

SIU-C

VOLTAGE & FREQUENCY
PROTECTION RELAY

Primary & Secondary Distribution Protection



Feeder



Capacitor
Bank



Grid
Interconnection

PM I V f CI Current sensors VI Voltage sensors



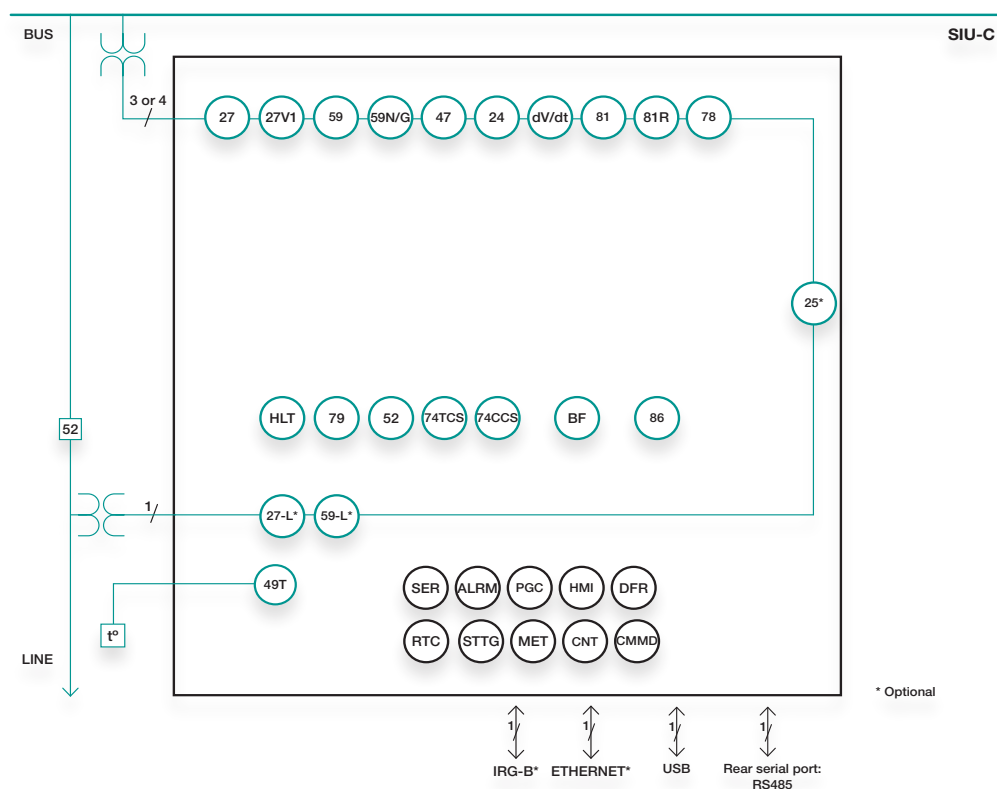
KEMA Labs

G99
Compliant

- The SIU-C is a voltage and frequency protection relay for transformers and electrical machines in high, medium, and low voltage distribution systems, fitted with an auxiliary power supply of 24-230 Vdc/ac.
- 5 voltage channels for conventional VTs.
- Capability of measuring up to 1.000 volts when connected directly to the low voltage line.
- Metal housing with high electromagnetic compatibility level (EMC) and a wide range of operating temperature.
- Protection against decoupling, load shedding and Loss of Main (islanding). Loss of Main (islanding) occurs when part of the public utility network loses connection with the rest of the system. If this situation is not detected, a network safety hazard can be present if the generator remains connected, since an automatic reconnection of the generator may occur causing damage to the generator and the network. SIU-C relay detects this hazardous situation thanks to its voltage and frequency functions based on the Rate Of Change Of Frequency (ROCOF) method.
- Signalling and control of the circuit breaker (52 function) and the recloser (79 function).
- The front part of the SIU-C relays is provided with a navigation keypad made of 7 keys (including the RESET key), 6 programmable hot keys that by default are configured: two (2) keys to open and close the CB, two (2) keys to block and unblock the recloser and two (2) keys to put the relay in local or remote mode with their associated three (3) configurable control LEDs. Besides, eight (8) programmable alarm LEDs.
- To allow the communication, relays are provided with a local micro-USB front port and with remote communication with different options (ports and protocols) on the rear side:
 - » Rear Serial Port: IEC60870-5-103, Modbus RTU or DNP3.0 Serial (selectable by general settings).
 - » Rear Ethernet Port (RJ45 or FO-LC): Modbus TCP/IP, DNP3.0 TCP/IP, IEC60870-5-104 or IEC61850 (selectable by general settings) + SNMP Protocol + Web Server.

- Wireless communication (Wi-Fi) and synchronization through IRIG-B are optional (depending on the model).
- Alarms panel is available.
- The SIU-C is provided with (depending on the model):
 - » 8 configurable inputs and 7 configurable outputs.
 - » 11 configurable inputs and 5 configurable outputs.
- SIU-C is provided with non-volatile RAM memory in order to store up to 3072 events and the disturbance fault recording (DFR), maintaining date & time thanks to its internal RTC (Real Time Clock). The configurable options are:
 - » 5 records in data and COMTRADE format (300 cycles each record): 1 to 8 pre-fault cycles + 292 to 299 post-fault cycles.
 - » 25 records in data and COMTRADE format (60 cycles each record): 1 to 8 pre-fault cycles + 52 to 59 post-fault cycles.
 - » 50 records in data and COMTRADE format (30 cycles each record): 1 to 8 pre-fault cycles + 22 to 29 post-fault cycles.
 - » 100 records in data and COMTRADE format (15 cycles each record): 1 to 8 pre-fault cycles + 7 to 14 post-fault cycles.
- Each oscillographic record contains 9 analogue channels and up to 96 configurable 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).

FUNCTIONS DIAGRAM SIU-C



ANSI CODE PROTECTIONS

59	Inverse time phase overvoltage (Bus Bar)
59N/G	Inverse time calculated/measured neutral overvoltage (Bus Bar)
59-L	Inverse time phase overvoltage (Line)
47	Phase balance voltage protection (Bus Bar)
27	Inverse time phase undervoltage (Bus Bar)
27-L	Inverse time phase undervoltage (Line)
27V1	Inverse time positive sequence undervoltage (Bus Bar)
81O/U	Under/Overfrequency
81R	Rate of Change of Frequency (ROCOF)
78	Out of Step (Vector Shift)
24	Overfluxing
dV/dt	Rate of Change of Voltage
49T	External trip
79	AC Reclosing device
52	Breaker wear monitoring
25	Synchro Check
HLT	Hot Line Tag
BF	Circuit Breaker Failure
74TCS	Trip Circuit Supervision
74CCS	Close Circuit Supervision
86	Trip lockout
PGC	Programmable logic control

ADDITIONAL FUNCTIONS

CNT	Counters
RTC	Real Time Clock
ALRM	Alarm panel
PGC	Programmable Logic Control
HMI	Human Machine Interface
SER	Sequential Event Recording
DFR	Disturbance Fault Recording
MET	Metering
STTG	Settings Groups
CMMD	Commands

TECHNICAL PARAMETERS SIU-C

Function 27-1	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.060 to 300.000 s (step 0.001 s)
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Minimum level: 0.00 to 1.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 90%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 99%
Function 27-2	Defined time, voltage deactivation level: 101%
Function 27-3	Temporized deactivation
Function 27-4	Timing accuracy for IDMT curve selection:
	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)
Function 27V1-1	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.060 to 300.000 s (step 0.001 s)
	Voltage tap: 0.15 to 2.00 xUn (step 0.01xUn)
	Minimum level: 0.00 to 1.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 90%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 99%
Function 27V1-2	Defined time, voltage deactivation level: 101%
	Temporized deactivation
	Timing accuracy for IDMT curve selection:
	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)
Function 27-L (*)	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.060 to 300.000 s (step 0.001 s)
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Minimum level: 0.00 to 1.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 90%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 99%
	Defined time, voltage deactivation level: 101%
	Temporized deactivation
	Timing accuracy for IDMT curve selection:
	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)

Function 59-1	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.045 to 300.000 s (step 0.001 s)
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 110%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 101%
	Defined time, voltage deactivation level: 99%
Function 59-2	Temporized deactivation
Function 59-3	Timing accuracy for IDMT curve selection:
Function 59-4	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)
Function 59N/G-1	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.045 to 300.000 s (step 0.001 s)
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 110%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 101%
	Defined time, voltage deactivation level: 99%
Function 59N/G-2	Temporized deactivation
Function 59N/G-3	Timing accuracy for IDMT curve selection:
	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)
Function 59-L (*)	Function enable: No/Alarm/Trip
	Curve type: IDMT or DT
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Time delay: 0.045 to 300.000 s (step 0.001 s)
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Curve, voltage activation level: 110%
	Curve, voltage deactivation level: 100%
	Defined time, voltage activation level: 101%
	Defined time, voltage deactivation level: 99%
	Temporized deactivation
	Timing accuracy for IDMT curve selection:
	± 30 ms or ± 5% (greater of both)
	Timing accuracy for defined time curve selection:
	± 30 ms or ± 0.5% (greater of both)

TECHNICAL PARAMETERS SIU-C

Function 47-1 Function 47-2	Function enable: No/Alarm/Trip
	Voltage tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Time delay: 0.045 to 300.000 s (step 0.001 s)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Activation level: 101%
	Deactivation level: 99%
Function dV/dt-1 Function dV/dt-2	Temporized deactivation
	Timing accuracy: ± 30 ms or $\pm 0.5\%$ (greater of both)
	Function enable: No/Alarm/Trip
	Type: Increase or Decrease
	Activation level: 1.0 to 20.000 V/s (step 0.1 V/s)
	Time Delay: 0.500 to 30.00 s (step 0.001 s)
Function 81-1 Function 81-2 Function 81-3 Function 81-4 Function 81-5 Function 81-6 Function 81-7 Function 81-8	Reset time: 0.02 to 300 s (step 0.001 s)
	Timing accuracy: ± 60 ms or $\pm 5\%$ (greater of both).
	Function enable: No/Alarm/Trip
	Type: Underfrequency or overfrequency
	Activation level: 45.000 to 65.000 Hz (step 0.001 Hz)
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Function blocked if phase B voltage is lower than 20 volts P-N (35 volts P-P)
	Activation level: 100%
	Underfrequency reset level: activation level + 50mHz
	Overfrequency reset level: activation level - 50 mHz
	Temporized deactivation
Function 81R-1 Function 81R-2 Function 81R-3 Function 81R-4 Function 81R-5 Function 81R-6	Timing accuracy: ± 35 ms or $\pm 0.5\%$ (greater of both).
	The frequency measurement is an average value of the frequency measured during 8 cycles. The accuracy of the Time Delay is the adjusted value plus the necessary time to achieve the measurement during 8 cycles.
	Function enable: No/Alarm/Trip
	Type: Increase/Decrease
	Activation level: 0.10 to 5.00 Hz/s (step 0.01 Hz/s)
	Time delay: 0.060 to 40.000 s (step 0.001 s)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Function blocked if phase B voltage is lower than 20 volts P-N (35 volts P-P)
	Activation level: 100%
	Temporized deactivation
	The frequency measurement is an average value of the frequency measured during 8 cycles. The accuracy of the Time Delay is the adjusted value plus the necessary time to achieve the measurement during 8 cycles.
Function 78-1 Function 78-2	Function enable: No/Alarm/Trip
	Activation level: 1 to 25° (step 1°)
	Reset time: 0.020 to 300.000 s (step 0.001 s)
	Function blocked if phase B voltage is lower than 20 volts P-N (35 volts P-P)
	Temporized deactivation
	Measurement accuracy: $\pm 1^\circ$ or $\pm 10\%$ (greater of both)
Function 24-1 Function 24-2	Function enable: No/Alarm/Trip
	Curve Type: Inverse A, Inverse B, Inverse C and Defined Time.
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Time dial (TMS): 0.05 to 25.00 (step 0.01)
	Activation level: 0.50 to 2.00 xUn/Fn (step 0.01 xUn/Fn)
	Reset Time: 0.00 to 300.000 s (step 0.01 s)
	Curve, activation level: 110%
	Curve, deactivation level: 100%
	Defined time, activation level: 100%
	Defined time, deactivation level: 95%
	Temporized deactivation
	Timing accuracy for curves selection: ± 30 ms or $\pm 5\%$ (greater of both)
Function 79	Timing accuracy for defined time curve selection: ± 30 ms or $\pm 0.5\%$ (greater of both)
	Number of recloses: 0 to 4 (step 1)
	Reclose time 1, 2, 3, 4: 0.020 to 2000.000 s (step 0.01 s)
	Hold Enable: No/Yes/No Time
	Hold time: 0.02 to 2000.000 s (step 0.01 s)
	Reset time: 0.020 to 2000.000 s (step 0.01 s)
	Safe time: 0.020 to 2000.000 s (step 0.01 s)
	Locking possibilities: pulse inputs, level inputs, commands.
	Dead tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Live tap: 0.08 to 2.00 xUn (step 0.01xUn)
	Voltage supervision time: 0.060 to 300.000 s (step 0.001 s)
	Voltage difference: 0.05 to 2.00 xUn (step 0.01xUn)
Function 25 (*)	Phase difference: 2 to 90 ° (step 1°)
	Frequency difference: 0.060 to 10.000 Hz (step 0.001 Hz)
	Synchro check time: 0.020 to 300.000 s (step 0.001 s)
	Maximum number of openings: 1 to 100,000 (step 1)
	Repetitive number of openings: 1 to 100,000 (step 1)
	Time for repetitive number of openings: 1 to 300 min (step 1 min)
	Maximum opening time: 0.020 to 300.000 s (step 0.01 s)
	Maximum closing time: 0.020 to 300.000 s (step 0.01 s)
	Function enable: No/Yes
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Continuity in circuits A and B
Function 52	Function enable: No/Yes
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Continuity in circuits A and B
	Function enable: No/Yes
	Time delay: 0.020 to 300.000 s (step 0.001 s)
	Continuity in circuits A and B
	Function enable: No/Yes
	Time delay: 0.020 to 1.000 s (step 0.001 s)
Function 74TCS Function 74CCS	Available through configurable inputs thanks to the programmable logic
Function BF Function 49T	It allows to latch (lock out) the contact trip due to programmable logic (PGC: RSFF or SRFF).
Function 86	

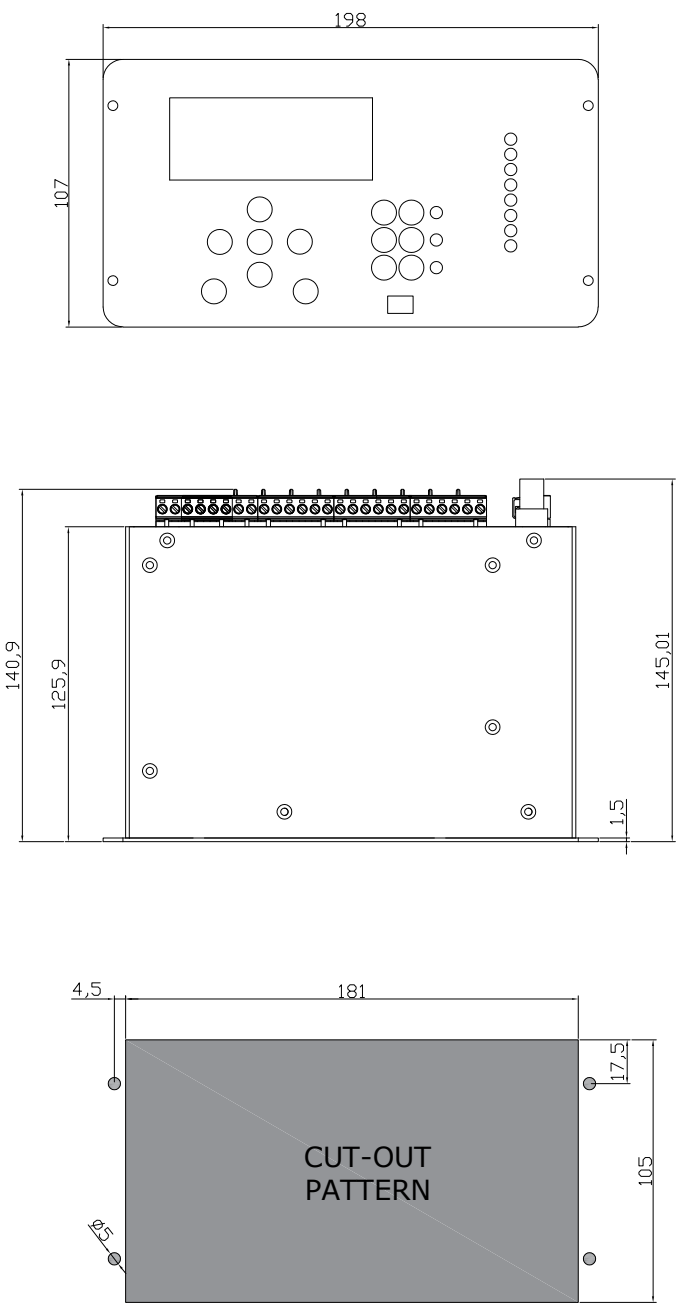
TECHNICAL PARAMETERS SIU-C

Programmable logic control (PGC)	OR, OR_1PULSE, OR_PULSES, OR_BLINKING, OR_TIMER UP, OR_TIMER DOWN NOR, NOR_1PULSE, NOR_PULSES, NOR_BLINKING, NOR_TIMER UP, NOR_TIMER DOWN AND, AND_1PULSE, AND_PULSES, AND_BLINKING, AND_TIMER UP, AND_TIMER DOWN NAND, NAND_1PULSE, NAND_PULSES, NAND_BLINKING, NAND_TIMER UP, NAND_TIMER DOWN XOR, OR_1PULSE, XOR_PULSES, XOR_BLINKING, XOR_TIMER UP, XOR_TIMER DOWN SRFF, SRFF_1PULSE, SRFF_PULSES, SRFF_BLINKING, SRFF_TIMER UP, SRFF_TIMER DOWN, SRFF_NON VOLATIL RSFF, RSFF_1PULSE, RSFF_PULSES, RSFF_BLINKING, RSFF_TIMER UP, RSFF_TIMER DOWN, RSFF_NON VOLATIL R_EDGE, R_EDGE_1PULSE F_EDGE, F_EDGE_1PULSE
Settings Groups	4 settings groups Selectable by input, communications, user commands or general setting.
Sequential Events Recording (SER)	3072 events
Disturbance fault recording (DFR)	32 samples/cycle
	Fault start configurable
	Configurable number of records depending on the size:
	5 records in data and COMTRADE format (300 cycles each record): 1 to 8 pre-fault cycles + 292 to 299 postfault cycles.
	25 records in data and COMTRADE format (60 cycles each record): 1 to 8 pre-fault cycles + 52 to 59 postfault cycles.
Inputs (*)	50 records in data and COMTRADE format (30 cycles each record): 1 to 8 pre-fault cycles + 22 to 29 postfault cycles.
	100 records in data and COMTRADE format (15 cycles each record): 1 to 8 pre-fault cycles + 7 to 14 postfault cycles.)
	COMTRADE IEEE C37.111-1991 - 5 analog channels and 96 digital channels
Outputs (*)	Depending on Model: - 8 configurable inputs - 11 configurable inputs The voltage of the inputs is the same as the auxiliary power supply Burden: 24 Vdc: <20 mW 230 Vdc: <200 mW 24 Vac: <50 mW 230 Vac: <500 mW
Frequency	50/60Hz

Energizing Quantities	Burden of voltage inputs: < 70 mVA Burden of power supply unit: 24-230 Vdc/Vac: < 20 VA Burden for binary inputs: 24 Vdc: <20 mW 230 Vdc: <200 mW 24 Vac: <50 mW 230 Vac: < 500 mW
Voltage measurements	Phase voltage (VA, VB, VC), Line Voltage (VL)*, phase-phase voltage (UAB, UBC, UCA), neutral voltage (VR, 3V0), positive sequence (V1) and negative sequence (V2), Maximum voltage (VMAX) and V/f.
	Fundamental values (DFT)
	Sampling: 32 samples/cycle
	Measured voltage: 1% precision in a band covering $\pm 20\%$ of nominal voltage and 4% in the rest of the range (ambient temperature) Calculated voltage: 2% precision in a band covering $\pm 20\%$ of nominal voltage and 4% in the rest of the range (ambient temperature) - With VTs: 3-250 V - Direct connection: Up to 1000 V
Angle Measurement	Voltage Angles: VA, VB, VC, VR, VL*, 3V0, UAB, UBC and UCA.
Frequency measurements	Busbar Frequency, Line Frequency, Rate of change of frequency (df/dt)
	Minimum voltage: 20V P-N (35 P-P) Accuracy: ± 0.005 Hz
Communications	Local port (micro-USB): Modbus RTU
	Remote port RS485: Modbus RTU, DNP3.0 or IEC60870-5-103
Power supply	Rear Ethernet Port (RJ45 (10/100 Base-Tx) or FO-LC(10/100 Base-Fx)): Modbus TCP/IP, DNP3.0 TCP/IP, IEC60870-5-104 or IEC61850 (selectable by general settings) + SNTP Protocol + Web Server + IRIG-B(*)
	24-230 Vac/dc (24-220 Vdc ($\pm 20\%$) / 100-230 Vac ($\pm 15\%$)) Burden: 24-230 Vdc/Vac: < 20 VA
Environmental conditions	Operating temperature: -40 to 70°C
	Storage temperature: -40 to 80°C
Mechanical characteristics	Relative humidity: 95%
	Metallic box
	Panel mounted
	Vertical assembly: HxWxD: 198x107x145.01 (mm) Horizontal assembly: HxWxD: 107x198x145.01 (mm) IP-54 (front)
(*) Optional depending on model	

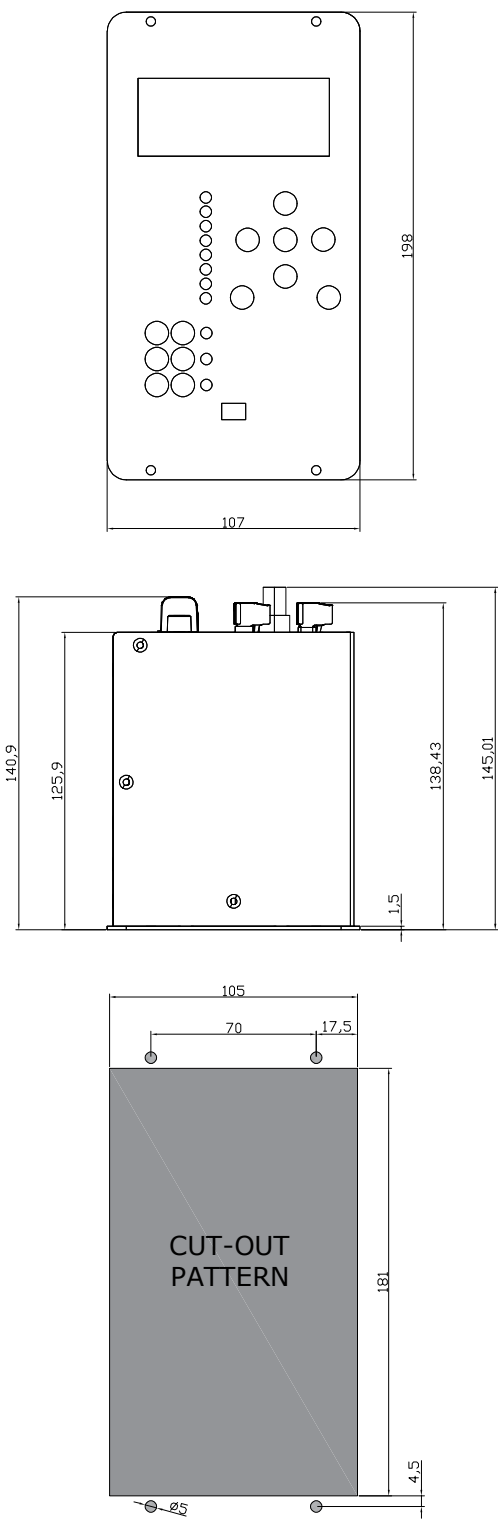
DIMENSIONS AND CUTOUT SIU-C

Horizontal assembly



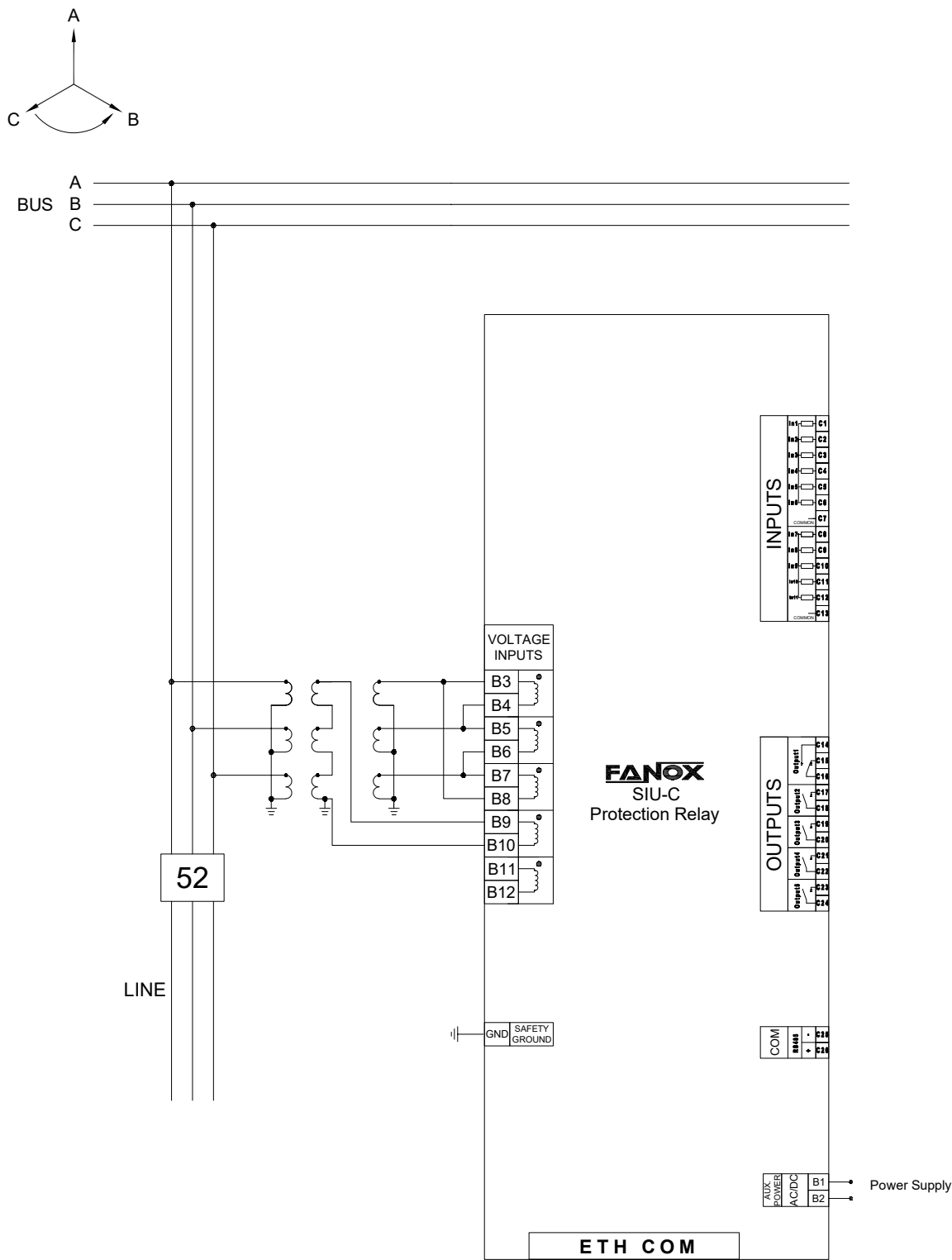
DIMENSIONS AND CUTOUT SIU-C

Vertical assembly



CONNECTIONS DIAGRAM SIU-C

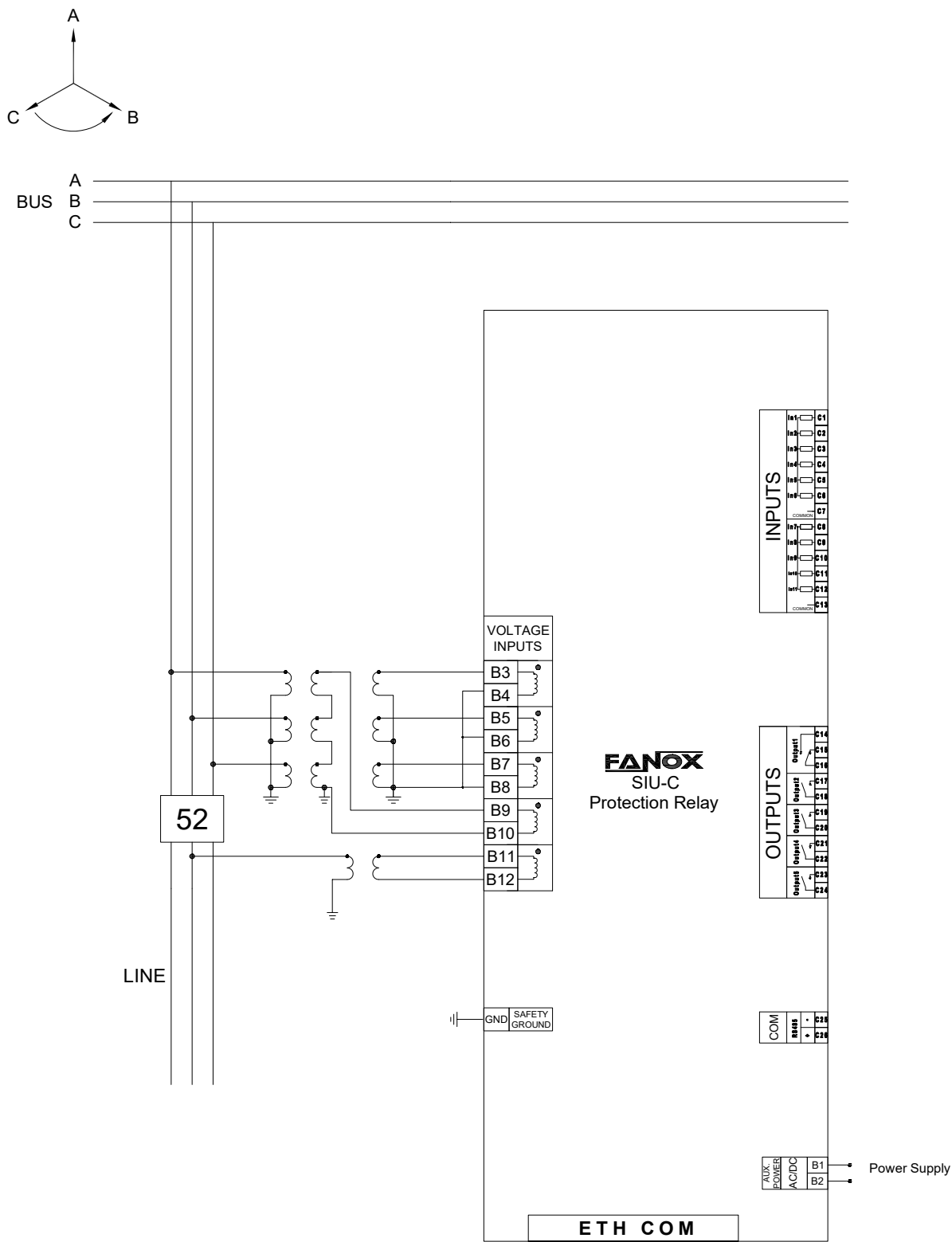
3 VTs CONFIGURATION (PHASE-PHASE) + RESIDUAL VOLTAGE



(*) Example of connections diagram

CONNECTIONS DIAGRAM SIU-C

3 VTs CONFIGURATION (PHASE-NEUTRAL) + RESIDUAL VOLTAGE + 1 VT FOR SYNCHRONISM



(*) Example of connections diagram

SELECTION & ORDERING DATA SIU-C

SIU-C

Voltage & Frequency Protection Relay

0										PHASE MEASUREMENT Up to 1000 V (direct connection) or 250 V (with VTs)
	0									NEUTRAL MEASUREMENT Defined by General Settings
		0								NET FREQUENCY Defined by General Settings
			C							POWER SUPPLY 24-230 Vac/dc
				0 1						ADDITIONAL FUNCTIONS - + 25 + 27-L + 59-L
					A B G O P Q R					COMMUNICATIONS A: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) B: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3.0 TCP or IEC60870-5-104) + Web Server + SNTP Protocol + IRIG-B G: USB (Modbus RTU) + WiFi + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3.0 TCP or IEC60870-5-104) + Web Server SNTP Protocol + IRIG-B O: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3 TCP, IEC 60870-5-104 or IEC61850) + Web Server SNTP Protocol + IRIG-B P: USB (Modbus RTU) + WiFi + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (RJ45) (Modbus TCP, DNP3 TCP, IEC 60870-5-104 or IEC61850) + Web Server SNTP Protocol + IRIG-B Q: USB (Modbus RTU) + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (FO-LC) (Modbus TCP, DNP3 TCP, IEC 60870-5-104 or IEC61850) + Web Server SNTP Protocol + IRIG-B R: USB (Modbus RTU) + WiFi + Rear Serial Port (Modbus RTU, IEC60870-5-103 or DNP3.0 Serial) + Rear Ethernet Port (FO-LC) (Modbus TCP, DNP3 TCP, IEC 60870-5-104 or IEC61850) + Web Server SNTP Protocol + IRIG-B
						0 1				INPUTS AND OUTPUTS 8 Inputs + 7 Outputs 11 Inputs + 5 Outputs
							C D E F			MECHANICAL ASSEMBLY Vertical Assembly Horizontal Assembly Vertical Assembly with anticorrosive treatment Horizontal Assembly with anticorrosive treatment
								A E F		LANGUAGE English, Spanish, German and French English, Spanish, Turkish and Russian English, Spanish, German and Portuguese
									B	ADAPTATION (4) 27 + (2) 27V1 + (4) 59 + (3) 59N/G + (2) 47 + (2) dV/dt + (8) 81U/O + (6) 81R + (2) 78 + (2) 24 + 74TCS + 74CCS + BF + 52 + 79 + 86 + 49T + HLT

Example of ordering code:

0	0	0	C	1	A	1	D	A	B	SIU-C 0 0 0 C 1 A 1 D A B
SIU-C										