inputs for fault messages (e.g. for digital auxiliary contacts)

User interface:
- 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 shows changes and states of components in graphics
- Operation of the plant
- Maintenance calls after operating hours, adjustable

Control functions:
- Fully automated engine start/stop
- Synchronisation with voltage adjustment and time supervision
- Heating up control
- Speed governor with speed ramping function (no external governor needed)
- Power ramp function for smooth start and stop

- Prerun and postrun of auxiliaries
- Postrun of the engine
- Load reduction function due to receiver temperature, throttle position, room air temperature and exhaust temperatures
- Operation of motorised circuit breakers
- Analogue power setpoint
- Peak shaving
- Heat-controlled operation
- CH4-value-controlled operation
- Gas level- or gas pressure-controlled operation
- Voltage adjustment and CosPhi control
- 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
- Support of a safety chain
- Demand signal to a compressor
- Second gas type selectable

Typical scope of delivery:
- DM-4 Gas hardware
- Touch panel PC if desired
- Example wiring diagram
- I/O list
- List of error messages
- Commissioning check list
- P&ID example
- Handbook

1.2 System components

1.2.1 General description

The whole DM-4 Gas system consists of only three hardware modules. Each module contains its own processor, therefore it works independently.

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

- 24 TE for 2 modules
- 42 TE for 3 to 4 modules
- 60 TE for 6 to 8 modules

A standard configuration for a 12 cylinder engine covers e.g. the following components in a 42 TE rack:

- 1 PCM 4.3
- 1 SCM 4.1
- 3 IOM 4.2

1.2.2 PCM 4.3

The PCM 4.3 is power supply and main control module of the DM-4 Gas system with a module width of 8 TE. 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 the following interfaces:

- 3 CAN interfaces 125...1000 kBd
- 1 RS485 interface 9600...38400 Bd
- 1 ARC-net interface 2.5 MBd
- 1 USB interface
- 1 Ethernet 10/100 MBd
- 1 serial port (9600...38400 Bd TTL) for a GSM modem connection (SMS alarming)

In a plant control system, the module behaves as central control. The application software is located in this module; therefore it determines the overall functionality of the plant.

1.2.3 SCM 4.1

The SCM module is used for the measurement of electrical values and execution of fast protections and control functions. It measures voltages up to 690V AC (three-phase) directly (L1 L2 L3 N generator, L1 L2 L3 N mains/busbar). It performs an independent synchrocheck function, can directly trip the circuit breaker and evaluates the breaker feedbacks. Three-phase currents are captured via CTs (1 A or 5 A sec). The SCM module offers a certified measurement of voltage, current, frequency, active power, reactive power and phase angle at class 0.5 between 40 and 70 Hz.

The measurements are transferred to the PCM module once per period. Further protection functions are located, trending and logging as a part of the application software.

1.2.4 IOM 4.2

The IOM is a multi-functional I/O module for connection of different sensor types. It also interfaces to other systems by standard analogue and digital signals. The module offers:

- **6 inputs for Pt100 or Pt1000 sensors** in 2-, 3- or 4-wire technique, or **6 thermocouples type K (NiCr-Ni)**.
- **4 analogue inputs** 0(4)...20 mA with 12 bits resolution.
- **4 analogue outputs** for transducer signals or setpoint signals, burden up to 500 Ohms, output range -20...+20 mA, resolution 10 bits for connection of speed governors, AVRs or frequency converters.
- **12 digital inputs**, 9…36V DC with common potential for sensors switching to plus or minus.
- **4 individual galvanically separated digital inputs**, 9…36 V, for RPM sensor input or pulse signals (1.25 MHz sampling rate).
- **10 digital outputs** with external power supply 9…36V DC, push-pull outputs with a stable operation against GND and against supply voltage up to 200 mA continuously. The outputs are short-circuit protected and furthermore protected against thermal overload.
- Each board possesses an own galvanic separation between analogue I/O, digital I/O and internal potential. This avoids loops through several boards.

1.3 User interface

1.3.1 User interface description

The DM-4 Gas system shows a unique user interface that allows running the operating terminal function on any standard Windows PC like industrial touch-panel PCs and laptop computers. All possibilities for local and remote access wire-less or wire-bound are available using Ethernet or USB connection to the PCM module.

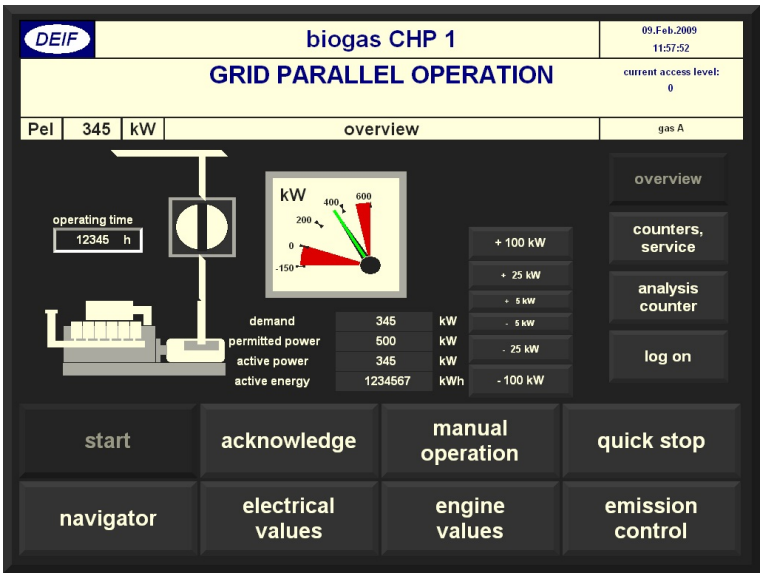
If several users are online at the same time, they see the same user interface, each one on his own computer. The remote start can be blocked by a manual switch on the switchboard panel door for safety reasons. This way - during maintenance - the remote access allows for diagnosis and visualisation, but the start can only be performed locally.

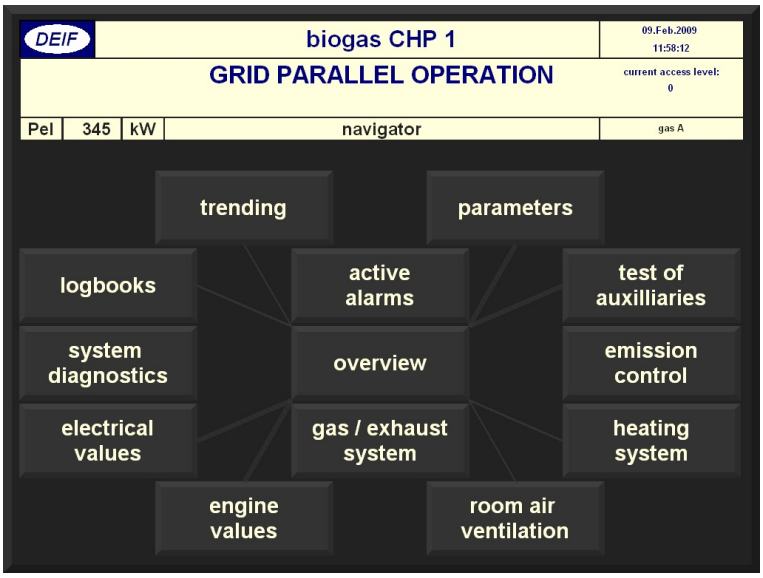
The user interface uses a browser principle with universal, plant-independent browser software. The information that has to be displayed is therefore defined on application level. Because of this principle, the data is always consistent. The PCM module is the "Server", whereas the different users are "Clients".

Buttons on the fully graphical user surface allow easy access to all visualisation pages. The pages are grouped by themes and can be reached fast and easy either using the menu structure or a central navigator. The status field is structured in the same way on all pages. It shows the state of the plant and - if active - the most important error message. Graphical elements like remote position indicators, bar graphs, pointer instruments for electrical values (kW, A, V, CosPhi) give a full overview of the occurrences that take place at engine, generator, mains and plant.

The protections are visualised on special diagnostic pages together with the actual states, measurements, limits and running timers.

1.3.2 User interface examples

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emission control
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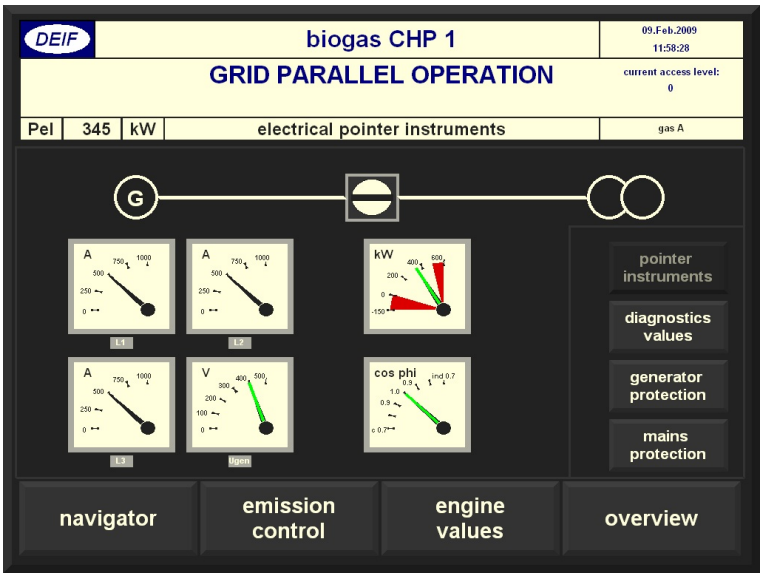
gas / exhaust system
heating system
engine values
room air ventilation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pointer instruments
diagnostics values
generator protection
mains protection
navigator
emission control
engine values
overview

2. Technical information

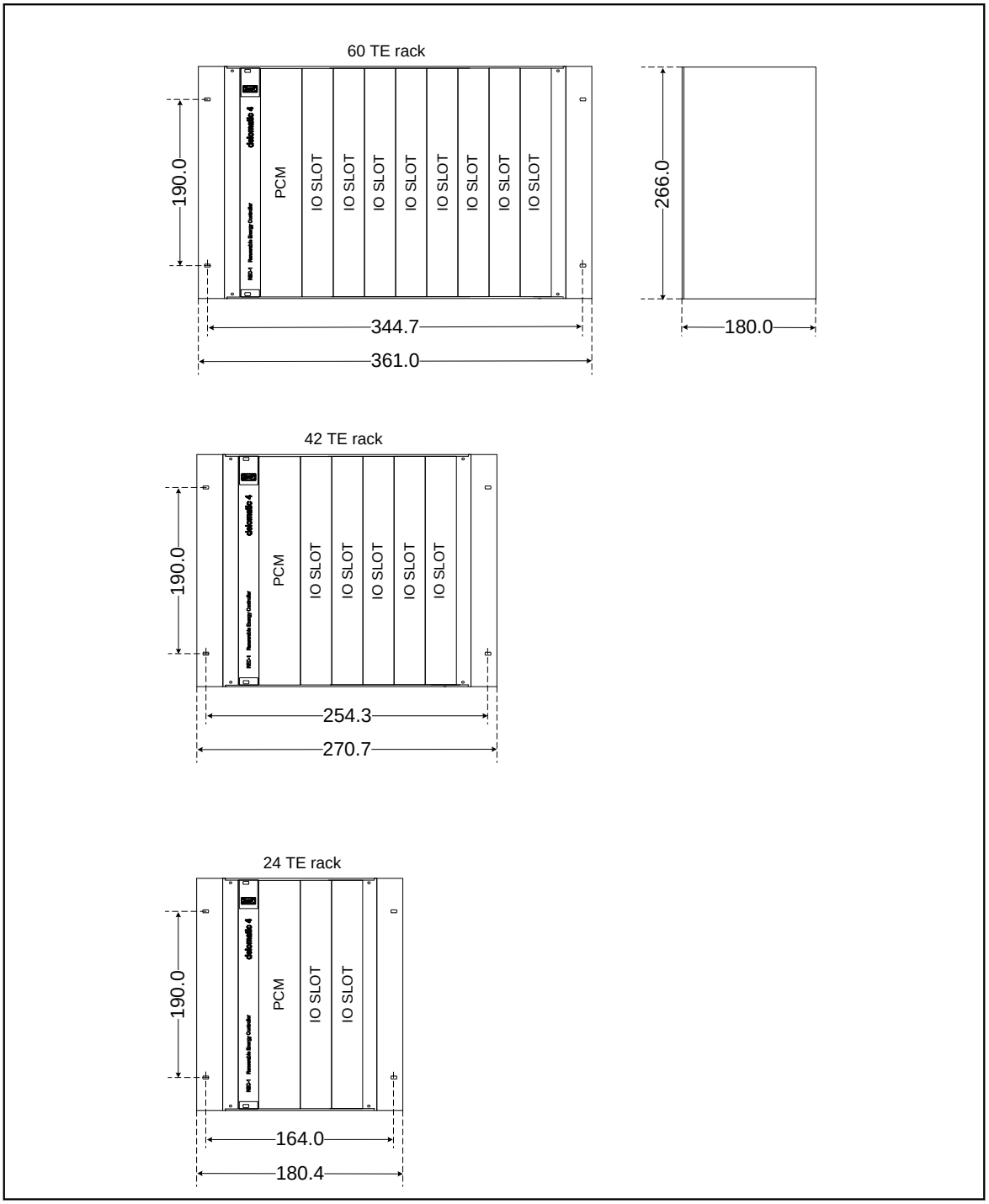
2.1 Data, dimensions and disclaimer

2.1.1 Technical data

Rack system	
Operating temp.:	-25…70°C (-13…158°F)
Vibration class:	DNV A+C 3 mm: 3.0… 13.2 Hz, 2.1 g: 13.2…50 Hz, 0.7 g: 50…100 Hz
Protection class:	IP 2x Higher class by application of standard housing for DM-4 racks
Climate:	Class E according to DIN 40040
Mounting:	Vertical
EMC/CE:	To EN 61000-6-V2/3/4, SS4631503 (PL4)
Material:	Plastic headers according to UL94-V0, Al housing, steel front plates
Connectors:	Phoenix Cage clamp terminals 6/8/20 Arms Screw terminals 20 Arms
Weight:	Depends on configuration
PCM 4.3 module	
Aux. supply:	18…30V DC Max. 6 A
CAN:	3 independent CAN interfaces 125…1000 Mbps Terminals for loop through and termination
RS485:	1 interface up to 38400 Baud, terminals for loop through and termination
SCM 4.1 module	
Safety:	To EN 61010-1 Overvoltage category III 690V AC Pollution degree 2
Meas. range (Un):	Up to 690 Vrms directly Other ranges after adaptation by VTs ../100 or ../110V AC Burden max. 0.5 A per phase Overload max. 2*Un tolerated for 10 s External prefuse max. 2 A time-lag

Meas. range (In):	Current transformer ../-1 Arms or ../-5 Arms Burden max. 0.4 VA per phase Continuous overload 10 Aeff, <75 A - 10 s < 300 A - 1 s
Galvanic separation:	2.5 kV isolation between voltage tips and all other potentials
Frequency:	40…70 Hz
Accuracy:	Class 0.5 according to IEC 60688
Harmonics:	Up to 500 Hz are measured
IOM 4.2	
Digital inputs:	9…36V DC, input resistance type. 2.4 kOhm, common reference potential + or -, inputs galvanically separated from other potentials (600 V)
Frequency inputs:	Same as digital inputs, but with 2 terminals per input Frequency max. 20 kHz pulse-pause ratio > 40% Frequency below 10 kHz, pulse-pause ratio >20%
Accuracy:	Class 1.0
Analogue inputs:	0(4)…20 mA, input impedance type 50 Ohm, galvanically coupled to the analogue outputs, Pt100 inputs and thermocouple inputs, galvanically separated from the rest of the system (600 V rms)
Accuracy:	16 bit, better than 0.5% of the full range (40 mA) over the entire temperature range
Pt100 input:	2-, 3- or 4-wire Pt100 or Pt1000, wire break and short-circuit detection
Measurement range:	-40...+200°C
Accuracy:	+/- 0.5 K over the full measurement range with 4-wire connection, +/- 1 K with 3- or 2-wire connection, if cable length less than 1 m
Thermocouple input:	2-wire thermocouple type K (NiCr/Ni)
Measurement range:	0 ...1000 K more than cold junction, temperature compensation by measurement of the cold junction with a single Pt100 sensor in the whole system
Accuracy:	+/- 5 K (@ 500...750°C), +/- 10 K (@ -20...500°C)
Analogue outputs:	-20 mA … +20 mA, burden up to 500 Ohm
Accuracy:	10 bits, better than 0.5% of full range (40 mA) over the entire temperature range
Digital outputs:	Output voltage 8…35V DC with external supply 9…36V DC Output current 0..200 mA (source and sink) Short-circuit protection by current limitation Short-circuit proof. In case of short-circuit or thermal overload, the outputs will be disabled and an error message will appear

2.1.2 Unit measurements in mm



2.1.3 Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.