

PCM1 Automatic Gen.-set Controller/AMF Controller



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The automatic Engine/Generator Controller

USE

Gen.-set island mode
AMF (automatic mains failure) and peak load operation in parallel with the mains
CHP (combined heat and power)

ENGINE MANAGEMENT

Start-stop-logic for diesel and gas engines

MEASURING VALUES

Voltage, current, frequency (speed), active power, reactive power, $\cos\phi$, temperature

COUNTER

KWh, running hours, maintenance call, start of genset

MONITORING and PROTECTION

Voltage, current, frequency, temperature, phase-shift, reverse/reduced power, load imbalance, overload, short circuit

AUTO MAINS FAILURE

with logic for mains-generator-change-over

SYNCHRONIZATION

Adjustment of frequency and voltage for no-break-transfer of connected consumers from mains to generator and vice versa, for operation in parallel with the mains and for isolated parallel operation.

AUTOMATIC CONTROL

Frequency/speed, voltage, soft-loading, soft deloading, active power, $\cos\phi$, load-/var sharing, start/stop for CHP-plant in dependence of the temperature.

POWER MANAGEMENT

automatic start/stop in dependence of the import/export power, generator power or temperature (for up to 8 gensets)

EXTENSIONS

Extension modules are available (intelligent terminals) for additional digital inputs and relay outputs

INTERFACES/BUSES/PROTOCOLS

RS232, RS485 MOD bus slave*, CAN bus, Profibus DP*, modem*
(* via external gateway PCK5)

RECORDING/

REMOTE MONITORING/CONTROL/ PARAMETERIZATION

Event and alarm recorder with real time clock in FIFO-mode.

Remote monitoring, control, parameterization via PC or Laptop (direct) or PC/Laptop/PLC/SCADA (via external gateway PCK5)

1 Overview

1.1 Basics

The multiprocessor system *PCM1*, is designed for power and heat generating plants and includes all functions - **control, monitoring, operating and display** - for the control of an engine driven genset, in isolated operation or operation in parallel with the mains. It acquires the necessary data (without external measuring transducer) and indicates them via an two line / 16 character display. The values of setpoints, status and alarms are displayed in plain text, the measuring values are displayed in primary quantities (VDE 0108). Up to 8 *PCM1* can be linked. The use of the *PCM1* reduces the space required in the switchboard provides ease of installation. The operation of the plant will become more user-friendly and safer, the availability of the plant increases. Monitoring of the readiness for operation is effected by cyclical self tests with redundant failure recognition.

The internal **relay manager** permits the free allocation of the internal status and their connection to output relays. The digital **alarm inputs** can be freely parameterized (name of alarm, time delay, open-circuit or closed-circuit signal input and alarm class). In addition, it is possible to scale and monitor the limiting values of **analog inputs** (Pt100, 0/4..20 mA). The analog output manager allows to allocate and scale the analog output(s) 0/4..20 mA of a value measured by the unit. The *PCM1* can be equipped with **analog controller outputs** 0/4..20 mA for speed and/or voltage adjustment instead of dry type change over contact outputs. This allows direct triggering of engine speed governors and generator voltage regulators.

The optional **event recorder** (FIFO) and the optional **real time clock** enable the recording of important changes in status, alarms and appropriate time. These can be displayed e.g. after an unplanned stop of the genset. For international use, plain text can be displayed in english instead of german by means of the **language manager**.

1.2 Extensions

The data transfer to higher levels is handled by **interfaces and buses** (RS232, RS485, MODBUS^{RTU slave}, CAN bus and PROFIBUS^{DP}) by means of the Gateway **PCK5***. The unit can be parameterized directly from a PC or Laptop, by using the units serial port, or from remote from a PC/Laptop, PLC or SCADA system via **Gateway PCK5***. If the **PCK5*** is used, up to 8 *PCM1* can be remotely parameterized, monitored and controlled.

Two different types are available:
 PCM1-G for 1-CB-systems (e.g single Gen.-Sets)
 PCM1-M for 2-CB-systems (e.g. AMF-Sets)

* To be ordered separately
 ** on request

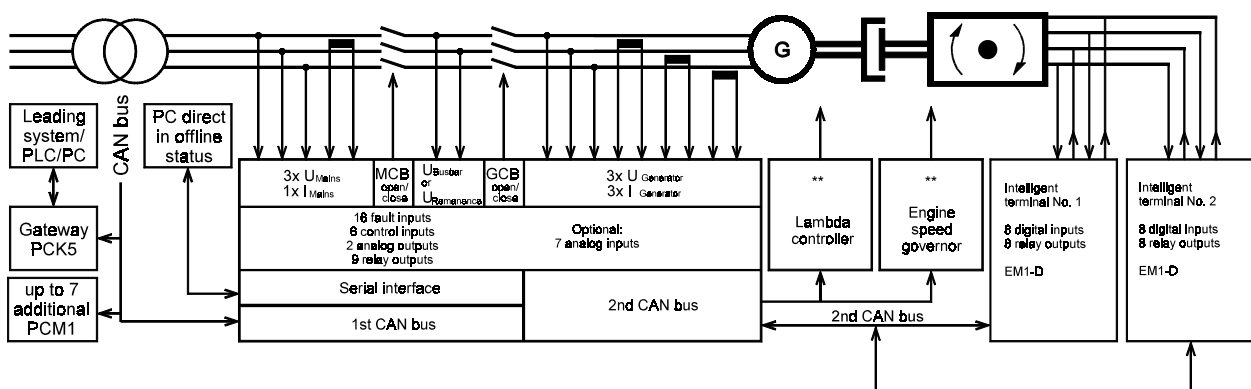


Figure 1.1

2 Features

2.1 Operating Elements

- Automatic, test and load test modes, manually, stop and acknowledgement
- Manual start and manual stop
- Change of setpoint value for P, U, f, $\cos \varphi$
- Push-buttons for parameterization and to fetch the operating, status and alarm messages
- Coding levels with access authorization
- Assignment of releases via passwords

2.2 Auto Engine Start/Stop, Alarm Message System

- For one genset, adjustable for diesel, vegetable oil or gas engines
- 16 freely parameterizable alarm inputs (Parameter: name, close circuit/operating current, alarm class, time delay, engine delay)
- 7 freely parameterizable relay outputs

2.3 Measuring values

Voltage	$U_{Gen1/1N/12N/13N/112/123/131}, U_{SS1/2}, U_{Batt}, U_{Rem}$
Current	$I_{Mains1/1N/12N/13N/112/112/131}$
Frequency	$f_{Gen1}, f_{Busbar}, f_{Mains}$
Power	$P_{Gen}, P_{Import/Export}, Q_{Gen}, \cos \varphi_{Generator}$
Current slave pointer	

2.4 Counter Functions

- Engine start counter
- Running hours counter
- kWh counter
- Maintenance call counter

2.5 Automatic Control

- Frequency controller
- Voltage controller
- Power factor $\cos \varphi$ controller
- Constant generator power controller and import/export power controller including part-load lead for genset heating
- Load/var sharing between up to 8 gensets in isolated operation or in operation in parallel with the mains
- Automatic start/stop of one or several gensets in dependence of the import/export power in operation in parallel with the mains or the generator power in isolated operation

2.6 Engine/Generator Protection

- Generator overload monitoring
- Generator reverse power monitoring
- Generator reduced load monitoring
- Generator load imbalance monitoring
- Generator over-/undervoltage monitoring
- Generator over-/underfrequency monitoring
- Engine overspeed monitoring
- Independent overcurrent time protection
- Battery voltage monitoring
- Circuit breaker monitoring

2.7 Mains Failure Recognition

According to VDEW rule: (mains decoupling adjustable via GCB or MCB)

- Mains over-/undervoltage monitoring
- Mains over-/underfrequency monitoring
- Vector surge or optional phase shift monitoring

2.8 Operation Modes/power circuit Breaker Logic

- AMF automatic mains failure/stand-by logic: voltage monitoring for assessment of a mains failure (operating time approx. 300 ms) as well as start logic for the genset and add-on logic for the circuit breaker to the dead busbar
- Reverse synchronization of the busbar to the mains after their return
- Isolated operation logic with voltage and frequency control via three-position controllers
- Logic for a constant or import/export power control in parallel to the mains for peak load operation
- Mains protection according to VDEW
- ATS automatic transfer switching
- No-break transfer (overlapping synchronization) for non-interrupted supply of the busbar
- Softloading (power down before opening CB)
- External operation of the power circuit breakers

2.9 Special Features

- Language manager for access/display texts
- PC direct parameterization via RS232 service interface (the direct parameterization cable PCM1-RS232 is necessary and must be ordered in addition (the parameterization PCx/MPU-Soft software will be supplied together with the PCx/MPU-RS232)

2.10 AMF/Isolated Operation Logic

- Switching from mains to generator supply after the mains fail (AMF) and after return of the mains from generator to mains supply
- Black busbar start: in isolated operation, the signal "GCB close" is given after having reached the adjusted speed/frequency and the voltage for switching to the black busbar

2.11 Synchronization

- Permanent or impulse output "GCB close" for synchronization of the generator to the busbar
- Connect impulse "MCB close" for non-interrupt re-synchronization of the busbar
- Adjustment of frequency and voltage with one three-position controller each (or optionally with analog controller outputs)
- Lead angle calculation by the close time and the differential frequency for optimum connection to the black busbar
- Isolated operation with automatic control of the rated voltage and the rated frequency
- Selectable synchronization logic
- Switching black to the busbar GCB/MCB
- Rapid reclosing relay function (switch ON the MCB to the black busbar after the mains returns)

2.12 Connection Logic

- for the generator power circuit breaker
- Output of the signal "GCB close" after the adjusted frequency of the higher-level network is reached
- Acquisition of frequency via the remanence voltage of the non-excited synchronous generator

2.13 Data In/Output

- One 0/4..20 mA input for measuring the mains interchange power
- Three inputs PT100
- Two analogue outputs (0/4..20 mA) incl. assignment manager

Customer specific applications upon request

3 Alternative control outputs

Analog controller outputs alternatively to the contact outputs for direct control of an external engine speed governor and/or external generator voltage controller.
Versions (free selectable) 4..20 mA, 0..20 mA
Controlling of (n ±), (P ±), (U ±), (Q ±)

4 High end modules

High end modules are equipped with the following additional features.

4.1 Analogue inputs

7 analog inputs instead of 4 analog inputs with internal measuring transducer plus 2-step limit-value monitoring:

- 5x Pt100 input in 2-/3-wire system instead of 3x only
- 2x 0/4..20 mA measuring input instead of 1x only

4.2 Automatic Start/Stop

- Temperature dependent start/stop of one or several gensets (Pt100 measuring input)

4.3 Data input/output

- Software for connection of an external interface converter (Gateway) PCK5 to connect remote parameterization, monitoring and control systems (CAN/MODBUS_{RTU}/PROFIBUS_{DP}/RS232 with SEG Standard Protocol SDP/Modem)

4.4 System Extensions

- Event recorder with real time clock for up to 50 events, with FIFO-mode.

5 Technical Data and Dimensions

Measuring values	<ul style="list-style-type: none"> - Measuring voltages - Measuring currents - Measuring frequency - Accuracy 	[1] 100..115 V _{AC} , [4] 380..440 V _{AC} ../1 A, ../5 A 40.0..70.0 Hz Class 1
Ambient variables	<ul style="list-style-type: none"> - Power supply - Ambient temperature - Ambient humidity 	9.5..32 V _{DC} , Intrinsic consumption max. 15 W -20..70 °C 95 %, non-condensing
Measuring inputs	<ul style="list-style-type: none"> • Voltage <ul style="list-style-type: none"> - Continuous input voltage - Linear measuring range up to - Input resistance - Maximum power consumption per path • Current <ul style="list-style-type: none"> - Maximum continuous current - Power consumption - Rated short time current (1 s) 	Resistances 0.1 % $2.0 \times U_N$ $1.3 \times U_N$ [1] 0.21 M Ω , [4] 0.7 M Ω 0.15 W metalically separated $I_{Gen} = 3.0 \times I_{N'}$, $I_{Mains} = 1.5 \times I_N$ < 0.15 VA [..1/A] 50.0 $\times I_{N'}$, [../5 A] 10.0 $\times I_N$
Discrete inputs	<ul style="list-style-type: none"> - electrically isolated - Input range - Input resistance ca. 	4..40 V _{DC} 6.8 k Ω
Potential-free outputs	<ul style="list-style-type: none"> - electrically isolated - Contact material - Electric service life (ohmic load) - Load - Maximum switching voltage - Maximum switching voltage DC 	AgCdO min. 100,000 switching cycles at 2 A / 250 V _{AC} maximum 2 A for 250 V _{AC} or 24 V _{DC} 250 Vac or 24 V _{DC} 45 W
Analog inputs	<ul style="list-style-type: none"> - Freely scaleable - Pt100/Pt1000 Input - 0/4..20 mA input 	resolution 10 Bit for measuring resistances according to IEC 751 2/3-conductor measurement, 0..200 °C, Difference measurement, load 150 Ω
Analog outputs	<ul style="list-style-type: none"> - at rated output - Resolution PWM - 0/4..20 mA output - 0..10 V/±5 V output 	freely scalable, electrically isolated, insulation voltage 3,000 V _{DC} 0..5 V, ±5 V, 0..10 V, 0..20 mA 8/12 bit (depending on model) maximum load 500 Ω internal resistance • 1 k Ω
Interface	<ul style="list-style-type: none"> - electrically isolated - Version 	insulation voltage 3,000 V _{DC} variable
Housing	<ul style="list-style-type: none"> - type - Dimensions (BxHxT) - Front cutout (BxH) - Connection - Weight 	APRANORM DIN 43 700 144 × 144 × 118 mm 138 × 136 mm 1.5 mm ² or 2.5 mm ² screw terminals depending on the plug connector depending on model, ca. 1,000 g

Protection

- Degree of protection IP 21
- Front foil insulating surface
- Disturbance Test (CE) tested in accordance with valid EN Guidelines

DIN EN 50 081-2

Electromagnetic compatibility (EMC), Generic Emission Standard,
Part 2: Industrial Environment

DIN EN 50 082-2

Electromagnetic compatibility (EMC),
Generic Standard, Immunity Part 2: Industrial Environment

DIN EN 61000-4-2

Electromagnetic compatibility (EMC), Part 4 – Testing and measurement techniques –
Paragraph 2 - Electrostatic discharge immunity test.

DIN EN 61000-4-3

Electromagnetic compatibility (EMC), Part 4 – Testing and measurement techniques –
Paragraph 3 – Radiated, radio-frequency, electromagnetic field immunity test.

DIN EN 61000-4-4

Electromagnetic compatibility (EMC), Part 4 – Testing and measurement techniques –
Paragraph 4 – Electrical fast transient/burst immunity test.

DIN EN 61000-4-5

Electromagnetic compatibility (EMC), Part 4 – Testing and measurement techniques –
Paragraph 5 – Surge immunity test.

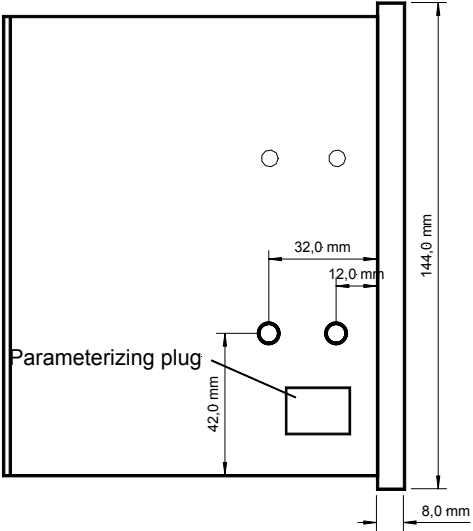
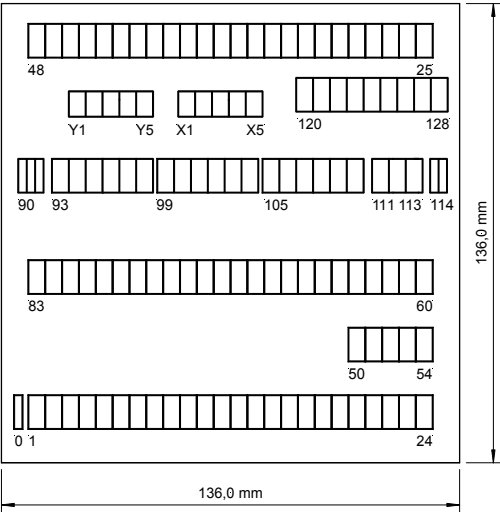
DIN EN 61000-4-6

Electromagnetic compatibility (EMC), Part 4 – Testing and measurement techniques –
Paragraph 6 – Immunity to conducted disturbances, induced by radio-frequency fields.

EN 55 011

Industrial, scientific and medical radio-frequency equipment (ISM Devices);
Radio disturbance characteristics – Limits and methods of measurement.

Dimensions





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