SEM Three

SEM Three is a three-phase energy meter that allows to monitor electrical parameters of your installation including active energy, reactive energy, voltage, current, power, maximum demand and more. These parameters are measured separately for each phase, what gives SEM Three high versatility to work as a three-phase analyzer or a triple single-phase analyzer.

The design, occupying a single DIN rail module, allows that SEM Three can be placed easily at any installation.

The device has removal connectors for power supply (85-265 Vac), external current transformers (250 mA output) and RS-485 communications.

The communication of measured data works over Modbus RTU standard protocol.

TECHNICAL CHARACTERISTICS

Power circuit	
Input voltage	110 …. 264 Vac
Frequency	47 …. 63 Hz
Maximum consumption	2,5 …. 4,5 VA
Environmental conditions	
Temperature range	-10 …. +60ºC
Humidity range	5 …. 95%
Mechanical characteristics	
Enclosure material	Plastic UL94 – V0 Self-extinguishable
Protection grade	IP30
Unit dimensions (Width x Height x Length)	18 x 70 x 109 mm
Weight	70 g
Mounting	DIN Rail (1 module)
Maximum working altitude	2000 m
Serial interface	
Type	RS-485 three wires
Baud rate	9600 / 19200 bps configurable
Data bits	8
Parity	Without parity / Even configurable
Stop bits	1 / 2 configurable
Characteristics and electrical security	
Security	CAT III 300 V under EN 61010
Protection class	Class II
External current transformers	Series TRC and TRA (In / 0,250 A)
Standards	
Standards	UNE EN 61010-1:2010, UNE-EN 61000-6-2, UNE-EN 61000-6-4

COMMUNICATION

The device comes equipped with a RS-485 communication port to read and write the parameters of the device or other devices connected. The protocol used is Modbus RTU.

By default the device is configured with **peripheral number 72** (decimal) and **communication mode 4** (9600 bps, 8, N, 1). Using the command for changing the device number it is possible to assign any other number (maximum FF in hexadecimal or 255 in decimal).

In case you don't remember the slave number, you can return to default number and communication mode following this steps:

- Power off the device
- Press permanently reset button
- Power on the device and stop pressing the reset button

WORKING MODE

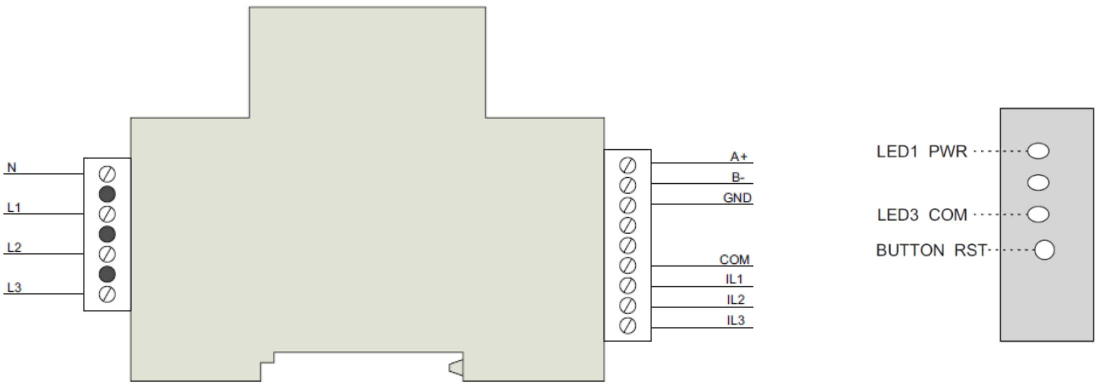
SEM Three has 4 different working modes for measuring the electrical parameters of an installation. To change the working mode you must change the value of register "Working mode" between mode 0 (default), 1, 2 or 3. Belong are shown the details of each mode:

- Mode 0: L1, L2 and L3 single-phase. Sum of all values measured in three-phase parameters
- Mode 1: L2 and L3 single-phase. L1 equilibrated three-phase. Sum of all values measured in three-phase parameters
- Mode 2: L3 single-phase. L1 and L2 equilibrated three-phase. Sum of all values measured in three-phase parameters
- Mode 3: L1, L2 and L3 equilibrated three-phase. Sum of all values measured in three-phase parameters

Mode 0	L1	Total three-phase
	L2	
	L3	
Mode 1	L1 (x3)	
	L2	
	L3	
Mode 2	L1 (x3)	
	L2 (x3)	
	L3	
Mode 3	L1 (x3)	
	L2 (x3)	
	L3 (x3)	

CONNECTIONS AND LEDS

Input voltage of **SEM Three** is connected at terminals L1 and N and external current transformers are used for current metering. Next are detailed all connections and leds:



INSTALLATION

During the installation, you must disconnect all the circuits in order to avoid any electrical risk.
If you are installing the current transformers, first connect the transformer wires to the energy meter and after that place the split or closed core around the electric cable that you want to monitor.
The SEM Three unit must be installed on an electric panel or enclosure, attached to a DIN rail (IEC 60715).
The unit must be connected to a power circuit that is protected with gl (IEC 269) or M type fuses with a rating of 0.5 to 2 A. It must be fitted with a circuit breaker or equivalent device, in order to be able to disconnect the unit from the power supply network. The power circuit must be connected with cables that have a minimum cross-section of 1mm^2.
The secondary line for the current transformer shall have a minimum cross section of 2.5 mm^2.
The temperature rating of insulation of wires connected to the device will be at minimum 62ºC.

OPERATING TIME COUNT

The module of operating time count allows to know how long a threshold value is exceeded to monitor an important time counter of a machine usage, a work shift efficiency or the generation time during a day.

SEM Three has two counters per phase and two for three-phase parameters, a counter of **Partial operating time and a Total operating time**, that will be activated depends on the parameter configured in *Parameter for Operating time*, once the *Threshold for Operating time* is exceeded longer than the time configured in *Delay on counting for Operating time*.

The value that must be written in *Parameter for Operating time* is shown at column **Symbol** of the Modbus RTU Commands. For example, to configure the *Voltage*, you must write the value 1 on the above-mentioned register.

MODBUS RTU COMMANDS

Magnitude	Symbol	Registers	Unity	Function
Peripheral number	NPER	0x00	ID 72 (default)	3,6,16(0x10)
Communication parameters	COM	0x01	0: 9600, 8, E, 1 1: 19200, 8, E, 1 2: 9600, 8, N, 2 3: 19200, 8, N, 2 4: 9600, 8, N, 1 (default) 5: 19200, 8, N, 1	3,6,16(0x10)
Hardware version	HVER	0x07		3
Software version	SVER	0x08		3
Serial number	SERIAL	0x09-0x0A		3
Working mode	WRKM	0x0C	0: L1, L2, L3 (default) 1: L1(x3), L2, L3 2: L1(x3), L2(x3), L3 3: L1(x3), L2(x3), L3(x3)	3,6,16(0x10)
Current transformer XX/250mA phase 1	CT1	0x32	100 A (default)	3,6,16(0x10)
Current transformer XX/250mA phase 2	CT2	0xFA	100 A (default)	3,6,16(0x10)
Current transformer XX/250mA phase 3	CT3	0x1C2	100 A (default)	3,6,16(0x10)
Parameter for Operating time phase 1	OTVAR1	0x278		3,6,16(0x10)
Threshold for Operating time phase 1	OTVAL1	0x279-0x27A	V/mA/w/var/VA	3,6,16(0x10)
Delay on counting for Operating time phase 1	OTDLY1	0x27F	s	3,6,16(0x10)
Parameter for Operating time phase 2	OTVAR2	0x2DC		3,6,16(0x10)
Threshold for Operating time phase 2	OTVAL2	0x2DD-0x2DE	V/mA/w/var/VA	3,6,16(0x10)
Delay on counting for Operating time phase 2	OTDLY2	0x2E3	s	3,6,16(0x10)
Parameter for Operating time phase 3	OTVAR3	0x340		3,6,16(0x10)
Threshold for Operating time phase 3	OTVAL3	0x341-0x342	V/mA/w/var/VA	3,6,16(0x10)
Delay on counting for Operating time phase 3	OTDLY3	0x347	s	3,6,16(0x10)
Parameter for Operating time III	OTVART	0x3A4		3,6,16(0x10)
Threshold for Operating time III	OTVALT	0x3A5-0x3A6	V/mA/w/var/VA	3,6,16(0x10)
Delay on counting for Operating time III	OTDLYT	0x3AB	s	3,6,16(0x10)
Voltage phase 1	VI1 (1)*	0x02-0x03	V x 10	4
Current phase 1	AI1 (2)*	0x04-0x05	mA	4
Active power phase 1	APITOT1 (3)*	0x06-0x07	W	4
Reactive power phase 1	RPITOT1 (4)*	0x08-0x09	var	4
Apparent power phase 1	VAITOT1 (5)*	0x0A-0x0B	VA	4
Power factor phase 1	PFI1 (6)	0x0C-0x0D	x 1000	4
Maximum demand phase 1	MDI1 (7)*	0x0E-0x0F	W	4
Cos φ phase 1	COSI1 (8)*	0x26-0x27	x 1000	4
Frequency phase 1	FQI1 (9)*	0x28-0x29	Hz x 100	4
Active energy phase 1	AETOT1	0x3C-0x3D	Wh	4
Inductive reactive energy phase 1	IETOT1	0x3E-0x3F	varLh	4
Capacitive reactive energy phase 1	CETOT1	0x40-0x41	varCh	4
Apparent energy phase 1	VAETOT1	0x42-0x43	VAh	4
Active power consumed phase 1	API1 (10)*	0x258-0x259	w	4

Inductive reactive power consumed phase 1	IPI1 (11)*	0x25A-0x25B	varL	4
Capacitive reactive power consumed phase 1	CPI1 (12)*	0x25C-0x25D	varC	4
Apparent power consumed phase 1	VAI1 (13)*	0x25E-0x25F	VA	4
Active power generated phase 1	NAPI1 (14)*	0x260-0x261	w	4
Inductive reactive power generated phase 1	NIPI1 (15)*	0x262-0x263	varL	4
Capacitive reactive power generated phase 1	NCPI1 (16)*	0x264-0x265	varC	4
Apparent power generated phase 1	NVAI1 (17)*	0x266-0x267	VA	4
Active energy consumed phase 1	AE1	0x268-0x269	wh	4
Inductive reactive energy consumed phase 1	IE1	0x26A-0x26B	varLh	4
Capacitive reactive energy consumed phase 1	CE1	0x26C-0x26D	varCh	4
Apparent energy consumed phase 1	VAE1	0x26E-0x26F	VAh	4
Active energy generated phase 1	NAE1	0x270-0x271	wh	4
Inductive reactive energy generated phase 1	NIE1	0x272-0x273	varLh	4
Capacitive reactive energy generated phase 1	NCE1	0x274-0x275	varCh	4
Apparent energy generated phase 1	NVAE1	0x276-0x277	VAh	4
Operating time partial counter phase 1	OTP1	0x27B-0x27C	s	4,6,16(0x10)
Operating time total counter phase 1	OTT1	0x27D-0x27E	s	4
Voltage phase 2	VI2 (1)*	0x66-0x67	V x 10	4
Current phase 2	AI2 (2)*	0x68-0x69	mA	4
Active power phase 2	APITOT2 (3)*	0x6A-0x6B	W	4
Reactive power phase 2	RPITOT2 (4)*	0x6C-0x6D	var	4
Apparent power phase 2	VAITOT2 (5)*	0x6E-0x6F	VA	4
Power factor phase 2	PFI2 (6)*	0x70-0x71	x 1000	4
Maximum demand phase 2	MDI2 (7)*	0x72-0x73	W	4
Cos φ phase 2	COSI2 (8)*	0x8A-0x8B	x 1000	4
Frequency phase 2	FQI2 (9)*	0x8C-0x8D	Hz x 100	4
Active energy phase 2	AETOT2	0xA0-0xA1	Wh	4
Inductive reactive energy phase 2	IETOT2	0xA2-0xA3	varLh	4
Capacitive reactive energy phase 2	CETOT2	0xA4-0xA5	varCh	4
Apparent energy phase 2	VAETOT2	0xA6-0xA7	VAh	4
Active power consumed phase 2	API2 (10)*	0x2BC-0x2BD	w	4
Inductive reactive power consumed phase 2	IPI2 (11)*	0x2BE-0x2BF	varL	4
Capacitive reactive power consumed phase 2	CPI2 (12)*	0x2C0-0x2C1	varC	4
Apparent power consumed phase 2	VAI2 (13)*	0x2C2-0x2C3	VA	4
Active power generated phase 2	NAPI2 (14)*	0x2C4-0x2C5	w	4
Inductive reactive power generated phase 2	NIPI2 (15)*	0x2C6-0x2C7	varL	4
Capacitive reactive power generated phase 2	NCPI2 (16)*	0x2C8-0x2C9	varC	4
Apparent power generated phase 2	NVAI2 (17)*	0x2CA-0x2CB	VA	4
Active energy consumed phase 2	AE2	0x2CC-0x2CD	wh	4
Inductive reactive energy consumed phase 2	IE2	0x2CE-0x2CF	varLh	4
Capacitive reactive energy consumed phase 2	CE2	0x2D0-0x2D1	varCh	4
Apparent energy consumed phase 2	VAE2	0x2D2-0x2D3	VAh	4
Active energy generated phase 2	NAE2	0x2D4-0x2D5	wh	4
Inductive reactive energy generated phase 2	NIE2	0x2D6-0x2D7	varLh	4
Capacitive reactive energy generated phase 2	NCE2	0x2D8-0x2D9	varCh	4
Apparent energy generated phase 2	NVAE2	0x2DA-0x2DB	VAh	4
Operating time partial counter phase 2	OTP2	0x2DF-0x2E0	s	4,6,16(0x10)
Operating time total counter phase 2	OTT2	0x2E1-0x2E2	s	4
Voltage phase 3	VI3 (1)*	0xCA-0xCB	V x 10	4
Current phase 3	AI3 (2)*	0xCC-0xCD	mA	4
Active power phase 3	APITOT3 (3)*	0xCE-0xCF	W	4
Reactive power phase 3	RPITOT3 (4)*	0xD0-0xD1	var	4
Apparent power phase 3	VAITOT3 (5)*	0xD2-0xD3	VA	4
Power factor phase 3	PFI3 (6)*	0xD4-0xD5	x 1000	4
Maximum demand phase 3	MDI3 (7)*	0xD6-0xD7	W	4
Cos φ phase 3	COSI3 (8)*	0xEE-0xEF	x 1000	4
Frequency phase 3	FQI3 (9)*	0XF0-0xF1	Hz x 100	4
Active energy phase 3	AETOT3	0x104-0x105	Wh	4
Inductive reactive energy phase 3	IETOT3	0x106-0x107	varLh	4
Capacitive reactive energy phase 3	CETOT3	0x108-0x109	varCh	4

Apparent energy phase 3	VAETOT3	0x10A-0x10B	VAh	4
Active power consumed phase 3	API3 (10)*	0x320-0x321	w	4
Inductive reactive power consumed phase 3	IPI3 (11)*	0x322-0x323	varL	4
Capacitive reactive power consumed phase 3	CPI3 (12)*	0x324-0x325	varC	4
Apparent power consumed phase 3	VAI3 (13)*	0x326-0x327	VA	4
Active power generated phase 3	NAPI3 (14)*	0x328-0x329	w	4
Inductive reactive power generated phase 3	NIPI3 (15)*	0x32A-0x32B	varL	4
Capacitive reactive power generated phase 3	NCPI3 (16)*	0x32C-0x32D	varC	4
Apparent power generated phase 3	NVAI3 (17)*	0x32E-0x32F	VA	4
Active energy consumed phase 3	AE3	0x330-0x331	wh	4
Inductive reactive energy consumed phase 3	IE3	0x332-0x333	varLh	4
Capacitive reactive energy consumed phase 3	CE3	0x334-0x335	varCh	4
Apparent energy consumed phase 3	VAE3	0x336-0x337	VAh	4
Active energy generated phase 3	NAE3	0x338-0x339	wh	4
Inductive reactive energy generated phase 3	NIE3	0x33A-0x33B	varLh	4
Capacitive reactive energy generated phase 3	NCE3	0x33C-0x33D	varCh	4
Apparent energy generated phase 3	NVAE3	0x33E-0x33F	VAh	4
Operating time partial counter phase 3	OTP3	0x343-0x344	s	4,6,16(0x10)
Operating time total counter phase 3	OTT3	0x345-0x346	s	4
Active power III	APITOTT (1)**	0x132-0x133	W	4
Reactive power III	RPITOTT (2)**	0x134-0x135	var	4
Apparent power III	VAITOTT (3)**	0x136-0x137	VA	4
Power factor III	PFIT (4)**	0x138-0x139	x 1000	4
Maximum demand III	MDIT (5)**	0x13A-0x13B	W	4
Cos φ III	COSIT	0x152-0x153	x 1000	4
Active energy III	AETOTT	0x168-0x169	Wh	4
Inductive reactive energy III	RETOTT	0x16A-0x16B	varLh	4
Capacitive reactive energy III	CETOTT	0x16C-0x16D	varCh	4
Apparent energy III	VAETOTT	0x16E-0x16F	VAh	4
Active power consumed III	APIT (6)**	0x384-0x385	w	4
Inductive reactive power consumed III	IPIT (7)**	0x386-0x387	varL	4
Capacitive reactive power consumed III	CPIT (8)**	0x388-0x389	varC	4
Apparent power consumed III	VAIT (9)**	0x38A-0x38B	VA	4
Active power generated III	NAPIT (10)**	0x38C-0x38D	w	4
Inductive reactive power generated III	NIPIT (11)**	0x38E-0x38F	varL	4
Capacitive reactive power generated III	NCPIT (12)**	0x390-0x391	varC	4
Apparent power generated III	NVAIT (13)**	0x392-0x393	VA	4
Active energy consumed III	AET	0x394-0x395	wh	4
Inductive reactive energy consumed III	IET	0x396-0x397	varLh	4
Capacitive reactive energy consumed III	CET	0x398-0x399	varCh	4
Apparent energy consumed III	VAET	0x39A-0x39B	VAh	4
Active energy generated III	NAET	0x39C-0x39D	wh	4
Inductive reactive energy generated III	NIET	0x39E-0x39F	varLh	4
Capacitive reactive energy generated III	NCET	0x3A0-0x3A1	varCh	4
Apparent energy generated III	NVAET	0x3A2-0x3A3	VAh	4
Operating time partial counter III	OTPT	0x3A7-0x3A8	s	4,6,16(0x10)
Operating time total counter III	OTTT	0x3A9-0x3AA	s	4

*Only for parameters of Operating time phase 1, 2 and 3
**Only for parameters of Operating time III (three-phase)

MODEL REFERENCE

Model	Reference	Current secondary	Protocol	Communication
SEM Three	M010	250 mA	Modbus/RTU	RS-485

CURRENT TRANSFORMERS REFERENCES

PickData recommends the use of efficient transformers from series TRA and TRC for SEM Three:

Model	Reference	Maximum current	Power class	Inner diameter
TRA1 20A	T024	20 A	1	16 mm
TRA1 80A	T004	80 A	1	10 mm
TRA1 100A	T005	100 A	1	16 mm
TRA1 250A	T025	250 A	1	24 mm
TRC1 20A	T026	20 A	0,5	13 mm
TRC1 100A	T006	100 A	0,5	12 mm
TRC1 250A	T007	250 A	0,5	19 mm

SAFETY PRECAUTIONS

DANGER
Warns of a risk, which could result in personal injury or material damage caused by an incorrect handling or installation of the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire. Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.

DISCLAIMER

PickData, SL reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

PickData, SL on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

MAINTENANCE AND TECHNICAL SERVICE

Device doesn't require maintenance.
In the case of any query in relation to unit operation or malfunction, please contact the PickData, SL technical support service.

PickData, SL – Technical support service
Calle Innovació, 3
08232 – Viladecavalls (Barcelona), SPAIN
Tel: (34) 935 117 505 (España)
Email: sat@pickdata.net