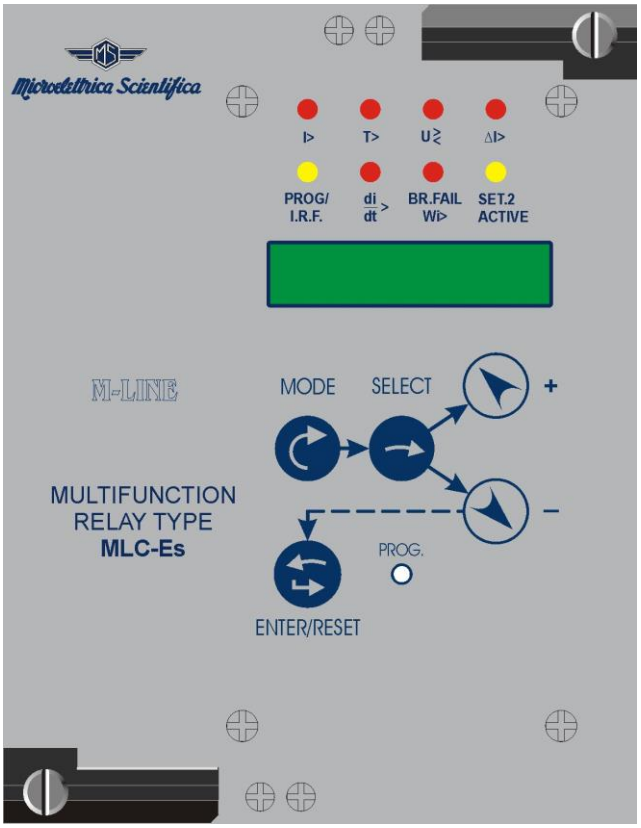
MICROPROCESSOR PROTECTION RELAY

TYPE

MLC-ES

OPERATION MANUAL



CE

INDEX

1. General utilization and commissioning directions

1.1 - Storage and Transportation

Must comply with the environmental conditions stated on the product's instruction 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 - Setting and Calibration

Carefully check the proper setting of the different functions according to the configuration of the protected system, the safety regulations and the co-ordination with other equipment.

1.8 - Safety Protection

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

1.9 - 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 reduced by M.S. are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

a. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
b. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit tracks or connectors.
c. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.
d. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
e. Store or transport the module in a conductive bag.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF.

1.10 - 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.

1.11 - 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.

1.12 - Fault Detection and Repair

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

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

2. GENERAL CHARACTERISTICS

Two current input 0 – 20mA are available for measurements.
Characteristics channels:

❑	Channel 1	(terminals 25-26)	:	+/-20mA	⇔	+/- 1In	
		(terminals 27-28)	:	+/-20mA(10In)	⇔	+/- 10In	(full range 12.5In).
❑	Channel 2	(terminals 29-30)	:	+/-20mA	⇔	+/- Un	(full range 2Un)

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

2.1 - Power Supply

The relay can be fitted with two different types of **power supply** module :

a) - { 24V(-20%) / 110V(+15%) a.c. / 24V(-20%) / 125V(+20%) d.c.

b) - { 80V(-20%) / 220V(+15%) a.c. / 90V(-20%) / 250V(+20%) d.c.

Before energising the unit check that supply voltage is within the allowed limits.

2.2 - Clock And Calendar

The unit features a built in clock calendar with Years, Months, Days, Hours, Minutes, Seconds, Tenths of seconds and Hundredths of seconds.

2.2.1 - Clock synchronization.

The clock can be synchronized via the serial communication interface.
The following synchronization periods can be set: 5, 10, 15, 30, 60 minutes.
Synchronization can also be disabled, in which case the relay ignores the serial broadcast signal.
In case synchronization is enabled, the unit expects to receive a sync signal at the beginning of every hour and once every T_{syn} minutes. When a sync signal is received, the clock is automatically set to the nearest expected synchronization time.
For example: if T_{syn} is 10min and a sync signal is received at 20:03:10 January the 10th, 98, then the clock is set to 20:00:00 January the 10th, 1998.
On the other hand, if the same sync signal were received at 20:06:34, the clock would be set to 20:10:00, January the 10th 98.
Note that if a sync signal is received exactly in the middle of a T_{syn} period, the clock is set to the previous expected synchronization time.

2.2.2 - Date and time setting.

When the PROG/SETTINGS menu is entered, the current date is displayed with one of the groups of digits (YY, MMM or DD) blinking.
The DOWN key operates as a cursor. It moves through the groups of digits in the sequence YY => MMM => DD => YY => …
The UP key allows the user to modify the currently blinking group of digits.
If the ENTER button is pressed the currently displayed date is set.
Pressing the SELECT button the current time is displayed which can be modified using the same procedure as for the date.
If synchronization is enabled and the date (or time) is modified, the clock is stopped until a sync signal is received via the serial port. This allows the user to manually set many units and have them to start their clocks in a synchronized fashion.
If synchronization is disabled the clock is never stopped.
Note that the setting of a new time always clears 10ths and 100ths of sec.

2.2.3 - Time resolution.

The clock has a 10ms resolution. This means that any event can be time-stamped with a 10ms accuracy, although the information concerning 10ths and 100ths of sec. can be accessed only via the serial communication interface.

2.3.4 - Operation during power off.

The unit has an on board Real Time Clock which maintains time information for at least 1 hour in case of power supply failure.

2.3.5 - Time tolerance.

During power on, time tolerance depends on the on board crystal (+/-50ppm typ, +/-100ppm max. over full temperature range).
During power off, time tolerance depends on the RTC's oscillator (+65 /–270 ppm max over full temperature range).

2.3 - Oscillographic recording

The relay continuously records in a circular buffer the samples of the input zero sequence current and voltage. The total maximum recording capability is about 500ms.
The trigger can be activated internally by the pick-up of one or more protection functions or externally via the digital input D2 (see § Digital Input).
Enabling / Disabling of the oscillographic recording is done via the parameter “Trg” (ON-OFF) associated to any protection function.
Once is started the oscillographic recording always fills up totally the recording buffers ignoring whichever trigger activated during the oscillographic recording.
The oscillographic recording is memorized until a new trigger produces a new oscillographic recording overwriting it to the firmware one in the memory.
The pre-trigger and post-trigger recorded samples can be chosen by adjusting the trigger level programming the parameter ITrg = (0-99)%

ITrg = 0% = Post-trigger samples recording only

ITrg = 99% = Pre-trigger samples recording only

3. PROTECTION FUNCTIONS OPERATION

3.1 - Input quantities

Preliminarmente devono essere programmati i dati relativi alle grandezze in entrata:

- **In** : Rated primary current of the shunt.
  The rated primary current corresponding a 20mA input.
  In = (1 - 9999)A, step 1A.
- **Vn** : Rated primary voltage of system.
  The rated primary voltage corresponding a 20mA input.
  Vn = (1 - 9999)V, step 1V

3.2 - F76 (1I>): First Directional/Non-Directional Overcurrent Element

Parameter Description:

Name	Unit	Range	Step	Description
ab1I	-	ON - OFF	-	Function Enabling
1IDir	-	- / + / Dis	-	Trip Direction
1I	A	100 - 9999	1	Trip level of first element
t1I	s	0 - 10	0.01	Definite Trip Time Delay
1ITr	-	ON - OFF	-	Oscillographic recording Trigger enabling

- **ab1I** : This parameter allows to Enable (ON) or Disable (OFF) the Overcurrent Protection Element.
- **1IDir** : This parameter allows to choose the Overcurrent Protection Element Trip Direction. When set to “Dis.” The overcurrent element is Non-Directional; i.e. in case of fault the relay trips whichever is the current flow direction.
- **1I** : This parameter is the Pick-up Level of the Overcurrent Protection Element.
- **t1I** : This parameter is the Definite Trip Time Delay of the Overcurrent Protection Element.
- **1ITr** : This parameter allows to Enable (ON) or Disable (OFF) the Oscillographic recording Trigger associated to the trip of the protection function.

3.3 - F76 (2I>): Second Directional/Non-Directional Overcurrent Element

Parameter Description: Same as First Directional/Non-Directional Overcurrent Element

Name	Unit	Range	Step	Description
ab2I	-	ON - OFF	-	Function Enabling
2IDir	-	- / + / Dis	-	Trip Direction
2I	A	100 - 9999	1	Trip level of second element
t2I	s	0 - 10	0.01	Definite Trip Time Delay
2ITr	-	ON - OFF	-	Oscillographic recording Trigger enabling

3.4 - (1ΔI): First ΔI Element (First Current Step Element)

Parameter Description:

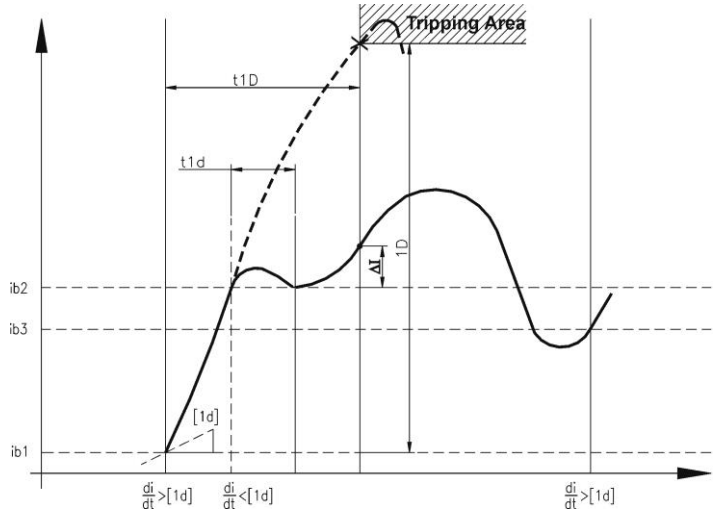
Name	Unit	Range	Step	Description
ab1D	-	ON - OFF	-	Function Enabling
1D	A	100 - 9999	1	Trip level of first element
t1D	ms	0 - 999	1	ΔI Time Delay
1d	A/ms	2 - 200	1	Current rate of rise for ΔI detection
t1d	ms	0 - 100	1	Duration of rate of rise below [1ΔI]
1DTr	-	ON - OFF	-	Oscillographic recording Trigger enabling

- **ab1D** : This parameter allows to Enable (ON) or Disable (OFF) the ΔI Element.
- **1D** : This parameter sets the ΔI trip level of maximum
- **t1D** : This parameter sets the ΔI trip time delay of maximum
- **1d** : This parameter sets the minimum current step level for ΔI start.
- **t1d** : This parameter sets the trip time delay for ΔI reset, it always has to be smaller than t1D
- **1DTr** : This parameter allows to Enable (ON) or Disable (OFF) the Oscillographic recording Trigger associated to the trip of the protection function.

3.4.1 - Operation of the Current step monitoring element

The timely detection of a current step allow to clear a near short circuit long before the current can reach the prospective peak value.

(see Figure):



- Any time a current rate of rise exceeding the set value [1d] is detected the value of the current "i_{1b}" is recorded as reference basic value to evaluate the current step "$\Delta I = i - i_{1b}$" and the timer "t1D" is started. "ΔI" is evaluated every 1ms.
- If during [t1D] the rate of rise "di/dt" never goes below the set level [1d] for a time longer than [tdi], when [t1D] expires, the difference $\Delta I = i - i_{1b}$ is measured and if "ΔI≥[1D]" the protection function trips.
- If during [t1D] the rate of rise "di/dt" goes below the set level [1d] for a time longer than [t1d], a new value of the current i_{2b} is recorded and, when [t1D] expires. If the difference $\Delta I = i - i_{2b}$ measured is greater than [1D], the protection function trips.

  In terms of equation the protection function operation is as follow:

$$\text{If } \frac{di}{dt} \geq [1d] \Rightarrow \left\{ \begin{array}{l} \text{Value of Current } i_{1b} \text{ is recorded} \\ \text{Timer t1D is Started} \end{array} \right\} \Rightarrow \text{If During t1D} \Rightarrow$$

$$\Rightarrow \left\{ \begin{array}{l} \frac{di}{dt} \geq [1d] \text{ during t1d} \Rightarrow \text{Trip if } \Delta = i - i_{1b} \geq [1D] \text{ after t1D} \\ \frac{di}{dt} < [1d] \text{ during t1d} \Rightarrow \text{New Value of Current } i_{2b} \text{ is recorded} \Rightarrow \text{Trip if } \Delta = i - i_{2b} \geq [1D] \text{ after t1D} \end{array} \right.$$

If, at the end of [t1D] no trip occurs "ΔI " evaluation is stopped and will restart when the set "di/dt" level is exceeded again.

3.5 - (2ΔI): Second ΔI Element (Second Current Step Element)

Parameter Description:

Name	Unit	Range	Step	Description
ab2D	-	ON - OFF	-	Function Enabling
2D	A	100 - 9999	1	Trip level of second element
t2D	ms	0 - 999	1	ΔI Time Delay
2d	A/ms	2 - 200	1	Current rate of rise for ΔI detection
t2d	ms	0 - 100	1	Duration of rate of rise below [1ΔI]
2DTr	-	ON - OFF	-	Oscillographic recording Trigger enabling

- **ab2D** : This parameter allows to Enable (ON) or Disable (OFF) the □I Element.
- **2D** : This parameter sets the ΔI trip level of maximum
- **t2D** : This parameter sets the ΔI trip time delay of maximum
- **2d** : This parameter sets the minimum current step level for ΔI start.
- **t2d** : This parameter sets the trip time delay for ΔI reset, it always has to be smaller than t2D
- **2DTr** : This parameter allows to Enable (ON) or Disable (OFF) the Oscillographic recording Trigger associated to the trip of the protection function.

Protection Function Operation: Same as First ΔI Element

3.6 - (1di/dt): First di/dt Element

Parameter Description:

Name	Unit	Range	Step	Description
ab1G	-	ON - OFF	-	Function Enabling
1G	A/ms	3 - 200	1	Trip level of first element
t1G	ms	10 - 200	1	Trip Time Delay (Evolution of 1G)
1GTr	-	ON - OFF	-	Oscillographic recording Trigger enabling

- **ab1G** : This parameter allows to Enable (ON) or Disable (OFF) the di/dt Element.
- **1GTr** : This parameter allows to Enable (ON) or Disable (OFF) the Oscillographic recording Trigger associated to the trip of the protection function.

Protection Function Operation:

Every time that $\frac{di}{dt} > [1G]$ is recorded the sample of the current i_1 and the timer t1G is started.

When [t1G] is expired, the protection function trips if: $\sum_{1}^{t1G}{}_{i} \frac{i_{i+1} - i_i}{t1G} \geq t1G$

3.7 - (2di/dt): Second di/dt Element

Parameter Description: Same as First di/dt Element

Name	Unit	Range	Step	Description
ab2G	-	ON - OFF	-	Function Enabling
2G	A/ms	3 - 200	1	Trip level of second element
t2G	ms	10 - 200	1	Trip Time Delay (Evolution of 1G)
2GTr	-	ON - OFF	-	Oscillographic recording Trigger enabling

- **ab2G :** This parameter allows to Enable (ON) or Disable (OFF) the di/dt Element.
- **2GTr :** This parameter allows to Enable (ON) or Disable (OFF) the Oscillographic recording Trigger associated to the trip of the protection function.

Protection Function Operation: Same as First di/dt Element

3.8 - F49 (T>): Cable Thermal Image

Parameter Description:

Name	Unit	Range	Step	Description
abT	-	ON - OFF	-	Function Enabling
Ta>	°C	50 - 150	1	Prealarm temperature
Ts>	°C	50 - 150	1	Trip temperature
tr	s	0 - 100	1	Trip Time Delay
S	mm^2	50 - 999	1	Conductor Section

- **abT :** This parameter allows to Enable (ON) or Disable (OFF) the Thermal Image Element.

3.8.1 - Function Operation

- Alarm : The protection produces the alarm signalization as soon as the calculated computed temperature of the conductor "Tc" exceeds the set level [Ta>].
- Trip : The overtemperature trip is produced when the calculated conductor's temperature "Tc" remains above the set trip level [Ts>] for longer that the set time delay [tr].

The temperature of the conductor "Tc" is calculated by the accumulation of the contribution due to the Irradiation and the Convection.
The Joule effect is based on the measurement of the current flowing in the total cross section [S] of the conductor.

For Irradiation and Convection the following hypothesis have been assumed:

- Ambient temperature = 303°K (30°C)
- Average air speed = 1 m/s
- Power received by irradiation = $0.45 \times \sqrt{\frac{S \bullet 4}{\Pi}}$
- Density of solar irradiation power = 900 W/m
- Conductor's material - Copper ($\rho=1.8 \cdot 10^{-8}\ \Omega/m$)

3.9 - F45 (U>): First OverVoltage Element

Parameter Description:

Name	Unit	Range	Step	Description
ab1U>	-	ON-OFF	-	Function Enabling
1U>	V	100-3600	1	Trip level of first element
t1U>	s	0-650	1	Definite trip time delay
1U>Tr	-	ON-OFF	-	Oscillographic recording Trigger enabling

3.10 - F45 (U>): Second OverVoltage Element

Parameter Description:

Name	Unit	Range	Step	Description
ab2U>	-	ON-OFF	-	Function Enabling
2U>	V	100-3600	1	Trip level of first element
t2U>	s	0-650	1	Definite trip time delay
2U>Tr	-	ON-OFF	-	Oscillographic recording Trigger enabling

3.11 - F80 (U<): First UnderVoltage Element

Parameter Description:

Name	Unit	Range	Step	Description
ab1U<	-	ON-OFF	-	Function Enabling
1U<	V	100-3600	1	Trip level of first element
t1U<	s	0-650	1	Definite trip time delay
1U<Tr	-	ON-OFF	-	Oscillographic recording Trigger enabling

3.12 - F80 (U<): Second UnderVoltage Element

Parameter Description:

Name	Unit	Range	Step	Description
ab2U<	-	ON-OFF	-	Function Enabling
2U<	V	100-3600	1	Trip level of first element
t2U<	s	0-650	1	Definite trip time delay
2U<Tr	-	ON-OFF	-	Oscillographic recording Trigger enabling

3.13 - Breaking Energy Accumulation (circuit breaker diagnostic)

Name	Unit	Range	Step	Description
Ii	**In**	0.1-9.99	1	C/B rated current
WI	**Wc**	1-9999	-	Maximum interruption energy before maintenance alarm

3.13.1 - Function Operation

The relay computes the Arc Energy developed during each interruption of the Circuit Breaker and accumulates these values.
The operation of this function is based on the following parameters:

Ii = Circuit Breaker Rated Current in multiples of the relay rated input current In; Ii=(0.10-9.99)In

Wc = $Ii^2 \bullet t_X$ = Conventional unit of interruption energy corresponding to C/B rated current and rated interruption time.

W = $I^2 \bullet t_X$ = Conventional interruption energy corresponding to interrupted current I and rated interruption time "t_x".

Wi = Maximum allowed amount of accumulated interruption energy before maintenance as stated by the C/B Manufactured. "Wi" is set as multiple of the conventional interruption energy unit "Wc". Wi=(1-9999)Wc

Any time the Circuit Breaker opens (terminals 1-3 of the digital input B3 closed by C/B Normally Close contact 52b) the relay accumulates the energy corresponding to a number of conventional interruption units:

$$nWc = \frac{I^2 t_x}{I_i^2 t_x} = \frac{I^2}{I_i^2}$$

When the amount of the accumulated energy exceeds the set value [Wi] the relay energized a user programmable output relay.

This relay can not be reset unless a " CLEAR " procedure is entered.

The "CLEAR" procedure is accomplished via the relay front panel face keyboard as follows:

- Press white button " MODE " to show the "PROGR" mode displayed.
- Press the green button " SELECT " to show the " SETTINGS " mode displayed
- Operate the in direct access button " PROG " and, while keeping this button pressed, also press the red buttons " + " and " – " and the green button " SELECT ".
  As all the four button are pressed at the same time, the display shows "CLEAR? ", press the yellow button " ENTER " to clear all relay recorded values (last trip – trip counters, energy accumulated)

Example:

- C/B rated current = 630A
- CT rated current = 500A
- Number of conventional interruptions that the C/B can perform before maintenance is needed NWc=500

The relay variables are set accordingly: $Ii = \frac{630}{500} = 1.26; \quad Wi = 500Wc$

An interruption with current, for example, 2000A produces an accumulation $\frac{2000^2}{630^2} = 10Wc$.

When the summation of the accumulations exceeds the set limit Wi = 500Wc the maintenance alarm is issued.

In the menu “TRIPNUM” exists a measurement “%Wi” that, at any interruption, is decremented by the amount of energy relevant to the interruption computed as % of the value set for “Wi”.

In the above example, the accumulation relevant to the interruption of 2000A was 10Wc corresponding to:

$$\frac{10}{500} \cdot 100 = 2\% \, Wi$$

This 2% is subtracted from the existing measurement “%Wi” so that the actual value “%Wi” shows the percent of the C/B utilization still remaining before maintenance is needed.

3.14 – Breaker Failure Protection

The Breaker Failure function is related to the functions programmed to operate the output relay R1.

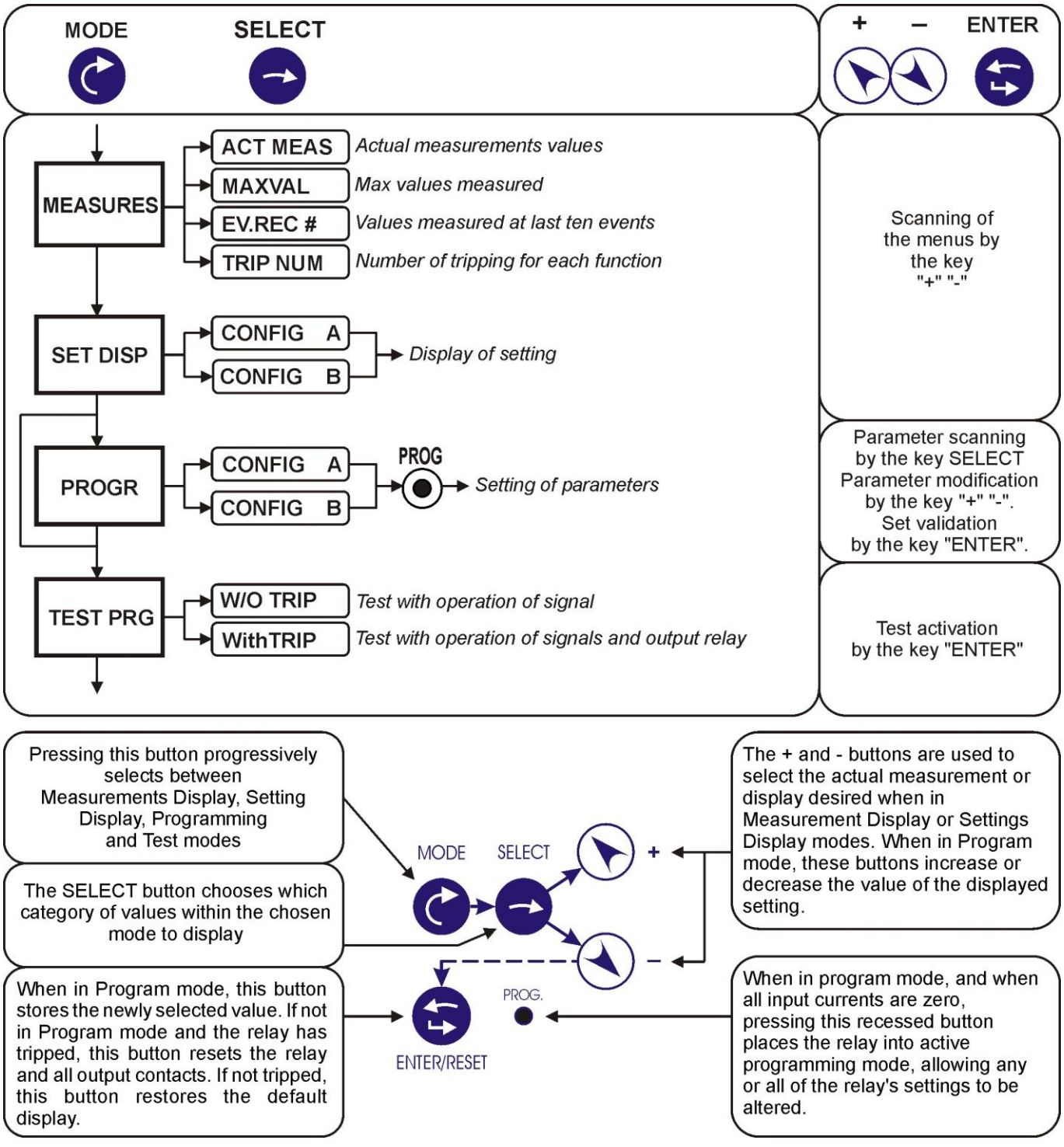
If, after R1 pick-up, the input current does not drop to zero within the set time “tBF”, the signalization Breaker Failure is activated. (see § Signalization)

In the version 4.01, besides the signalization, the relay R4 is also energized.

4. CONTROLS AND MEASUREMENTS

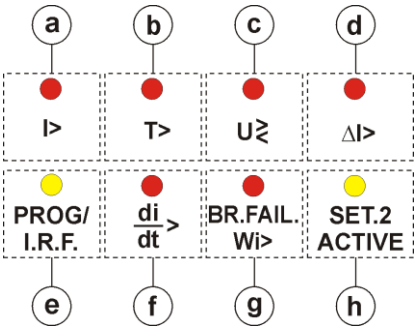
Five key buttons allow for local management of all relay's functions.
A 8-digit high brightness alphanumerical display shows the relevant readings **(xxxxxxxx)**
(see synoptic table fig.1)

FIG.1



5. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**I>**	❑ Flashing when measured current exceeds the set trip level 1I,2I. ❑ Illuminated on trip after expiry of the set trip time delay t1I ,t2I.
b)	Red LED	**T>**	❑ Flashing when the level of temperature element reaches the set alarm temperature [Ta>]. ❑ Illuminated when the temperature reaches the set trip temperature [Ts>] after expiry of the set trip time delay [tr].
c)	Red LED	**U><**	❑ Flashing when measured current exceeds the set trip level 1U< ,1U>,2U<,2U> ❑ Illuminated on trip after expiry of the set trip time delay t1U< ,t1U>,t2U<,t2U>.
d)	Red LED	**ΔI>**	❑ Flashing when measured current exceeds the set trip level 1D, 2D. ❑ Illuminated on trip after expiry of the set trip time delay t1D, t2D.
e)	Yellow LED	**PROG/ I.R.F.**	❑ Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**di/dt >**	❑ Flashing when measured current exceeds the set trip level 1G, 2G ❑ Illuminated on trip after expiry of the set trip time delay t1G, t2G
g)	Red LED	**BR.FAIL. Wi>**	❑ Lit-on when the BREAKER FAILURE function is activated. ❑ Flashing when the maximum power stored is exceed.
h)	Yellow LED	**Set.2 Active**	❑ Illuminated when Setting “2” is active.

The reset of the leds takes place as follows:

Leds a,c,d,f,g	:	❑ From flashing to off, automatically when the lit-on cause disappears. ❑ From ON to OFF, by "ENTER/RESET" push button or via serial communication only if the tripping cause has disappeared.
Leds b,e,h	:	❑ From ON to OFF, automatically when the lit-on cause disappears.

In case of auxiliary power supply failure the status of the leds is recorded and reproduced when power supply is restored.

6. OUTPUT RELAYS

Five output relays are available (R1, R2, R3, R4, R5)

❑ **R1** = Normally energized :		See § Output Relays
❑ **R2** = Normally deenergized :		
❑ **R3** = Normally deenergized :		
❑ **R4** = Normally deenergized :		
❑ **R5** = Normally energized :	(deenergized on trip) on: ❑ Internal fault ❑ Power supply failure ❑ Or in whichever non-operating situation (for example during the programming)	

7. SERIAL COMMUNICATION

The relays fitted with the serial communication option can be connected via a cable bus a fiber optic bus for interfacing with a Personal Computer (type IBM or compatible).
All the functionalities that can be operated locally (for example reading of input measurement and changing of relay's settings) are also possible via the serial communication interface.
Furthermore the serial port allows the user to read event recording and stored data.
The unit has a RS232 / RS485 interface and can be connected either directly to a P.C. via a dedicated cable or to a RS485 serial bus, allowing having many relays to exchange data with a single master P.C. using the same physical serial line. A RS485/232 converter is available on request.
The communication protocol is MODBUS RTU (only functions 3, 4 and 16 are implemented).
Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C.
A dedicated communication software (MSCOM) for Windows 95/98/NT4 SP3 (or later) is available.
Please refer to the MSCOM instruction manual for more information Microelettrica Scientifica.

8. DIGITAL INPUT

Three digital inputs are provided: they are active when the relevant terminals are shorted

❑ **D2**	(terminals 1 - 2)	C/B signalization Closed	Input Closed = C/B Closed Input Open = C/B non Closed
		Trigger Oscillographic Recording	
❑ **D3**	(terminals 1 - 3)	C/B signalization Open	Input Closed = C/B Open Input Open = C/B non Open
❑ **D14**	(terminals 1 - 14)	Change program	"TOGGLE" active setting Config A → Pulse 150ms minimum → Config B → →Pulse 150ms minimum → Config A

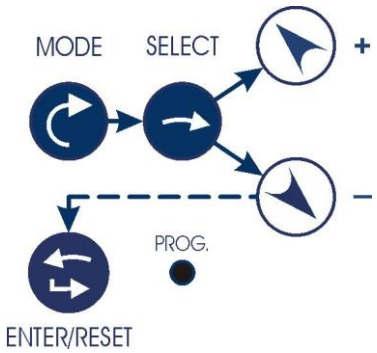
9. TEST

Besides the normal "WATCHDOG" and "POWERFAIL" functions, a comprehensive program of self-test and self-diagnostic provides:

- ❑ Diagnostic and functional test, with checking of program routines and memory's content, run every time the aux. power is switched-on: the display shows the type of relay and its version number.
- ❑ Dynamic functional test run during normal operation every 15 min. (relay's operation is suspended for less than ≤4 ms). If any internal fault is detected, the display shows a fault message, the Led "PROG/IRF" illuminates and the relay R5 is deenergized.
- ❑ Complete test activated by the keyboard or via the communication bus either with or without tripping of the output relays.

10. KEYBOARD AND DISPLAY OPERATION

All controls can be operated from relay's front or via serial communication bus.
The keyboard includes five hand operable buttons **(MODE) - (SELECT) - (+) - (-) - (ENTER/RESET)** plus one indirect operable key **(PROG)** (see synoptic table a fig.1):



a) - 	**MODE**	:	When operated it enters one of the following operation modes indicated on the display :
	MEASURES	=	Reading of all the parameters measured and of those recorded in the memory
	SET DISP	=	Reading of the settings and of the configuration of the output relays as programmed.
	PROG	=	Access to the programming of the settings and of relay configuration.
	TEST PROG	=	Access to the manual test routines.
b) - 	**SELECT**	:	When operated it selects one of the menus available in the actual operation MODE When in the program mode scroll the parameters.
c) - 	"**+**" AND "**-**"	:	The + and - buttons are used to select the actual measurement or display desired when in Measurements Display or Settings Display modes. When in Program mode, these buttons increase or decrease the value of the displayed setting.
d) - 	**ENTER/RESET**	:	It allows the validation of the programmed settings - the actuation of test programs - the forcing of the default display indication - the reset of signal Leds.
e) - 	**PROG.**	:	Enables access to the programming.

11. READING OF MEASUREMENTS AND RECORDED PARAMETERS

Enter the MODE "MEASURE", SELECT the menus "ACT.MEAS"-"MAX VAL"-"LASTTRIP"--"TRIP NUM", scroll available information by key "+" or "-" .

11.1 - ACT.MEAS

Actual values as measured during the normal operation.
The values displayed are continuously refreshed.

Display			Description
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
I+	xxxxx	**A**	True R.M.S. value of the current displayed as primary Amps.(0 - 99999)
U	xx.xx	**V**	True R.M.S. value of the voltage displayed as primary V
Tc	xxx	**°K**	Conductor temperature

11.2 - MAX VAL

Maximum demand values recorded starting from 100ms after closing of main Circuit Breaker plus highest inrush values recorded within the first 100ms from Breaker closing, (updated any time the breaker closes).

Display			Description
I	xxxxx	**A**	True R.M.S. value of the current displayed as primary Amps.(0 - 99999)
G	xxxxx	**A/ms**	Current rate of rise
SI	xxxxx	**A**	True R.M.S. value of the current on closing C/B
SG	xxxxx	**A/ms**	Rated of rise

11.3 – EV.REC

Display of the function which caused the tripping of the relay plus values of the parameters at the moment of tripping. The last five events are recorded
The memory buffer is refreshed at each new relay tripping with a decreasing numbering (FIFO logic).

Display			Description
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
LastTr-x			Indication of the recorded event (x= 0 to 9) Example: Last event (LastTr -0) Last but one event (LastTr-1) etc...
F:xxxxxx			Function which produced the event being displayed and faulty phase in case of phase current element's trip: **1 I** ↑ (F76) **2 I** ↑ (F76) **1 D** ↑ (1ΔI) **WI** **t1I** (F76) **t2I** (F76) **t1D** (1ΔI) **T>** (F49) **1 I** ↓ (F76) **2 I** ↓ (F76) **1 D** ↓ (1ΔI) **2 D** (2ΔI) **1 G** ↑ (1di/dt) **2 G** ↑ (1di/dt) **t2D** (2ΔI) **t1G** (1di/dt) **t2G** (1di/dt) **2 D** (2ΔI) **1 G** ↓ (1di/dt) **2 G** ↓ (1di/dt) **1U<** ↑ (F80) **2U<** ↑ (F80) **1U>** (F45) **2U>** ↑ (F45) **t1U<** (F80) **t2U<** (F80) **t1U>** (F45) **t2U>** (F45) **1U<** ↓ (F80) **2U<** ↓ (F80) **1U>** (F45) **2U>** ↓ (F45)
I	xxxxx	**A**	True R.M.S. value of the current (value recorded at the moment of tripping)
U	xx.xx	**V**	True R.M.S. value of the voltage (value recorded at the moment of tripping)
Tc	xxx	**°K**	Value of Conductor temperature (value recorded at the moment of tripping)
G	xxx	**A/ms**	Rated of rise

11.4 - TRIP NUM

Counters of the number of operations for each of the relay functions.
The memory is non-volatile and can be cancelled only with a secret procedure.

Display			Description	
1I	0		Trip number of	1I
2I	0		Trip number of	2I
1D	0		Trip number of	1D
2D	0		Trip number of	2D
1G	0		Trip number of	1G
2G	0		Trip number of	2G
T>	0		Trip number of	T>
1U>	0		Trip number of	1U>
2U>	0		Trip number of	2U>
1U<	0		Trip number of	1U<
2U<	0		Trip number of	2U<
OPS	0		Number of Circuit Breaker's operations	
%Wi	100		% of maximum interruption energy storable before maintenance alarm	
tCh	0	**ms**	Closing time	
tAp	0	**ms**	Opening time	

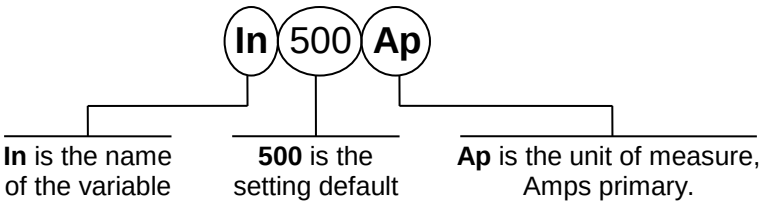
12. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

Enter the mode "SET DISP", select the menu "CONFIG A" or "CONFIG B", scroll information available in the menu by keys "+" or "-".
"CONFIG A" or "CONFIG B" = values of relay's operation parameters as programmed

13. PROGRAMMING

The relay is supplied with the standard default programming used for factory test. [Values here below reported in the " Display " column].
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
Programming via the serial port is always enabled but a password is required to access the programming mode. The default password is the null string; in the standard application program for communication "MS-COM" it is also provided an emergency password which can be disclosed on request only.
As soon as programming is enabled, the Led PRG/IRF flashes and the alarm relay R5 is deenergized..
Enter MODE "PROG" and SELECT either "CONFIG A" or "CONFIG B" for programming of parameters; enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT while "+" or "-" are pressed.
Press key "ENTER/RESET" to validate the set values.

13.1 - Programming of Functions Settings



Mode PROG menu "CONFIG A" or "CONFIG B". (Production standard settings here under shown).

Display			Description	Setting Range	Step	Unit
xxXXXxx			Current date	GGMMMAA	-	-
xx:xx:xx			Current time	HH:MM:SS	-	-
NodAd	1	**-**	Identification number for connection on serial communication bus	1 - 250	1	-
In	4000	**A**	Rated primary current	1 - 9999	1	A
Un	1500	**V**	Rated primary voltage	1 - 9999	1	V
			1F-76			
ab1I	OFF	**-**	Function enabling	ON-OFF	-	-
1IDir	Dis	**-**	Trip direction	-, + , Dis	-	-
1I	500	**A**	Trip level of first element	100-9999	1	A
t1I	2.0	**s**	Definite trip time delay	0 - 10	0.01	s
1I Tr	OFF	**-**	Oscillographic recording Trigger enabling 1I	ON-OFF	-	-
			2F-76			
ab2I	OFF	**-**	Function enabling	ON-OFF	-	-
2Dir	Dis	**-**	Trip direction	-, + , Dis	-	-
2I	1000	**A**	Trip level of second element	100-9999	1	A
t2I	2.0	**s**	Definite trip time delay	0 - 10	0.01	s
2ITr	OFF	**-**	Oscillographic recording Trigger enabling 2I	ON-OFF	-	-
			FIRST ΔI ELEMENT			
ab1D	OFF	**-**	Function enabling	ON-OFF	-	-
1D	1500	**A**	Trip level of first element	100-9999	1	A
t1D	100	**ms**	Definite trip time delay	0 - 999	1	ms
1d	10	**Ams**	Current rate of rise for ΔI detection	2 - 200	1	A/ms
t1d	100	**ms**	Duration of rate of rise below 1d	0 - 100	1	ms
1D Tr	OFF	**-**	Oscillographic recording Trigger enabling 1D	ON-OFF	-	-

SECOND ΔI ELEMENT						
ab2D	OFF	**-**	Function enabling	ON-OFF	-	-
2D	1000	**A**	Trip level of second element	100 - 9999	1	A
t2D	100	**ms**	Definite trip time delay	0 - 999	1	ms
2d	20	**Ams**	Current rate of rise for ΔI detection	2 - 200	1	A/ms
t2d	100	**ms**	Duration of rate of rise below 2d	0 - 100	1	ms
2D Tr	OFF	**-**	Oscillographic recording Trigger enabling 2D	ON-OFF	-	-
FIRST CURRENT RATE OF RISE ELEMENT						
ab1G	OFF	**-**	Function enabling	ON-OFF	-	-
1G	10	**Ams**	Trip level of first element	3 - 200	1	A/ms
t1G	20	**ms**	Definite trip time delay	10 - 200	1	ms
1G Tr	OFF	**-**	Oscillographic recording Trigger enabling 1G	ON-OFF	-	-
SECOND CURRENT RATE OF RISE ELEMENT						
ab2G	OFF	**-**	Function enabling	ON-OFF	-	-
2G	20	**Ams**	Trip level of second element	3 - 200	1	A/ms
t2G	20	**ms**	Definite trip time delay	10 - 200	1	ms
2G Tr	OFF	**-**	Oscillographic recording Trigger enabling 2G	ON-OFF	-	-
F49 (THERMAL IMMAGE)						
abT	OFF	**-**	Function enabling	ON-OFF	-	-
Ta>	50	**°C**	Prealarm temperature	50-150	1	°C
Ts>	75	**°C**	Trip temperature	50-150	1	°C
tT>	10	**s**	Trip time delay	0-100	1	s
S	100	**mm²**	Conductor section	50 –999	1	mm²
F45 (FIRST OVERVOLTAGE ELEMENT)						
ab1U>	OFF	**-**	Function enabling	ON-OFF	-	-
1U>	1800	**V**	Trip level of first element	100 - 3600	1	V
t1U>	10	**s**	Definite trip time delay	0 - 650	1	s
1U>Tr	OFF	**-**	Oscillographic recording Trigger enabling	ON-OFF	-	-
F45 (SECOND OVERVOLTAGE ELEMENT)						
ab2U>	OFF	**-**	Function enabling	ON-OFF	-	-
2U>	2000	**V**	Trip level of second element	100 - 3600	1	V
t2U>	10	**s**	Definite trip time delay	0 - 650	1	s
2U>Tr	OFF	**-**	Oscillographic recording Trigger enabling	ON-OFF	-	-
F80 (FIRST UNDERVOLTAGE ELEMENT)						
ab1U<	OFF	**-**	Function enabling	ON-OFF	-	-
1U<	1300	**V**	Trip level of first element	100-3600	1	V
t1U<	10	**s**	Definite trip time delay	0 - 650	1	s
1U<Tr	OFF	**-**	Oscillographic recording Trigger enabling	ON-OFF	-	-
F80 (SECOND UNDERVOLTAGE ELEMENT)						
ab2U<	OFF	**-**	Function enabling	ON-OFF	-	-
2U<	1000	**V**	Trip level of second element	100-3600	1	V
t2U<	10	**s**	Definite trip time delay	0 - 650	1	s
2U<Tr	OFF	**-**	Oscillographic recording Trigger enabling	ON-OFF	-	-
LINE VOLTAGE LACK ALARM						
UL>	750	**V**	Line voltage lack alarm level	100 - 3600	1	V
BREAKER FAILURE						
tBF	0.25	**s**	Time delay for Breaker Failure alarm	0.05-0.75	0.01	s
BFTr	OFF	**-**	Oscillographic recording Trigger enabling	ON-OFF	-	-
CIRCUIT BREAKER DIAGNOSTIC						
Ii	1.0	**In**	C/B rated current	0.1-9.99	0.01	In
WI	100	**Wc**	Maximum interruption energy before maintenance alarm	1-9999	1	Wc
TRIGGER						
ITrg	50	**%**	Trigger (Oscillographic Recording)	0 - 99	1	%
TrEx	OFF	**-**	External Trigger	Ap-Ch	-	-
SYNCRONISM						
Tsyn	Dis	min	Synchronisation Time Expected time interval between sync. pulses.	5-10-15-30-60-Dis	5-10-15-30-60-Dis	min

13.2 - Output Relays (firmware version 4.00) - MLC-Es

Display		Description	Action
t1I	**-**	First **O/C** Element	Alarm
t2I	**R1+R2**	Second **O/C** Element	C/B Opening
t1D	**-**	First **ΔI** Element	Alarm
t2D	**R1+R3**	Second **ΔI** Element	C/B Opening
t1G	**-**	First **di/dt** Element	Alarm
t2G	**R1+R4**	Second **di/dt** Element	C/B Opening
Ta>	**-**	**Cable Thermal Image**	Alarm
Ts>	**R1**	**Cable Thermal Image**	C/B Opening
t1U>	**-**	First **O/V** Element	Alarm
t2U>	**R1**	Second **O/V** Element	C/B Opening
t1U<	**-**	First **U/V** Element	Alarm
t2U<	**R1**	Second **U/V** Element	C/B Opening
W_i	**-**	**Max. Interruption Energy**	Alarm
tBF	**-**	**Breaker Failure** Element	Signal

13.3 - Output Relays (firmware version 4.01) - MLC-Es/BmV

Display		Description	Action
t1I	**R2**	First **O/C** Element	Alarm
t2I	**R1**	Second **O/C** Element	C/B Opening
t1D	**R2**	First **ΔI** Element	Alarm
t2D	**R1**	Second **ΔI** Element	C/B Opening
t1G	**R2**	First **di/dt** Element	Alarm
t2G	**R1**	Second **di/dt** Element	C/B Opening
Ta>	**R2**	**Cable Thermal Image**	Alarm
Ts>	**R1**	**Cable Thermal Image**	C/B Opening
t1U>	**R2**	First **O/V** Element	Alarm
t2U>	**R1**	Second **O/V** Element	C/B Opening
t1U<	**R2**	First **U/V** Element	Alarm
t2U<	**R1**	Second **U/V** Element	C/B Opening
W_i	**R3**	**Max. Interruption Energy**	Alarm
tBF	**R4**	**Breaker Failure** Element	Signal

14. MANUAL TEST OPERATION

14.1 - Mode "TESTPROG" subprogram "W/O TRIP"

Operation of the yellow key activates a complete test of the electronics and the process routines.
All the leds are lit-on and the display shows (TEST RUN). If the test routine is successfully completed the display switches-over to the default reading (xx:xx:xx).
If an internal fault is detected, the display shows the fault identification code and the relay R5 is deenergized. This test can be carried-out even during the operation of the relay without affecting the relay tripping in case a fault takes place during the test itself.

14.2 - Mode "TESTPROG" subprogram "WithTRIP"

Access to this program is enabled only if the current detected is zero (breaker open).
Pressing the yellow key the display shows "TEST RUN?". A second operation of the yellow key starts a complete test which also includes the activation of all the output relays.
The display shows (TEST RUN) with the same procedure as for the test with W/O TRIP.
Every 15 min during the normal operation the relay automatically initiates an auto test procedure (duration ≤ 10ms). If any internal fault is detected during the auto test, the relay R5 is deenergized, the relevant led is activated and the fault code is displayed.

ATTENZIONE

Running the **WithTRIP** test will operate all of the output relays. Care must be taken to ensure that no unexpected or harmful equipment operations will occur as a result of running this test.
It is generally recommended that this test be run only in a bench test environment or after all dangerous output connections are removed.

15. MAINTENANCE

No maintenance is required. Periodically a functional check-out can be made with the test procedures described under MANUAL TEST chapter. In case of malfunctioning please contact Microelettrica Scientifica Service or the local Authorised Dealer mentioning the relay's Serial No reported in the label on relays enclosure.

ATTENZIONE

In case of Internal Relay Fault detection, proceed as here-below indicated :

- If the error message displayed is one of the following “DSP Err”, “ALU Err” ,”KBD Err” ,”ADC Err”, switch off power supply and switch-on again. If the message does not disappear send the relay to Microelettrica Scientifica (or its local dealer) for repair.
- If the error message displayed is “E2P Err”, try to program any parameter and then run “W/OTRIP”.
- If message disappear please check all the parameters.
- If message remains send the relay to Microelettrica Scientifica (or its local dealer) for repair.

16. POWER FREQUENCY INSULATION TEST

Every relay individually undergoes a factory insulation test according to IEC255-5 standard at 2 kV, 50 Hz 1min. Insulation test should not be repeated as it unusefully stresses the dielectrics.
When doing the insulation test, the terminals relevant to serial output must always be short circuited to ground. When relays are mounted in switchboards or relay boards that have to undergo the insulation tests, the relay modules must be drawn-out of their enclosures and the test must only include the fixed part of the relay with its terminals and the relevant connections. This is extremely important as discharges eventually tacking place in other parts or components of the board can severely damage the relays or cause damages, not immediately evident to the electronic components.

17. ELECTRICAL CHARACTERISTICS

APPROVAL: CE
REFERENCE STANDARDS IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

❑ Dielectric test voltage		IEC 60255-5	2kV, 50/60Hz, 1 min.		
❑ Impulse test voltage		IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50μs		
❑ Insulation resistance		> 100MΩ			
Environmental Std. Ref. (IEC 60068)					
❑ Operation ambient temperature		-10°C / +55°C			
❑ Storage temperature		-25°C / +70°C			
❑ Environmental testing	(Cold)	IEC60068-2-1			
	(Dry heat)	IEC60068-2-2			
	(Change of temperature)	IEC60068-2-14			
	(Damp heat, steady state)	IEC60068-2-78	RH 93% Without Condensing AT 40°C		
CE EMC Compatibility (EN50081-2 - EN50082-2 - EN50263)					
❑ Electromagnetic emission		EN55022	industrial environment		
❑ Radiated electromagnetic field immunity test		IEC61000-4-3 ENV50204	level 3	80-2000MHz 900MHz/200Hz	10V/m 10V/m
❑ Conducted disturbances immunity test		IEC61000-4-6	level 3	0.15-80MHz	10V
❑ Electrostatic discharge test		IEC61000-4-2	level 4	6kV contact / 8kV air	
❑ Power frequency magnetic test		IEC61000-4-8		1000A/m	50/60Hz
❑ Pulse magnetic field		IEC61000-4-9		1000A/m, 8/20μs	
❑ Damped oscillatory magnetic field		IEC61000-4-10		100A/m, 0.1-1MHz	
❑ Immunity to conducted common mode disturbance 0Hz-150KHz		IEC61000-4-16	level 4		
❑ Electrical fast transient/burst		IEC61000-4-4	level 3	2kV, 5kHz	
❑ HF disturbance test with damped oscillatory wave (1MHz burst test)		IEC60255-22-1	class 3	400pps, 2,5kV (m.c.), 1kV (d.m.)	
❑ Oscillatory waves (Ring waves)		IEC61000-4-12	level 4	4kV(c.m.), 2kV(d.m.)	
❑ Surge immunity test		IEC61000-4-5	level 4	2kV(c.m.), 1kV(d.m.)	
❑ Voltage interruptions		IEC60255-4-11			
❑ Resistance to vibration and shocks		IEC60255-21-1 - IEC60255-21-2 10-500Hz 1g			

CHARACTERISTICS

❑ Accuracy at reference value of influencing factors	1% In , 1%Un for measure 2% +/- 10ms for times
❑ Rated Current Rated Voltage	0 - ±20mA (±40) ≡ 0 – In (2In) 0 - 20mA (40) ≡ 0 – Vn (2Vn)
❑ Power Supply	132Vcc ± 20%
❑ Average power supply consumption	62,5 W
❑ Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)

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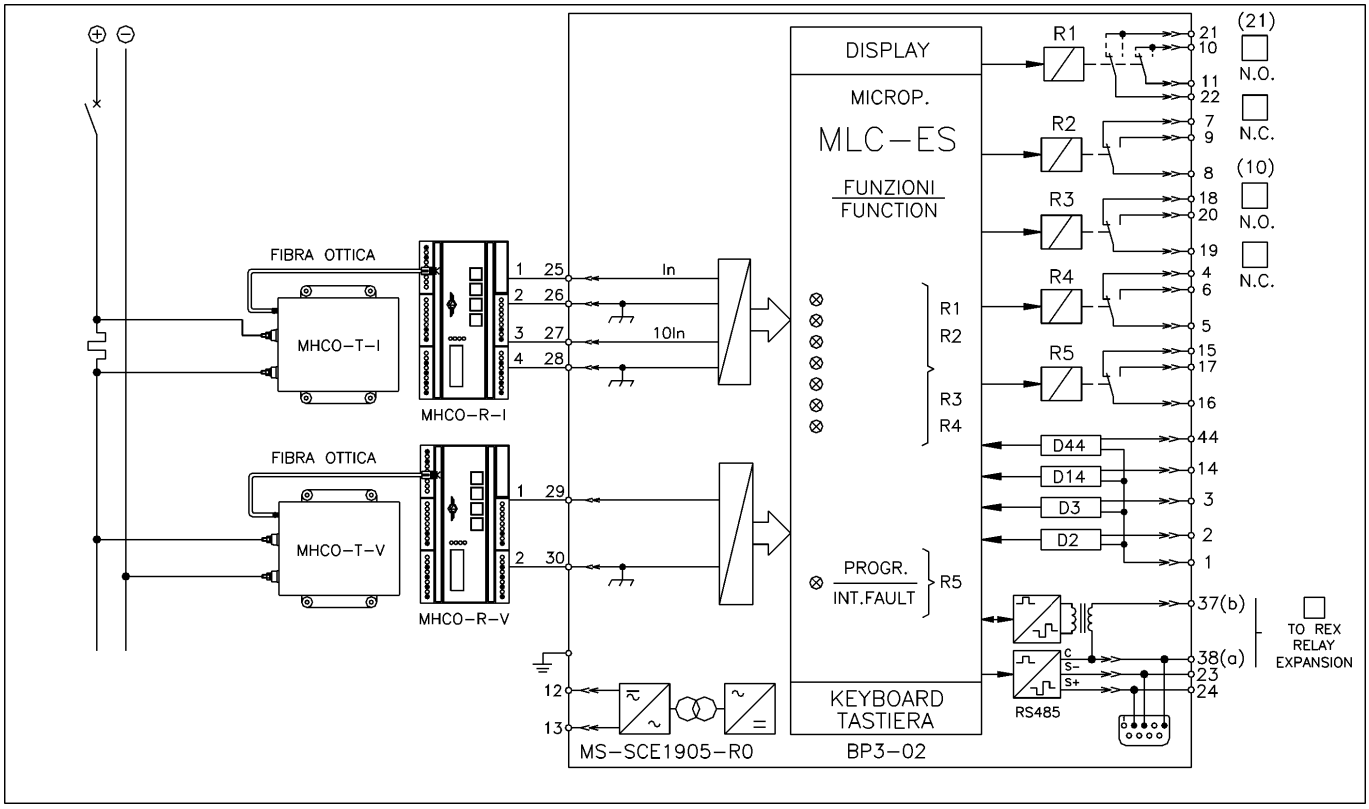
Tel. (+39) 02 575731 - Fax (+39) 02 57510940
http://www.microelettrica.com **e-mail :** sales.relays@microelettrica.com

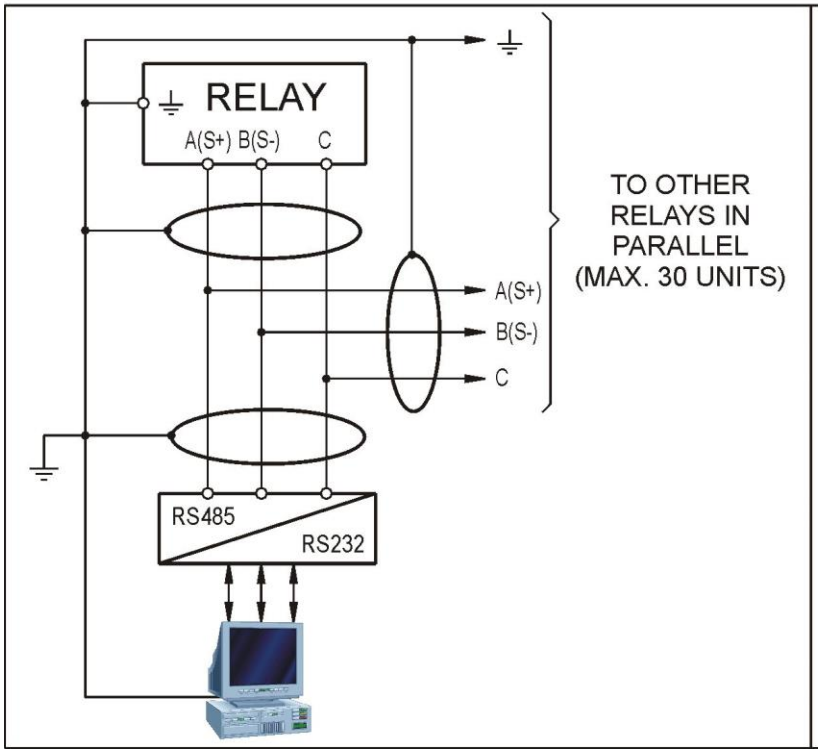
The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice

18. CONNECTION DIAGRAM (SCE1905 Rev.0 Standard Output)

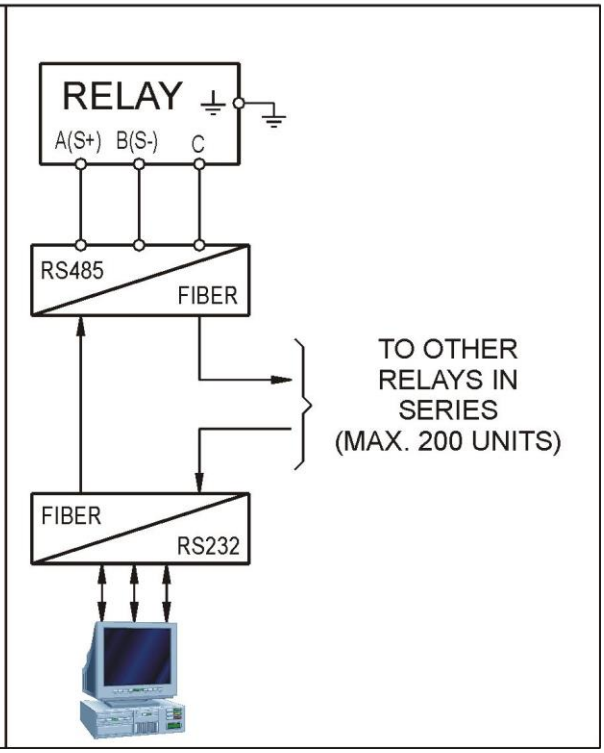


19. WIRING THE SERIAL COMMUNICATION BUS

CONNECTION TO RS485



FIBER OPTIC CONNECTION



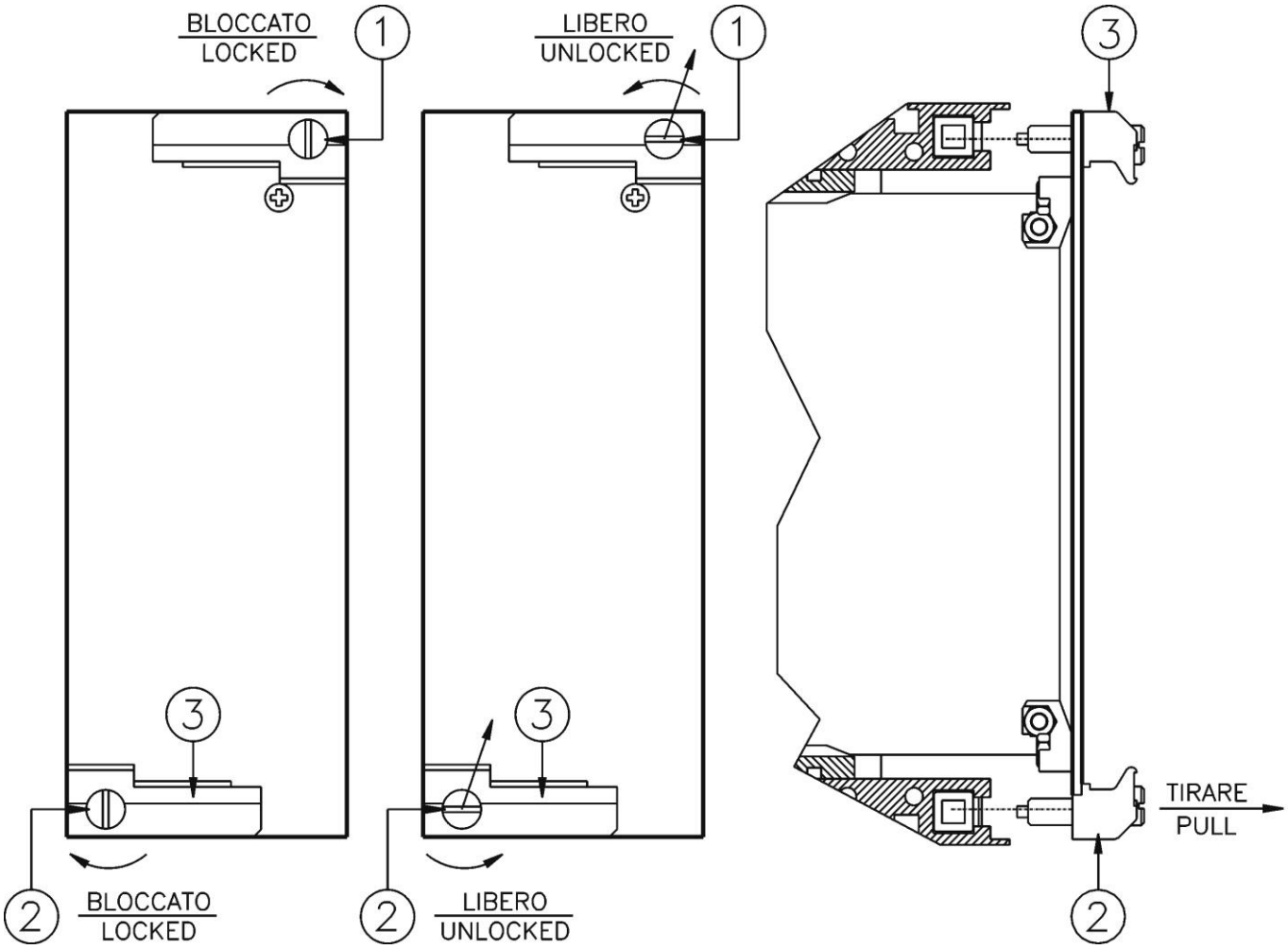
20. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

20.1 - Draw-out

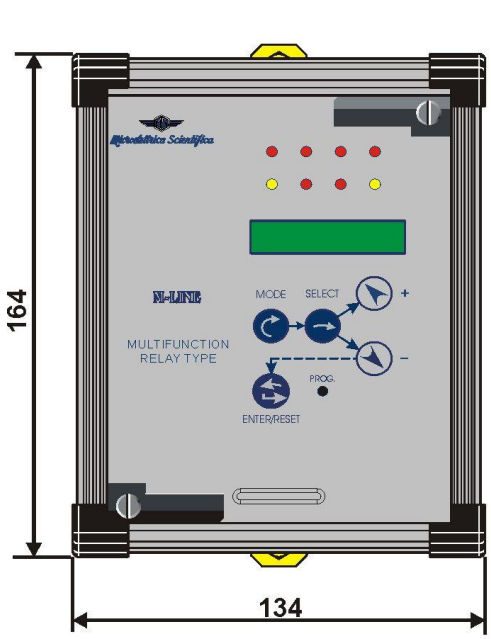
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

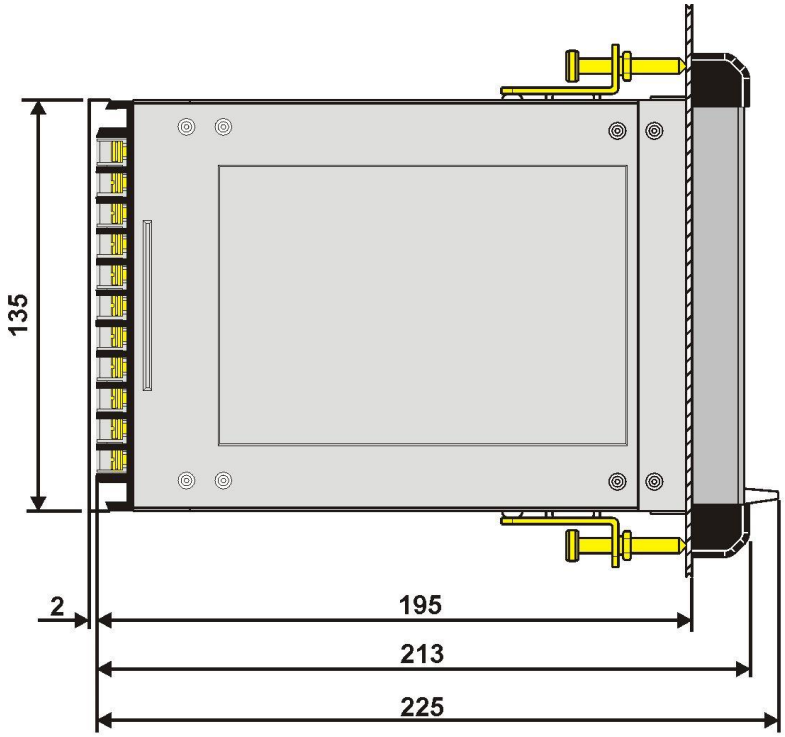
20.2 - Plug-in

Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position (locked).

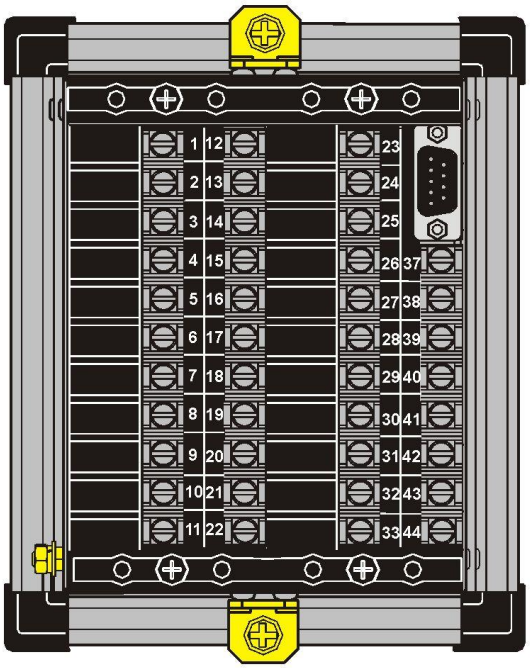


21. MOUNTING



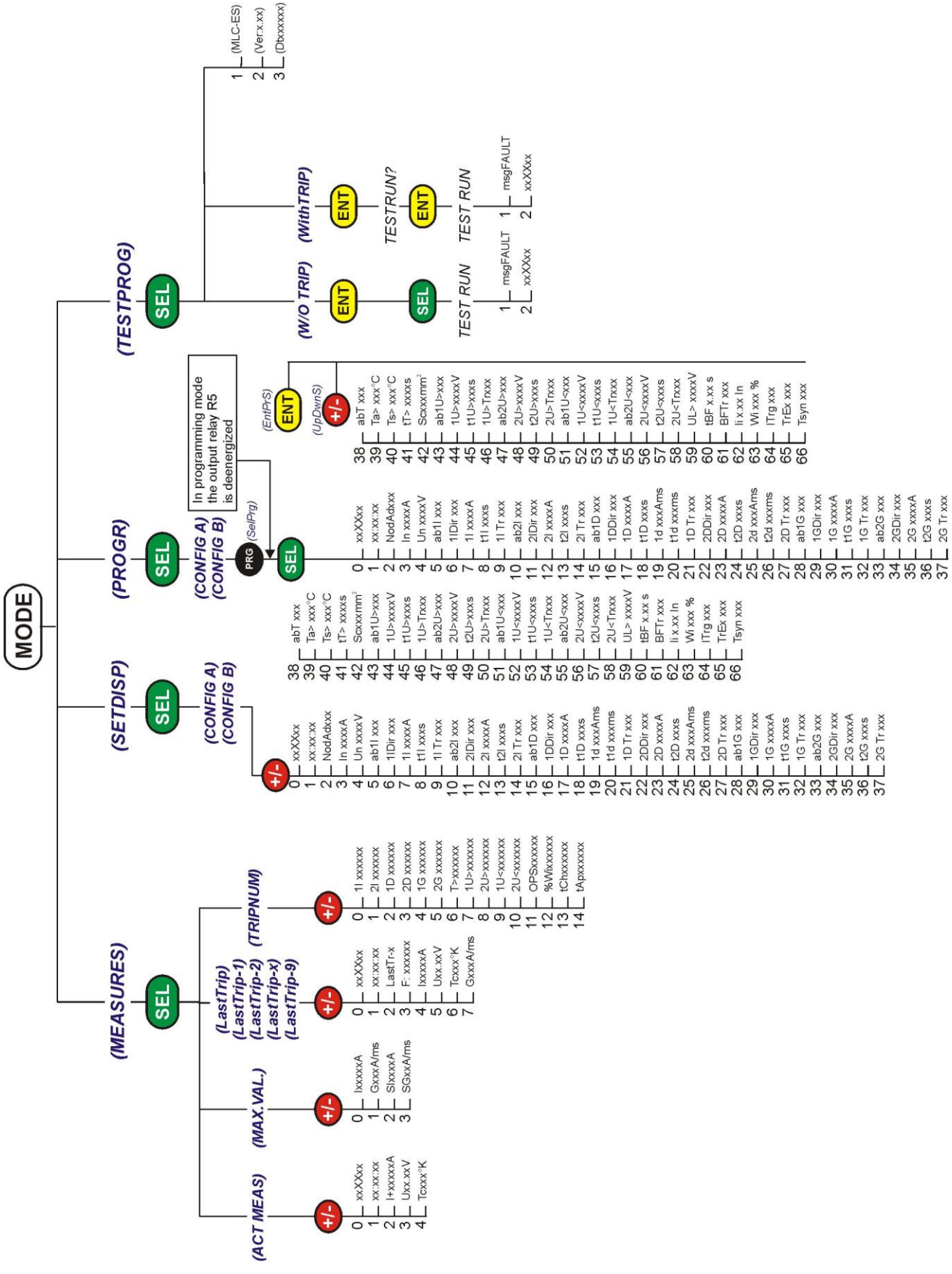


FORATURA PANNELLO
PANEL CUT-OUT
113x142 (LxH)



VISTA POSTERIORE - MORSETTI DI CONNESSIONE
VIEW OR REAR - TERMINAL CONNECTION

22. KEYBOARD OPERATIONAL DIAGRAM



23. SETTING FORM – COMMISSIONING TEST RECORD

Relay Type	**MLC-Es**	**Station :**		**Circuit :**	
Date :	**/ /**	**FW Version:**		**Relay Serial Number :**	
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c.	24V(-20%) / 125V(+20%) d.c.	**Rated Current :**	☐ **1A**	☐ **5A**
	☐ 80V(-20%) / 220V(+15%) a.c.	90V(-20%) / 250V(+20%) d.c.			

RELAY PROGRAMMING

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
xxXXXxx	Current date	GGMMMAA	-				
xx:xx:xx	Current time	HH:MM:SS	-				
NodAd	Identification number for connection on serial communication bus	1 - 250	-	1			
In	Rated primary current	1 - 9999	**A**	4000			
Un	Rated primary voltage	1 - 9999	**V**	1500			
	1F-76						
ab1I	Function enabling	ON-OFF	-	OFF			
1IDir	Trip direction	-, + , Dis	-	Dis			
1I	Trip level of first element	100-9999	**A**	500			
t1I	Definite trip time delay	0 - 10	**s**	2.0			
1I Tr	Oscillographic recording Trigger enabling 1I	ON-OFF	-	OFF			
	2F-76						
ab2I	Function enabling	ON-OFF	-	OFF			
2Dir	Trip direction	-, + , Dis	-	Dis			
2I	Trip level of second element	100-9999	**A**	1000			
t2I	Definite trip time delay	0 - 10	**s**	2.0			
2ITr	Oscillographic recording Trigger enabling 2I	ON-OFF	-	OFF			
	FIRST ΔI ELEMENT						
ab1D	Function enabling	ON-OFF	-	OFF			
1D	Trip level of first element	0-9999	**A**	1500			
t1D	Definite trip time delay	0 – 999	**ms**	100			
1d	Current rate of rise for ΔI detection	2 – 200	**A/ms**	10			
t1d	Duration of rate of rise below 1d	0 – 100	**ms**	100			
1D Tr	Oscillographic recording Trigger enabling 1D	ON-OFF	-	OFF			
	SECOND ΔI ELEMENT						
ab2D	Function enabling	ON-OFF	-	OFF			
2D	Trip level of second element	100 - 9999	**A**	1000			
t2D	Definite trip time delay	0 – 999	**ms**	100			
2d	Current rate of rise for ΔI detection	2 - 200	**A/ms**	20			
t2d	Duration of rate of rise below 2d	0 - 100	**ms**	100			
2D Tr	Oscillographic recording Trigger enabling 2D	ON-OFF	-	OFF			
	FIRST CURRENT RATE OF RISE ELEMENT						
ab1G	Function enabling	ON-OFF	-	OFF			
1G	Trip level of first element	3 - 200	**A/ms**	10			
t1G	Definite trip time delay	10 - 200	**ms**	20			
1G Tr	Oscillographic recording Trigger enabling 1G	ON-OFF	-	OFF			
	SECOND CURRENT RATE OF RISE ELEMENT						
ab2G	Function enabling	ON-OFF	-	OFF			
2G	Trip level of second element	3 - 200	**A/ms**	20			
t2G	Definite trip time delay	10 - 200	**ms**	20			
2G Tr	Oscillographic recording Trigger enabling 2G	ON-OFF	-	OFF			
	F49 (THERMAL IMMAGE)						
abT	Function enabling	ON-OFF	-	OFF			
Ta>	Prealarm temperature	50-150	**°C**	50			
Ts>	Trip temperature	50-150	**°C**	75			
tT>	Trip time delay	0-100	**s**	10			
S	Conductor section	50 –999	**mm²**	100			

F45 (FIRST OVERVOLTAGE ELEMENT)							
ab1U>	Function enabling	ON-OFF	**-**	OFF			
1U>	Trip level of first element	100 - 3600	**V**	1800			
t1U>	Definite trip time delay	0 - 650	**s**	10			
1U>Tr	Oscillographic recording Trigger enabling	ON-OFF	**-**	OFF			
F45 (SECOND OVERVOLTAGE ELEMENT)							
ab2U>	Function enabling	ON-OFF	**-**	OFF			
2U>	Trip level of second element	100 - 3600	**V**	2000			
t2U>	Definite trip time delay	0 - 650	**s**	10			
2U>Tr	Oscillographic recording Trigger enabling	ON-OFF	**-**	OFF			
F80 (FIRST UNDERVOLTAGE ELEMENT)							
ab1U<	Function enabling	ON-OFF	**-**	OFF			
1U<	Trip level of first element	100-3600	**V**	1300			
t1U<	Definite trip time delay	0 - 650	**s**	10			
1U<Tr	Oscillographic recording Trigger enabling	ON-OFF	**-**	OFF			
F80 (SECOND UNDERVOLTAGE ELEMENT)							
ab2U<	Function enabling	ON-OFF	**-**	OFF			
2U<	Trip level of second element	100-3600	**V**	1000			
t2U<	Definite trip time delay	0 –300	**s**	10			
2U<Tr	Oscillographic recording Trigger enabling	ON-OFF	**-**	OFF			
LINE VOLTAGE LACK ALARM							
UL>	Line voltage lack alarm level	100-3600	**V**	750			
BREAKER FAILURE							
tBF	Time delay for Breaker Failure alarm	0.05-0.75	**s**	0.25			
BFTr	Oscillographic recording Trigger enabling	ON-OFF	**-**	OFF			
CIRCUIT BREAKER DIAGNOSTIC							
Ii	C/B rated current	0.1-9.99	**In**	1.0			
WI	Max. interruption energy before maintenance alarm	1-9999	**Wc**	100			
TRIGGER							
ITrg	Trigger (Registrazione Oscillografica)	0 - 99	**%**	50			
TrEx	External Trigger	Ap-Ch	**-**	OFF			
SYNCRONISM							
Tsyn	Synchronisation Time Expected time interval between sync. pulses.	5-10- 15-30- 60-Dis	min	Dis			

☐	CONFIGURATION OF OUTPUT RELAYS (Firmware Version 4.00) - MLC-Es		
Default Setting			**Actual Setting**
Protect. Element / **Output Relays**	**Description**		
t1I	-	First **O/C** Element		Alarm
t2I	**R1+R2**	Second **O/C** Element		C/B Opening
t1D	-	First **ΔI** Element		Alarm
t2D	**R1+R3**	Second **ΔI** Element		C/B Opening
t1G	-	First **di/dt** Element		Alarm
t2G	**R1+R4**	Second **di/dt** Element		C/B Opening
Ta>	-	**Cable Thermal Image**		Alarm
Ts>	**R1**	**Cable Thermal Image**		C/B Opening
t1U>	-	First **O/V** Element		Alarm
t2U>	**R1**	Second **O/V** Element		C/B Opening
t1U<	-	First **U/V** Element		Alarm
t2U<	**R1**	Second **U/V** Element		C/B Opening
W_i	-	**Max. Interruption Energy**		Alarm
tBF	-	**Breaker Failure** Element		Signal

☐	CONFIGURATION OF OUTPUT RELAYS (Firmware Version 4.01) - MLC-ES/BmV		
Default Setting			**Actual Setting**
Protect. Element / **Output Relays**	**Description**		
t1I	R2	First **O/C** Element		Alarm
t2I	R1	Second **O/C** Element		C/B Opening
t1D	R2	First **ΔI** Element		Alarm
t2D	R1	Second **ΔI** Element		C/B Opening
t1G	R2	First **di/dt** Element		Alarm
t2G	R1	Second **di/dt** Element		C/B Opening
Ta>	R2	**Cable Thermal Image**		Alarm
Ts>	R1	**Cable Thermal Image**		C/B Opening
t1U>	R2	First **O/V** Element		Alarm
t2U>	R1	Second **O/V** Element		C/B Opening
t1U<	R2	First **U/V** Element		Alarm
t2U<	R1	Second **U/V** Element		C/B Opening
W_i	R3	**Max. Interruption Energy**		Alarm
tBF	R4	**Breaker Failure** Element		Signal

Tecnico : _____ **Data :** _____

Cliente : _____ **Data :** _____