



SYMAP®

**ADVANCED DIGITAL PROTECTION RELAYS
DISTANCE PROTECTION**

EXPERIENCED IN ON- AND OFFSHORE APPLICATIONS



Stucke Elektronik GmbH
PROTECTION
MADE IN GERMANY
since 1968



Stucke Elektronik GmbH offers

- Future proof technical product solutions
- Full service support including on site commissioning
- In depth product training
- Efficient after sales support and service
- Ultra fast delivery times
- Subsidiaries and partners in key locations worldwide



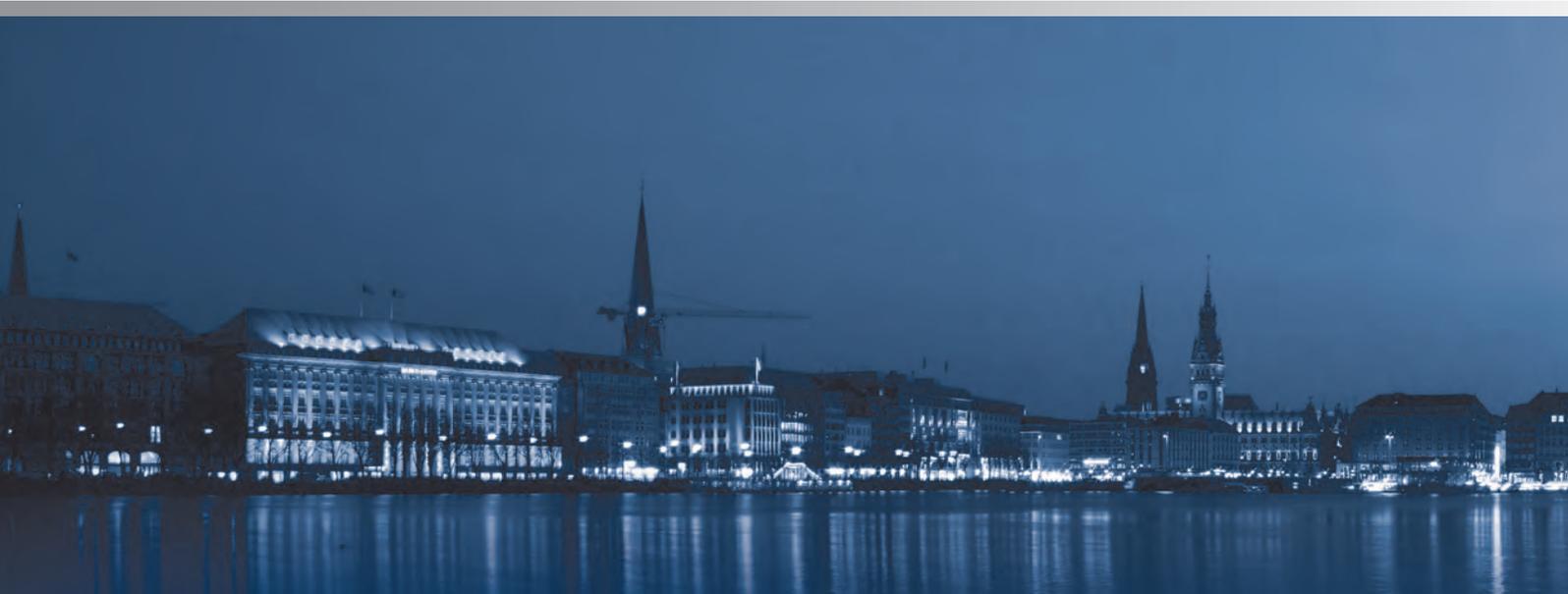
STUCKE ELEKTRONIK GmbH



with headquarter in Hamburg, Germany, since 1968. Here we design, plan and realise high-quality and high-performance electronic devices.

Our products guarantee supervision, protection and control for a reliable supply of electricity. All products are manufactured exclusively and entirely in Hamburg. Our headquarter has been active for over 40 years in the field of »electronic protection systems«.

Our company is certified according to **ISO 9001:2000** and **ISO 14001:2004**.



OUR CUSTOMERS

- Marine companies
- Offshore companies
- Power companies
- Engine producers
- Medium-voltage producers
- Genset companies

For diesel and gas engines we develop, plan and manufacture control systems for single and multiple-generator systems, generator protection, network protection as well as multifunctional protective relays in low- and medium-voltage installations.

We can provide you with electro technologically relevant services in the areas of CAD design, turnkey technology and the production and installation of control systems for on- and offshore industries.

DEVELOPMENT & SUPPLY OF

- Diesel-Automation System
- Generator-Protection System
- Mains Protection System
- Power Management Control for multi Generating Set
- Multifunction-Protection Relay
- Marine- and Land Based Powerstation
- Emergency Power Plants
- Hydro-Stream Turbine Control
- Gas Engine Control



DEVELOPMENT NEWS

Our target is to achieve excellent relay functionality in a compact design.

The SYMAP® series provide flexible and powerful solutions. To meet the needs especially for the utility market, the relays will come with **IEC 61850** communication, and brand new with **distance protection**.

THE SYMAP® FAMILY REACHES A TYPE APPROVAL FROM THE FOLLOWING CLASSIFICATION SOCIETIES:

Germanischer Lloyd	GL
Lloyds Register	LR
American Bureau of Shipping	ABS
Det Norske Veritas	DNV
Bureau Veritas	BV
Russian Maritime Register of Shipping	RMRS
China Classification Society	CCS
Polski Rejestr Statkow	PRS
Nippon Kaiji Kyokai	NPK
Registro Italiano Navale (Italy)	RINA
Gossudarstwenny Standart (Russia)	GOST
Korean Register	KR
<i>Additional:</i>	
Conformité Européenne	CE
Deutsche Kraftwerk Union	KWU
Korea Electrotechnology Research Institute	KERI
IEC61850 Certificate	KEMA

Stucke Elektronik GmbH

PROTECTION
MADE IN GERMANY

since 1968

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 switch bays.

With **three powerful microprocessors**, SYMAP® offers complete protection functions for generators, motors (synchronous and asynchronous), transformers, power lines, and distributions.

All protection functions can be activated simultaneously and there are no limits to using all of them at the same time.

With SYMAP®, **five main breaker controls** can be activated with all the necessary functions, such as display, control, and blocking, for optimal breaker management. A small **integrated PLC** allows individual 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.

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 using a laptop. Using a laptop offers certain advantages, such as parameter data stored in the laptop can be easily input into other SYMAP® units. Either way, ease of programming is guaranteed and on-site visits by the manufacturer's engineers during commissioning are not required.

SYMAP® provides four hotkeys under the LCD through which four main groups of values can be accessed:

»Meters«, »Alarm«, »Process« and »Breaker Control«.

The user can press the hotkeys to scroll through pages of information pertaining to these values.

Under the hotkey »Meters«, detailed information of electric measurement values, counters for active and reactive power, and of working hours is provided. Under the hotkey »Alarms«, all active alarms, eventstores, and blockings are displayed. Under »Process«, all process data, such as synchronization display, motor thermal indication, and breaker counters, are shown. Under »Breaker Control«, up to five breakers can be accessed and controlled.

When programming breaker controls, the user has access to various layout configurations available through a library of graphics maintained within SYMAP®. 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 »|«.

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

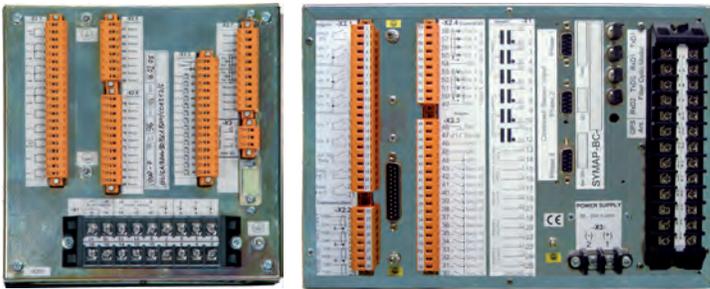
The **code system offers dual access:** by a transponder card or by password input.



SYMAP® ADVANCED DIGITAL PROTECTION RELAYS

TERMINAL CONNECTIONS

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



ANALOGUE 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 for feeder current**
- **3 x CT for differential current**
- **2 x CT for ground current**
- **3 x PT for feeder voltage**
- **3 x PT for bus bar 1 voltage**
- **3 x PT for bus bar 2 voltage**
- **2 x PT for ground voltage**

By use of combined sensors, SYMAP® can provide:

- **3 x for feeder current**
- **3 x for feeder 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**
- **MODEM** (Analogue or ISDN)
- **1 x PROFIBUS DP** (RS485 or fiber optic port)
- **MODBUS** (RS485 or fiber optic port)
- **IEC 60870-5-103** (RS485 or fiber optic port)
- **IEC 61850** (RJ45 or fiber optic port)
- **CANBUS1** (communication between devices as power management system, breaker control interlocking)
- **CANBUS2** (engine control: MTU, VOLVO, DEUTZ etc.)

EXTENDED BOARD (OPTIONAL)

An extended board can be connected to SYMAP®, providing additional in and output channels.

The extended board is customized to individual client requirements and can be equipped to a maximum of the following in and output channels:

- 44 digital inputs
- 32 relay outputs
- 40 analog inputs- Multi Purpose
- 4 analog inputs - VDO
- 24 analog inputs -NiCrNi
- 20 analog outputs
- 8 multi purpose inputs

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, the oldest data will be recorded over. transferred and analyzed via a PC tool. Regardless of power supply, the data store is permanent.

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, the oldest data will be recorded over.

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 in such a way as record event data even before the event happens.

Stopping the recorder can be triggered either by an event or by a preset time. For easier management and trouble-shooting, event data can be transferred and analyzed via a laptop computer. The transfer of data 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 as follows:

- **All memories (ROMs, RAMs, EEPROMs)**
- **All analog reference voltages**
- **Automated test sequences**
- **Control power ON/OFF of SYMAP®**
- **Binary input and output for control logic**

The following supervising systems are offered by SYMAP®:

- **Self diagnostics of SYMAP®**
- **The inputs of analog data** (auxiliary circuit)
- **The 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)**



THREE SERIES OF SYMAP® UNITS ARE AVAILABLE AS FOLLOWS:



SYMAP®-Y (EC, ECG, F, G, M, T, LD, D)

Essential cost series with power management, diesel and turbine control:

- **EC Engine Control***
- **ECG Engine Control +Generator Protection***
- **F Feeder Protection***
- **G Generator Protection***
- **M Motor Protection***
- **T Transformer Protection***
- **LD Line Differential***
- **D Distance Protection***

*see the hardware and software capabilities

SYMAP®-BC (BC, BCG)

Basic series expanded to include LED indicators, event data recorder, extended board, power management, diesel, gas engine and turbine control , optional differential protection.

- **SYMAP®-BC - Multifunctional Protection Relay***
- **SYMAP®-BCG - Multifunctional Protection Relay***

*see the hardware and software capabilities

TECHNICAL DATA

No	Description	Specification	
1	Dimension (w x h x d)	Y: 192 x 192 x 110 (mm)	
		BC: 279 x 192 x 150 (mm)	
2	Weight	Y: 2.3 kg	
		BC: 5 kg	
3	Power supply	12–36 V DC, 36–72 V DC, 80–300 V DC or 60–230 V AC	
4	Power consumption	< 30W	
5	Ambient condition	Service temperature	-20°C to +70°C
		Storage temperature	-40°C to +70°C
		Transport temperature	-40°C to +70°C
		Humidity	< 80 %
6	Degree of protection	Front panel	IP54 (IEC529)
		Connections	IP10 (IEC529)
7	Vibration	Standards	IEC 60068-2-6
		Frequency range	5 Hz to 100 Hz
		Cross over frequency	15.8 Hz; +/- 1.0 mm amplitude to 1 g acceleration in 3 orthogonal axes (X, Y, Z)
8	Seismic vibration (BC Series)	Standards	KWU DWR 1300
		Frequency range	5 Hz to 100 Hz
		Cross over frequency	11.2 Hz; +/- 10.0 mm amplitude to 5 g acceleration
		Sweep rate 5 Hz to 35 Hz	1 Octave/min
		Sweep rate 35 Hz to 100 Hz	10 Octaves/min
			in 3 orthogonal axes (X, Y, Z)
9	Tests	Electro magnetic compatibility	EN 55011, EN 61000-4, KERI
		Protection functions	IEC255, KERI

HARDWARE-CAPABILITIES OF SYMAP® FAMILY

SYMAP Series	Y								BC		CMA			
	EC	ECG	F	G	M	T	LD	D	BC	BCG	216/ 217	218	228***	238
OPERATING UNIT														
Graphic-LCD	X	X	X	X	X	X	X	X	X	X	-	-	-	-
Keyboard	X	X	X	X	X	X	X	X	X	X	-	-	-	-
7 segment displays	-	-	-	-	-	-	-	-	X	X	-	-	-	-
Status LED's	3	3	3	3	3	3	3	3	5	5				
8 Alarm LED's	-	-	-	-	-	-	-	-	X	X	-	-	-	-
Transponder access	-	-	-	-	-	-	-	-	(X)	(X)	-	-	-	-
COMMUNICATION														
RS232	X	X	X	X	X	X	X	X	X	X	-	-	-	-
PROFIBUS (ring optical, ST or RS485)	(X)	(X)	(X)	-	-	-	-							
CANBUS1	(X)	(X)	(X)	(X)	(X)	(X)	-	(X)	X	X	-	-	-	-
CANBUS2	(X)	(X)	-	-	-	-	-	-	X	X	-	-	-	-
MODBUS, RS485/422	(X)	(X)	(X)	-	-	-	-							
IEC 60870-5-103 (RS485 or optical, ST)	(X)	(X)	(X)											
IEC 61850 (RJ45 or optical, ST)	(X)	(X)	(X)	(X)	(X)	(X)		(X)	(X)	(X)	-	-	-	-
MODEM (ISDN or analog)	(X)	(X)	-	-	-	-	-	-	-	-	-	-	-	-
INPUTS / OUTPUTS														
Digital inputs	14 (20)	14 (20)	14 (20)	14 (20)	14 (20)	14 (20)	14 (20)	14 (20)	14	14	-	-		
Digital inputs ext. board	(44)	(44)	(44)	(44)	(44)	(44)	-	-	(38)	(38)	24	-	12	
Relay outputs basic unit	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12 (16)	12	12	-	-		
Relay outputs ext. board	(40)	(40)	(40)	(40)	(40)	(40)	-	-	(36)	(36)	24	-	8	
ANALOG I/O 4-20 MA														
Analog in 4-20 mA	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	4	4	-	-	32****	8*****
Analog out 4-20 mA	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	4	4	-	-	12	
PT100/PT1000 + ext. converter	-	-	-	-	-	-	-	-	-	-	6	6	-	-
PT100/PT1000 ext. board	-	-	-	-	-	-	-	-	-	-	6**	6	-	-
ANALOG INPUT FOR MEASURING AND PROTECTION														
Total analog inputs	-	13	13	13	13	13	13	13	17	17	-	-	-	-
3 CT's for FEEDER CURRENT	-	X	X	X	X	X	X	X	X	X	-	-	-	-
3 Ph. current via combined sensor	-	-	-	-	-	-	-	-	(X)	(X)	-	-	-	-
3 CT's for DIFF. CURRENT	-	-	-	-	-	-	-	-	(X)	(X)	-	-	-	-
CT for GROUND CURRENT 1	-	(X*)	X	X	-	-	-	-						
CT for GROUND CURRENT 2	-	-	-	-	-	-	-	-	(X)	(X)	-	-	-	-
3 PT's for FEEDER VOLTAGE	X	X	X	X	X	X	X	X	X	X	-	-	-	-
3 Ph. voltage via combined sensor	-	-	-	-	-	-	-	-	(X)	(X)	-	-	-	-
3 PT's for BUS VOLTAGE 1	X	X	X	X	X	X	X	X	X	X	-	-	-	-
3 PT's for BUS VOLTAGE 2	(X)	(X)	(X)	-	-	-	-							
PT for GROUND VOLTAGE 1	(X*)	(X)	(X)	-	-	-	-							
PT for GROUND VOLTAGE 2	-	-	-	-	-	-	-	-	X	X	-	-	-	-
RECORDING UNIT														
Data recorder	(X)	(X)	(X)	-	-	-	-							
Event History	X	X	X	X	X	X	X	X	X	X				
Detailed protection history	X	X	X	X	X	X	X	X	X	X	-	-	-	-

*: one ground input available: UGND IGND

** : in communication with CMA217

(X): function is special equipment which can be ordered separately (see order information)

***: two units can be combined to obtain double number of in- and outputs

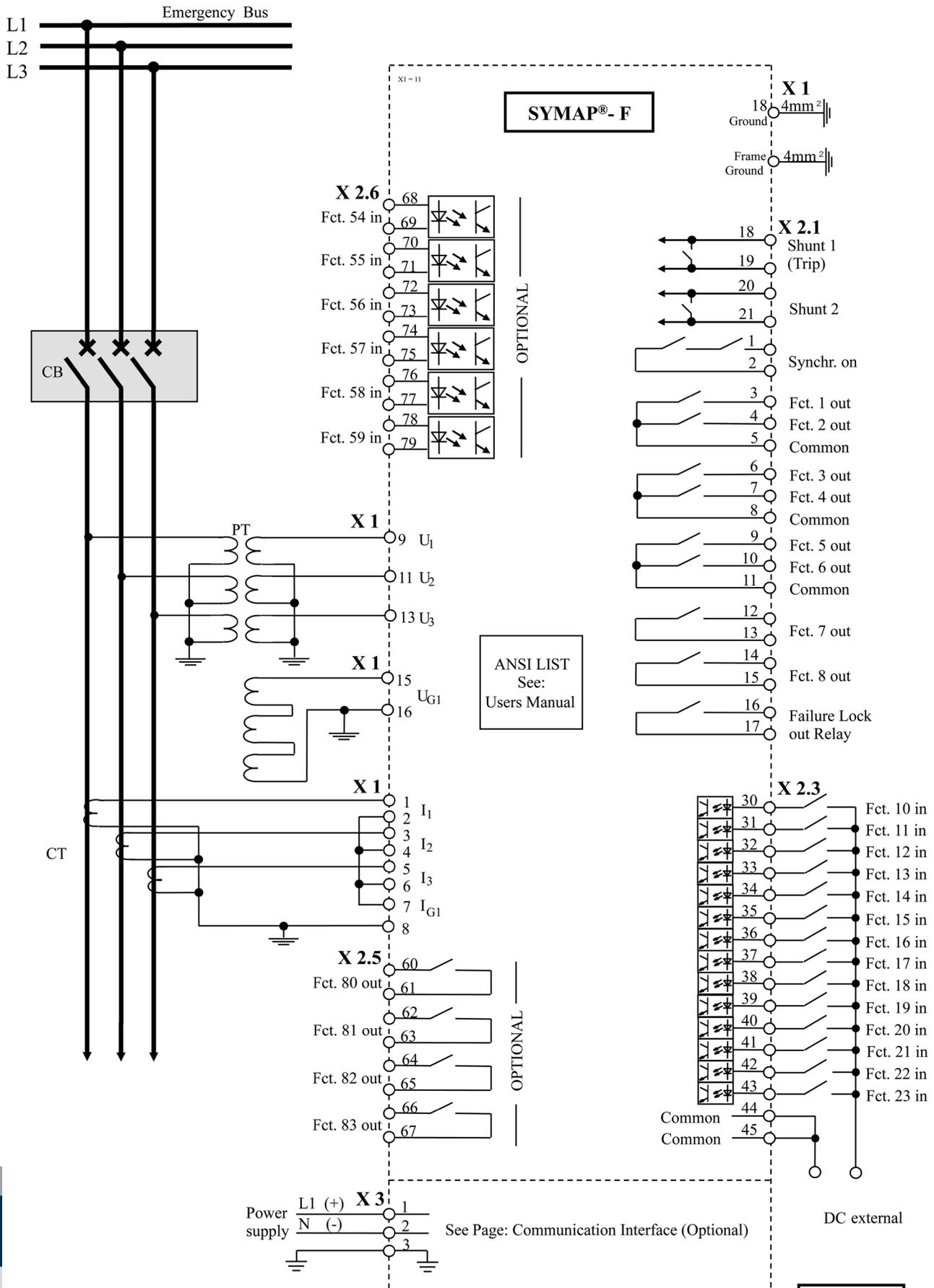
****: 20 x multi purpose, 2 x VDO, 10 x NiCrNi

*****: Multi Purpose (0/4..20mA, 0-10V or PT100/1000, BI)

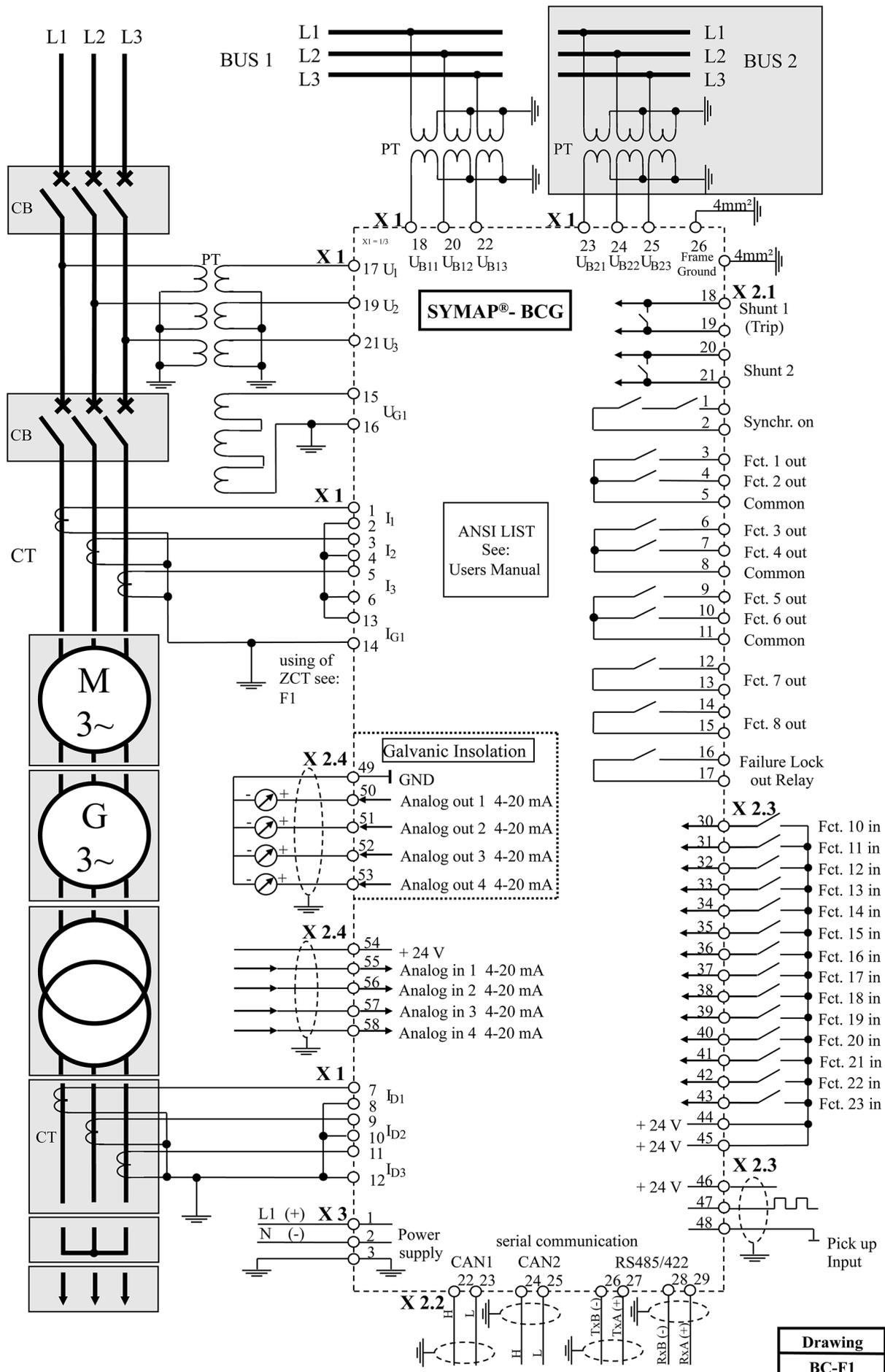
SOFTWARE-CAPABILITIES OF SYMAP® FAMILY

SYMAP Series		Y								BC	
Type		EC	ECG	F	G	M	T	LD	D	BC	BCG
POWER MANAGEMENT MODULES											
Synchronizing unit		X	X	X	X	X	X	X	X	X	X
Load sharing/asymmetrical load ctrl.		-	X	-	X	-	-	-	-	-	X
Frequency controller		X	X	-	X	-	-	-	-	-	X
Voltage regulator		X	X	-	X	-	-	-	-	-	X
Power factor control		-	X	-	X	-	-	-	-	-	X
Load controller (big consumer)		-	X	-	-	-	-	-	-	-	X
Load depending start/stop (PMS)		-	X	-	-	-	-	-	-	-	X
Preferential trip management		-	X	-	-	-	-	-	-	-	X
Blackout management		X	X	-	-	-	-	-	-	-	X
Diesel control (engine control)		X	X	-	-	-	-	-	-	-	X
LOGIC BUILDER UNIT (PLC)											
Breaker controls/interlocks		X	X	X	X	X	X	X	X	X	X
Logic diagrams		X	X	X	X	X	X	X	X	X	X
PROTECTION RELAYS (ACCORDING TO ANSI DEVICE NUMBERS)											
15	Matching device (motorpoti)	X	X	-	-	-	-	-	-	X	X
21	Distance protection	-	-	-	-	-	-	-	X	-	-
24	Overexcitation protection	-	X	-	X	X	-	-	-	X	X
25/A	Automatic synchroniz., Synchro-Check	X	X	X	X	X	X	-	X	X	X
27	Undervoltage, inst., def. time	X	X	X	X	X	X	X	X	X	X
27B	BUS undervoltage, def.time	X	X	(X)	(X)	-	(X)	(X)	X	X	X
32	Overload relay	-	X	X	X	X	(X)	(X)	X	X	X
37	Undercurrent protection	-	X	-	X	X	-	-	-	X	X
40/Q	Loss of field, reac.power, impedance	-	(X)	-	(X)	-	-	-	-	X	X
46	Reverse phase current	-	X	-	X	X	-	-	X	X	X
47	Phase sequence voltage	(X)	X	X	X	X	X	X	X	X	X
49	Thermal overload protection	-	X	X	X	X	X	X	X	X	X
50BF	Breaker failure	-	X	X	X	X	X	X	-	X	X
50	Overcurrent, instantaneous	-	X	X	X	X	X	X	X	X	X
50G/N	Current earth fault, instantaneous	-	X	X	X	X	X	X	X	X	X
51	AC time overcurrent, def.time, IDMT	-	X	X	X	X	X	X	X	X	X
51G/N	AC Ground overcurr., def.time, IDMT	-	X	X	X	X	X	X	X	X	X
51LR	Locked rotor	-	-	-	-	X	-	-	-	X	X
51V	Voltage restrained overcurrent	-	-	-	-	X	-	-	X	X	X
59	Overvoltage, inst., def. time, norm.inv.	(X)	X	X	X	X	X	X	X	X	X
59B	BUS overvoltage, relay definite time	(X)	X	X	X	X	X	X	X	X	X
59N	Residual overvoltage	(X)	X	X	X	X	X	X	X	X	X
60FF	Fuse failure (voltages)	(X)	X	X	X	X	X	X	-	X	X
64	Ground overvoltage	(X)	X	X	X	X	X	X	X	X	X
66	Start inhibit	-	-	-	-	X	-	-	-	X	X
67	AC dir. overcurrent, def. time, IDMT	-	X	X	X	X	X	X	X	X	X
67GS/GD	AC directional earth fault, definite time	-	(X)	(X)	(X)	(X)	(X)	(X)	X	X	X
78	Vector surge supervision	(X)	X	(X)	X	-	-	-	X	X	X
78S	Out of step tripping	-	X	-	X	-	-	-	-	X	X
79	Auto reclosing	-	-	X	-	-	X	X	X	X	X
81	Frequency supervision	X	X	X	X	X	X	X	X	X	X
81B	BUS frequency supervision	(X)	X	X	X	X	X	X	X	X	X
86	Electrical lock out	X	X	X	X	X	X	X	X	X	X
87G/M	Generator/Motor differential	-	-	-	-	-	-	-	-	X	X
87LD	Line differential	-	-	-	-	-	-	X	-	-	-
87N	Restrict earth fault relay	-	-	-	-	-	-	-	-	X	X
87T	Transformer differential	-	-	-	-	-	-	-	-	X	X
94	Trip circuit supervision	X	X	X	X	X	X	X	X	X	X
95I	Inrush blocking	-	-	X	-	-	X	X	X	X	X
FL	Fault locator	-	-	X	-	-	(X)	-	X	X	-

SYMAP® CONNECTION DRAWINGS



Drawing
Y-F2



Drawing
BC-F1



Stucke Elektronik GmbH
Merkurring 26 · 22143 Hamburg · Germany
Phone +49(0)40 2274 68 11 · Fax +49(0)40 2274 68 24
mail@stuckegmbh.de · www.stuckegmbh.com

Stucke Elektronik GmbH
PROTECTION
MADE IN GERMANY
since 1968