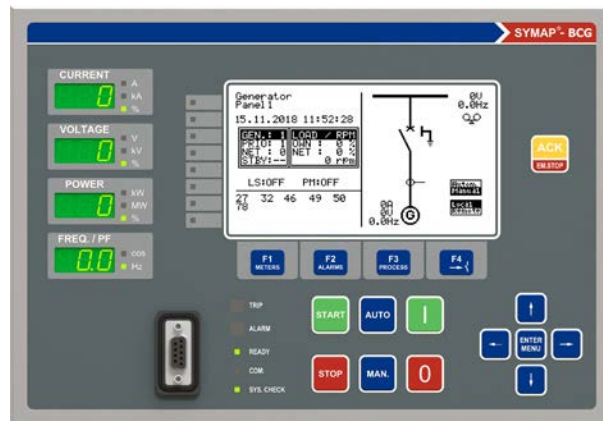


Power solutions. Worldwide.
Made in Germany. Since 1968.



SYMAP®

Digital Protection Relays



Experienced in
maritime and offshore
applications

IEC 61850
KEMA
certified





stuckeGROUP offers

- innovative, robust, reliable, state-of-the-art products and solutions
- customizable, flexibly programmable and expandable devices
- service and support during the entire product lifecycle
- worldwide service through partnership network
- high-quality products designed and manufactured in Germany
- product training
- consulting and project management



stuckeGROUP

Assuring the availability of energy on land and at sea as well as safe energy supply solutions through network protection and control systems – this is what stuckeGROUP products and solutions offer.

Made in Germany – we manufacture our products, including development, exclusively in Hamburg. Our multifunctional protection and control systems offer engine control as well as comprehensive protection functionalities for generators, motors, transformers and other feeder lines, besides distance line differential and grid protection. Functionalities include power management, DP system logics, arc protection, reactive power undervoltage protection, grid decoupling and power plant control for low, medium and high voltage systems, for gas and diesel engines, gensets and power units as well as hybrid systems. They stand out for reliability and longevity, and we hold spare parts for all product generations on stock.

Our customers are for example system integrators, shipyards, shipowners and -managers, designers, owners and operators of power plants, sites for generation of renewables or of emergency energy systems. Customer focus, a profound understanding of customer needs and prompt availability are important for us.

The project department offers our customers planning, design, production, installation and commissioning of complete and tailor-made switch and control cabinets for low and medium voltage solutions.

Our company is certified according to DIN EN ISO 9001 and 14001.



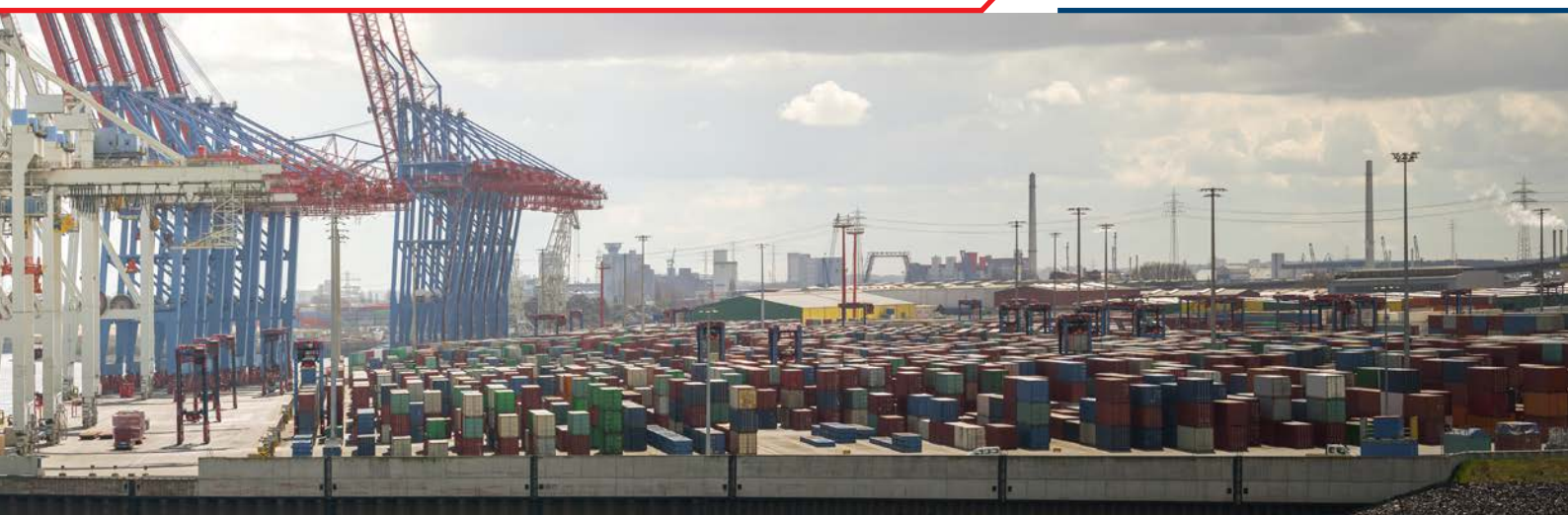
Our customers

- maritime industry
- offshore companies
- power supply and power distribution companies
- engine manufacturers
- low and medium voltage switchboard manufacturers
- genset suppliers (design and manufacturing)

For diesel and gas engines we develop, design and manufacture control systems for single and multiple generator systems, for generator and network protection as well as multifunctional protective relays for low and medium voltage installations. We can provide you with electrical engineering such as CAD design, turn-key solutions and the production and installation of control systems for on- and offshore applications.

Development and supply of

- diesel automation systems
- generator protection systems
- hybrid-powered electrical networks
- mains protection systems
- power management control for multi-generator sets
- multifunctional protection relays
- marine- and land-based power station controls
- emergency power plant stations
- hydro-stream turbine control
- gas engine control



SYMAP® series have type approvals
from the following classification societies:

Lloyds Register	LR
American Bureau of Shipping	ABS
Det Norske Veritas	DNV
Bureau Veritas	BV
China Classification Society	CCS
Polski Rejestr Statkow	PRS
Nippon Kaiji Kyokai	NPK
Registro Italiano Navale	RINA
Korean Register	KR

Additional:

Conformité Européenne	CE
V-Check	KTC
IEC61850 Certificate	KEMA

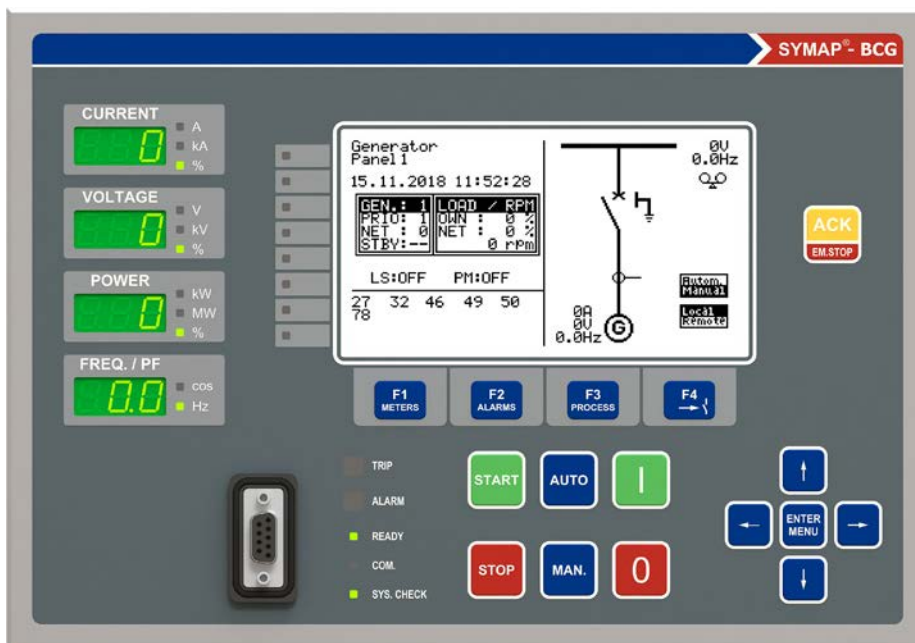
Product overview

SYMAP® is a flexible microprocessor-based digital protection device for use in low, medium and high voltage power systems.

Because of its integrated protection functions and human machine interface capabilities it is an efficient and cost-effective solution for all types of switchboards. With three powerful microprocessors SYMAP® offers comprehensive protection functions for generators, motors (synchronous and asynchronous), transformers, power lines and distributions.

All protection functions can be activated simultaneously. With SYMAP® five main breaker controls can be activated with all necessary functions such as display, control and blocking for optimal breaker management. A small integrated PLC allows individual functionality, such as interlocks from controlling functions. For flexibility in commissioning and during use, both digital and analog outputs can be used to connect the SYMAP® control unit to main switchboard controls. Additionally, a variety of serial interfaces with different kinds of protocols can be used for communication between SYMAP® units and the central control system.

For diagnostics and monitoring, SYMAP® has three microprocessors that supervise each other, providing a watchdog system. Important functions are laid out in a double redundancy combination, operating independently with the second processor. Connected separately, an optional unit for short circuit protection operates parallel to the SYMAP® device and will do so even if the entire voltage fails.



**DNV Cyber Secure Essential
Type Approved**

Human Machine Interface

SYMAP® is easy to program and operate. A large graphic LCD with optional LED indicators conveys important data such as position of all connected breakers, parameter settings, and event histories at a glance. Graphics and measurements are displayed side-by-side on the LCD, so that the user does not have to switch between pages.

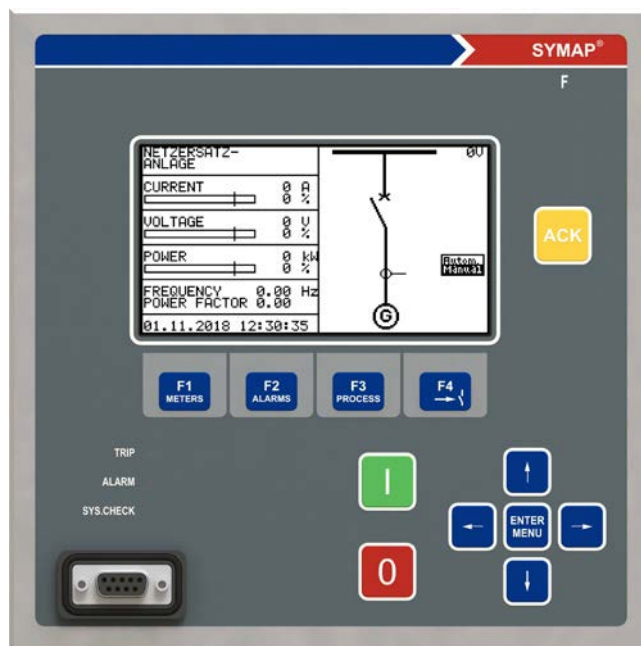
The entire programming of SYMAP® can be done with the keys on its front panel or by using a notebook. Using a notebook offers the advantage that stored parameters can easily be applied to other SYMAP® units. Either way, easy programming is guaranteed and on-site visits by the manufacturer's engineers during commissioning is not required.

SYMAP® provides four hotkeys placed underneath the LCD to access four main groups of values, namely »Meters«, »Alarm«, »Process« and »Breaker Control«. The user can press the hotkeys to scroll through pages of information.

The hotkey »Meters« provides detailed information on electric measurement values, counters for active and reactive power and working hours. The hotkey »Alarm« displays all active alarms, event log and blockings. »Process« shows all process data such as the synchronization display, motor thermal indication and a counter of breaker operations. Under »Breaker Control«, up to five breakers can be accessed and controlled.

When programming breaker controls the user has access to various layout configurations via a library. Programmed blockings remain active when manual control of the breaker is used. Each of the highlighted breakers in the LCD can be further controlled by the keys »0« and »I«.

For security, access to SYMAP®'s parameter and breaker control data is protected by a code system, accessed by a password.



Features and interfaces

Terminal connections

All connections to SYMAP® are made with terminal plugs on the back of the device, allowing the device to be exchanged easily.



Analog input for measurement

SYMAP® provides inputs for analog sensors at the rear of the device. If terminal plugs for the CTs are disconnected, the circuits will be linked automatically so there is no disconnection in the CT circuit loops.

A total of 17 analog inputs for current and voltage transformers are used for protection functions. The following list shows possible connections for current transformers (CT) and potential transformers (PT):

- 3 x CT inputs for feeder current
- 1 x CT input for ground current
- 3 x PT inputs for feeder voltage
- 3 x PT inputs for 1st bus bar voltage
- 3 x PT inputs for 2nd bus bar voltage
- 1 x PT input for ground voltage

Communication

SYMAP® can serve as the main bay controller for the power management system or substation system. The following list shows the station system items available through SYMAP®:

- remote supervision
- remote control
- remote parameter setting
- central registration of measured and calculated values
- central event logging
- central fault recording, analysis and logging
- plant power management

Communication interfaces

SYMAP® provides communication ports available with the following interfaces and protocols:

- 1 x RS 232 on the front panel for programming and data output
- 1 x RS 422/485 port
- 1 x PROFIBUS DP (RS485 or fiber optic port)
- MODBUS RTU
- MODBUS TCP (RJ45 or fiber optic port)
- IEC 60870-5-103 (RS485 or fiber optic port)
- IEC 61850 (RJ45 or fiber optic port)
- CANBUS 1 (communication between devices as power management system, breaker control interlocking)
- CANBUS 2 (engine control interface: MTU, VOLVO, DEUTZ etc.)

Extension boards (optional)

One type of extension board can be connected to SYMAP® at a time to provide additional in- and output channels.

The following extension boards are available (in addition to the standard I/O of the main device):

	SYMAP®Y	SYMAP®BC-BCG
CMA 216		
	18 DI + 18 DO	24 DI + 24 DO
CMA 216+237		
	18 DI + 18 DO	24 DI + 24 DO
	8 AI + 8 AO	8 AI + 8 AO
CMA 238		
	8 AI	8 AI

CMA 215 – High current relay card

One channel relay card converting input channel to 12V (max. 60V) / 40A output contact for direct controls of start/stop or other solenoid valves.

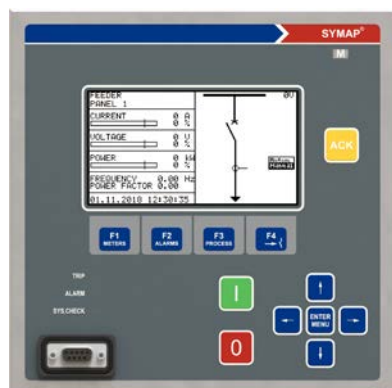
CMA 198 – Current-fed short circuit redundancy

An optional safety device is available by applying the extension board CMA 198 to realize a self-powered and redundant short circuit protection independent of a SYMAP® unit. The board is available in three versions:

- CMA 198A: 1A secondary rated current; 3-phase (short circuit setpoint (Amp) x In: 2.0 – 7.0 x In)
- CMA 198B: 1A secondary rated current; 3-phase (short circuit setpoint (Amp) x In: 1.2 – 3.5 x In)
- CMA 198C: 5A secondary rated current; 3-phase (short circuit setpoint (Amp) x In: 2.0 – 7.0 x In)

Detailed protection function history

SYMAP® automatically collects and stores all activated events related to protection functions with a time stamp. A maximum of 1,000 protection function events can be stored. In case of overflow, overwriting follows the FIFO principle.



Event history

SYMAP® automatically collects and stores all activated events with their number, title, appearing and disappearing status and a time stamp. A maximum of 5,000 events can be stored. In case of overflow, overwriting follows the FIFO principle. The event history can be transferred to a PC and evaluated by a PC tool. Regardless of power supply, the data store is permanent.

Data recorder (optional)

The data recorder can log analog inputs, digital inputs, and digital outputs. The recorder has the following settings:

- number of samples (6-72)
- recording period (5-60 sec)
- pre-trigger (0-100%)
- trigger event (start for recorder)
- trigger event (stop for recorder)

The recording period depends on the number of samples. The recorder can be set with the pre-trigger to record event data even before the event happens.

Stopping the recorder can be triggered by either an event or a preset time. For easier management and trouble-shooting, event data can be transferred and analyzed. The data transfer is made by a link through a plug on the front panel of the SYMAP® device.

Diagnostics and monitoring

SYMAP® provides various diagnostic and monitoring functions:

- all memories (ROMs, RAMs, EEPROMs)
- all analog reference voltages
- automated test sequences
- control power ON/OFF
- binary input and output for control logic

The following supervising systems are offered by SYMAP®:

- self-diagnostics
- inputs of analog data (auxiliary circuit)
- status and position of switching device and motor's on-off status
- supervising supply of trip coil
- gas pressure
- temperature inside panel
- each operating life of breaker (hours)

SYMAP® series offer the following versions:



SYMAP®Y (EC, ECG, F, G, M, T, LD, DC, BAT)

Relays with power management and diesel automation:

- EC engine control*
- ECG engine control & generator protection*
- F feeder protection*
- G generator protection*
- M motor protection*
- T transformer protection*
- LD line differential protection*
- DC DC protection*
- BAT battery applications (hybrid energy sources)



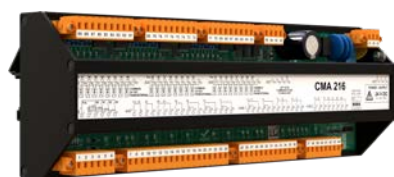
SYMAP®BC (BC, BCG)

Relays with power management, diesel automation and differential protection:

- BC multifunctional protection relay*
- BCG multifunctional protection relay, power management*

*see hardware and software capabilities

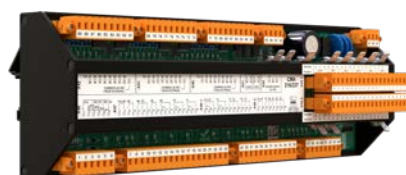
Extension boards



CMA 216



CMA 238



CMA 216+237



CMA 198



CMA 215

[illegible]

Software capabilities

SYMAP®		Y										BC	
Device variants		EC	ECG	T1	T2	T3	M	G	F	LD	DC	BC	BCG
Protection Functions (continued)													
87G/M	Generator/Motor differential	–	✓ ³	–	✓	✓	✓	–	–	–	–	✓	✓
87LD	Line differential	–	–	–	–	–	–	–	–	✓	–	–	–
87N	Restrict earth fault relay	–	✓ ²	–	✓	✓	–	–	–	–	–	✓	✓
87T	Transformer differential	–	–	–	✓	✓	–	–	–	–	–	✓	✓
94	Trip circuit supervision	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
95i	Inrush blocking	–	–	✓	✓	✓	–	–	✓	✓	–	✓	✓
FL	Fault locator	–	–	✓	–	–	✓	✓	✓	✓	–	✓	✓
Control & Interlocking													
Indirect control: 5 switching elements (SE); Field interlocking: up to 5 SE)		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Power Management													
Load sharing / asymmetrical load control		–	✓	–	–	–	–	✓	–	–	–	–	✓
Frequency controller		✓	✓	–	–	–	–	✓	–	–	–	–	✓
Voltage controller		✓	✓	–	–	–	–	✓	–	–	–	–	✓
Power factor controller		–	✓	–	–	–	–	✓	–	–	–	–	✓
Load controller (big consumer)		–	✓	–	–	–	–	–	–	–	–	–	✓
Load depending Start/Stop (PMS)		–	✓	–	–	–	–	–	–	–	–	–	✓
Preferential trip management		–	✓	–	–	–	–	–	–	–	–	–	✓
Blackout management		✓	✓	–	–	–	–	–	–	–	–	–	✓
Diesel control		✓	✓	–	–	–	–	–	–	–	–	–	✓
Measurement (Indication)													
Current measurement values		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Voltage measurement values		–	✓	✓	–	✓ ¹	✓	✓	✓	✓	✓	✓	✓
Power measurement values		–	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓
Min/Max and average (AVG) meas. values (statistic)		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Counters													
Operating hours		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Energy		–	✓	✓	–	–	✓	✓	✓	✓	✓	✓	✓
Switched currents		–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Switching operations (breaker control)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Monitoring Functions													
Wire break supervision (binary inputs)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Short circuit supervision (binary inputs)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CW Contact wear measurement (switched currents)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Auxiliary limits		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Logical Functions													
Event builder (PLC functionality)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communication Protocols													
Internal: programming interface		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Modbus (RTU), Kuhse, Remote, IEC 60870-5-103, Blue Vision 1, Blue Vision 2, Blue Vision 3		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Internal: Line differential protection		–	–	–	–	–	–	–	–	(✓)	–	–	–
CANBUS 1: • Extension boards CMA, or • Device-to-Device communication		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	✓	✓
CANBUS 2: • (CANBUS 1 redundancy, or • ECU engine protocol (parameterizable) or • CANopen (SCADA)		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Profibus DP		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Ethernet: Modbus TCP, IEC 61850		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Internal: Extension boards CMA		–	–	–	–	–	–	–	–	–	–	✓	✓
Recording Functions													
Alarm control		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Active alarms/events		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Event history		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Detailed protection history		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recorder unit (RU)		(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)

✓ : standard

(✓) : option (see order information)

1 : 1-phase only (U1)!

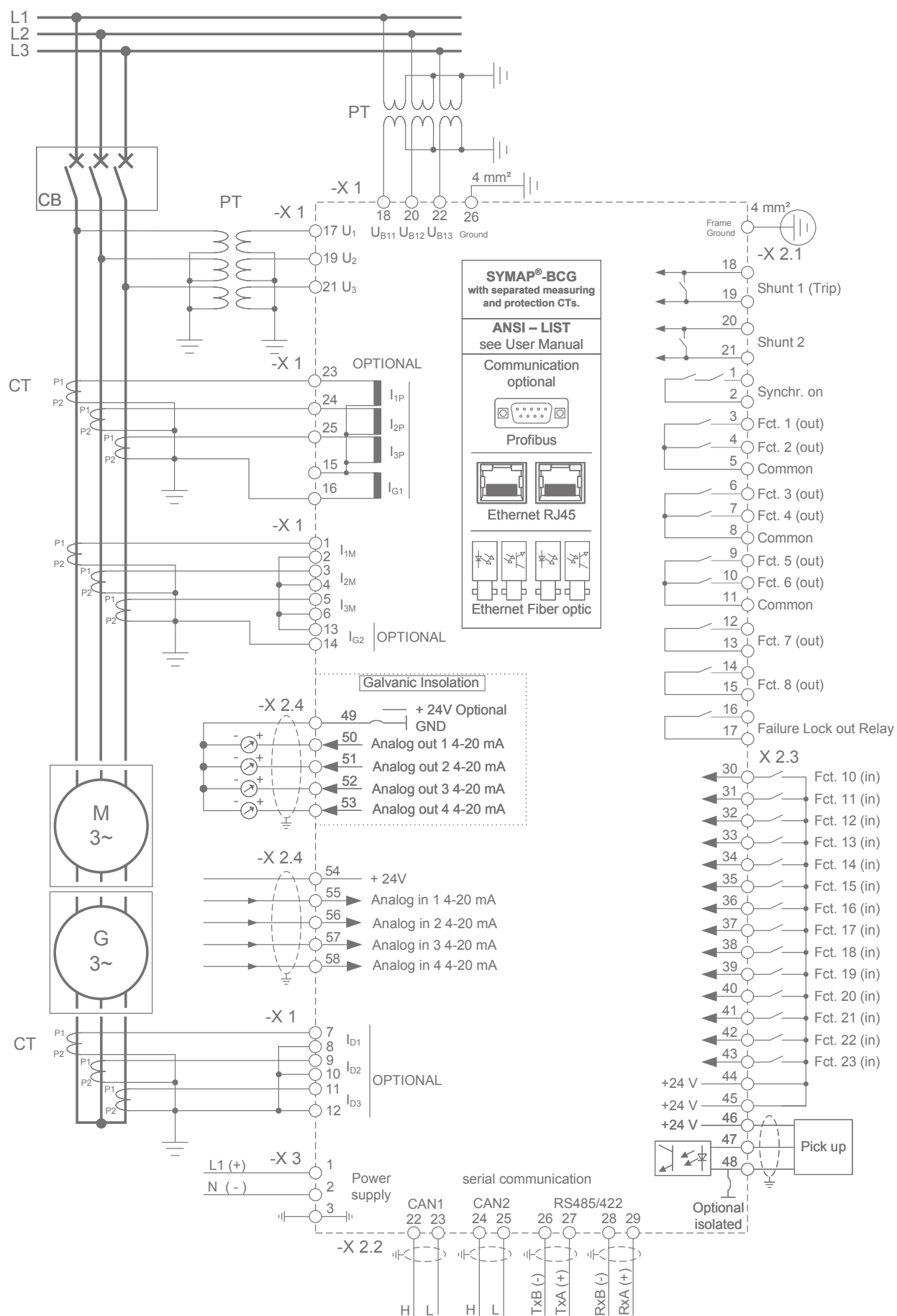
2 : ANSI 87N is only available on SYMAP® ECG when current measurement input CT GND is selected!

3 : ANSI 87G/M is only available on SYMAP® ECG when current transformer (CT-Diff) is selected! Available only for low voltage applications!

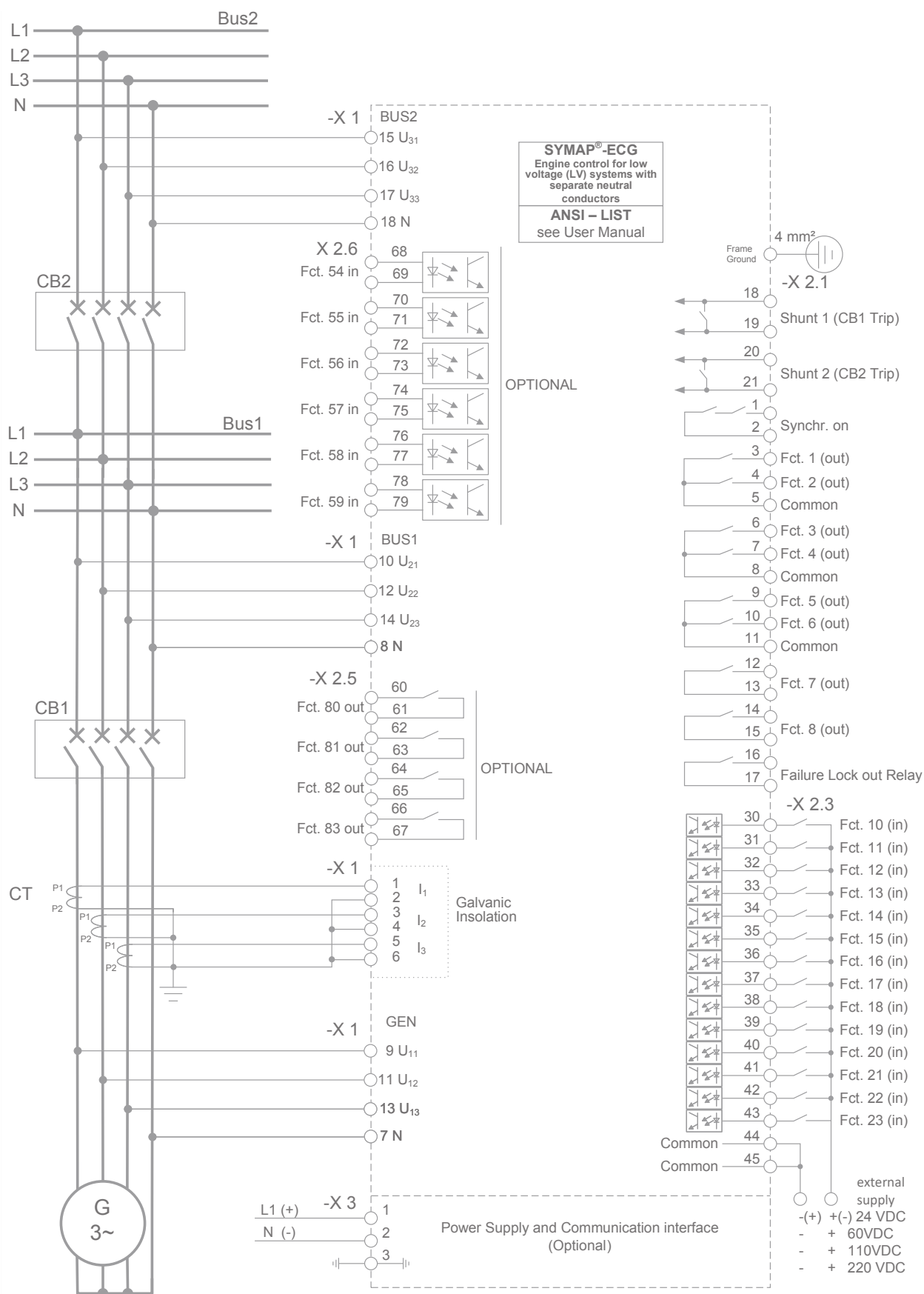
Hardware capabilities

SYMAP®	Y										BC	
Device variants	EC	ECG	T1	T2	T3	M	G	F	LD	DC	BC	BCG
Front Panel												
Graphic-LCD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5 Navigation keys (front plate: Up, Down, Right, Left, Enter)	5	5	5	5	5	5	5	5	5	5	5	5
7 Function keys (front plate: ACK, ON, OFF, AUTO, MAN, START, STOP)	✓	✓	–	–	–	–	–	–	–	–	–	✓
3 Function keys (front plate: ACK, ON, OFF)	–	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	–
4 Hot keys (front plate: F1, F2, F3, F4)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Seven-segment displays (3 digits)	–	–	–	–	–	–	–	–	–	–	4	4
3 Status LEDs (TRIP, ALARM, SYS.CHECK)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8 Alarm LEDs (red, green, yellow)	–	–	–	–	–	–	–	–	–	–	✓	✓
Power Supply												
12–36 V DC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
36–72 V DC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
60–230 V AC; 80–300 V DC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Communication Interfaces												
RS232 (programming interface)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RS485/422 (Serial Port 1, Modbus RTU and other protocols)	(✓)	(✓)	(✓)	(✓)	✓	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
RS485/422 (Serial Port 2, L-Diff)	–	–	–	–	–	–	–	–	(✓)	–	–	–
CAN 1	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	✓	✓
CAN 2	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Fibre optics (FO) (ST® BFOC, L-Diff, 2km)	–	–	–	–	–	–	–	–	(✓)	–	–	–
Fibre optics (FO) (SC, L-Diff, 10km)	–	–	–	–	–	–	–	–	(✓)	–	–	–
RS485 (D-SUB9, Profibus DP)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Fibre optics (FO) (Profibus DP, 2km)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Fibre optics (FO) (IEC 61850, 2km)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)
Extension board CMA interface (25-pole)	–	–	–	–	–	–	–	–	–	–	✓	✓
Binary Inputs / Outputs												
Binary inputs	20	20	20	20	20	20	20	20	20	20	14	14
Binary outputs (pot.-free relay contacts)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	8 (12)	8 (12)
Analog Inputs (alternatively)												
Analog inputs 0/4–20 mA	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	–	(2)	4	4
Pickup input 24V DC, PNP	(1)	(1)	–	–	–	(1)	(1)	–	–	–	–	1
Magnetic pickup (MPU)	(1)	(1)	–	–	–	(1)	(1)	–	–	–	–	1
Analog Outputs (alternatively)												
Analog outputs 0/4–20 mA	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	–	(2)	4	4
Analog outputs +/–10 V	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	–	(2)	–	–
Analog outputs +/–20 mA	(2)	(2)	–	–	(2)	(2)	(2)	(2)	–	–	–	–
Analog output PWM	(1)	(1)	–	–	–	(1)	(1)	(1)	–	–	–	–
Current and Voltage Measurement Inputs												
3-Phase current transformer (CT)	–	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓
3-Phase current transformer (CT-Diff)	–	(✓) ¹	–	✓	✓	–	–	–	–	–	(✓)	(✓)
1-Phase current transformer (CT Ground 1)	–	✓ ²	✓ ²	✓	✓	(✓) ²	(✓) ²	(✓) ²	(✓) ²	–	✓	✓
1-Phase current transformer (CT Ground 2)	–	–	–	–	–	–	–	–	–	–	(✓)	(✓)
3-Phase voltage transformer (PT FEEDER)	✓	✓	✓	–	(✓)	✓	✓	✓	✓	–	(✓)	(✓)
1-Phase voltage transformer (PT FEEDER)	–	–	–	–	✓	–	–	–	–	–	–	–
3-Phase voltage transformer (PT BUS1)	✓	✓	✓	–	–	✓	✓	✓	✓	–	✓	✓
3-Phase voltage transformer (PT BUS2)	(✓)	(✓)	(✓)	–	–	(✓)	(✓)	(✓)	(✓)	–	(✓)	(✓)
1-Phase voltage transformer (PT Ground 1)	(✓) ²	(✓) ²	(✓) ²	(✓)	(✓)	(✓) ²	(✓) ²	(✓) ²	(✓) ²	–	(✓)	(✓)
1-Phase voltage transformer (PT Ground 2)	–	–	–	–	–	–	–	–	–	–	(✓)	(✓)
DC input (0-200mA, current measurement)	–	–	–	–	–	–	–	–	–	✓	–	–
DC input (0-50mA, voltage measurement)	–	–	–	–	–	–	–	–	–	✓	–	–
Recording Functions												
Recorder unit (RU)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)

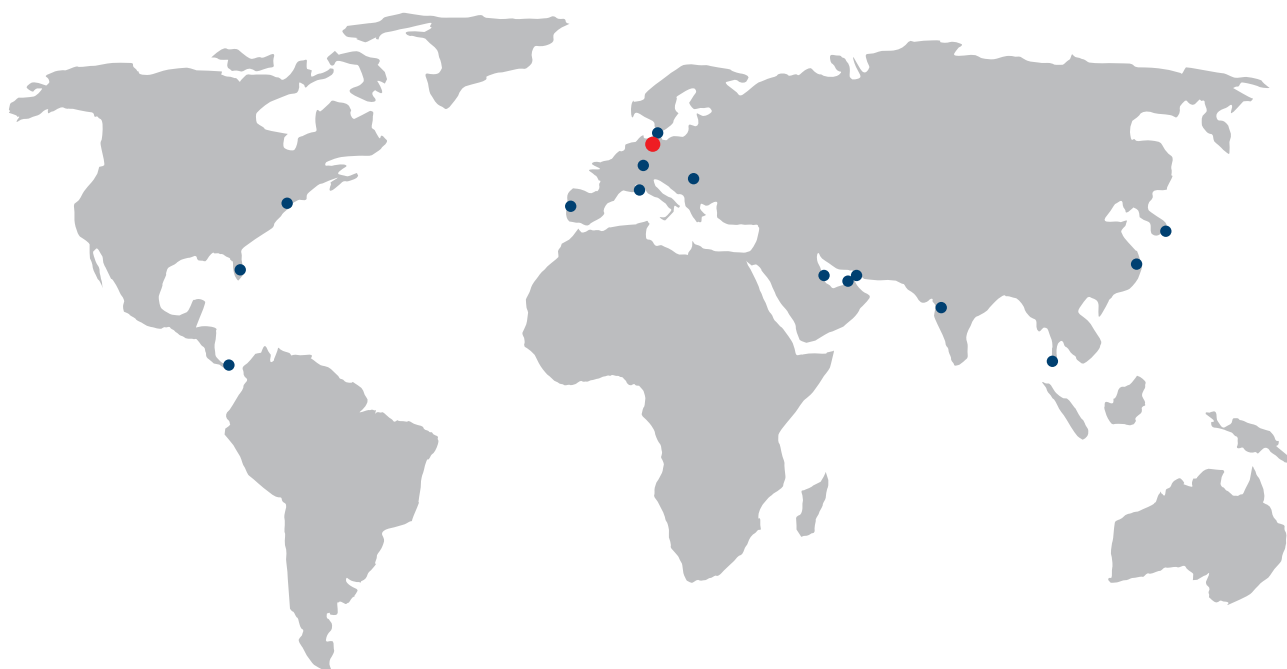
Connection drawing SYMAP®BCG



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