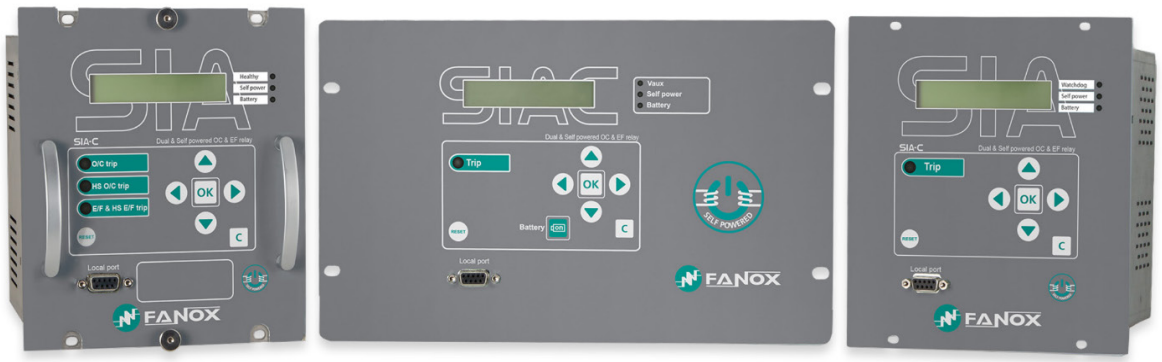
SIA-C

OC&EF Dual & Self Powered Protection Relay

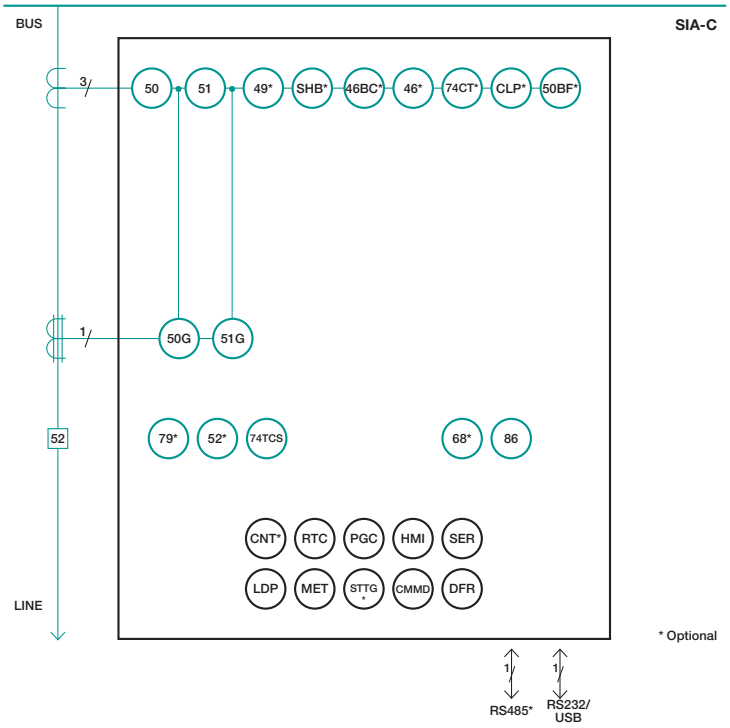
Secondary Distribution Protection
RMUs, MRMUs, and SF6 Insulated Switchgears



SELF-POWERED TECHNOLOGY

- The SIA-C is an OC&EF protection relay with self-powered and dual-powered (self-powering + auxiliary power) options.
- The relay is self-powered using the operating current through three /5 (5VA) or /1 (2.5VA) standard current transformers fitted on the lines. These transformers are also used to obtain current measurements. Besides, the SIAC relay can be used with an auxiliary power supply (24 Vdc, 230 Vac, 48 Vdc, or 100-230 Vdc/ac). The relay can occasionally be supplied by an external battery portable kit (KITCOM). The models with USB can also be supplied by a USB cable connected to the laptop or with a standard power bank.
- Internal Commissioning battery as optional (Lithium battery: 20 years lifetime).
- Metallic box with high electromagnetic compatibility level (EMC) and wide range of operating temperature.
- Low start-up levels in self-powered mode, 0.1 times of the nominal current in a three-phase system/0.2 times of the nominal current in a single-phase system.
- Test menu allows the trip circuit to be tested before the transformation centre is powered up.
- There are bistable magnetic indicators (flags) which indicate the trip cause, maintaining their position even though the relay loses the supply.
- Self-diagnosis of the relay status (WATCHDOG) through the configurable LEDs and outputs.
- Low power consumption.
- To allow communication, relays are provided with a front local port and an optional remote communication RS485 port (Modbus RTU or IEC60870-5-103 protocol, selectable by general settings) on the rear side.
- The SIA-C is provided with a trip output for low power coil (24 Vdc – 135 mJ) or for standard coil depending on model and, optionally, 1 external trip input, up to 2 configurable inputs, and up to 3 configurable outputs.
- The SIA-C is fitted with the demand of current (Load Data Profiling) with the following characteristics:
  - » Number of records: 168
  - » Recording mode circular
  - » Sampling rate (interval): configurable through communications 1-60 min
- The SIA-C is provided with non-volatile RAM memory in order to store up to 1.024 events and disturbance fault recording (DFR-20 fault reports and depending on model 10 oscillographic records in COMTRADE format), maintaining date & time thanks to its internal RTC (Real Time Clock) even without power supply.
- Each oscillographic record contains 4 analogue channels and up to 32 digital channels. The oscillography is downloaded by a communications port. The SICom communications program allows the oscillography record to be downloaded and saved in COMTRADE format (IEEE C37.111-1991).
- The installation and subsequent maintenance of external batteries is eliminated. The operating costs of the centre are reduced.
- Different sizes of SIA-C relays are available by model list to fulfil all the market needs and to make the installation easier.

Functions diagram SIA-C



ANSI CODE PROTECTIONS	
50	Instantaneous phase overcurrent
51	Inverse time phase overcurrent
50G	Instantaneous measured neutral overcurrent
51G	Inverse time measured neutral overcurrent
SHB	Second Harmonic Blocking
49T	External trip
46	Phase balance current protection
49	Thermal overload
TB	Trip Block for switch disconnector
CLP	Cold Load Pickup
46BC	Broken Conductor Detection
52	Breaker wear monitoring
79	AC Reclosing device
74CT	Phase CT supervision
74TCS	Trip voltage supervision
50BF	Circuit Breaker Failure
68	Zone selection interlocking
PGC	Programmable logic control

ADDITIONAL FUNCTIONS	
CNT	Counters
RTC	Real Time Clock
PGC	Programmable Logic Control
HMI	Human Machine Interface
SER	Sequential Event Recording
DFR	Disturbance Fault Recording
LDP	Load Data Profiling
MET	Metering
STTG	Settings Groups
CMMD	Commands

Technical parameters SIA-C

Function 50-1 **Function 50-2 (*)**	Function Enable: Yes/No/SHB(*)
	Current Tap: 0.10 to 30.00 xIn (step 0.01 x In)
	Time Delay: 0.02 to 300.00 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 30 ms or ± 0.5% (greater of both). Adaptation C with SHB permitted: ± 40 ms or ± 0.5% (greater of both).
Function 50G-1 **Function 50G-2 (*)**	Function Enable: Yes/No/SHB(*)
	Current Tap: 0.10 to 30.00 xIn (step 0.01 x In)
	Time Delay: 0.02 to 300.00 s (step 0.01 s)
	Activation level 100%
	Deactivation level 95%
	Instantaneous deactivation
	Timing accuracy: ± 30 ms or ± 0.5% (greater of both). Adaptation C With SHB permitted: ± 40 ms or ± 0.5% (greater of both).
Function 51	Function Enable: Yes/No/SHB(*)
	Curve Type: IEC 60255-151 and IEEE curves. IEC (Definite time, standard inverse, very inverse, extremely inverse, long time inverse) and IEEE (Moderately inverse, very inverse, extremely inverse). Time delay: 0.02 to 300.00 s (step 0.01 s)
	Time Dial (TMS): 0.02 to 1.25 (step 0.01)
	Current Tap: 0.10 to 7.00 xIn (step 0.01 xIn)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy for IEC and IEEE curve selection: ± 30 ms or ± 5% (greater of both). Adaptation C With SHB permitted: ± 40 ms or ± 5% (greater of both). Timing accuracy for defined time selection: ± 30 ms or ± 0.5% (greater of both). Adaptation C with SHB permitted: ± 40 ms or ± 0.5% (greater of both).

Function 51G	Function Enable: Yes/No/SHB(*)
	Curve Type: IEC 60255-151 and IEEE curves. IEC (Definite time, standard inverse, very inverse, extremely inverse, long time inverse) and IEEE (Moderately inverse, very inverse, extremely inverse). Time delay: 0.02 to 300.00 s (step 0.01 s)
	Time Dial (TMS): 0.02 to 1.25 (step 0.01)
	Current Tap: 0.10 to 7.00 xIn (step 0.01 xIn)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy for IEC and IEEE curve selection: ± 30 ms or ± 5% (greater of both). Adaptation C With SHB permitted: ± 40 ms or ± 5% (greater of both). Timing accuracy for defined time selection: ± 30 ms or ± 0.5% (greater of both). Adaptation C with SHB permitted: ± 40 ms or ± 0.5% (greater of both).
Function SHB (*)	Function enable: No/Yes
	Current Tap: 10 to 50% (step 1%)
	Reset Time: 0.00 to 300.00 (step 0.01 s)
	Block Threshold: 0.10 to 30.00 xIn (step 0.01 xIn)
	Activation level: 100%
	Deactivation level: 95%
	Temporized deactivation
Function 49 (*)	Function enable: No/Yes
	Current tap: 0.10 to 2.40 In (step 0.01xIn)
	ζ heating: 3 to 600 min (step 1 min)
	ζ cooling: 1 to 6 xζ heating (step 1)
	Alarm: 20 to 99% (step 1%)
	Trip level: 100%
	Deactivation level: 95% of alarm level
	Timing accuracy: ± 5% respect of theorical value.
Function TB (*)	Function Enable: Yes/No
	Tap: 1.50 to 20.00 xIn (step 0.01 xIn)

Technical parameters SIA-C

Function 46 (*)	Function enable: No/Yes
	Curve Type: IEC 60255-151 and IEEE curves. IEC (Definite time, standard inverse, very inverse, extremely inverse, long time inverse) and IEEE (Moderately inverse, very inverse, extremely inverse). Time delay: 0.02 to 300.00 s (step 0.01 s)
	Time Dial (TMS): 0.02 to 1.25 (step 0.01)
	Current tap: 0.10 to 7.00 xIn (step 0.01xIn)
	Curve, current activation level: 110%
	Curve, current deactivation level: 100%
	Defined time, current activation level: 100%
	Defined time, current deactivation level: 95%
	Instantaneous deactivation
	Timing accuracy for IEC and IEEE curve selection: ± 30 ms or ± 5% (greater of both). Adaptation C With SHB permitted: ± 40 ms or ± 5% (greater of both). Timing accuracy for defined time selection: ± 30 ms or ± 0.5% (greater of both). Adaptation C With SHB permitted: ± 40 ms or ± 0.5% (greater of both).
Function CLP (*)	Function Enable: Yes/No
	Settings groups: 1 to 4 (step 1)
	No load Time: 0.02 to 300.00 s (step 0.01 s)
	Cold load Time: 0.02 to 300.00 s (step 0.01 s)
	Open breaker activation 0.6% In and reset threshold: 0.8% In
Function 50BF (*)	Function Enable: Yes/No
	Time Delay: 0.02 to 1.00 s (step 0.01 s)
	Open breaker activation and reset threshold: 0.6% In
Function 74CT (*)	Function Enable: yes/no
	Time Delay: 0.02 to 300 s (step 0.01 s)
	Timing accuracy: ±30 ms or ±0.5% (greater of both)
Function 74TCS	Trip supervision through the control of the trip voltage level.
Function 68 (*)	Available through configurable inputs and outputs thanks to the programmable logic (PGC).
Function 52 (*)	Maximum number of openings: 1 to 10.000 (step 1)
	Maximum accumulated amperes: 0 to 100.000 ($M(A^2)$) (step 1)
	Opening time: 0.02 to 30.00 s (step 0.01 s)
	Closing time: 0.02 to 30.00 s (step 0.01 s)
	Excessive repeated openings: 1 to 10.000 (step 1)
	Repetitive openings/Time: 1 to 300 min (step 1 min)
	Open breaker activation and reset threshold: 0.6% In

Function 79 (*)	Function Enable: Yes/No
	Hold Enable: Yes/No/No Time
	Number of reclosings: 1 to 5
	Reclosing time 1, 2, 3, 4, 5: 0.02 to 300 s (step 0.01 s)
	Hold time: 0.02 to 300 s (step 0.01 s)
	Reset time: 0.02 to 300 s (step 0.01 s)
	Safe time: 0.02 to 300 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
Programmable logic control (PGC)	OR4, OR4_LATCH, OR4_PULSES, OR4_TIMERUP, OR4_PULSE, NOR4, NOR4_TIMERUP, NOR4_PULSE, NOR4_PULSES, AND4, AND4_PULSES, AND4_TIMERUP, AND4_PULSE, AND4_LATCH, NAND4, NAND4_TIMERUP, NAND4_PULSE
Settings tables	Without adaptation: 1 Settings group. Adaptation A and C: 3 settings groups Adaptation B: 4 settings groups
	Selectable by input (*) or general setting.
SER	1024 events
Disturbance fault recording (DFR)	16 samples/cycle
	4 analog channels and 32 digital channels
	20 fault reports, 16 events in each. 10 disturbance records in COMTRADE format (50 cycles each). (*) Only for adaptation C
	COMTRADE IEEE C37.111-1991
Load Data Profiling (LDP)	Demand of power with the following characteristics: - Number of records: 168 - Recording mode circular - Sampling rate (interval): configurable through communications (1-60 min)
Trip output	For Striker: 24 Vdc-135 mJ For coil (optionally with TCM adapter): 250 Vac – 8A 30 Vdc – 8A
Outputs (*)	Up to 3 configurable outputs (output 2, output 3 and output 4): 220 Vdc – 1 A 250 Vac – 1 A
Inputs (*)	1 external trip input and 2 configurable inputs: They are activated by short-circuiting the terminals without external supply
Current measurements	RMS Fundamental values (DFT) (Only for adaptation C)
	Sampling: 16 samples/cycle
	±2% in a band of ± 20% the nominal current and ±4% or ± 5 mA in the rest of the band.
	Current measurement range: 0.1 to 30 times the nominal current

Technical parameters SIA-C

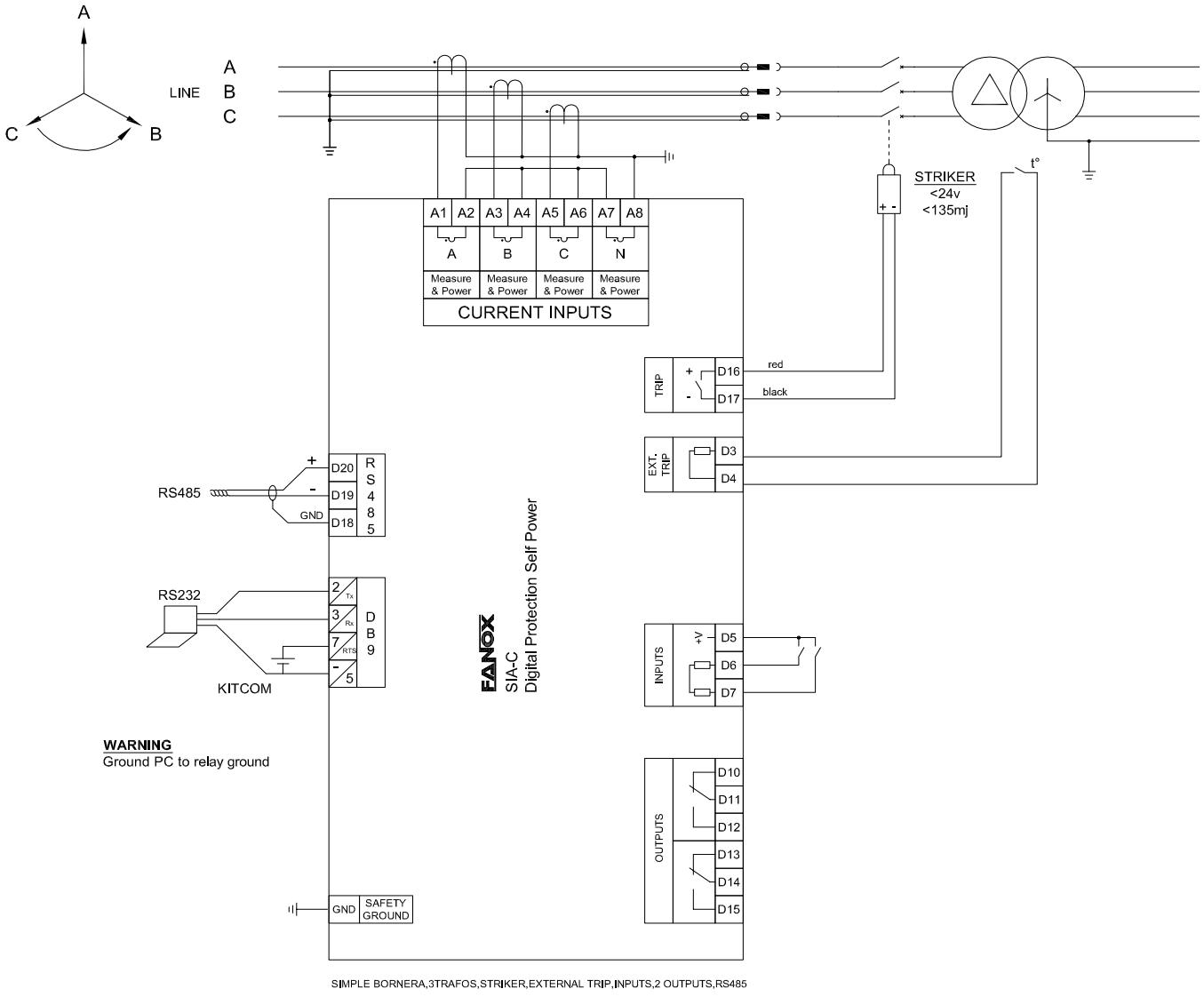
Communications	Local port (RS232 or USB depending on model): Modbus RTU
	RS485 port: Modbus RTU (*)
	RS485 port: Modbus RTU or IEC 60870-5-103 (*)
Self powering from current	Three phase self-powering level: Adaptation C: In= 1A→I > 0.13 xIn In=5A→ I >0.1xIn Other adaptations: I > 0.1 xIn
Power supply (*)	230 Vac (± 20%)
	24 Vdc (± 20%)
	48 Vdc (± 20%)
	100-230 Vac/Vdc (± 15%)
Battery Supply	Externally, with adapter (Kitcom) DB9 port (*)
	Internal commissioning battery (*)
Transformers	Power supply and measurement standard CTs /1 or /5
Environmental conditions	Operating temperature: -40 to 70ºC
	Storage temperature: -40 to 80ºC
	Relative humidity: 95%

Mechanical characteristics	Metallic box
	Panel mounted
	Height x Width: Compact Vertical model:177 x 155 (mm) Standard Vertical model: 177 x 189 (mm) Horizontal model: 177.8 x 290.3 (mm)
	Depth: Model with RS232 port: Compact Vertical model:147.1 mm Vertical withdrawable model: 153 mm Standard Vertical model: 145.8 mm Horizontal model: 100.75 mm Model with USB port: Compact Vertical model:151.7 mm Vertical withdrawable model: 153.6 mm
	Weight: 3.5 kg
	IP-54 panel mounted

(*) Optional depending on model

Connections diagram SIA-C

- 3 power supply-measurement CTs
- Solid neutral
- 2 inputs + 2 outputs
- RS485
- Trip by means of Striker
- External trip



(*) Other connections available depending on model.

(*) Example of connections diagram

Connections diagram SIA-C

- 3 power supply-measurement CTs
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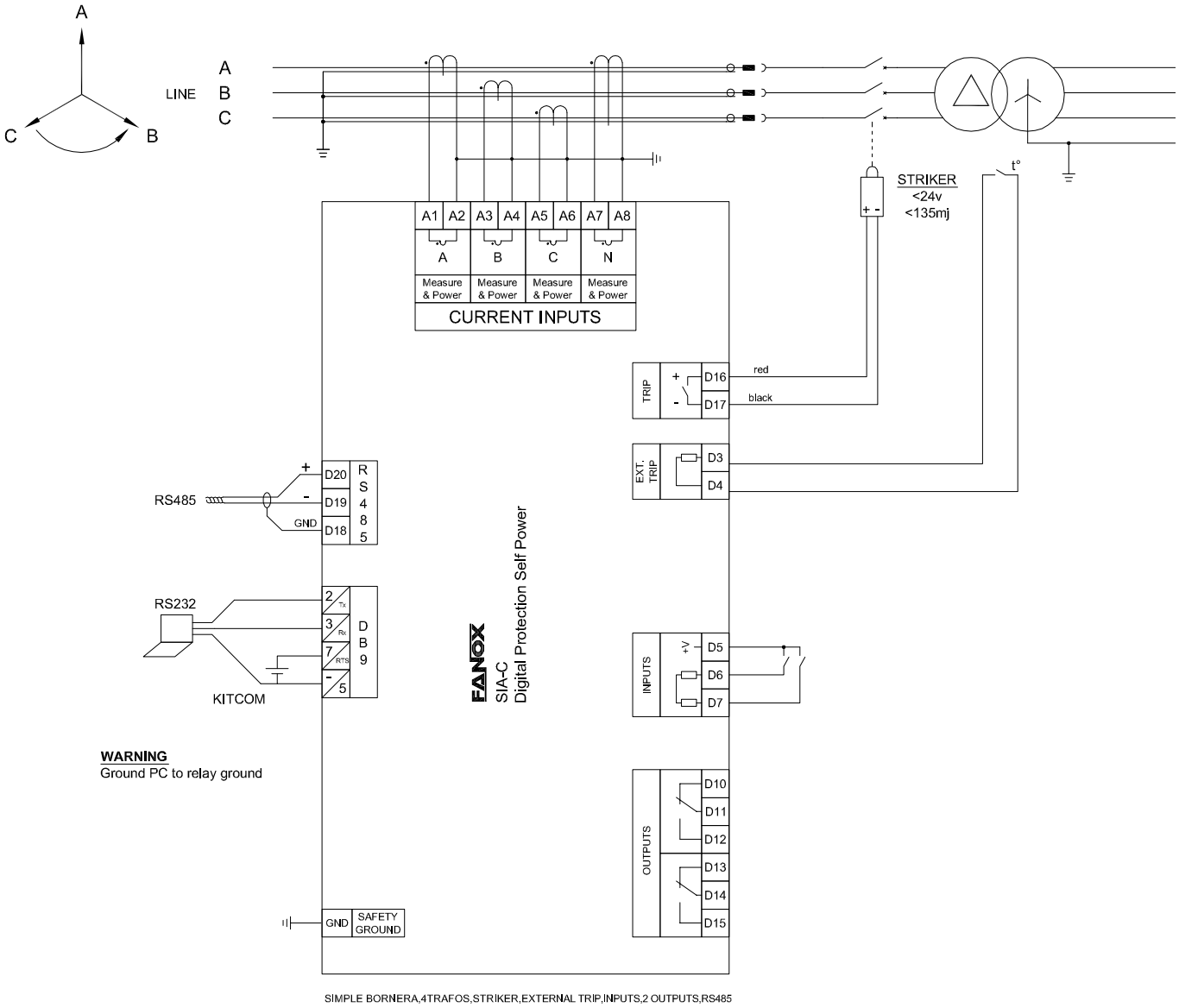


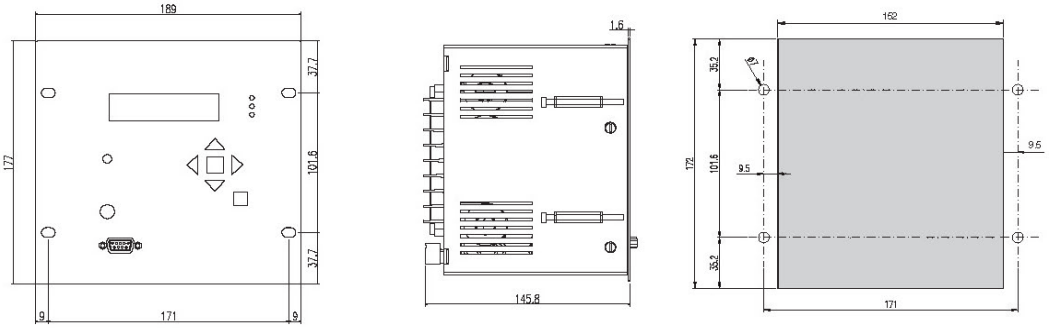
(*) Other connections available depending on model.

(*) Example of connections diagram

Dimensions and cutout SIA-C

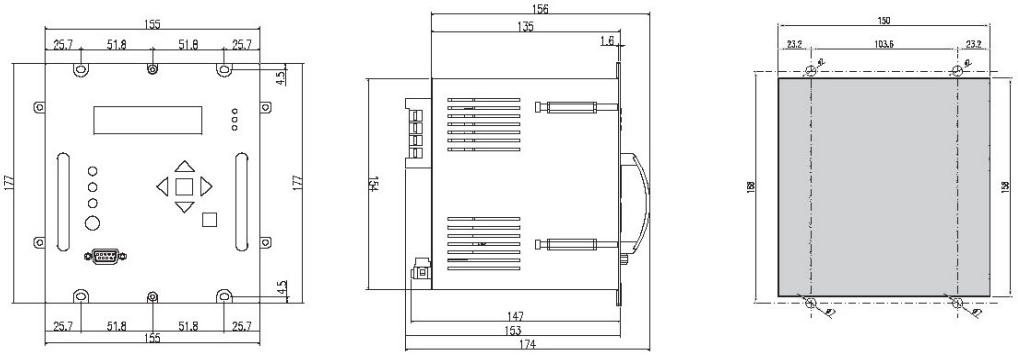
Vertical assembly

Mechanical assembly: D



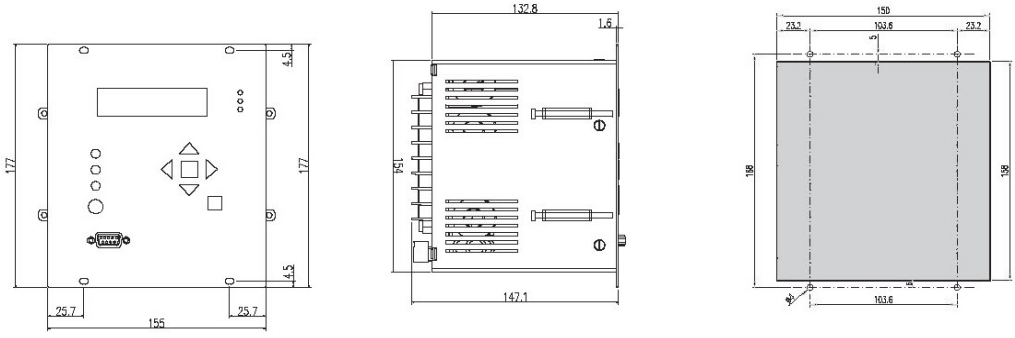
Withwadrable Vertical assembly Compact size

Mechanical assembly: F



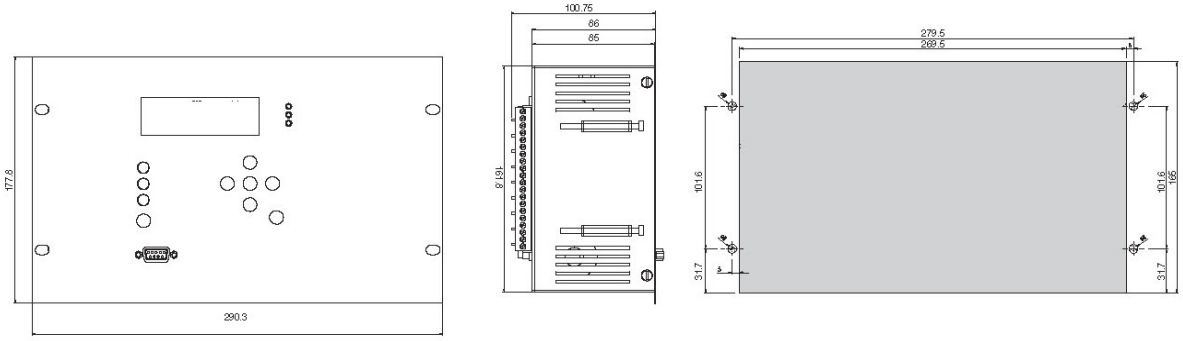
Vertical assembly Compact size

Mechanical assembly: E, G, J



Horizontal assembly

Mechanical assembly: B, C



Kema Standards SIA-C

TEST	TEST STANDARD	LEVEL
1. **DIELECTRIC TESTS**		
1.1. **Impulse voltage**	IEC60255-27 Clause 10.6.4.2	5 kV 1 kV
1.2. **Dielectric voltage**	IEC60255-27 Clause 10.6.4.3	2 kV 0,5 kV
1.3. **Insulation resistance**	IEC60255-27 Clause 10.6.4.4	500 VDC
2. **ELECTROMAGNETIC COMPATIBILITY (EMC) tests**		
2.1. **EMISSION**		
2.1.1. **Radiated emission**	IEC 60255-26 CISPR11 CISPR22	class A class A
2.1.2. **Conducted emission**	IEC 60255-26 CISPR22	class A
2.2. **IMMUNITY**		
2.2.1. **Slow damped oscillatory wave (1 MHz)**	IEC 60255-26 (IEC 61000-4-18) Clause 7.2.6	2,5 kV CM 1,0 kV DM 1 kV CM 0 kV DM
2.2.2. **Electrostatic discharges**	IEC 60255-26 (IEC 61000-4-2) Clause 7.2.3	6 kV cont. 8 kV air
2.2.3. **Radiated radio frequency magnetic field**	IEC 60255-26 (IEC 61000-4-3) Clause 7.2.4	80 - 1000 MHz 10 V/m 1,4 – 2,7 GHz 10 V/m 80, 160, 380, 450, 900, 1850, 2150 MHz 10 V/m
2.2.4. **Fast transient/burst**	IEC 60255-26 (IEC 61000-4-4) Clause 7.2.5	☒ Zone A 4 kV CM 2 kV CM ☐ Zone B 2 kV CM 1 kV CM
2.2.5. **Surge**	IEC 60255-26 (IEC 61000-4-5) Clause 7.2.7	☒ Zone A to 4 kV LE to 2 kV LL ☐ Zone B to 2 kV LE to 1 kV LL
2.2.6. **Conducted disturbance induced by RF fields**	IEC 60255-26 (IEC 61000-4-6) Clause 7.2.8	0,15 - 80 MHz 10 V 27, 68 MHz 10 V
2.2.7. **Power frequency voltage (50 Hz)**	IEC 60255-26 (IEC 61000-4-16) Clause 7.2.9	☒ Zone A 150 V DM 300 V CM ☐ Zone B 100 V DM 300 V CM
2.2.8. **Power frequency H-field (50 Hz)**	IEC 60255-26 (IEC 61000-4-8) Clause 7.2.10	30 A/m cont. 300 A/m 1-3 s
2.2.9. **D.C. Voltage dips**	IEC 60255-26 (IEC 61000-4-29) Clause 7.2.11	100%; 10-1000 ms 60%; 200 ms 30%; 500 ms
2.2.10. **A.C. voltage dips**	IEC 60255-26 (IEC 61000-4-11) Clause 7.2.11	100%; 0,5 – 25 c. 60%; 10/12 c. 30%; 25/30 c.
2.2.11. **D.C. voltage interruptions**	IEC 60255-26 (IEC 61000-4-29) Clause 7.2.11	100%; 5s
2.2.12. **A.C. voltage interruptions**	IEC 60255-26 (IEC 61000-4-11) Clause 7.2.11	100%; 250/300 c
2.2.13. **D.C. Ripple**	IEC 60255-26 (IEC 61000-4-17) Clause 7.2.12	15% Ut_dc 100/120 Hz
2.2.14. **D.C gradual shut-down/start-up**	IEC 60255-26 Clause 7.2.13	Shut-down ramp 60 s 5 min off Start-up ramp 60 s
2.2.15. **Damped oscillatory magnetic field (100 kHz and 1 MHz)**	IEC 61000-4-10	☒ Zone A 100 A/m (peak) ☐ Zone B 30 A/m (peak)
2.2.16. **Pulse magnetic field**	IEC 61000-4-9	1000 A/m
3. **MECHANICAL ENVIRONMENTAL CONDITIONS**		
3.1. **Vibration response**	IEC 60255-1 (IEC 60255-21-1) Clause 6.13.1	class 1
3.2. **Vibration endurance**	IEC 60255-1 (IEC 60255-21-1) Clause 6.13.1	class 1
3.3. **Shock response**	IEC 60255-1 (IEC 60255-21-2) Clause 6.13.2	class 1
3.4. **Shock withstand**	IEC 60255-1 (IEC 60255-21-2) Clause 6.13.2	class 1
3.5. **Bump**	IEC 60255-1 (IEC 60255-21-2) Clause 6.13.2	class 1

Kema Standards SIA-C

3.6. **Seismic (single axis sweep)**	IEC 60255-1 (IEC 60255-21-3) Clause 6.13.3	class 1
4. **CLIMATIC ENVAIRONMENTAL CONDITIONS**		
4.1. **Dry heat operational**	IEC 60255-1 (IEC 60068-2-2, test Bd) Clause 6.12.3.1	+70°C; 72h
4.2. **Cold operational**	IEC 60255-1 (IEC 60068-2-1, test Ad) Clause 6.12.3.2	-40°C; 72h
4.3. **Dry heat storage**	IEC 60255-1 (IEC 60068-2-2, test Bb) Clause 6.12.3.3	+80°C; 72h
4.4. **Cold storage**	IEC 60255-1 (IEC 60068-2-1, test Ab) Clause 6.12.3.4	-40°C; 72h
4.5. **Change of temperature**	IEC 60255-1 (IEC 60068-2-14, test Nb) Clause 6.12.3.5	-40°C; +70°C 3 hours 5 cycles
4.6. **Damp heat, steady state**	IEC 60255-1 (IEC 60068-2-78, test Cab) Clause 6.12.3.6	+40°C; 93% 10 days
4.7. **Damp heat, cyclic**	IEC 60255-1 (IEC 60068-2-30, test Db) Clause 6.12.3.7	+25°C; 40°C 97%; 93% 6 cycles

Selection & Ordering data SIA-C

SIA-C

Overcurrent & Earth Fault Protection Relay – Dual & Self-powered

1 5											PHASE CURRENT MEASUREMENT 1 A 5 A
	1 5 A B										NEUTRAL CURRENT MEASUREMENT 1 A 5 A 0.1 A 0.2 A
		5 6									NET FREQUENCY 50 Hz 60 Hz
			0 1 3 4 5 A B D E F								POWER SUPPLY 0: Self-powered 1: Self-powered + 230 Vac (Dual) 3: Self-powered + 24 Vdc (Dual) 4: Self-powered + 48 Vdc (Dual) 5: Self-powered + 100-230 Vac/dc (Dual) A: Self-powered + Commissioning battery + front USB (Only for mechanics digits F and G) B: Self-powered + 230 Vac (Dual) + Commissioning battery + front USB (Only for mechanics digits F and G) D: Self-powered + 24 Vdc (Dual) + Commissioning battery + front USB (Only for mechanics digits F and G) E: Self-powered + 48 Vdc (Dual) + Commissioning battery + front USB (Only for mechanics digits F and G) F: Self-powered + 100-230 Vac/dc (Dual) + Commissioning battery + front USB (Only for mechanics digits F and G)
				0 1 2 3 4							ADDITIONAL FUNCTIONS Striker Striker with external trip (49T) Coil Coil with external trip (49T) Striker with external trip adapted at 230 Vac
					0 1 2						COMMUNICATIONS 0: Local port (Modbus RTU) 1: Local port (Modbus RTU) + RS485 (Modbus RTU) 2: Local port (Modbus RTU) + RS485 (Modbus RTU or IEC60870-5-103) (“Only for Adaptation C”)
						0 1 2 3					INPUTS AND OUTPUTS Trip Trip + 2 outputs Trip + 2 outputs + 2 inputs Trip + 3 outputs
							1 2				MEMORY Non-volatile RAM memory Non-volatile RAM memory + Fast start-up
								A B C D			LANGUAGE English, Spanish, and German English, Spanish, and Turkish English, Spanish, and French English, Spanish, and Russian
									B C D E F G H I J		MECHANICS B: Horizontal assembly with 1 magnetic Flag C: Horizontal assembly with 3 magnetic Flags D: Double rear terminals, Vertical assembly with 1 magnetic Flag E: Vertical, Compact Size with 3 magnetic Flags F: Vertical, Compact Size with 3 Flags, Backlight LCD, Withdrawable G: Vertical Assembly, compact size with 1 magnetic indicator, Backlight LCD H: Double rear terminals, Vertical assembly with 1 magnetic Flag with anti-corrosive treatment I: Vertical, Compact Size with 3 magnetic Flags with anti-corrosive treatment J: Vertical, Compact Size with 3 magnetic Flags, Backlight LCD. SBEF application
										- A B C	ADAPTATION 50_1 + 51 + 50G_1 + 51G +74TCS + PGC A: 50_1 + 51 + 50G_1 + 51G +74TCS + PGC + 50_2 + 50G_2 + 3 Settings group B: 50_1 + 51 + 50G_1 + 51G +74TCS + PGC + CLP + 4 Settings groups C: 50_1 + 51 + 50G_1 + 51G +74TCS + PGC + 50_2 + 50G_2 + 46 + 50BF+ 49 + 79 + 52 + 74CT + 46BC + SHB + 3 settings groups (Only for communication digit “2”)

Example of ordering code:

1	1	5	0	0	0	3	2	A	F	A	SIA C 1 1 5 0 0 0 3 2 A F A
SIA-C											