

Multifunction network analyzer
Q15U2... - Q96U2L - Q96U4...
Q15E2... - Q96E2... - MCU - MCUH
Programmable transducer MCUU...

OPERATING MANUAL

lpm0163.8 - Edition 06.09

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1. SAFETY PRECAUTIONS

The following general safety precautions must be observed during all phases of installation and operation of this instrument.

- Installation and operation of this instrument can be performed by qualified personnel only and according to the relevant Normatives.
- Servicing can be performed at Factory only.
- Before installing the instrument make sure that the housing is not damaged, otherwise the unit must be rejected and returned to the Factory for servicing.
- Ensure that the line and auxiliary power supply are switched off before connecting the instrument to the circuits.
- Wiring diagrams must be respected according to the required model.
- Make sure to operate the instrument according to the technical specifications as listed in this Manual.
- Do not operate the instrument in an explosive atmosphere and in presence of flammable liquids or vapours.
- The environmental operating conditions must be in the range as specified in this Manual.
- Never attempt to open the instrument's housing for any reason.
- Water or other liquid cleaners must be avoided.

Failure to comply with these precautions and with the instructions given elsewhere in this Manual violates safety standards of design, manufacture, and intended use of this instrument.

Langer Messtechnik GmbH assumes no liability for the Customer's failure to comply with these requirements.



When installing the meters, a protection of the voltage input terminals and of the auxiliary supply terminals must be carried out by means of fast or ultra fast fuses with rated current at 1A or 2A, rated voltage suitable to the system voltage, and breaking power adequate to the short-circuit current available at the connection point (the types 10x38, with ceramic body, rated voltage at 500V or at 660V, gG or FF characteristic and breaking power at 100KA are normally suitable for this application).

NOTE: The contents of this Manual are subject to change without prior notice as a result of improvements in performances and functions. Should you have any questions, please contact Langer Messtechnik GmbH.

2. TECHNICAL CHARACTERISTICS

LCD alphanumeric display
engineering unit and decimal point position
readings update
measuring type
basic accuracy

specified input range
reference frequency
VT ratio programming range
CT ratio programming range
continuous overload
short-term overload (1 second)
current circuits consumption
voltage circuits consumption
standard power supply

power supply consumption
operating temperature
storage temperature
galvanic insulation
test voltage
surge test
energy counting
maximum counting
accuracy class (energy)
bidirectionality
data retention time

backlighted, 2x16 characters (not MCU, MCUH) or 4x16 characters
automatic
0.5 sec.
TRMS
 $\pm 0.5\%$
 $\pm 0.2\%$ optional (not Q15E2..., Q96E2..., Q15U2X100)
5-120% U_n (90-110% U_n for self-supplied versions), 5-120% I_n
50/60Hz
1..10000 (not Q15U2X100, Q15E2..., Q96E2...)
1..10000 (not Q15U2X100)
2x I_n ; 1.2x U_n (1.1x U_n for Q15E2..., Q96E2...)
20x I_n ; 2x U_n (1.2x U_n for Q15E2..., Q96E2...)
< 0.5VA
< 0,5VA (for self-supplied versions add 6VA)
230Vac (other on request)
self-supplied for Q15E2..., Q96E2.. and Q15U2X100
(aux. supply on request)
6VA
-10...0...+45...+50°C
-30...+70°C
full
2kV, 50Hz, 60sec.
5kV, 1.2/50 μ sec.
kWh and kVarh
99999999 MWh/MVArh
2 (kWh), 3 (kVArh)
yes (KWh+/KWh-)
>20 years

alarm outputs (optional, not for Q15E2.../Q96E2...)
activation delay
programmability
pulse outputs (optional, not for Q15E2.../Q96E2...)
programmability
pulse length
serial interface (standard for Q96E2X005M, Q15E2X005M
MCU, MCUH, optional for Q15U2..., Q96U2L, MCUU..)
communication protocol
speed (bps)
communication parameters
addressing range

photo-mos 250V, 100mA
programmable 0...99 sec.
type, variable, value, out status
programmable as alternative to alarms
type of energy, pulse weight
programmable 30...1000 msec.
RS485 insulated

ModBus RTU
9600/19200
1,8,N,2/1,8,E,1/1,8,O,1
1...247 programmable

3. DISPLAY PAGES SEQUENCE

At the power on, the display shows the current firmware version and, after a few seconds, automatically shows the first measurement page. By pressing the key \uparrow it is possible to display the following measurement pages as the sequence listed below.

Single-phase (Q15U2S, Q96U2S):

- Voltage and current
- Active and reactive power
- Power factor and frequency
- Imported active and reactive energy
- Exported active and reactive energy
- Thermal current, calculated in a settable time period, and maximum thermal current
- Average power calculated in a settable time period and maximum demand

Three-phase (Q15U2..., Q96U2L, Q15E2..., Q96E2...):

- Line voltages L1 - L2 - L3
- Phase voltages L1 - L2 - L3
- Line currents L1 - L2 - L3
- Total active and reactive power
- Total apparent power and frequency (Q15U2H only)
- Total apparent power and total power factor (no Q15U2H only)
- System power factor and $\cos\phi$ (Q15U2H only)
- Phase power factors L1 - L2 - L3
- System power factor and frequency (no Q15U2H only)
- Phase $\cos\phi$ L1 - L2 - L3 (Q15U2H only)
- Average system power factor ($\cos \arctan[\text{KVarh+}/\text{KWh+}]$) and neutral current (Q15U2H only)
- Phase current crest factors L1 - L2 - L3 (Q15U2H only)
- Phase voltage crest factors L1 - L2 - L3 (Q15U2H only)
- Phase sequence meter and hours counter (meter operation time)

- Phase current total harmonic distortion L1 – L2 – L3 related to their nominal value (Q15U2H only)
- Phase voltage total harmonic distortion L1 – L2 – L3 related to their nominal value (Q15U2H only)
- Phase current total harmonic distortion L1 – L2 – L3 related to their rms or fundamental value (as programmed in the parameters settings menu) (Q15U2H only)
- Phase voltage total harmonic distortion L1 – L2 – L3 related to their rms or fundamental value (as programmed in the parameters settings menu) (Q15U2H only)
- Total imported active and reactive energy (KWh+, Kvarh+)
- Total exported active and reactive energy (KWh-, Kvarh-)
- Phase thermal currents L1 - L2 - L3, calculated in a settable time period
- Phase maximum thermal currents L1 - L2 - L3
- Average power calculated in a settable time period and maximum demand

Three-phase (Q96U4..):

- Line voltages L1-L2, L2-L3, L3-L1, phase currents L1 - L2 - L3, total active power, total power factor
- Phase voltages L1 - L2 - L3, phase currents L1 - L2 - L3, frequency (Q96U4L only)
- Phase voltages L1 - L2 - L3, phase currents L1 - L2 - L3, neutral current, frequency (Q96U4H only)
- Phase active power L1 - L2 - L3 and 3-phase system active power
- Phase reactive power L1 - L2 - L3 and 3-phase system reactive power
- Phase apparent power L1 - L2 - L3 and 3-phase system apparent power
- Phase power factor L1 - L2 - L3 and 3-phase system power factor
- Phase $\cos\phi$ L1 - L2 - L3 and 3-phase system $\cos\phi$ (Q96U4H only)
- Phase voltage and current crest factors CFV1, CFV2, CFV3, CFI1, CFI2, CFI3; phase sequence meter
- Total imported (KWh+, Kvarh+) and exported (KWh-, Kvarh-) active and reactive energy
- Phase thermal currents L1 - L2 - L3 and 3-phase average power calculated in a settable time period
- Phase maximum thermal currents L1 - L2 - L3 and 3-phase average power maximum demand
- Phase current and voltage total harmonic distortion L1 – L2 – L3 related to their nominal value (Q96U4H only)
- Phase current and voltage total harmonic distortion L1 – L2 – L3 related to their rms or fundamental value (as programmed in the parameters settings menu) (Q96U4H only)

- Instantaneous medium current and line voltage, 3-phase system active power and power factor, hours counter (meter operation time), frequency, active imported energy
- Instantaneous medium current and line voltage, currents and line voltages unbalance, 3-phase system active power, system power factor, active imported energy (Q96U4H only)
- Instantaneous medium current and line voltage, currents and line voltages unbalance, 3-phase system reactive power, frequency, reactive imported energy (Q96U4H only)

Harmonic analysis pages (Q15U2H, and Q96U4H only):

While visualizing the total harmonic distortion THD pages, by pressing the \Rightarrow key it is possible to display the individual harmonics pages related to their rms or fundamental value (as programmed in the parameters settings menu):

- After the first pressure of the \Rightarrow key, the pages of the individual harmonics from the first (fundamental) to the 15th can be scrolled by the \hat{u} key.
- After the second pressure of the \Rightarrow key, the pages of the individual harmonics from the 16th to the 30th can be scrolled by the \hat{u} key.
- After the third pressure of the \Rightarrow key, the visualization returns to the total harmonic distortion pages.

4. PARAMETERS SETTING

To program instrument parameters press and hold the key ENTER and subsequently press the key \Rightarrow .

In Q15U2..., Q96U2L and Q96U4 models (if perform analog outputs option) and MCUU... models you enter in a page in which you select, using \hat{I} or \Rightarrow key, Analyzer option to enter in the instrument parameters setting, or Analog output option to enter analog outputs and additional alarms setting; press ENTER.

In Q15E2.../Q96E2... models or Q15U2.../Q96U2L and Q96U4... models (if don't perform analog outputs option) you enter directly in the instrument parameters setting procedure.

Instrument parameters setting procedure.

To run through the pages of the menu press the key \hat{I} , to enter in the single page press ENTER.

VT and CT Ratio: press ENTER and use the key \Rightarrow to choose the digit to be changed; and set the value by pressing the key \hat{I} ; all digits can be programmed in the same way. Press ENTER to confirm and return, then press \hat{I} to enter the next page.

Note: in Q15U2X100 model VT ratio must be always left to 1 and CT ratio must be always left to 100/100; in Q15E2.../Q96E2... models VT ratio must be always left to 1.

Out 1 configuration (not operating for Q15E2.../Q96E2... models): press ENTER and select by \hat{I} the output mode that can be a pulse output associated to an imported or exported energy (KWh+, KWh-, Kvarh+, Kvarh), an alarm output (AI Min, AI Max), a diagnostic alarm (watchdog) or disabled (Off).

- If the output is a pulse, press ENTER and select Weight Out1 by \hat{I} , i.e. 10Wh(varh), 20Wh(varh), 100Wh(varh), 200Wh(varh), 1KWh(Kvarh), 2KWh(Kvarh), 10KWh(Kvarh), (these values are automatically recalculated in case of CT or VT ratio changes); press ENTER and select Out pulse width choosing by \Rightarrow the digit to be changed and setting by \hat{I} the value (you can set values from 30 msec to 1000 msec). Press ENTER to confirm and return, then press \hat{I} to enter the next page.
- If the output is an alarm, press ENTER and select Out 1 alarm source and set by \hat{I} the alarm relative variable:
 - phase and line voltages VL1, VL2, VL3, VL1-2, VL2-3, VL3-1 (V in single-phase wiring)
 - three-phase phase and line voltages V_Y, V_Δ
 - phase, neutral (Q15U2H, Q96U4H and MCUH only), three-phase and three phase thermal currents I1, I2, I3, IN, I_Y, I_{avg} (I and I_{avg} in single-phase wiring)
 - phase active power (Q96U4... only) and 3-phase system active power P1 - P2 - P3, P_{tot} (P in single-phase wiring)
 - phase reactive power (Q96U4... only) and 3-phase system reactive power Q1 - Q2 - Q3, Q_{tot} (Q in single-phase wiring)

phase apparent power (Q96U4... only) and 3-phase system apparent power S1 - S2 - S3, Stot (S in single-phase wiring)

average active power Pavg (in single-phase wiring too)

phase and system power factors P.F.L1, P.F.L2, P.F.L3, P.F. (P.F. in single-phase wiring)

frequency freq (in single-phase wiring too)

phase voltage total harmonic distortion THD V1, THD V2, THD V3 (Q15U2H, Q96U4H and MCUH only)

phase current total harmonic distortion THD I1, THD I2, THD I3 (Q15U2H, Q96U4H and MCUH only)

press ENTER and select in Out 1 alarm level the threshold value choosing by \Rightarrow the digit to be changed and setting by $\hat{\uparrow}$ the value;

press ENTER and select Out 1 hysteresis value (hysteresis on restore from an alarm in % of the threshold value) choosing by \Rightarrow the digit to be changed and setting by $\hat{\uparrow}$ the value;

press ENTER and select Out 1 delay choosing by \Rightarrow the digit to be changed and setting by $\hat{\uparrow}$ the value (you can set values from 0 to 999 sec);

press ENTER and select Out 1 status choosing by $\hat{\uparrow}$ or \Rightarrow the output contact

type: normally open (NO) or normally closed (NC). Press ENTER to confirm and return, then $\hat{\uparrow}$ to enter the next page.

- If the output is the watchdog press ENTER to confirm, then press $\hat{\uparrow}$ to enter the next page.
- If you want to disable the output (Off) press ENTER to confirm and return, then $\hat{\uparrow}$ to enter the next page.

Out 2 configuration: see Out 1 configuration.

Out 3/4 configuration (Q96U4... only): it is not operating.

Harmonic analysis settings (Q15U2H and Q96U4H only): press ENTER and select, by $\hat{\uparrow}$, the reference value (RMS or Fundamental) used to display the percentage of the total and individual harmonic distortion values (i.e. % of the RMS value, or % of the fundamental value).

Press ENTER and select, by $\hat{\uparrow}$, the reference value (Nominal, RMS or Fundamental) used to transmit the percentage of the total and individual harmonic distortion values over the RS485 with ModBus protocol (i.e. % of the nominal value, or % of the RMS value, or % of the fundamental value).

Press ENTER to return and $\hat{\uparrow}$ to access the next page.

Averaging time setting: press ENTER and set the average time by \Rightarrow and $\hat{\uparrow}$ as previously done (values included from 01 min to 60 min).

Press ENTER to return and $\hat{\uparrow}$ to enter the next page.

Communication parameters: press ENTER and set the instrument logic address by \Rightarrow and $\hat{\uparrow}$ as previously done (values included from 0 to 247), press ENTER and set the Baud rate by $\hat{\uparrow}$ or \Rightarrow , press ENTER and set the parity (NO, EVEN, ODD) by $\hat{\uparrow}$ or \Rightarrow . Press ENTER to return and $\hat{\uparrow}$ to enter the next page.

Reset energy meters: press ENTER and choose by $\hat{\uparrow}$ or \Rightarrow the energy values reset (yes) or the return without reset (no). When the instrument is turned off the energy values are hold in the non-volatile memory, the reset cause the irreparable values lost. Press ENTER to return and $\hat{\uparrow}$ to enter the next page.

Password settings: press ENTER and choose by $\hat{\uparrow}$ or \Rightarrow if to enable (Yes) or not (No) a password, if (No) press ENTER to return and $\hat{\uparrow}$ to enter the next page, if (Yes) write a new password by \Rightarrow and $\hat{\uparrow}$; press ENTER and confirm (Yes) or not (No) the new password. If a password exists it is impossible to go in the programming menu without her.

If you forget the password, you can enter in parameters setting by means of the universal password "2730".

Press ENTER to return and $\hat{\uparrow}$ to exit to Confirm settings.

Confirm settings: choose if to confirm and enable the new parameters (Yes) or not (No) to leave the old parameters. Press ENTER to return in the measurement display.

Analog outputs and additional alarms setting procedure (Q15U2..., Q96U2L, Q96U4... and MCUU... only).

Entering in analog outputs setting menu in the option **Analog output**, choose **Add/Modify** or **Remove device** by $\hat{\uparrow}$ or \Rightarrow and press ENTER.

The instrument checks the connection with the three possible external modules (see paragraph 5) and shows the page **Select position** where there are three flags, corresponding to the modules, in which appears the address value assigned to the module (1, 2 or 3, see paragraph 5); the number is highlighted if the module was set and transmits, isn't highlighted if it transmits but wasn't set (i.e. module connected for the first time); if the module doesn't transmits or is not connected, it appears N. By the key \Rightarrow choose the flag corresponding to the external module to set (or to modify if it was already set), or N if you want to remove the setting of a disconnected module; press ENTER.

- If the option is **Add/Modify**, press $\hat{\uparrow}$ to choose the analog output (A1, A2, A3, A4) or the alarm output (D1, D2) that you want to set and press ENTER. If during this stage a communication error happens, at the end it appears **Error, retry?** then by the key $\hat{\uparrow}$ or \Rightarrow you can choose **Yes** to retry or **No** to exit; press ENTER.
- If you choose an analog output, choose the output variable by $\hat{\uparrow}$ and press ENTER. Related variables to the analog outputs are:
 - Phase and line voltages VL1, VL2, VL3, VL1-2, VL2-3, VL3-1 (V in single phase wiring)
 - Phase currents I1, I2, I3 (I in single phase wiring)
 - Neutral current IN (Q15U2H, Q96U4H and MCUH only)
 - Phase active power (Q96U4... only) and 3-phase system active power P1 - P2 - P3, Ptot (P in single-phase wiring)
 - Phase reactive power (Q96U4... only) and 3-phase system reactive power Q1 - Q2 - Q3, Qtot (Q in single-phase wiring)
 - Phase and system power factors P.F.L1, P.F.L2, P.F.L3, P.F. (P.F. in single-phase wiring)
 - Frequency Freq (in single phase wiring too)

Set **Min Input**, minimum value of the input variable by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set **Max Input**, maximum value of the input variable by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set **Min Output**, beginning scale value of the output by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set **Max Output**, full scale value of the output by $\hat{\uparrow}$ and \Rightarrow and press ENTER. Settable **Min output** and **Max output** values are fixed (0, ± 0.5 , ± 1 , ± 2 , ± 5 , $\pm 10V$ or 0, ± 1 , ± 2 , ± 4 , ± 10 , $\pm 20mA$). Choose (Config. new out?), by $\hat{\uparrow}$ or \Rightarrow , if to enter again to menu and to set a new output (Yes) or to exit to Confirm settings (No).

- If you choose an alarm output, choose the related output variable by $\hat{\uparrow}$ and press ENTER. Related variables to the alarm outputs are the same of the analog outputs.

Set the alarm type (Off, Min, Max) by $\hat{\uparrow}$ and press ENTER; set the threshold value (Alm threshold) by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set the hysteresis value (Hysteresis) on restore from an alarm (in % of the threshold value) by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set the delay value (Delay), from 0 to 999 sec, by $\hat{\uparrow}$ and \Rightarrow and press ENTER; set the contact status (Status) choosing by $\hat{\uparrow}$ or \Rightarrow the contact normally open (NO) or normally closed (NC); press ENTER. Choose (Config. new out?), by $\hat{\uparrow}$ or \Rightarrow , if to enter again to menu and to set a new output (Yes) or to exit to Confirm settings (No). Choosing alarm type Off you skip directly to Config. new out?.

Confirm settings: choose if to confirm and enable the new parameters (Yes) or not (No) to leave the old parameters. Press ENTER to return in the measurement display.

- If the option is Remove device, press $\hat{\uparrow}$ or \Rightarrow to choose if to exit (No) or to remove the setting of the module (Yes). This option is useful when you disconnected a module, in fact, erasing the settings, it prevents that the analyzer communicates with a no more existing module with risk of errors.

Reset of the average and maximum values and hours counter: when the instrument is turned off the current and power maximum values and the value of hours counter are hold in the non-volatile memory; to reset the average and maximum values press and hold $\hat{\uparrow}$ for 10 seconds while the instrument displays any page of measurement; to reset the hours counter press and hold ENTER for 10 seconds.

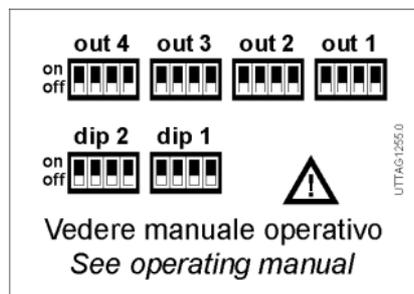
5. ANALOG OUTPUTS

It is possible to generate max. 12 analog outputs and max. 6 additional alarm outputs, each of them entirely settable (see "Analog outputs and additional alarms setting procedure"), by max. 3 additional external modules (code M52U...).

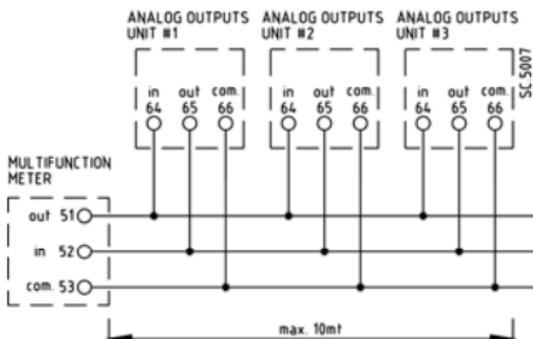
At any external module it must be assigned an univocal address (included from 1 to 3), and for any analog output it must be chosen if the output signal is voltage d.c. or current d.c.

Such settings are made by 6 dip-switches placed under the label on the rear of each module.

MODULE ADDRESS ASSIGNMENT								
Address	dip 2				dip 1			
	1	2	3	4	1	2	3	4
1								on
2							on	
3						on	on	

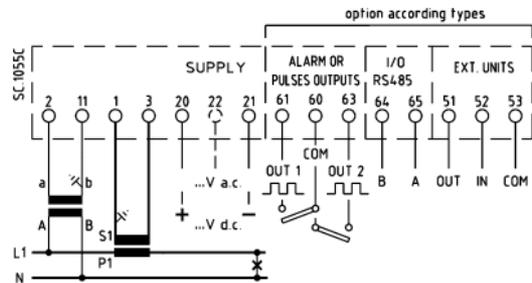


WIRING CONNECTION WITH ANALOG OUTPUTS UNITS



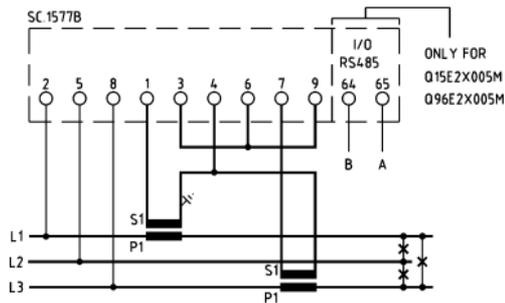
OUTPUT SIGNAL TYPE SELECTION				
Signal type	out1, 2, 3, 4			
	1	2	3	4
Current	on		on	
Voltage		on		On

6. WIRING DIAGRAMS

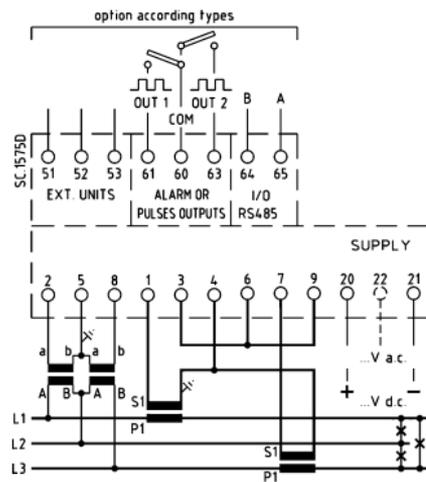


Single-phase (Q15U2S, Q96U2S*, MCU, MCUH, MCUU...)

*Without terminal no 22

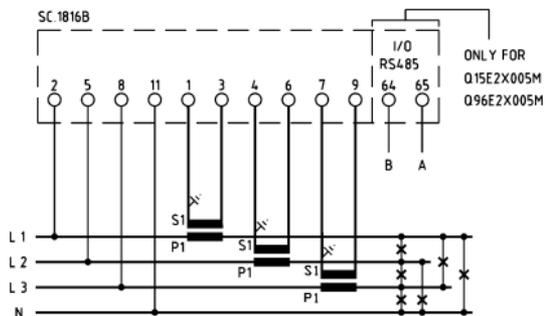


Three-phase 3 wires unbalanced load
(Q15E2, Q15E2X005M, Q96E2, Q96E2X005M)

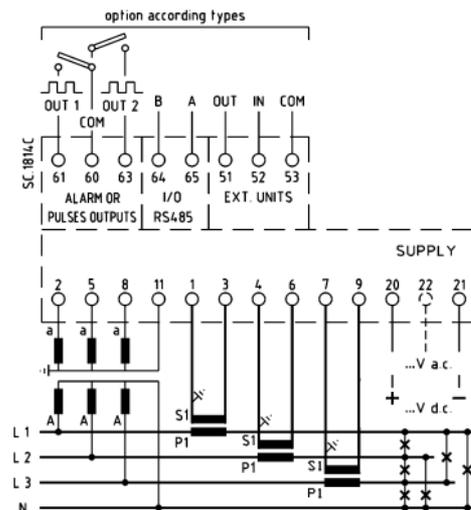


Three-phase 3 wires unbalanced load
(Q15U2L, Q15U2H, Q96U2L*, Q96U4L*, Q96U4H*,
MCU, MCUH, MCUU...)

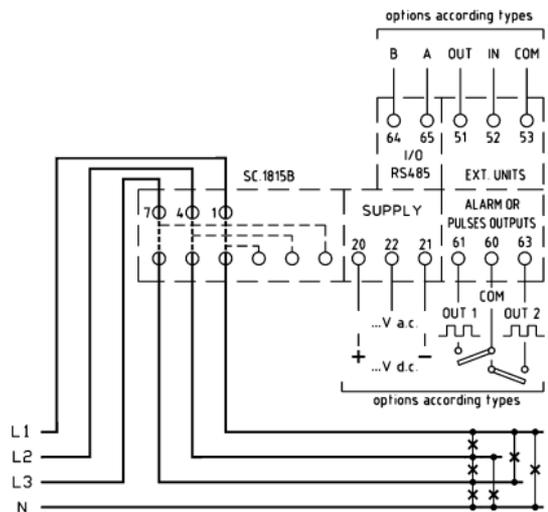
*Without terminal no 22



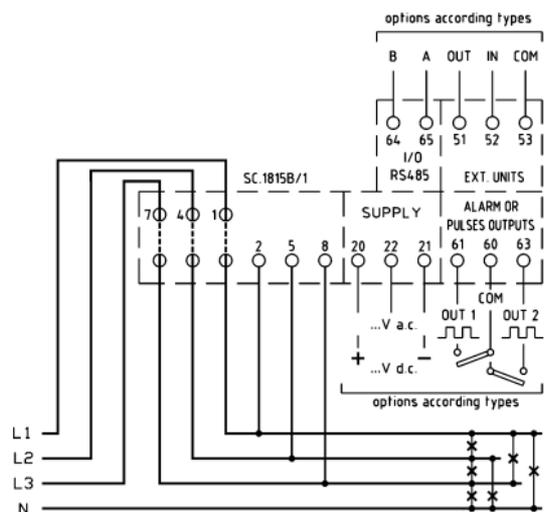
Three-phase 4 wires unbalanced load
(Q15E2, Q15E2X005M, Q96E2, Q15E2X005M)



Three-phase 4 wires unbalanced load
(Q15U2L, Q15U2H, Q96U2L*, Q96U4L*, Q96U4H*,
MCU, MCUH, MCUU...)
*Without terminal no 22

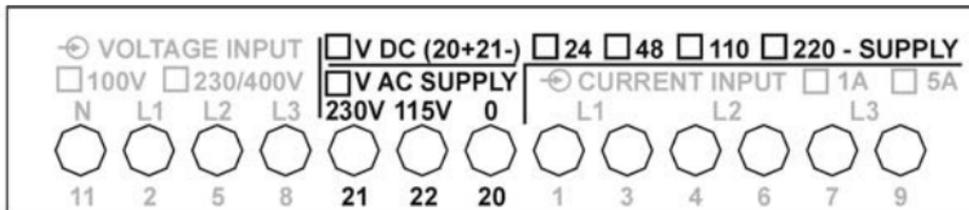


Three-phase 3 or 4 wires 100A direct connection (Q15U2X100)
Standard version



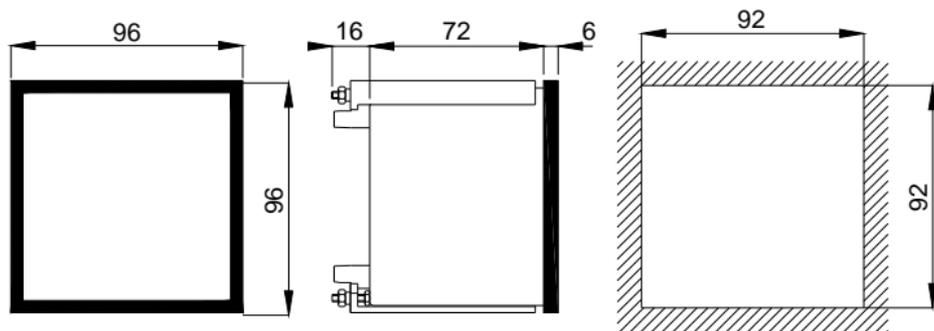
Three-phase 3 or 4 wires 100A direct connection (Q15U2X100)
On request version

NOTE: Q15U2X100 device, standard version, draws the voltmetric connection directly on the passing cables with an insulation piercing system; the three screws corresponding to the three passing cables must be tighten up to the end.

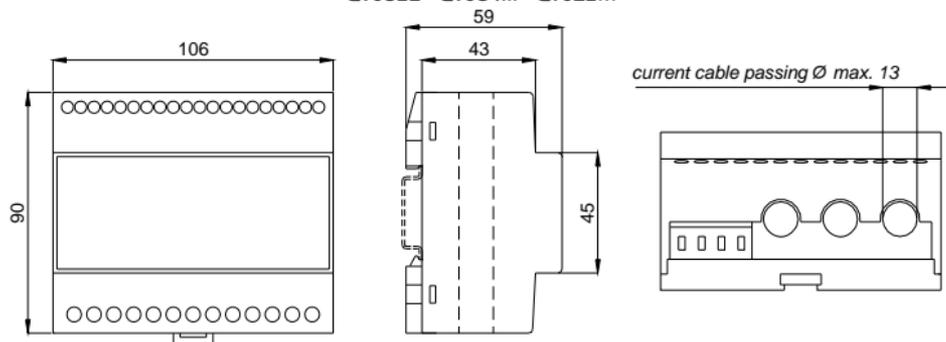


CAUTION (Q15U2 only): if the auxiliary supply marking boxes ARE NOT marked it means that the meter is self-supplied version and the terminals 20 21 22 HAVE NOT to be used.

6. OVERALL DIMENSIONS



Q96U2L - Q96U4... - Q96E2...



Q15U2... - Q15E2... - MCU...

Holes \varnothing 13 only for version with direct connection 100A.