

# DUCATI SISTEMI S. P. A.

## DUCA47-72 and DUCA47-72-SP

### USER MANUAL



#### Introduction

The instrument DUCA47-72 is a digital multimeter for panel mounting that allows the measurement of the principal electrical parameters in three-phase 230/400Vac networks and single-phase networks, including the max/min/average detection of the main electrical parameters and the active and reactive energy count. The different measured variables are displayed locally on four red 7-segment LED displays providing easy readability and simultaneous display of multiples measures. The DUCA47-72 combines also (in a single instrument) the functions of a voltmeter, ammeter, power factor meter, wattmeter, varmeter, frequency meter, active and reactive energy meters, allowing remarkable financial savings thanks to the reduction of space required for the panels and also of time required for cabling.

**Model DUCA47-72:** three-phase multimeter for panel mounting, used also in singlephase networks for the measurement of the main electric quantities. All the electric quantities can be displayed by pressing the corresponding scan keys.

**Model DUCA47-72-SP:** multimeter for panel mounting with the same characteristics as the previous model, but with a RS485 serial interface (with galvanic insulation) and two outputs for use either to generate pulses proportional to the count of active and reactive energy consumption, or to generate alarms on the main electrical parameters being measured. This instrument is ideal for the realization of monitoring networks and for the storage of the different consumption levels.

#### Main functionalities

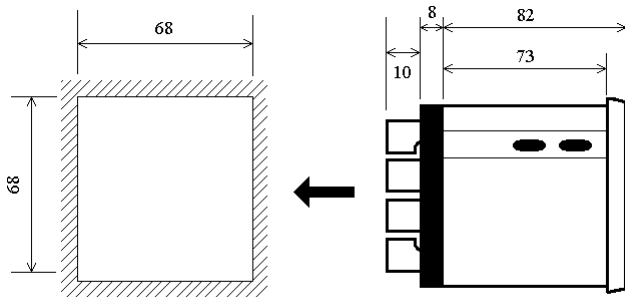
- Compact dimensions, for panel mounting 72x72, with 4 LED's display with 7 segments, for an excellent reading of the measurements
- Scan of the measures and indication of the visualised parameter with the switching on of the correspondent LED
- True RMS measurements
- Active and reactive energy count and storage of the maximum, minimum and average values with an integration period of 15 minutes
- High accuracy of the measurements thanks to "oversampling" techniques and automatic calibration process
- 68 total measurements with Energy-Analyser's functions
- User selectable "default displayed page" both for single line (display L1, L2 and L3) and three-phase system (4-th display) displays, visualised after about 1 minute of inactivity
- Automatic detection of CTs current flow direction for an easy installation of the system. If the operator makes a mistake during CTs installation (inversion's error), at power-up the instrument detects automatically the correct flow of the current, adjusting the error, in an independent way for each phase

- 2 time counters (hours and minutes). The first counter “t1”, resetable from the configuration menu, increases regularly and can be use as instrument’s working time indicator; the second counter “t2” continue counting down from the set value and can be use for maintenance reminder when it reaches the 0 value (than it decreases with negative values, showing the delay from the expiry programmed time)

**Only for the DUCA47-72-SP model:**

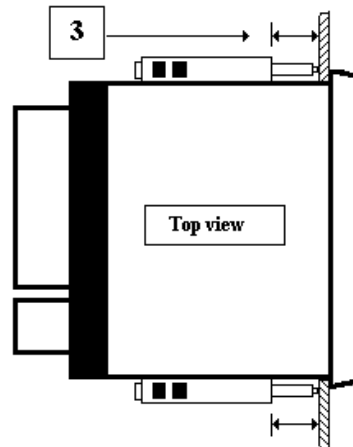
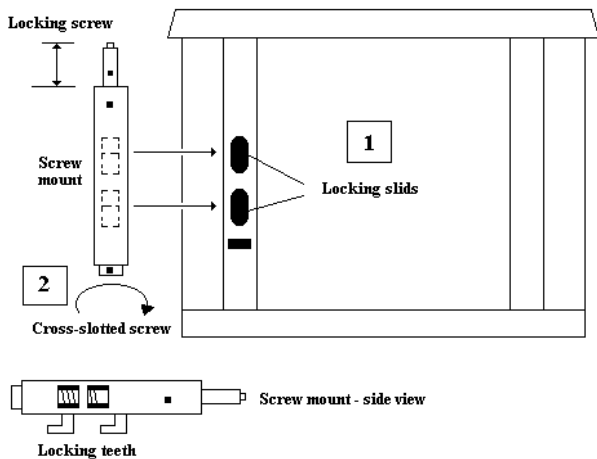
- Two outputs, for use either to generate pulses proportional to the count of active and reactive three-phase energy and proportional to an energy consumption which can be selected by the user, or to generate single-threshold alarms on the main electrical parameters being measured
- RS485 serial interface with two user selectable protocols: ASCII Ducati and MODBUS-RTU

**Assembly instructions**



a) Set the device in the hollow frame and push till the surfaces touch one another

IEC 61554



- b) Lock the screw mounts in the locking slids [ 1 ]
- c) Screw clockwise the cross-slotted screw [ 2 ] to lock the frame to the device [ 3 ]

**Terminal board connection and examples of connections**

Pin Power Supply	Description	Pin Current Inputs	Description	Pin Voltage Inputs	Description
0	0 ~ Power supply	S2-I1	S2 – input I1	N	N
230	230 ~ Power supply	S1-I1(*)	S1 – input I1	L1	L1 – Voltmeter inputs
400	400 ~ Power supply	S2-I2	S2 – input I2	L2	L2 – Voltmeter inputs
		S1-I2 (*)	S1 – input I2	L3	L3 – Voltmeter inputs
		S2-I3	S2 – input I3		
		S1-I3 (*)	S1 – input I3		

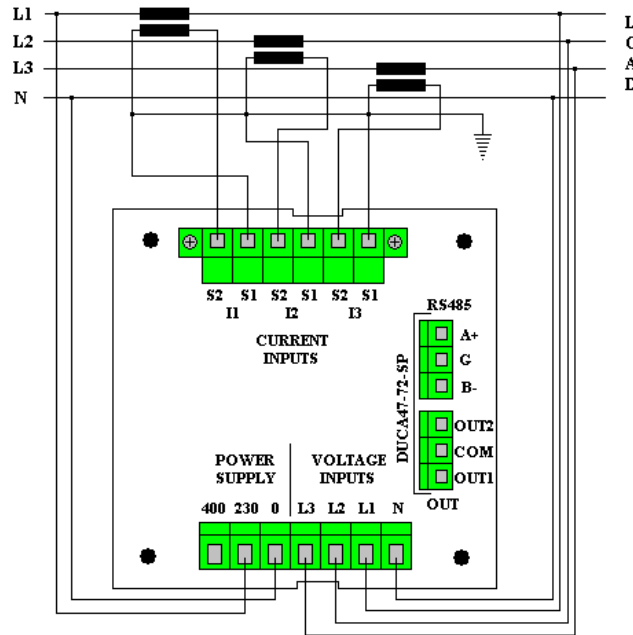
Pin RS485	Descrizione	Pin Digital Outputs	Descrizione
A (**)	A (+) RS485	OUT1 (**)	Digital Out 1 (pulse kWh/alarm 1)
B (**)	B (-) RS485	OUT2 (**)	Digital Out 2 (pulse kVArh/alarm 2)
G (**)	Shield	COM (**)	Digital Out Common

(\* In case of connection of the secondary of the CTs to Earth, only the pins S1-I1, S1-I2 and S1-I3 must be connect to Earth.

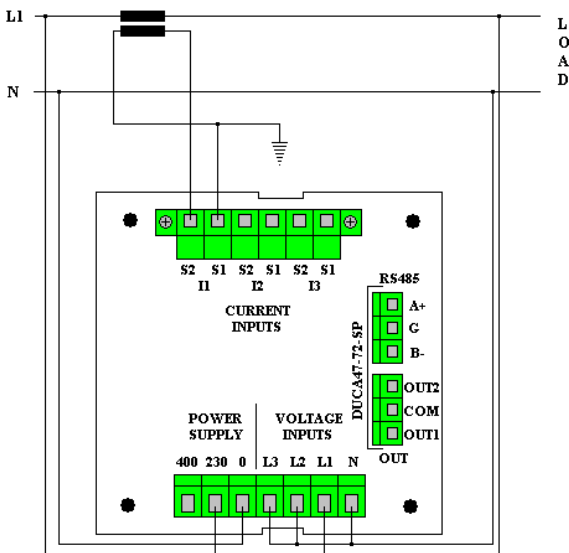
(\*\*) Terminals A, B, G, OUT1, OUT2 and COM are meaningful only for the DUCA47-72-SP model

**NOTES:**

- **CURRENT INPUTS** connector consists of a pull-out terminal that can be screw-locked onto the instrument; therefore, the terminal board should be locked after installation to prevent that it is accidentally removed
- Terminal size: **2,5mm<sup>2</sup>** (except for RS485 and Digital outputs)

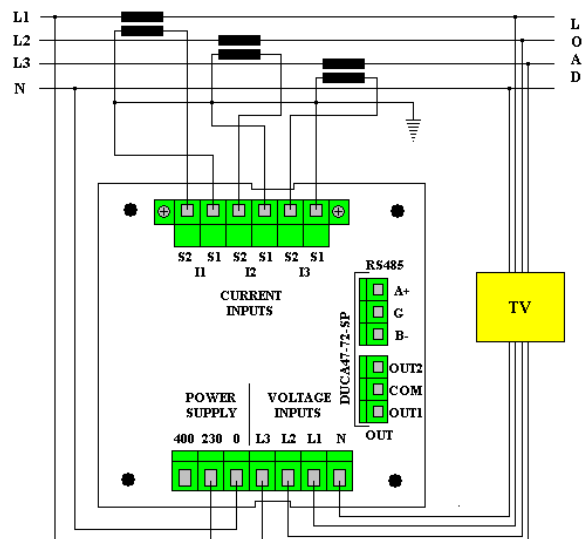


**LV three-phase connection with neutral**



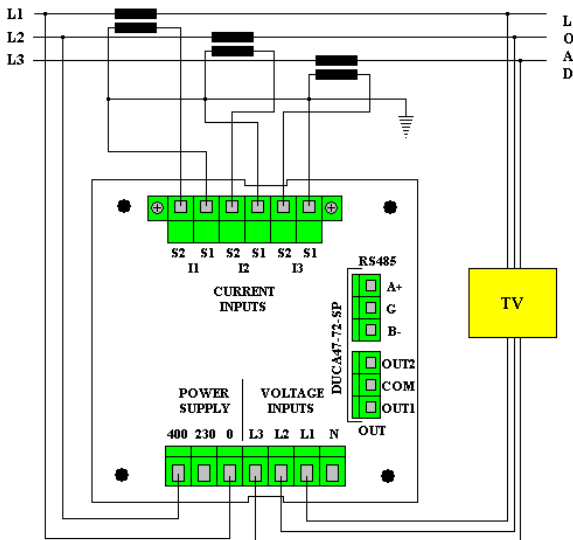
**LV single-phase connection**

**NOTE:** in single-phase connection the “Three-phase” measurements are not significant.



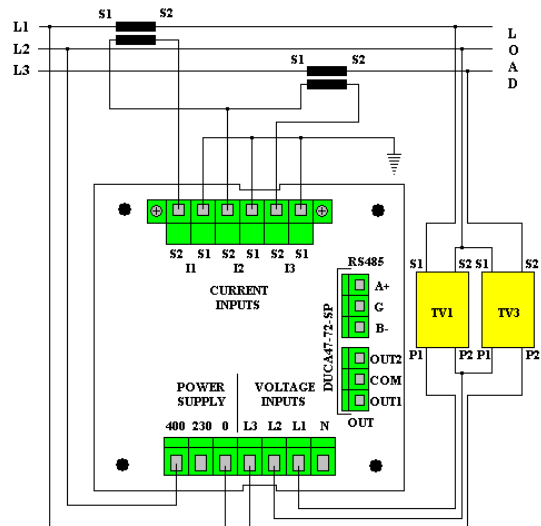
**Three-phase connection with neutral, with 3VTs and 3CTs**

**NOTE:** the use of the VTs in “star” connection is optional if the user want lower voltages on the electric measurement panel or need a further galvanic insulation.



**Three-phase connection without neutral, with 3VTs and 3CTs**

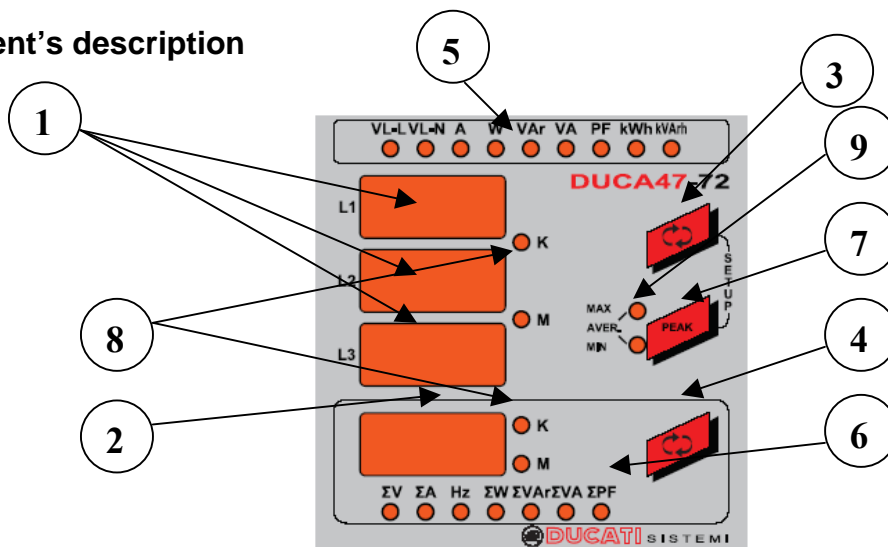
*NOTE: the use of the VTs in “delta” connection is optional if the user want lower voltages on the electric measurement panel or need a further galvanic insulation. In this cases is not allowed the connection of any of the phases of the VT’s secondary to Earth.*



**Three-phase connection without neutral, with 2TA and 2TV**

*NOTE: the use of the VTs is optional if the user want lower voltages on the electric measurement panel or need a further galvanic insulation. In this cases is not allowed the connection of any of the phases of the VT’s secondary to Earth.*

**Instrument’s description**



- (1) Display L1, L2, L3 for the visualisation of the electrical parameters of every phase, of the energy counters and the time counters (energy and time counters are visualised in sequence on the displays L1, L2 e L3; L1 holding the most significant digits and L3 the less significant digits)
- (2) 4-th display for the visualisation of the electrical parameters of the three-phase system
- (3) Key for the scan of the electrical parameters for each phase and the energy counters, visualised on the displays L1, L2, L3 (1), if you press-and-hold-down the previous page will be displayed
- (4) Key for the scan of the three-phase electrical parameters, visualised on the 4-th display (2) and the time counters, if you press-and-hold-down the previous page will be displayed
- (5) 9 LEDs for the indication of the electrical parameters displayed on the three displays L1, L2, L3 (1)

- (6) 7 LEDs for the indication of the electrical parameters displayed on the 4-th display ( (2) )
- (7) Key for set out the visualisation of maximum values of the electrical parameters (LED MAX (9) switched on), of minimum values (LED MIN (9) switched on) and average values (calculation period of 15 minutes) (AVERAGE, simultaneously LED MIN and MAX (9) switched on). When the LED, wich shows the selected type of visualisation, is switched on, it will be possible to scan in sequence the different electrical parameters by pressing (3) and (4) keys
- (8) LED for the identification of the visualised electrical parameters scale on both instrument's displays (1) and (2) (K = kilo, parameter x 1.000, M = mega, parameter x 1.000.000)
- (9) LED for the identification of the max/min/average values displayed on the displays (1) e (2)
- (3) + (7) Press together allow the access to the configuration menu (*setup*)

### Instrument's functionalities

The indication  $\Sigma$  refers to the three-phase measurements of the correspondent parameter.

<b>MEASURED PARAMETERS</b>	
Phase-to-Phase Voltage (VL-L)	VL1-L2, VL2-L3, VL3-L1
Line and Three-Phase Voltage (VL-N e $\Sigma V$ )	VL1-N, VL2-N, VL3-N, $\Sigma V$
Line and Three-Phase Current (A e $\Sigma A$ )	I1, I2, I3, $\Sigma I$
Frequency	Hz
Line and Three-Phase Active Power (W and $\Sigma W$ )	W1, W2, W3, $\Sigma W$
Line and Three-Phase Reactive Power (VAr and $\Sigma VAr$ )	VAr1, VAr2, VAr3, $\Sigma VAr$
Line and Three-Phase Apparent Power (VA and $\Sigma VA$ )	VA1, VA2, VA3, $\Sigma VA$
Line and Three-Phase Power-Factor/cos $\phi$ , with indication of the conventional sign (+ = Inductive Load, - = Capacitive Load)	PF1, PF2, PF3, $\Sigma PF$
Active and Reactive Line and Three-Phase Energy counters (visualisation concatenated on the displays L1, L2 e L3)	kWh-L1, kWh-L2, kWh-L3, $\Sigma kWh-3P$ kVARh-L1, kVARh-L2, kVARh-L3, $\Sigma kVARh-3P$
<b>MAXIMUM DISPLAYED VALUES</b>	
Line Voltage (VL-N)	VL1-N, VL2-N, VL3-N (MAX)
Line Current (A)	I1, I2, I3 (MAX)
Line and Three-Phase Active Power (W and $\Sigma W$ )	W1, W2, W3, $\Sigma W$ (MAX)
Line and Three-Phase Reactive Power (VAr and $\Sigma VAr$ )	VAr1, VAr2, VAr3, $\Sigma VAr$ (MAX)
Line and Three-Phase Apparent Power (VA and $\Sigma VA$ )	VA1, VA2, VA3, $\Sigma VA$ (MAX)
<b>MINIMUM DISPLAYED VALUES</b>	
Line Voltage (VL-N)	VL1-N, VL2-N, VL3-N (MIN)
Line Current (A)	I1, I2, I3 (MIN)
Three-Phase Active, Reactive and Apparent Power ( $\Sigma W$ )	$\Sigma W$ (MIN), $\Sigma VAr$ (MIN), $\Sigma VA$ (MIN)
<b>AVERAGE DISPLAYED VALUES (INTEGRATION PERIOD 15 MINUTES)</b>	
Line and Three-Phase Active Power (W and $\Sigma W$ )	W1, W2, W3, $\Sigma W$ (AVG)
Line and Three-Phase Reactive Power (VAr and $\Sigma VAr$ )	VAr1, VAr2, VAr3, $\Sigma VAr$ (AVG)
Line and Three-Phase Apparent Power (VA and $\Sigma VA$ )	VA1, VA2, VA3, $\Sigma VA$ (AVG)
<b>TIME COUNTERS</b>	
Hours counter (hours and minutes) "free-running" t1 resetable from setup menu, variable in the range 0 ÷ 10000000 hours (visualisation concatenated on the displays L1, L2 e L3)	
Hours counter (hours and minutes) "count-down" t2 for maintenance reminder (visualisation concatenated on the displays L1, L2 e L3), selectable in the range 1 ÷ 32000 hours (when the counter reaches zero than it shows negative values until -32000, indicating the delay from the expiry programmed time)	
<b>QUANTITIES SELECTABLE FOR ALARMS (only applicable to DUCA47-72-SP)</b>	
Phase-to-phase voltage (VL-L)	VL1-L2, VL2-L3, VL3-L1
Phase and Three-phase system voltage (VL-N and $\Sigma V$ )	VL1-N, VL2-N, VL3-N, $\Sigma V$
Phase and Three-phase system current (A and $\Sigma A$ )	I1, I2, I3, $\Sigma I$

Phase and Three-phase system active power ( <b>W</b> and $\Sigma W$ )	<b>W<sub>1</sub>, W<sub>2</sub>, W<sub>3</sub>, <math>\Sigma W</math></b>
Phase and Three-phase system reactive power ( <b>VA<sub>r</sub></b> and $\Sigma VA_r$ )	<b>VA<sub>r1</sub>, VA<sub>r2</sub>, VA<sub>r3</sub>, <math>\Sigma VA_r</math></b>
Phase and Three-phase system apparent power ( <b>VA</b> and $\Sigma VA$ )	<b>VA<sub>1</sub>, VA<sub>2</sub>, VA<sub>3</sub>, <math>\Sigma VA</math></b>
Phase and Three-phase system power factor ( <b>cosφ</b> )	<b>PF<sub>1</sub>, PF<sub>2</sub>, PF<sub>3</sub>, <math>\Sigma PF</math></b>
“Count-down” hour counter	<b>t2</b>

**NOTE:** Sometimes, when installing the device at the first time, due certain events or wrong maneuvers, or in case of not efficient non-volatile memory (E2prom), the instrument stops and a page with the writing “INI” on the first three displays will be displayed, following by an internal identification code. Pressing any key will set the default parameters, which may be changed by the user as required. In any case contact always the Ducati assistance for instrument’s maintenance.

### Instrument’s configuration menu (setup)

To access to the instrument’s configuration menu press together **3** and **7** keys, when the writing “**SETUP**” is visualised on the first three displays, press the **4** key.

In the configuration menu the keys have the following function:

- **3** **Increases** the selected parameter (two-speed autorepeat if hold down); in the reset pages it allows the “reset” of the selected parameters
- **7** **Decreases** the selected parameter (two-speed autorepeat if hold down)
- **4** Confirms modifications and **steps to the next page**; if you press-and-hold-down, the previous page will be displayed

The displayed pages (in sequence) in the configuration menu are the following:

- “**Ct rAt**”: set of the transformation ratio of CTs (KA), variable in the range 1 ÷ 1250, factory default value 1. For example if you have a 800/5A CT, you must insert the value 160
- “**Ut rAt**”: set of the transformation ratio VT (KV), variable in the range 1 ÷ 500, factory default value 1
- “**PULSE**” *only for DUCA47-72-SP model*: possible values 10, 100, 1.00K (1000) or 10.0K (10000)Wh/pulse VA<sub>r</sub>h/pulse), factory default value 10. Output OUT1 = kWh count, output OUT2 = kVA<sub>r</sub>h count. Active pulses only on outputs where the alarms function is disabled (dO1 = OFF, dO2 = OFF)
- “**dO1 ALr**” *only for DUCA47-72-SP model*: selection of the quantity for the alarm relating to output OUT1; OFF = alarm disabled (default). Selected quantities also identified by corresponding led coming on. HI = top threshold exceeded, LO = bottom threshold exceeded. Example: *dO1 HI L1* (led VL-N on) = alarm tripped on phase voltage L1 (VL1-N) when value measured is higher than preset threshold
  - “**dO1 th**”: threshold setting for selected quantity
  - “**dO1 dLy**”: setting for delay in seconds for enabling (and resetting) output OUT1 after an alarm has occurred, default 10
- “**dO2 ALr**” *only for DUCA47-72-SP model*: selection of the quantity for the alarm relating to output OUT2; OFF = alarm disabled (default). Selected quantities also identified by corresponding led coming on. HI = top threshold exceeded, LO = bottom threshold exceeded. Example: *dO2 LO L1* (led PF display 1 on) = alarm tripped on phase power factor L1 (PF<sub>1</sub>) when value measured is lower than preset threshold
  - “**dO2 th**”: threshold setting for selected quantity
  - “**dO2 dLy**”: setting for delay in seconds for enabling (and resetting) output OUT2 after an alarm has occurred, default 10
- “**PrOt**” *only for DUCA47-72-SP model*: selection of the communication protocol for the RS485 serial interface; 0 = DUCATI ASCII protocol, 1 = Modbus-RTU protocol, factory default value 1
- “**Id Adr**” *only for DUCA47-72-SP model*: instrument address for the communication with the RS485 serial interface, variable in the range 1 ÷ 247 (Modbus-RTU protocol) and 1 ÷ 98 (ASCII protocol), factory default value 31

- “**bAUd**” *only for DUCA47-72-SP model*: communication speed of the RS485 serial interface; it is possible to set the following values: 2.4, 4.8, 9.6, 19.2, where the numeric values correspond respectively to 2400bps, 4800bps, 9600bps and 19200bps, factory default value 9600bps (8 bit)
- “**PArItY**” *only for DUCA47-72-SP model*: it is possible to set the following values: O = odd, E = even, n = none; factory default value n
- - “**StOP**” *only for DUCA47-72-SP model*: stop bits; it is possible to set the following values: 1, 2 (with Parity = n), 1 (with Parity = O, E, n); factory default value 1
- “**PAG 1.2.3.**” e “**PAG 4.**”: number setting of the default displayed page, 0 ÷ 15 on the first three displays, factory default value 1; 0 ÷ 7 on the 4-th display, factory default value 1; 0 = it remains the last selected page
- “**t2**”: setting in hours of the count-down value of the hours counter t2, factory default value 8760.00 (1 year)
- “**rESEt PEAK**” (*PEAK = Peak Values*): maximum and minimum values reset (to reset see note below)
- “**rESEt AUG**” (*AVG = Average*): average values reset (to reset see note below)
- “**rESEt En**” (*En = Energies*): energy counters reset (to reset see note below)
- “**rESEt t1**”: hours counter t1 reset (to reset see note below)
- “**rESEt ALL**”: restore the default configuration and resets all the parameters (min/max values, average values, energies, t1 counter) - (to reset see note below)
- “**rEL**”: instrument’s firmware revision

**NOTE:** ➤ **to perform the previous described resets**, from the correspondent page, hold down for some seconds the **3** key until the visualisation of the “**-C- -L- -r-**” writing appears on the first three displays

➤ the peak values, the average values, the energy counters and the values of the counters t1 e t2 are maintained in the instrument memory in case of power failures

**Technical characteristics**

<b>DIMENSIONS AND WEIGHT</b>			
Dimensions: 72 mm x 72 mm x 90 mm (LxHxW) – IEC 61554		Weight : about 500g	
<b>PROTECTION</b>			
IP50 on the front panel, IP20 on the terminal blocks			
<b>POWER-SUPPLY</b>			
<b>Voltage</b>	<b>Frequency</b>	<b>Power consumption</b>	<b>Fuse</b>
230Vrms (± 10%) 400Vrms (± 10%)	45 ÷ 65Hz	< 6VA	<b>Fit external fuse T0,1A</b>
<b>VOLTMETER INPUTS</b>			
Range: 10 ÷ 500Vrms (L-N)	Max non-destructive value : 550Vrms	L-N input impedance: greater than 8MΩ	
<b>AMMETER INPUTS (USE ALWAYS EXTERNAL CTs)</b>			
Range: 50mA ÷ 5Arms	Overload: 1,1 permanent	Currents measurements using <b>external CTs</b>	
Max dispersed power: 1,4VA (with I <sub>max</sub> = 5A rms for each phase input)			
Direction of CTs current: detection and automatic adjustment at power up, independent for each phase			
<b>DIGITAL OUTPUTS (only for DUCA47-72-SP model)</b>			
Pulse duration: 50ms OFF (min)/50ms ON		Max frequency: 10 pulses/sec	
V <sub>max</sub> on contact: 48V (peak DC or AC)		I <sub>max</sub> on contact: 100mA (peak DC or AC)	
W <sub>max</sub> dissipatable: 450mW		Isolation: 750Vmax	
<b>ACCURACY OF THE MEASUREMENT</b>			
Voltage:	±0,5% F.S. ±1 digit in the range 10Vac÷500Vac rms V <sub>L-N</sub>		
Current:	±0,5% F.S. ±1 digit in the range 50mA÷5Arms		
Active power:	±1% ±0,1% F.S. (from cosφ = 0,3 Ind. to cosφ = -0,3 Cap.)		
Frequency:	40.0 ÷ 99.9Hz: ±0,2% ±0,1Hz	100 ÷ 500Hz: ±0,2% ±1Hz	

<b>ENERGY COUNT</b>		
Maximum value for the single-phase energy:	4294,9 MWh (MVArh) with KA = KV = 1	
Maximum value for the three-phase energy:	4294,9 MWh (MVArh) with KA = KV = 1	
Accuracy:	Class 1	
<b>OPERATIVE CONDITIONS</b>		
Storage temperature:	-10°C ÷ 60°C	
Operating temperature:	0°C ÷ 50°C	
Relative humidity:	90% max. (without condense) at 40°C	
<b>REFERENCE NORMATIVES</b>		
<b>LOW VOLTAGE</b> – EC directive No. 73/23/CEE: compliance with EN 61010-1 regarding hygroscopic pre-conditioning, dielectric rigidity and residual voltage		
<b>ELECTROMAGNETIC COMPATIBILITY</b> – EC directive No. 89/336/CEE: compliance with standard EN61326-1		
<b>CONFIGURATION MENU</b>		
<b>Parameters</b>	<b>Possible values</b>	<b>Factory default</b>
VT transformation ratio	1 ÷ 500	1
CT transformation ratio	1 ÷ 1250	1
Pulses programming value <sup>(1)</sup>	10, 100, 1.000, 10.000 Wh/imp (VArh/imp)	10
Quantities selectable for alarm on output OUT1 and/or OUT2 <sup>(1)</sup>	OFF, V <sub>12</sub> , V <sub>23</sub> , V <sub>31</sub> , V <sub>L1-N</sub> , V <sub>L2-N</sub> , V <sub>L3-N</sub> , ΣV, I <sub>1</sub> , I <sub>2</sub> , I <sub>3</sub> , ΣI, W <sub>1</sub> , W <sub>2</sub> , W <sub>3</sub> , ΣW, VAr <sub>1</sub> , VAr <sub>2</sub> , VAr <sub>3</sub> , ΣVAr, VA <sub>1</sub> , VA <sub>2</sub> , VA <sub>3</sub> , ΣVA, PF <sub>1</sub> , PF <sub>2</sub> , PF <sub>3</sub> , ΣPF, count. t <sub>2</sub>	(OFF = alarm disabled)
Alarm threshold for outputs OUT1 and/or OUT2 relating to the selected quantity <sup>(1)</sup>	Depending on measurement selected quantity	Approx. half the full scale of the selected quantity
Delay for enabling output OUT1 and/or OUT2 in the event of an alarm <sup>(1)</sup>	1 ÷ 900 (seconds)	10
Type of serial protocol <sup>(1)</sup>	0 = DUCATI ASCII 1 = Modbus-RTU	1
Analyzer's address <sup>(1)</sup>	ASCII Prot.: 1 ÷ 98 Modbus-RTU Prot.: 1 ÷ 247	31
Baud rate for the RS485 serial interface line <sup>(1)</sup>	2.4, 4.8, 9.6, 19.2 (es. 9.6 is related to 9600bit/s)	9.6
Parity for the RS485 serial interface line <sup>(1)</sup>	O = odd, E = even, n = none	n
Stop bits for the RS485 serial interface line <sup>(1)</sup>	1, 2 (with Parity = n), 1 (with Parity = O, E, n)	1
PAG 1.2.3. (default page for displays L1, L2 and L3)	0 ÷ 15 (0 = it remains the last displayed page)	1
PAG 4. (default page for the 4-th display)	0 ÷ 7 (0 = it remains the last displayed page)	1
“Free-running” counter t <sub>1</sub> (hours and minutes)	The counter can be reset from the configuration menu	Counter range: 0 ÷ 10000000 (hours) [about 1140 years]
“Count-down” counter t <sub>2</sub> (hours and minutes)	Initial set in hours: 1 ÷ 32000 (about 3,5 years)	8760 hours (1 year)
Calculation period for mean values	-	15 minutes

<sup>(1)</sup> only for DUCA47-72-SP model

DUCATI Sistemi S.p.A. shall not accept no liability for damage or personal injury arising from incorrect or improper use of its equipment.

In line with a policy of continuous improvement, DUCATI Sistemi S.p.A. reserves the right to implement changes to this manual without prior notice.

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