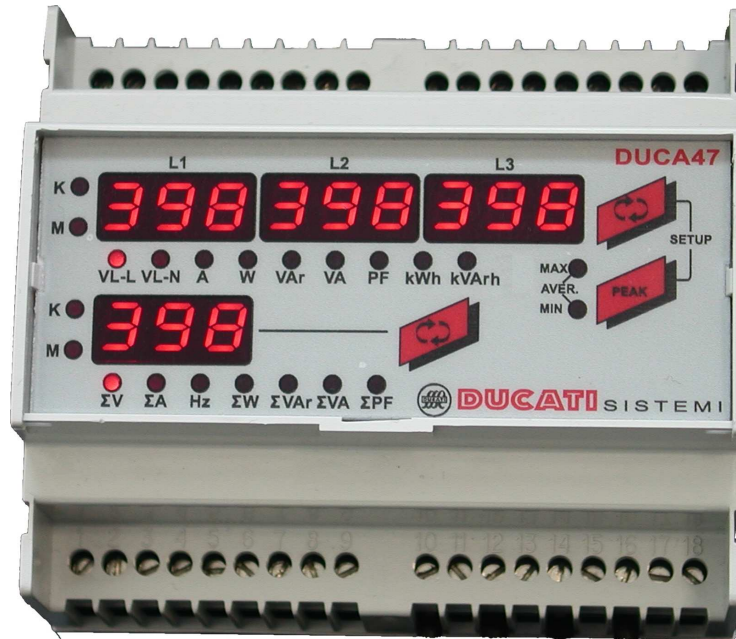# **DUCATI** SISTEMI S. p. A.

# DUCA47

USER MANUAL

Introduction

The instrument DUCA47 is a digital multimeter 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 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.

Main functionalities

- Compact dimensions *6 DIN modules*, 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*" tecniques 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)

Assembly instructions

DIN EN 50022 (35 mm ⌐⌐)
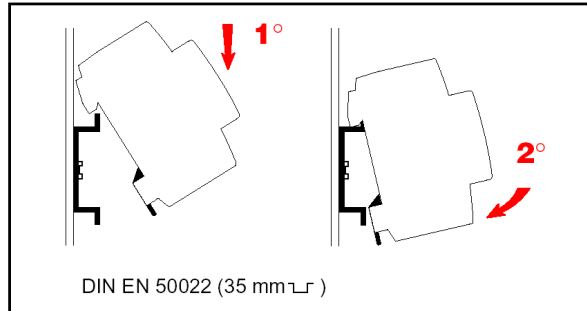
Terminal board connection and examples of connections

Pin	Description	Pin	Description	Pin	Description
19	0 ~ Power-supply	1	S2 – input I1	10	N – Voltmeter inputs
21	115 ~ Power-supply	2 (*)	S1 – input I1	12	L_1 – Voltmeter inputs
23	230 ~ Power-supply	4	S2 – input I2	14	L_2 – Voltmeter inputs
		5 (*)	S1 – input I2	16	L_3 – Voltmeter inputs
		7	S2 – input I3		
		8 (*)	S1 – input I3		

(*****) In case of connection to Earth of the secundary of the CTs, <u>only the S1 inputs of CTs must be connect to Earth and connect to the pins 2, 5 and 8 of the instrument</u>.
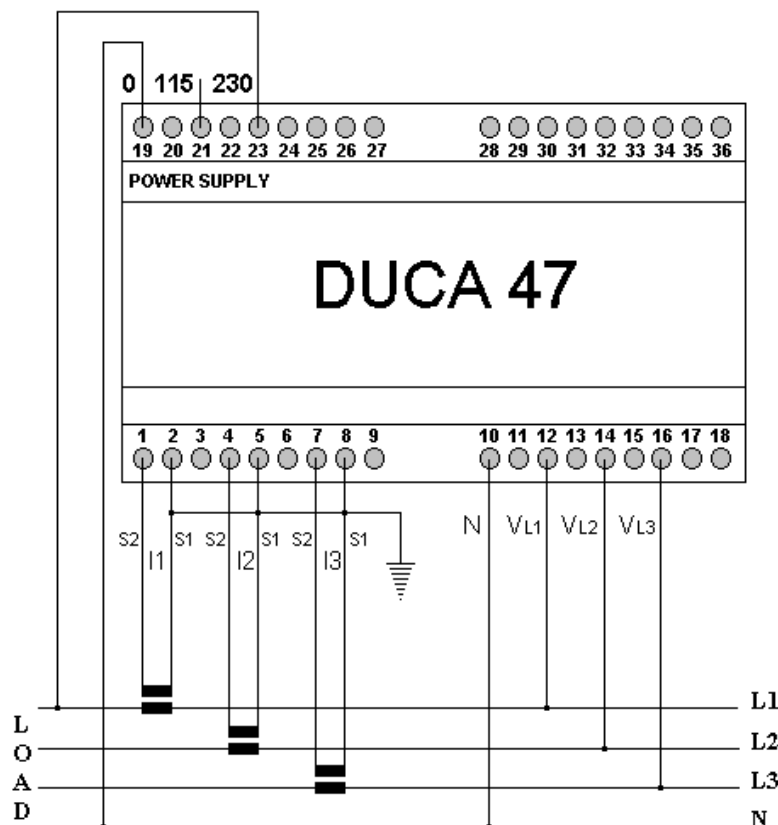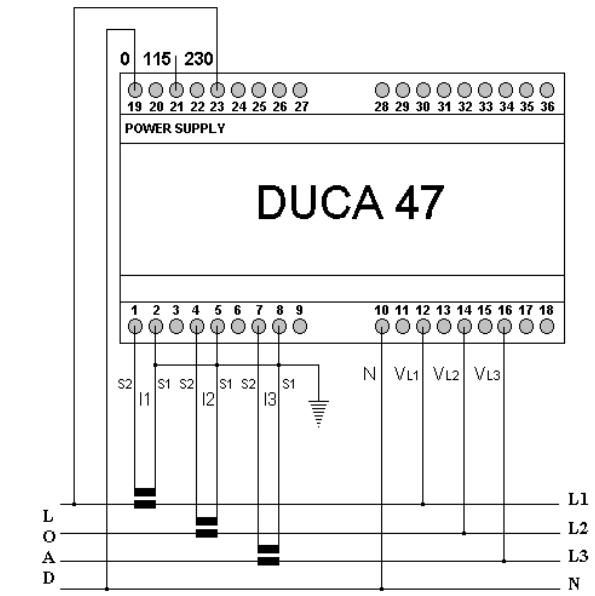

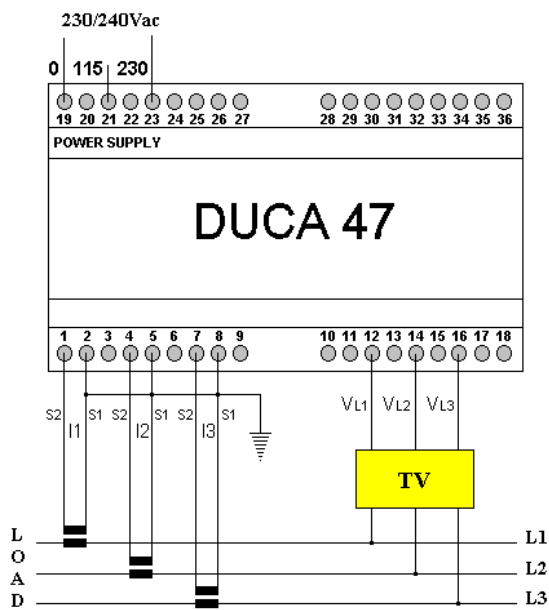*Three-phase direct connection with neutral*
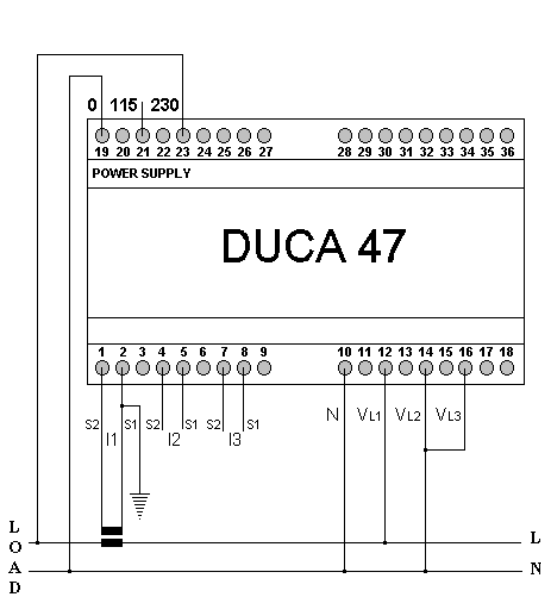
Single-phase direct connection

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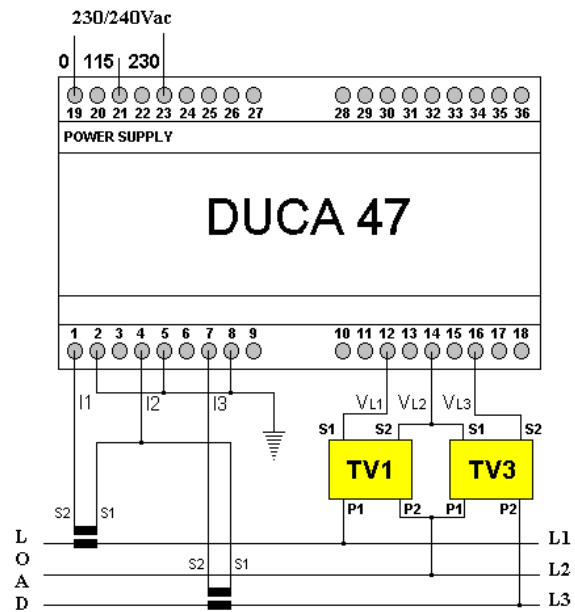

Three-phase indirect conn. with neutral with 3VTs and 3 CTs

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 indirect conn. without neutral with 3VTs and 3 CTs

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 secundary to Earth.*

Three-phase indirect conn. without neutral with 2CTs and 2VTs

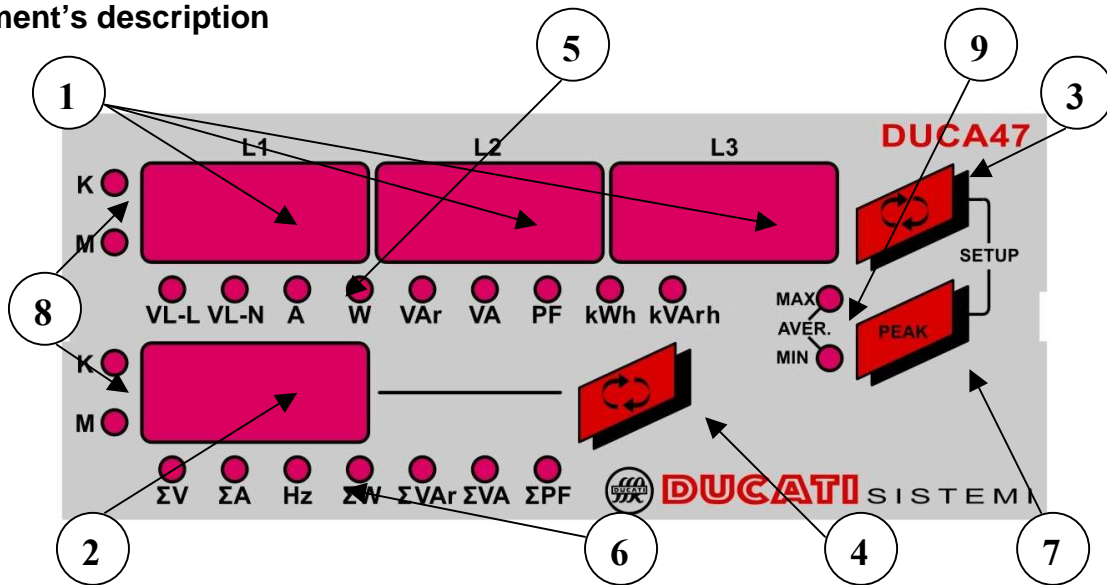*NOTE*: *the use of the VTs is optional if the user want lower voltages on the electric measurement panel or need a further galvanic insulation.In this cases is not allowed the connection of any of the phases of the VT's secundary to Earth.*

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

- 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 Σ refers to the three-phase measurements of the correspondent parameter.

MEASURED PARAMETERS	
Phase-to-Phase Voltage (**VL-L**)	**VL$_1$-L$_2$, VL$_2$-L$_3$, VL$_3$-L$_1$**
Line and Three-Phase Voltage (**VL-N** e **ΣV**)	**VL$_1$-N, VL$_2$-N, VL$_3$-N, ΣV**
Line and Three-Phase Current (**A** e **ΣA**)	**I$_1$, I$_2$, I$_3$, ΣI**
Frequency	**Hz**
Line and Three-Phase Active Power (**W** and **ΣW**)	**W$_1$, W$_2$, W$_3$, ΣW**
Line and Three-Phase Reactive Power (**VAr** and **ΣVAr**)	**VAr$_1$, VAr$_2$, VAr$_3$, ΣVAr**
Line and Three-Phase Apparent Power (**VA** and **ΣVA**)	**VA$_1$, VA$_2$, VA$_3$, ΣVA**
Line and Three-Phase Power-Factor/cosφ, with indication of the conventional sign (**+** = Inductive Load, **-** = Capacitive Load)	**PF$_1$, PF$_2$, PF$_3$, ΣPF**
Line and Three-Phase Active and Reactive Energy counters (visualisation concatenated on the displays L$_1$, L$_2$ e L$_3$)	**KWh-L1, KWh-L2, KWh-L3, ΣkWh-3P** **KVArh-L1, KVArh-L2, KVArh-L3, ΣkVArh-3P**
MAXIMUM DISPLAYED VALUES	
Line Voltage (**VL-N**)	**VL$_1$-N, VL$_2$-N, VL$_3$-N (MAX)**
Line Current (**A**)	**I$_1$, I$_2$, I$_3$ (MAX)**
Line and Three-Phase Active Power (**W** and **ΣW**)	**W$_1$, W$_2$, W$_3$, ΣW (MAX)**
Line and Three-Phase Reactive Power (**VAr** and **ΣVAr**)	**VAr$_1$, VAr$_2$, VAr$_3$, ΣVAr (MAX)**
Line and Three-Phase Apparent Power (**VA** and **ΣVA**)	**VA$_1$, VA$_2$, VA$_3$, ΣVA (MAX)**
MINIMUM DISPLAYED VALUES	
Line Voltage (**VL-N**)	**VL$_1$-N, VL$_2$-N, VL$_3$-N (MIN)**
Line Current (**A**)	**I$_1$, I$_2$, I$_3$ (MIN)**
Three-Phase Active Power (**ΣW**)	**ΣW (MIN)**
Three-Phase Reactive Power (**ΣVAr**)	**ΣVAr (MIN)**
Three-Phase Apparent Power (**ΣVA**)	**ΣVA (MIN)**
AVERAGE DISPLAYED VALUES (INTEGRATION PERIOD 15 MINUTES)	
Line and Three-Phase Active Power (**W** and **ΣW**)	**W1, W2, W3, ΣW (AVG)**
Line and Three-Phase Reactive Power (**VAr** and **ΣVAr**)	**VAr1, VAr2, VA3, ΣVAr (AVG)**
Line and Three-Phase Apparent Power (**VA** and **ΣVA**)	**VA1, VA2, VA3, ΣVA (AVG)**
TIME COUNTERS	
Hours counter (hours and minutes) "*free-running*" resetable from setup menu, variable in the range $0 \div 10000000$ hours	
Hours counter (hours and minutes) "*count-down*" for maintenance reminder, selectable in the range $1 \div 32000$ hours (when the counter reaches zero than it shows negative values until -32000, indicating the delay from the expiry programmed time)	

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 $1 \div 1250$, 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 $1 \div 500$, factory default value 1

- "**PAG 1.2.3.**" e "**PAG 4.**": number setting of the default displayed page, $0 \div 15$ on the first three displays, factory default value 1; $0 \div 7$ 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 PEA**" (*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

DIMENSIONS	
6 DIN rail model:	105 mm x 90 mm x 63 mm (LxHxW)

WEIGHT
About 350g

PROTECTION
IP50 on the front panel
IP20 on the terminal blocks

POWER-SUPPLY

Voltage	Frequency	Power consumption	Fuse
230V rms (+15% -10%) 240V rms (+10% -15%) 115V rms (+15% -10%) 120V rms (+10% -15%)	45 ÷ 65Hz	< 6VA	**Fit external fuse** T0,1A

VOLTMETER INPUTS	
Range	10 ÷ 500V rms (L-N)
Max non-destructive value	550V rms
L-N input impedance	Greater than 8MΩ

AMMETER INPUTS (USE ALWAYS EXTERNAL CTs)	
Range	50mA ÷ 5A rms
Overload	1,1 permanent
Max dispersed power (with Imax = 5A rms), for each phase input	1,4VA
Type of measurement	Current inputs through internal shunts and using **external CTs**
Direction of CTs current	Detection and automatic adjustment at power up, independent for each phase

ACCURACY OF THE MEASUREMENT	
Voltages	$\pm 0,5\%$ F.S. ± 1 digit in the range 10Vac÷500Vac rms V_{L-N}
Currents	$\pm 0,5\%$ F.S. ± 1 digit in the range 50mA÷5A rms
Active power	$\pm 1\%$ $\pm 0,1\%$ F.S. (from $\cos\varphi = 0,3$ Ind. to $\cos\varphi = -0,3$ Cap.)
Frequency	40.0 ÷ 99.9Hz: $\pm 0,2\%$ $\pm 0,1$Hz 100 ÷ 500Hz: $\pm 0,2\%$ ± 1Hz

ENERGY COUNT	
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

OPERATIVE CONDITIONS	
Operating temperature	0°C ÷ 50°C
Storage temperature	-10°C ÷ 60°C
Relative humidity	90% max. (without condense) at 40°C

REFERENCE NORMATIVES

- *LOW VOLTAGE – EC* directive No. 73/23/CEE: compliance with EN 61010-1 regarding hygroscopic pre-conditioning, dielectric rigidity and residual voltage

- *ELECTROMAGNETIC COMPATIBILITY – EC* directive No. 89/336/CEE: compliance with standard EN61326-1

CONFIGURATION MENU		
Parameters	*Possible values*	*Factory default*
VT transformation ratio	1 ÷ 500	1
CT transformation ratio	1 ÷ 1250	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 t1 (hours and minutes)	The counter can be reset from the configuration menu	The counter work in the range: 0 ÷ 10000000 (hours) (about 1140 years)
"*Count-down*" counter t2 (hours and minutes)	Initial set in hours: 1 ÷ 32000 (about 3,5 years)	8760 hours (1 year)
Calculation period for mean values (minutes)	-	15 minutes

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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