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Operating Manual for

SMC 133

Short version 2.0

The complete and most actual version of this manual is available online at http://www.KMB.cz/

Contents

1 General Description

The SMC 133 is specially designed for monitoring of energy and power quality in advanced power systems and smart grids. It is intended to be used mostly for DIN rail mounting. This display-less design with multiple communication options is suitable for a wide spectrum of automation tasks in modern buildings, distributed power generation, remote supervision of the infrastructure and also remote load management. Absence of local panel controls (display and keyboard) limits possibilities for hostile user interaction. To protect the actual setup and collected data each instrument can be locked by a custom pin. It uses standard RS-485 serial line for communication with remote control systems. Optionally it can be equipped with other communication peripherals such as or USB, WiFi and Ethernet interface.

It is equipped with three voltage inputs and three current inputs. The default option X/5A uses common X/5A or X/1A current transformers. The instrument can be also supplied with for current transformers with X/100 mA ratio,

Warning ! The X/100mA, options are specially designed to be used only in combination with provided external current sensors which are supported with the respective option.

The SMC 133 is available in several configurations according to the customer requirements[1]. See the ordering scheme on figure 1.

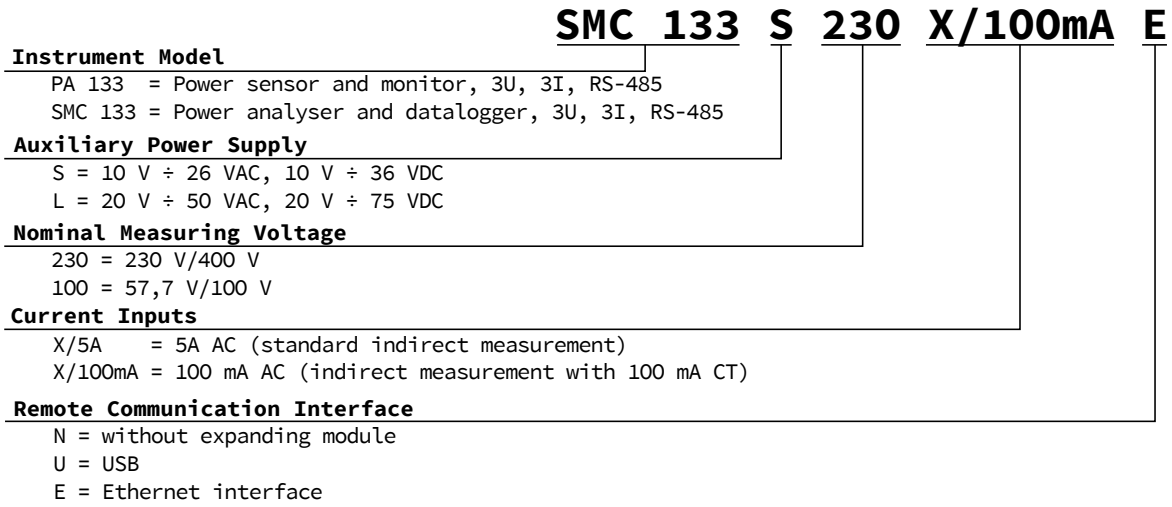

Figure 1: Schematics of the SMC 133 ordering options and variants. It includes special codes for proper current and voltage rating options.

2 Operating the Meter

2.1 Safety requirements when using SMC 133

Warning !: When working with the instrument it is necessary to perform all necessary measures for the protection of persons and property against injury and electric shock.

- The device must be operated by a person with all required qualifications for such work and this person must know in detail the operation principles of the equipment listed in this description!

[1]Complete and most up to date list of optional and other accessories are available on request from the device vendor.

- When the device is being connected to the parts which are under dangerous voltage it is necessary to comply with all the necessary measures to protect users and equipment against injury with electrical shock.
- Person, performing the installation or maintenance of the instrument must be equipped with and must use personal protective clothing and tools.
- If the analyzer is used in a manner not specified by the manufacturer, the protection provided by the analyzer may be impaired.
- If the analyzer or its accessories appear to be impaired or not functioning properly, do not use it and send it in for repair.

2.2 Installation of the instrument

Natural air circulation should be provided inside the distribution board cabinet, and in the instrument's neighborhood. Especially underneath the instrument, no other instrumentation that is source of heat should be installed or the temperature value measured may be influenced. A connection wire's maximum cross section area is 2.5 mm^2 in case of all screw terminals.

The SMC 133 is primarily intended for DIN-rail mounting. Dimensions of the instrument are on figure 2. There are also positions marked with dash dot lines of holes for wall-mounting with three screws.

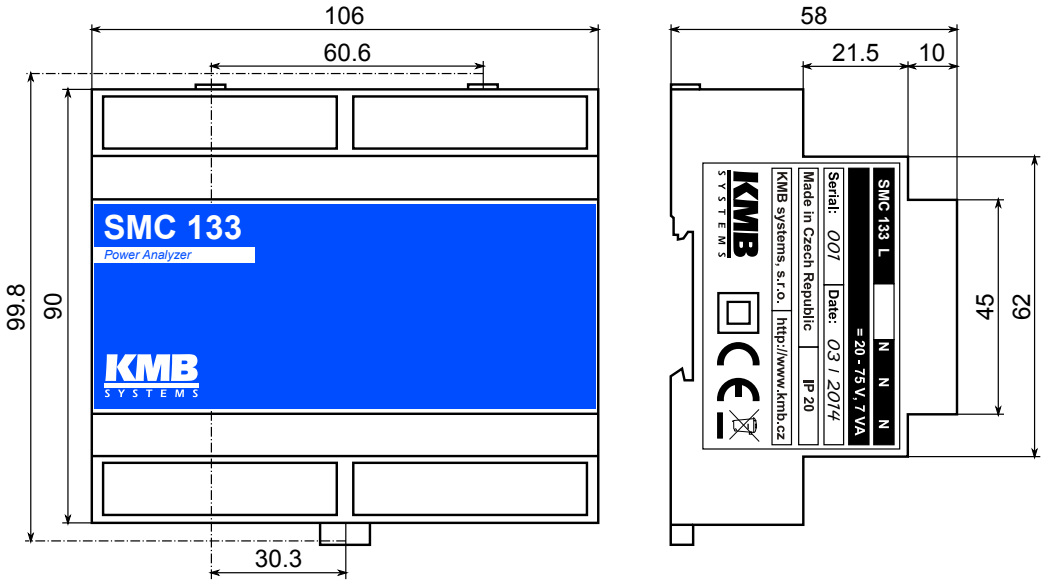

Figure 2: Dimensions of the SMC 133 analyzer.

2.2.1 Supply voltage

Warning !: SMC 133 instruments have only low voltage DC auxiliary power supply options L and S. Pay extra attention to use correct power supply.

Power supply voltage (options in ch. 3) must be connected to the terminals X1 and X2 via a circuit breaking device (power switch – see installation diagram on figure 3). It has to be located left to the instrument and reachable by the operator. The circuit breaking device must be identified as the equipment power disconnection

switch. A circuit breaker of the nominal value $1\,A$ is a convenient circuit breaking device. Its function and position has to be clearly identified (symbols '0' and 'I' acc. to IEC EN 61010-1). Internal power supply is galvanically isolated from internal circuits.

2.2.2 Measured voltage

The measured voltages are connected to the terminals L1, L2 and L3. Connect the neutral wire to the terminal N. With delta or Aaron connections terminal N remains unused. Voltage measurement inputs are connected with internal circuits over high impedance.

It is suitable to protect the measured voltage lines for example with 1A fuses of the required rating. Measured voltages can also be connected via instrument voltage transformers. A connection cable maximum cross section area is $2.5\,mm^2$ for voltage terminals.

2.2.3 Measured currents

The instruments are designed for indirect current measurement via external CT only. Proper current signal polarity (S1 or S2 terminals, k or l in the older notation) must be observed. You can check the polarity by the sign of phase active powers on the instrument display or in ENVIS application (in case of energy transfer direction is known, of course).

X/5A current input option The current signals from 5A or 1A instrument current transformers must be connected to the terminal pairs I11, I12, I21, I22, I31, I32. A connection cable maximum cross section area is $2.5\,mm^2$.

X/100mA current input option The supplied current transformers (which are standard accessory) must be clamped on measured wires and interconnected with corresponding terminal pairs I11, I12, I21, I22, I31, I32 using a twisted-pair cable of maximum length of 3 m.

Warning !: Connection of the common X/5A, X/1A or another unsupported current transformers to an instrument with X/100mA option is strictly forbidden !!! The instrument can be seriously damaged!

The secondary winding of the X/100mA transformers is led to the screw terminals. The S1, S2 (or „K"/„L" and „k"/„l") orientation is marked on the CT guide groove. A connection cable maximum cross section area is $1.5\,mm^2$.

2.2.4 Communication peripherals

All peripherals stated below are galvanically isolated from the rest of the instrument and from each other.

USB (optional) communication port for USB slave is located on the front panel. This communication port is intended for easy local configuration and fast download of archived data to the local PC. Use the supplied USB cable only (USB-A/mini). SMC 133 is a USB 2.0 slave device. For correct operation it needs a driver installed in your operating system (see the ENVIS user guide for more info).

Ethernet interface (optional) 10Base-T Ethernet interface with RJ-45 connector described *ETH* is situated on a top panel of the device. Ethernet interface can be used as substitution for the primary RS-485 for connection of the device to LAN and for easy connection of remote control PC.

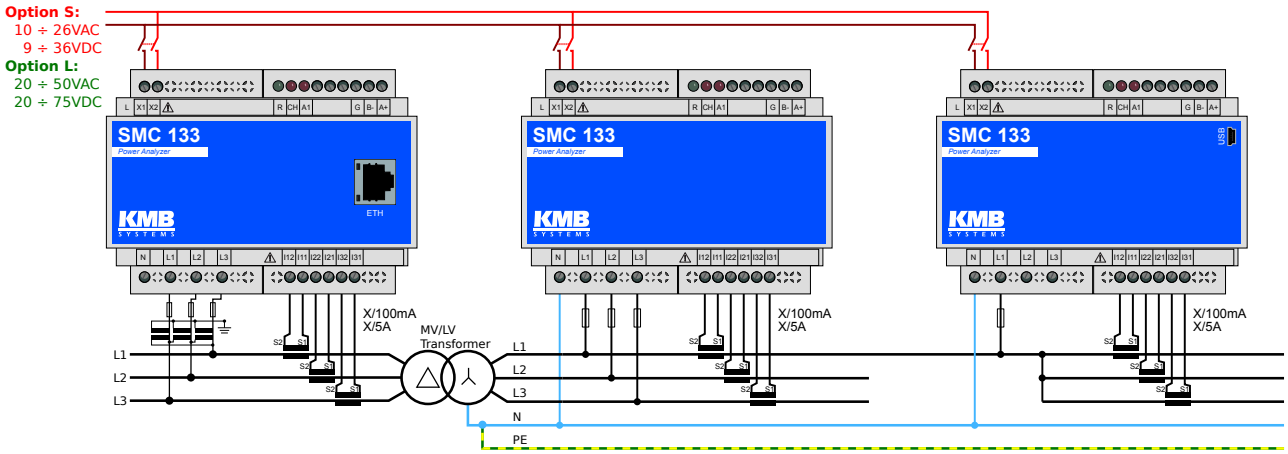

Figure 3: An example of typical installation of SMC 133 instrument in a low voltage network — options L or S for various LVDC power supplies. Typical connection options for voltage measurements: star, delta and single phase feeders. Option E for Ethernet port remote communication, option U for local USB communication port (all instruments provide RS485 serial line).

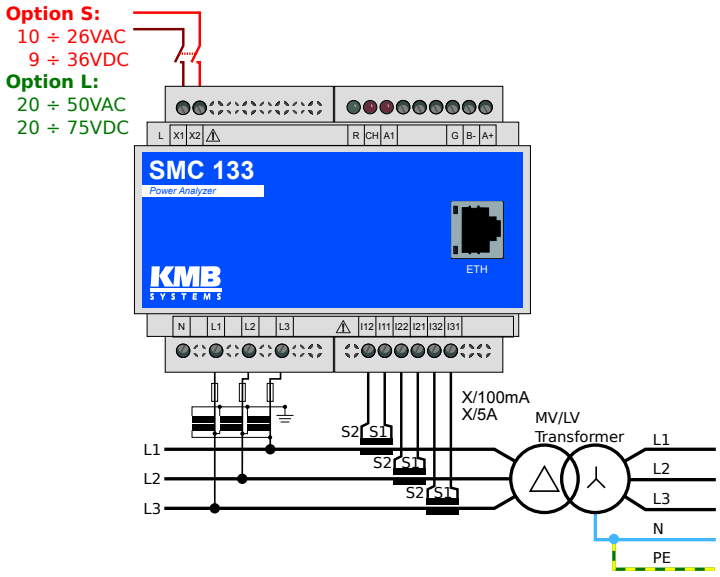

Figure 4: Example of typical connection of SMC 133 with indirect measurement via voltage transformers.

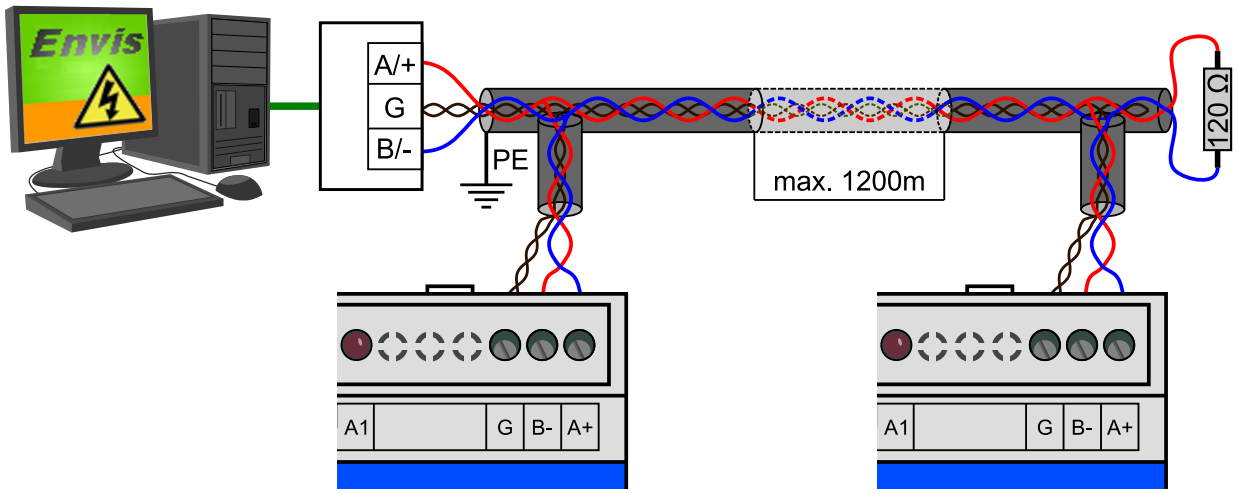

Figure 5: Typical wiring of the RS-485 communication line terminals in SMC 133 .

RS-485 serial line serves usually as a remote communication for reading of actual data, archive downloading and device configuration. Serial RS-485 line uses terminals *A+*, *B-* with shielding at terminal *G* of *COM1* block (fig. 5). The end point of the communication line must be properly terminated with ˜120Ω resistor.

2.3 Downloading data to PC

Connect the instrument to the PC and run ENVIS.Daq application. Select the appropriate communication option and connect to the instrument. In the next screen press *Refresh All*. This will load and display the actual status of each supported archive.

Device Information section contains editable description and name under which the actual record is stored. *Time Frame for Other Archives* tab allows you to limit the date ranges of all archives by the time interval of the main archive. In the *Destination* section the actual storage can be selected - either to the SQL database or to the file. The check boxes in *Archives to Download* determines which specific archive(s) you want to download.

The actual download will start by pressing the *Download All* button. progress is displayed on screen. When finished the archive can be viewed in the ENVIS application. User can open the downloaded file directly from ENVIS.Daq.

2.4 Energy meter readings

SMC 133 has an embedded three phase, four-quadrant energy meter with automatic meter reading functions and multiple programmable tariffs (Time-of-Use, TOU). The instrument registers active energy (EP, EP+, EP-) and reactive energy (EQL, EQC or EQC+, EQC-, EQL+, EQL-). According to the configuration of meter readings are shuffled to the respective tariffs. It automatically provides summaries per phase. For star connections and single phase measurements it can also register energy for each phase separately.

Meter data readings can be downloaded and analyzed in ENVIS or via the standard ModBus protool in any other system.

3 Technical Specifications

3.1 Basic Parameters

Auxiliary Voltage			
	model „L“	**model „S“**	
AC aux. voltage range, f: 40 ÷ 450 Hz	20 ÷ 50 VAC	10 ÷ 26 VAC	
DC aux. voltage range	20 ÷ 75 VDC	11 ÷ 36 VDC	
power supply	3,5 VA / 3,5 W		
overvoltage category	II		
pollution degree	2		
connection	isolated, polarity free		

Other Specifications	
operational temperature	- 20 to 60°C
storage temperature	- 40 to 80°C
operational and storage humidity	< 95 % - non-condensable environment
EMC – immunity	EN 61000 – 4 - 2 (6 kV / 8 kV) EN 61000 – 4 - 3 (10 V/m up to 3 GHz) EN 61000 – 4 - 4 (4 kV) EN 61000 – 4 - 5 (2 kVLL / 4 kVLG) EN 61000 – 4 - 6 (10 V) EN 61000 - 4 - 8 (100 A / 1000 A) EN 61000 – 4 - 11 (250 periods)
EMC – emissions	EN 55011, class A EN 55022, class A (not for home use)
communication ports	RS-485 (1200 ÷ 921600 Bd), optional USB, Ethernet 10Base-T
communication protocols	KMB, Modbus RTU and TCP, web server, DHCP
accuracy of RTC	± 2 seconds per day
capacity of RTC backup battery	> 5 years (without supply voltage applied)
protection class front panel whole instrument	 IP 40 IP 20
dimensions front panel whole instrument	 106 x 45 mm 106 x 90 x 58 mm
weight	max. 0.25 kg

3.2 Measured Quantities

Measured Quantities – Voltage	
Frequency	
f_{NOM}– nominal frequency	50 / 60 Hz
measuring range	40 ÷ 70 Hz
uncertainty	± 10 mHz
Voltage	
voltage input option	**standard variant („230“)**
U_{NOM} (U_{DIN})– rated voltage	180 ÷ 280 VAC
measuring range line-to-neutral	4 ÷ 420 VAC
measuring range line-to-line	7 ÷ 720 VAC
intrinsic uncertainty (t_A=23±2ºC)	+/- 0.05 % of rdg ± +/- 0.05 % of rng
temperature drift	+/- 0.03 % of rdg ± +/- 0.01 % of rng / 10 ºC
measurement category	300V CAT III
permanent overload	1820 VAC (UL–N)
peak overload, 1 second	2730 VAC (UL–N)
burden power (impedance)	< 0.05 VA (Ri = 3.78 MΩ)
Voltrage Unbalance	
measuring range	0 ÷ 10 %
measuring uncertainty	± 0.3% of rdg or ± 0.3
THDU	
measuring range	0 ÷ 20 %
measuring uncertainty	± 0.5
Harmonics (up to 50th order)	
reference conditions	other harmonics up to 200 % of class 3 acc. to IEC 61000–2-4 ed.2
measuring range	10 ÷ 100 % of class 3 acc. to IEC 61000–2-4 ed.2
measuring uncertainty	twice the levels of class II acc. to IEC 61000–4-7 ed.2

Measured Quantities – Current, Temperature			
Current			
current input option	**„X/100mA“**	**„X/5A“**	
I_{NOM} (I_B) – rated (basic) current	0.1 A_{AC}	5 A_{AC}	
measuring range	0.00025 ÷ 0.15 A_{AC}	0.0125 ÷ 7.5 A_{AC}	
intrinsic uncertainty (t_A=23 ±2 ºC)	+/- 0.05 % of rdg ± +/- 0.05 % of rng		
temperature drift	+/- 0.03 % of rdg ± +/- 0.01 % of rng / 10 ºC		
measurement category	600V CAT III	600V CAT III	
permanent overload	1 A_{AC}	10 A_{AC}	
peak overload 1 second, maximum repetition frequency > 5 minutes	10 A_{AC}	90 A_{AC}	
burden power (impedance)	< 0.001 VA (Ri < 0.1 Ω)	< 0.001 VA (Ri < 0.1 Ω)	
Current Unbalance			
measuring range	0 ÷ 100 %		
measuring uncertainty	± 1 % of rdg or ± 0.5		
Harmonics & Interharmonics (up to 50th order)			
reference conditions	other harmonics up to 1000 % of class 3 acc. to IEC 61000–2-4 ed.2		
measuring range	500 % of class 3 acc. to IEC 61000–2-4 ed.2		
measuring uncertainty	Ih <= 10 % I_{NOM} : ± 1 % I_{NOM}		
	Ih > 10 % I_{NOM} : ± 1 % of rdg		
THDI			
measuring range	0 ÷ 200 %		
measuring uncertainty	THDI <= 100 % : ± 0.6		
	THDI > 100 % : ± 0.6 % of rdg		
Temperature (internal sensor, measured value affected by the instrument power dissipation)			
measuring range	- 40 ÷ 80°C		
measuring uncertainty	± 2 ºC		

Measured Quantities – Power, Power Factor, Energy	
Active / Reactive Power, Power Factor (PF), cos φ (PNOM = UNOM x INOM)	
reference conditions “A” : ambient temperature (tA) U, I for active power, PF, cos φ for reactive power	 23 ± 2 ºC U = 80 ÷ 120 % UNOM, I = 1 ÷ 120 % INOM PF = 1.00 PF = 0.00
act. / react. power uncertainty	± 0.5 % of rdg ± 0.005 % PNOM
PF & cos φ uncertainty	± 0.005
“reference conditions ”B” : ambient temperature (tA) U, I for active power, PF, cos φ for reactive power	 23 ± 2 ºC U = 80 ÷ 120 % UNOM, I = 2 ÷ 120 % INOM PF >= 0.5 PF <= 0.87
act. / react. power uncertainty	± 1 % of rdg ± 0.01 % PNOM
PF & cos φ uncertainty	± 0.005
temperature drift of powers	± 0.05 % od rdg ± 0.02 % PNOM / 10 ºC
Energy	
measuring range	6 „quadrants“, corresponds to U & I measuring ranges
active energy uncertainty	class 1 acc. to EN 62053 – 21
reactive energy uncertainty	class 2 acc. to EN 62053 – 23

4 Maintenance, Service, Warranty

Maintenance: the SMC 133 power analyzer does not require any maintenance during its operation. For reliable operation it is only necessary to meet the operating conditions specified and not expose the instrument to violent handling and contact with water or chemicals which could cause mechanical damage.

The lithium cell built in the instrument can backup a real time circuit for more than 5 years without power supply, at average temperature $20^{\circ}C$ and load current in the instrument less than $10\,\mu A$. If the cell is empty, it is necessary to ship the instrument to the manufacturer for battery replacement.

The 18350 rechargable Li-ion battery cell for the instrument operation backup is also optionally installed inside the SMC 133 . If the battery fails it is necessary to ship the instrument to the manufacturer for battery replacement.

Service: in the case of failure or a breakdown of the product, you should contact the supplier at their address:

KMB Systems, s. r. o.
Tř. dr. M. Horákové 559
460 05 Liberec 7
Czech Republic
Tel. 485 130 314, Fax 482 739 957
E-mail: kmb@kmb.cz, Web: `www.kmb.cz`

The product must be in proper packaging to prevent damage during transit. A description of the problem or its symptoms must be delivered together with the product.

If a warranty repair is claimed, the warranty certificate must be sent in. In case of an out-of-warranty repair you have to enclose an order for the repair.

Warranty certificate: warranty period of 24 months from the date of purchase is provided for the instrument, however, no longer than 30 months from the day of dispatch from the manufacturer. Problems in the warranty period, provably because of faulty workmanship, design or inconvenient material, will be repaired free of charge by the manufacturer or an authorized servicing organization.

The warranty ceases even within the warranty period if the user makes unauthorized modifications or changes to the instrument, connects it to out-of-range quantities, if the instrument is damaged due to ineligible or improper handling by the user, or when it is operated in contradiction with the technical specifications presented.

Type of product:	SMC 133	Serial number:	.....
Date of dispatch:	.....	Final quality inspection:	.....
		Manufacturer's seal:	.....
Date of purchase:	.....	Supplier's seal:	.....