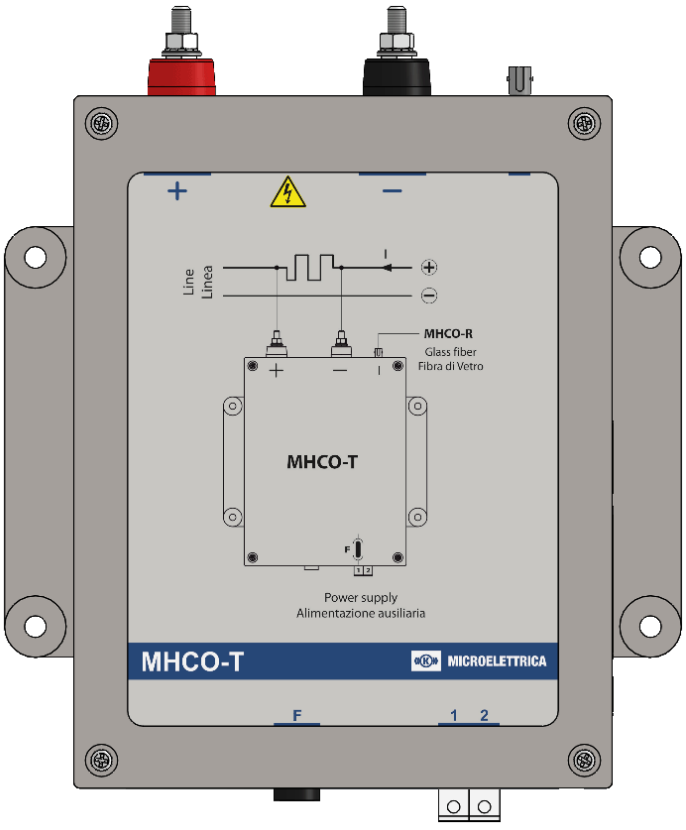
D.C. MEASURING CONVERTER

TYPE

"MHCO"

OPERATION MANUAL



CE

1. General Utilization and Commissioning Directions

Always make reference to the specific description of the product and to the Manufacturer's instruction.
Carefully observe the following warnings.

1.1 - Storage and Transportation

Must comply with the environmental conditions stated in the product's specification or by the applicable IEC standards.

1.2 - Installation

Must be properly made and in compliance with the operational ambient conditions stated by the Manufacturer.

1.3 - Electrical Connection

Must be made strictly according to the wiring diagram supplied with the Product, to its electrical characteristics and in compliance with the applicable standards particularly with reference to human safety.

1.4 - Measuring Inputs and Power Supply

Carefully check that the value of input quantities and power supply voltage are proper and within the permissible variation limits.

1.5 - Outputs Loading

Must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its effectiveness.

1.7 - Safety Protection

Carefully check that all safety means are correctly mounted, apply proper seals where required and periodically check their integrity.

1.8 - Handling

Notwithstanding the highest practicable protection means used in designing M.S. electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules.
The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits produced by M.S. are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; dismounting the modules without proper cautions expose them to the risk of damage.

1.9 - Maintenance

Make reference to the instruction manual of the Manufacturer; maintenance must be carried-out by specially trained people and in strict conformity with the safety regulations.

1.10 - Waste Disposal of Electrical & Electronic Equipment

(Applicable throughout the European Union and other European countries with separate collection program). This product should not be treated as household waste when you wish dispose of it. Instead, it should be handed over to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequence to the environment and human health, which could otherwise be caused by inappropriate disposal of this product. The recycling of materials will help to conserve natural resource.

1.11 - Fault Detection and Repair

Internal calibrations and components should not be altered or replaced.
For repair please ask the Manufacturer or its authorized Dealers.

Misapplication of the above warnings and instruction relieves the Manufacturer of any liability.

2. General Characteristics

The D.C. measuring converters MHCO are designed to allow safe and fully isolated HV D.C. measurements

Make electric connection in conformity with the diagram reported on relay's enclosure.
Check that input quanties are same as reported on the diagram and on the test certificate.
The auxiliary power is supplied by a built-in module fully isolated and self protected.

2.1 - Auxiliary Supply

The converter can be fitted with different types of **power supply** (see general characteristics)

2.2 – Interconnection Transmitter/Receiver

The two units are connected by a fiber optic belt 5m long with plug-in ST connectors.

Minimum bending radius: during the installation it is necessary to assess that the minimal beam of curving is **not less then 6 cm**; a little radius can damage the fiber optic or increase the dB loss thus causing an incorrect transfer of digital information between Transmitter and Receiver.

The fiber optic connector present on the Transmitter, the Receiver and the fiber optic belt, are protected by proper caps that must be used any time the fiber optic is disconnected.
Leaving the connectors without the protection cap can deteriorate the quality of transmission.

2.3 – Transmitter and Receiver Coupling

To guarantee the accuracy the Transmitter and Receiver must be tuned when coupled: therefore each Transmitter must work in combination with its Receiver ar indicated in the lable:
"TO BE USED WITH……"

3. Voltage Transmitter

3.1 - General Characteristics

Input Impedance	20 MΩ
Output	Fiber Optic free running serial output (type = 200.230.500μ ST-ST) Fiber Optic standard length 5m (max. 250m)
Measurement dynamic range	0 ± 2 Vn
Measurement accuracy	0.1% of full scale @ (–10 / +55)°C
Sampling frequency	3.9 kHz
Response time	0.5 msec. (compensated)
Enclosure	Material: BMCRF9 protection degree IP54 (IP55 on request)

3.2 - Voltage unit MHCO-T20-V

Directly connected to the H.V. line via self contained voltage divider

Power supply voltage	(**1**) 24 Vdc ±20% (**2**) 48 Vdc ±20% (**3**) 85 ÷ 160 Vdc (125 Vdc ±30%)	(**4**) 110 Vac ±20% (**5**) 230 Vac ±20%
Rated input voltage Vn	(**1**) 200 Vdc (**2**) 750 Vdc (**3**) 1000 Vdc	(**4**) 1500 Vdc (**5**) 3000 Vdc (**6**) 4000 Vdc
Connection terminals	Bolt type terminals (M6) for inputs; ST for the F.O. ; Screw type 2.5 mm^2 for Power Supply	
Power supply consumption	≤ 5 VA	

4. Current Transmitter

4.1 - General Characteristics

Output	Fiber Optic free running serial output (type=200.230.500μ ST-ST) F.O. standard length 5m (max. 250m)
Measurement dynamic range	(**1**) 0 ± 2 In; (**2**) 0 ± 10 In
Measurement accuracy	0.1% of full scale @ (–10 / +55)°C - (1% for auxiliary output 4)
Sampling frequency	3.9 kHz
Response time	0.5 msec. (compensated)

4.2 - Current unit MHCO-T20-I

Power supply voltage	(**1**) 24 Vdc ±20% (**2**) 48 Vdc ±20% (**3**) 85 ÷ 160 Vdc (125 Vdc ±30%)	(**4**) 110 Vac ±20% (**5**) 230 Vac ±20%
Rated input current In/mV	(**1**) 60 mVdc (**2**) 80 mVdc	(**3**) 100 mVdc
Diagnostic of Shunt's interruption	Signalization via Fiber Optic	
Enclosure	Material: BMCRF9 protection degree IP54 (IP55 on request)	
Connection terminals	Bolt type terminals (M6) for inputs; ST for the F.O. ; Screw type 2.5 mm^2 for Power Supply.	
Power supply consumption	≤ 5 VA	

5. Voltage/Current Unit - MHCO-T20-VI

Including both the Voltage and Current conversion units in a single enclosure.
Same characteristics as T20V, T20I

6. Receiver

6.1 - General Characteristics

Power supply consumption	≤ 8 VA
Power supply voltage	(**1**) 24 Vdc ±20% (**4**) 110 Vac ±20% (**2**) 48 Vdc ±20% (**5**) 230 Vac ±20% (**3**) 85 ÷ 160 Vdc (125 Vdc ±30%)
Outputs (configurable on request)	3 current loop outputs; Max. output power 0,7VA – 13,5V
Output accuracy	0.1% full scale @(–10 / +55)°C - (1% for auxiliary output 4 – only current receiver)
Response time	< 0.5 msec
Sampling frequency	3.9 kHz
Mesurement display	2 Led "ON" and "DIAG"
Relay pick-up time	< 200 msec
Enclosure	ABS protection degree IP42
Diagnostic alarm relay	Contact C/O. (Relay normally energized). Deenergized for Internal Fault (Transmitter, Receiver, F.O. interruption, Power Supply failure).
Insulation	2000 Vca for 1 min. power supply / output 2000 Vca for 1 min. relay / output
Connection Terminals	Bolt type terminals (2.5 mmq) - ST for Fiber Optic

6.2 - Voltage unit MHCO-R-V – Standard

Measuring input	Fiber Optic transmitter MHCO-T20V

6.2.1 - Standard Output Setting Range

Output 1 *(Terminals 1-2)*	(**1-1**) 0 ±20 (30) mA ≡ 0 ± Vn (1.5Vn) (**1-2**) 4 ÷ 20 (28) mA ≡ 0 ÷ ± Vn (1.5Vn) (**1-3**) 0 ±10 (15) mA ≡ 0 ± Vn (1.5Vn)
Output 2 *(Terminals 3-4)*	(**2-1**) 0 ±20 (30) mA ≡ 0 ± Vn (1.5Vn) (**2-2**) 4 ÷ 20 (28) mA ≡ 0 ÷ ± Vn (1.5Vn) (**2-3**) 0 ±10 (15) mA ≡ 0 ± Vn (1.5Vn)
Output 3 *(Terminals 5-6)*	(**3-1**) 0 ±20 (30) mA ≡ 0 ± Vn (1.5Vn) (**3-2**) 4 ÷ 20 (28) mA ≡ 0 ÷ ± Vn (1.5Vn) (**3-3**) 0 ±10 (15) mA ≡ 0 ± Vn (1.5Vn)

6.3 - Current unit MHCO-R

Measuring input	Fiber Optic transmitter MHCO-T20I

6.3.1 - Standard Output Setting Range

Output 1 *(Terminals 1-2)*	(**1-1**) 0 ±20 (40) mA ≡ 0 ÷ ± In (2In) (**1-2**) 4 ÷ 20 (36) mA ≡ 0 ÷ ± In (2In) (**1-3**) 0 ±10 (20) mA ≡ 0 ÷ ± In (2In) (**1-4**) 0 ±15 (30) mA ≡ 0 ÷ ± In (2In)
Output 2 *(Terminals 3-4)*	(**2-1**) 0 ±20 (40) mA ≡ 0 ÷ ± In (2In) (**2-2**) 4 ÷ 20 (36) mA ≡ 0 ÷ ± In (2In) (**2-3**) 0 ÷ ±10 (20) mA ≡ 0 ÷ ± In (2In) (**2-4**) 0 ÷ ±15 (30) mA ≡ 0 ÷ ± In (2In) (**2-5**) 0 ÷ ±20 (40) mA ≡ 0 ÷ ± 10In (20In)
Output 3 *(Terminals 5-6)*	(**3-1**) 0 ÷ ±20 (40) mA ≡ 0 ÷ ± In (2In) (**3-2**) 4 ÷ 20 (36) mA ≡ 0 ÷ ± In (2In) (**3-3**) 0 ÷ ±10 (20) mA ≡ 0 ÷ ± In (2In) (**3-4**) 0 ÷ ±15 (30) mA ≡ 0 ÷ ± In (2In)
Output 4 *(Terminals 7-8) (Optional)*	(**4-1**) 4 ÷ 20 mA ≡ -0.75In +1.5In (**4-2**) 4 ÷ 20 mA ≡ 0 ÷ +1.25In (**4-3**) 4 ÷ 20 mA ≡ 0 ÷ +1In (**4-4**) 4 ÷ 20 mA ≡ 0 ÷ +1.33In (**4-5**) 4 ÷ 20 mA ≡ -0.75In +0.75In (**4-6**) 4 ÷ 20 mA ≡ -1In +1In (**4-7**) 4 ÷ 20 mA ≡ -2In +2In (**4-8**) 4 ÷ 20 mA ≡ -1.33In +1.5In

7. Functional Test

The following procedures allow for a field check of the operation of system Transmitter + Fiber Optic + Receiver: the accuracy of the system is not under evaluation.

7.1 – Current Unit

7.1.1 – Check of zero input

Short circuit the input terminals of the Transmitter and read on the Receiver the value corrisponding to zero input: A residual measurement ≤ 0.5% of full scale value is acceptable.

Example:

Output Rating	*Admissible Offset*
0 ÷ 10mA	0.05mA
0 ÷ 20mA	0.1mA
4 ÷ 20mA	0.1mA

7.1.2 – Check full scale value

Connect a resistor "R" (see table) accross the input terminals of the Transmitter and read out of the Receiver the corrisponding value:

Note: This test is not made for checking the accuracy.

Input Rating			*R (Ω)*	*Rated Output (0 ÷ 20mA)*	*Acceptable measurement*
Shunt =	60mVcc	→	49.3	20mA	(18 ÷ 22)mA
Shunt =	80mVcc	→	53.9	20mA	(18 ÷ 22)mA
Shunt =	100mVcc	→	67.6	20mA	(18 ÷ 22)mA

7.2 – Voltage Unit

7.2.1 - Check of zero input

Short circuit the input terminals of the Transmitter and read on the Receiver the value corrisponding to zero input: A residual measurement ≤ 0.5% of full scale value is acceptable.

7.2.2 - Check full scale value

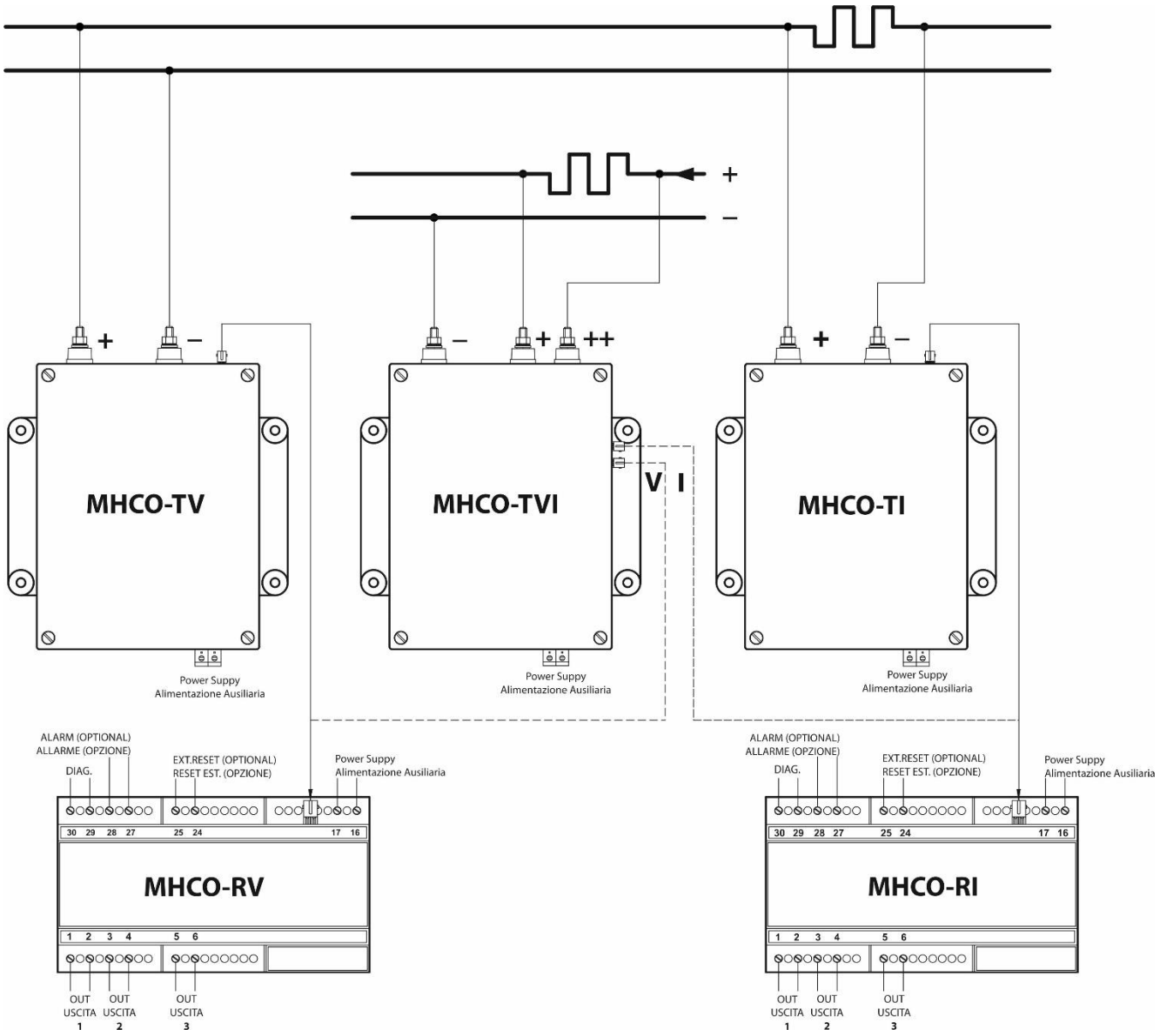
Apply to input terminals of the Transmitter a test voltage and check the corrisponding output of the Receiver.

Note: This test is not made for checking the accuracy.

Example (Rated input voltage 4000Vcc):

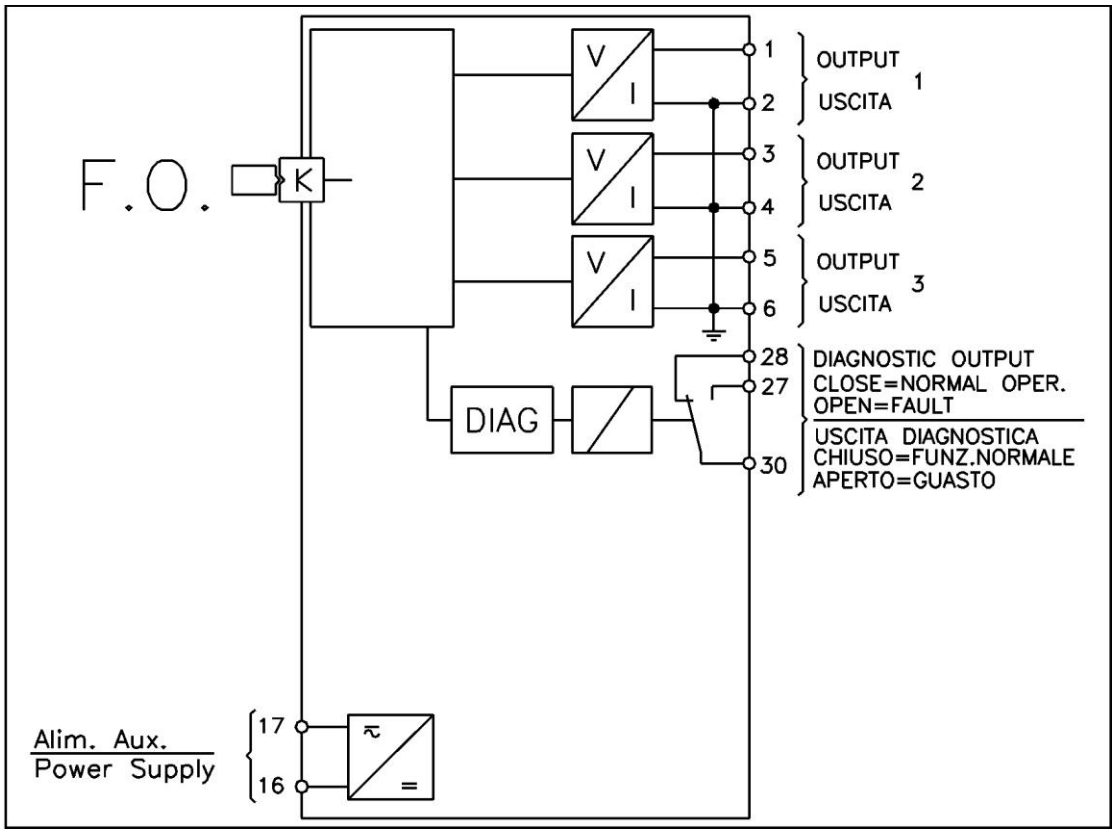
Test Voltage		*Output (0 ÷ 20mA)*	*Acceptable measurement*
400Vcc	→	2mA	(1.8 ÷ 2.2)mA

8. Wiring Diagram

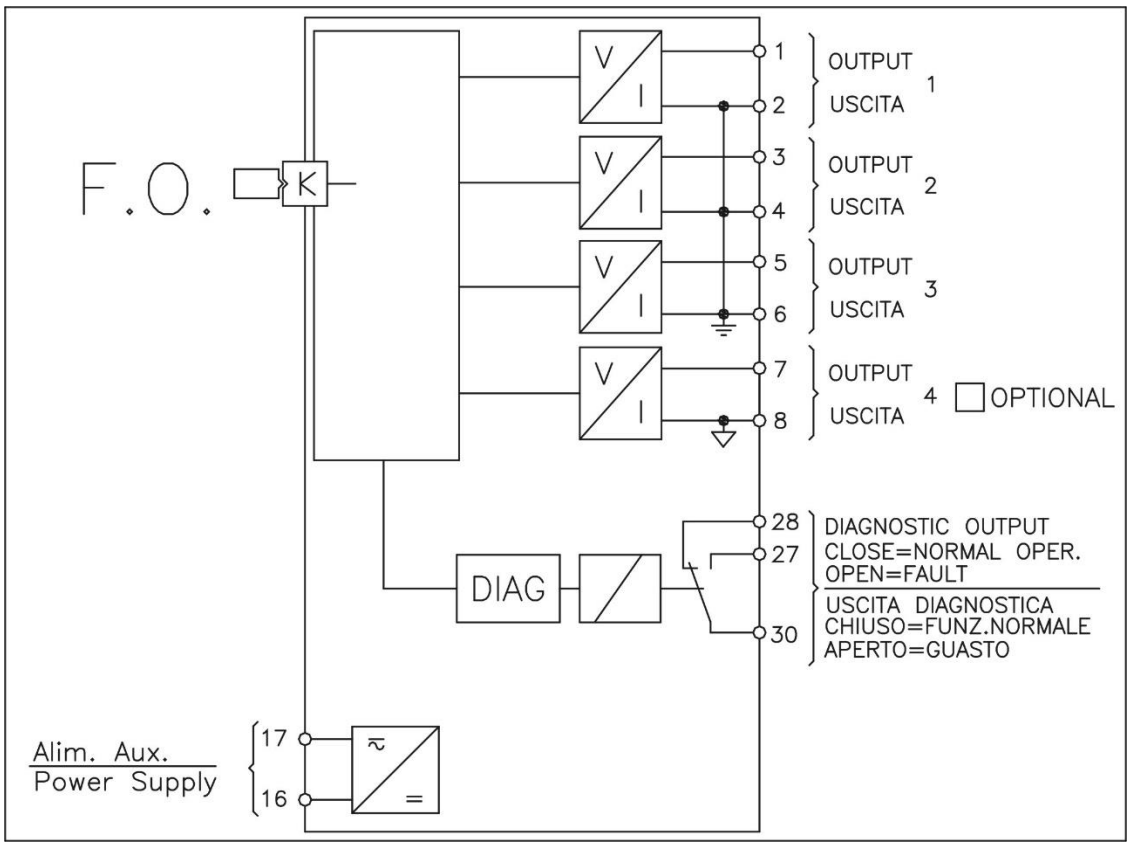


9. Wiring Diagram

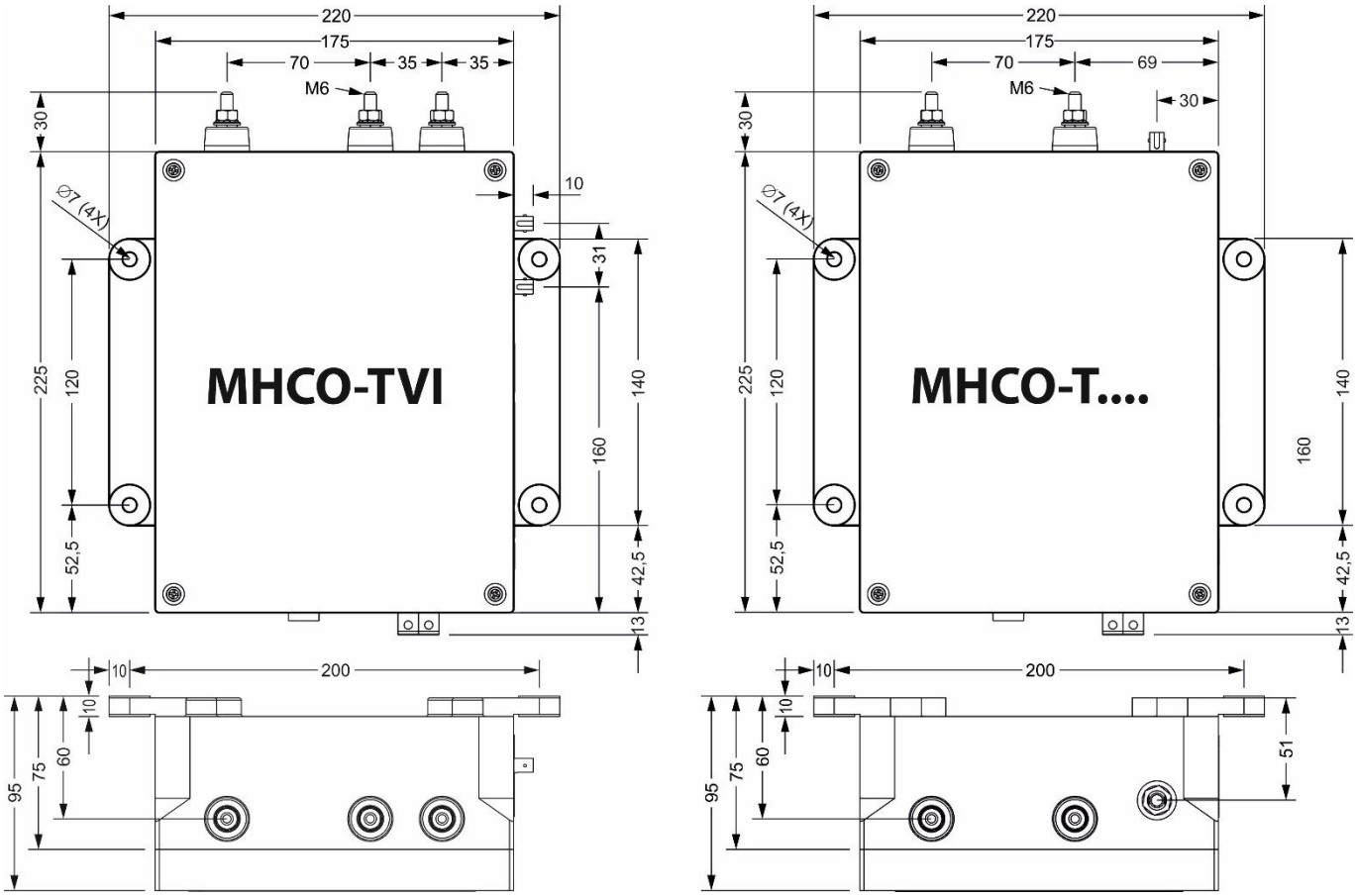
9.1 - Receiver for voltage measurement - MHCO-R-V



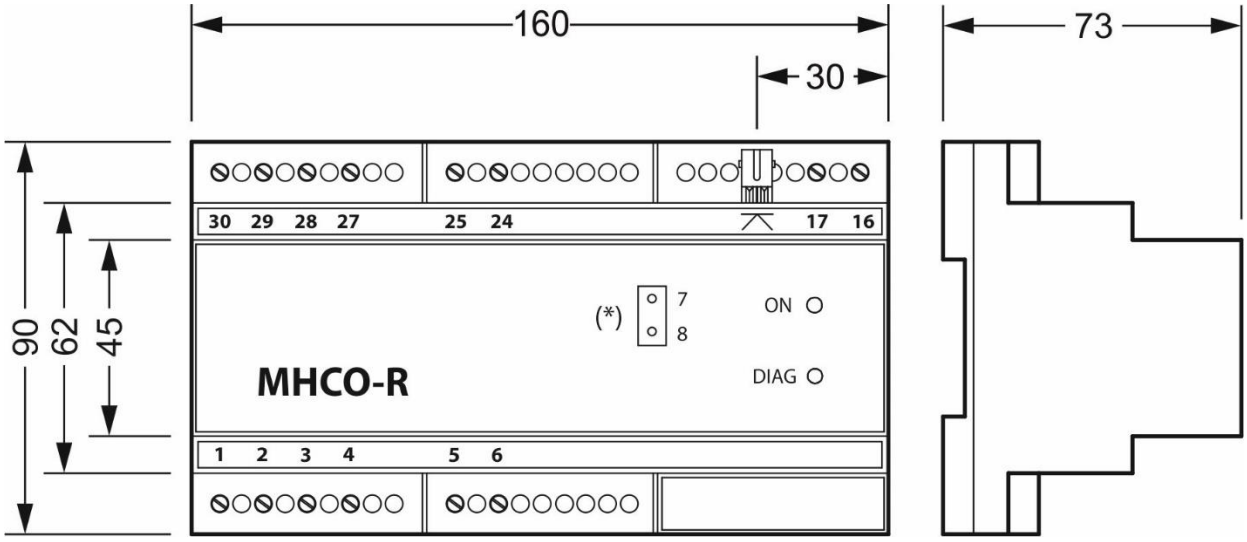
9.2 - Receiver for current measurement - MHCO-R-I – (Standard version)



10. Overall Dimensions - Transmitter



11. Overall Dimension - Receiver



(*) Output 4 – Optional.

12. Elecrical Characteristics

REFERENCE STANDARDS CE Directive - EN50123 – IEC60255

○ Dielectric test voltage	IEC60255-5 EN50123	cat IV – 2kV (EN50124-1 cat OV4 – 18.5kV)	
○ Impulse test voltage	IEC60255-5 EN50123	cat IV – 5kV (EN50124-1 cat OV4 – 40kV)	

Enviromental Rif.Std. (IEC 60068)

○ Operation ambient temperature	EN 60870-2-2	class C1 (3k5)	-10 °C / +55 °C
○ Environmental testing (Cold)	IEC 60068-2-1		-10 °C ; 16h
(Dry heat)	IEC 60068-2-2		+55 °C ; U.R.<=35% ; 16h
(Change of temperature)	IEC 60068-2-14		+55 °C ; -10 °C ; 3h
(Damp heat, steady state)	IEC 60068-2-3		+40 °C ; U.R.=93% ; 96h
○ Resistance to vibration	IEC 60255-21-1	class 2	10-500 Hz ; 2g
○ Resistance to vibration and shock(bump-shock)	IEC 60255-21-2	class 1	10g - 15g
○ Sismatic stress resistance	IEC 60255-21-3	class 2	1 g (xy) , 2 g (z)

CE EMC Compatibility

○ Electromagnetic emission	EN 55011		30-1000 MHz (tab1 EN50081-2)		A
○ Conducted disturbances immunity test	EN 55022	class B	0.15-30 MHz (tab1 EN50081-2)	10 V	A
○ Radiated electromagnetic field immunity test	EN60870-2-1 A.5.1 → IEC 61000-4-3	level 3	80-1000 MHz 80%AM	10 V/m	B
	EN50082-2 → EN 50140, EN 50204	level 3	900 MHz/200 Hz	10 V/m	A
	EN50082-2 → ENV 50140	level 3			A
○ Electrostatic discharge test	EN60870-2-1 A.3.1 → IEC 61000-4-2	level 3	6 kV contact / 8 kV air		B
○ Power frequency magnetic test	EN60870-2-1 A.4.1 → IEC 61000-4-8	level 5	Continuous 100 A/m	50/60 Hz	A
○ Conducted disturbances immunity test	EN50082-2 → IEC 61000-4-6	level 3	(80 +/-5)% AM1 kHz sinwave		A
○ Damped oscillatory magnetic field	EN60870-2-1 A.4.3 → IEC 61000-4-10	level 3	30 A/m, 0.1-1 MHz		B
○ Electrical fast transient/burst (Fast Trasient)	EN60870-2-1 A.2.3 → IEC 61000-4-4	level 3	2 kV(m.c.)		B
○ Dumped Oscillatory waves	EN60870-2-1 A.2.5 → IEC 61000-4-1	level 2	1 kV(m.c.)		
○ Power supply tollerance	IEC 60870-2-1	class DC3 class AC2			
○ Residual power supply voltage	IEC 60870-2-1	VR3	<=5%		
○ Surge immunity test	EN60870-2-1 A.2.2 → IEC 61000-4-5	level 3	8/20us 2 kV(m.c.)		B
○ Voltage interruptions	EN60870-2-1 A.1.5 → IEC 61000-4-11		20 ms		
○ Voltage ripple	EN60870-2-1 A.1.4 → IEC 61000-4-11				A=B

Characteristics

○ Accuracy at reference value of influencing factors	class 0,2
○ Average power supply consumption TX	5 VA
○ Average power supply consumption RX	7 VA
○ Output relays	rating 6 A; Vn = 250 V A.C. resistive switching = 1500VA (400V max) make = 30 A (peak) 0,5 sec.; break = 0.2 A, 110 Vcc, L/R = 40 ms (100.000 op.) – Meccanichal life 10^6op.

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