DIGITAL-MULTIFUNCTION
TRANSFORMER DIFFERENTIAL
PROTECTION RELAY

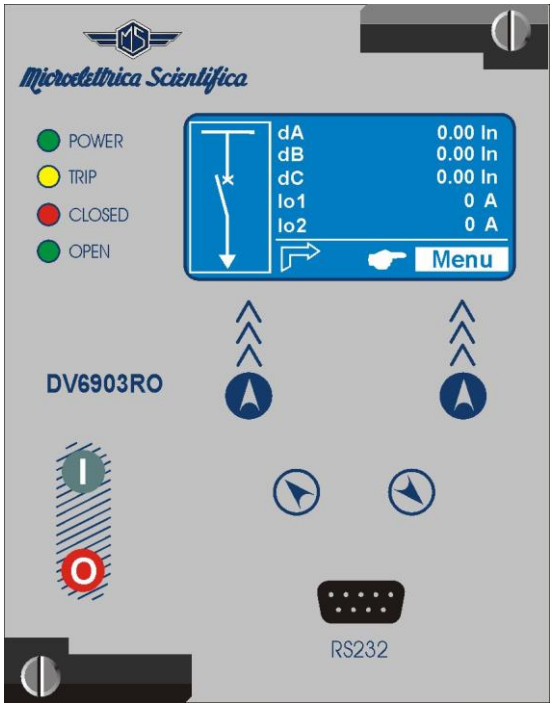
TYPE

DV6903RO

(Multiple I/O Boards)

ULTRA Line

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 - 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 produced 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.

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.

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1.12 - 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

Input currents are supplied to 8 current transformers: - three measuring phase current side 1 – three measuring phase current side 2 - one measuring the earth fault zero-sequence current side 1 - one measuring the earth fault zero-sequence current side 2.
Current input can be selected 1A or 5A by movable jumpers available on relay card.
The Measuring Ranges of different inputs are respectively:

Phase Currents : (0.02-25)In Neutral Current : (0.005-4)On

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

2.1 - Power Supply

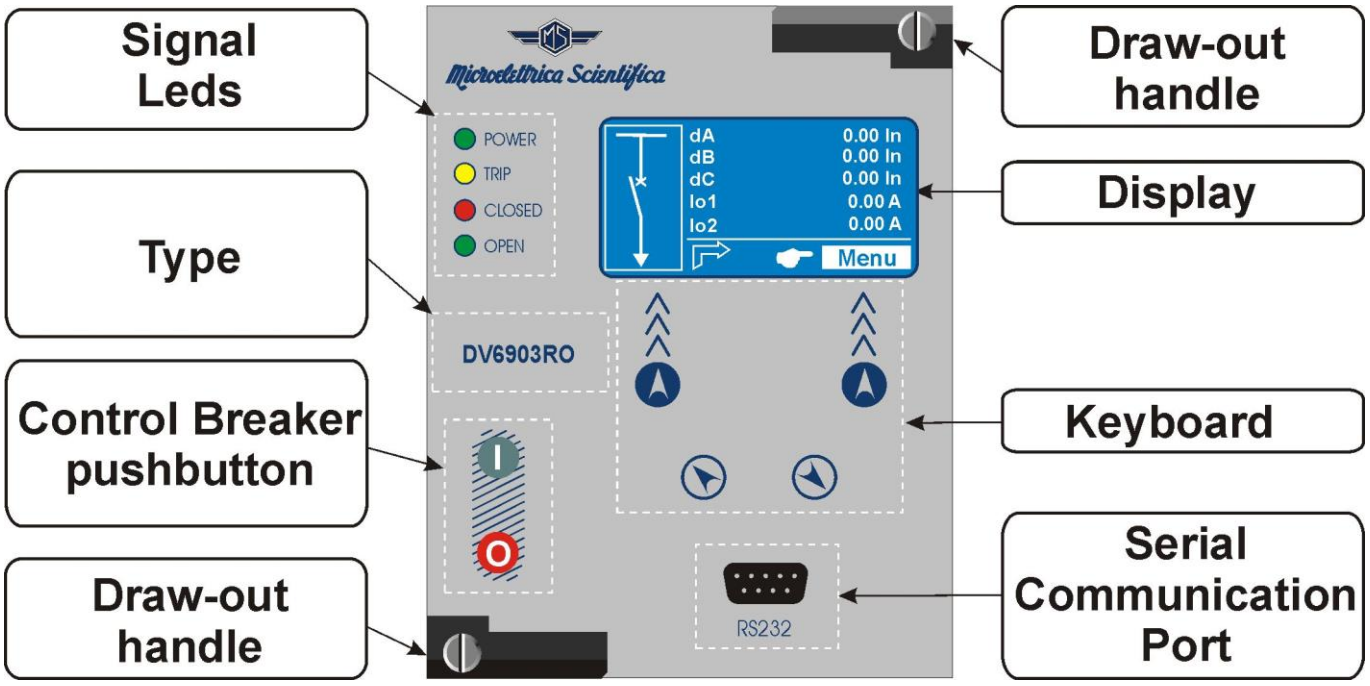
The relay can be fitted with two different types of **power supply**:

Type 1) - { 24V(-20%) / 110V(+15%) a.c. ; 24V(-20%) / 125V(+20%) d.c.

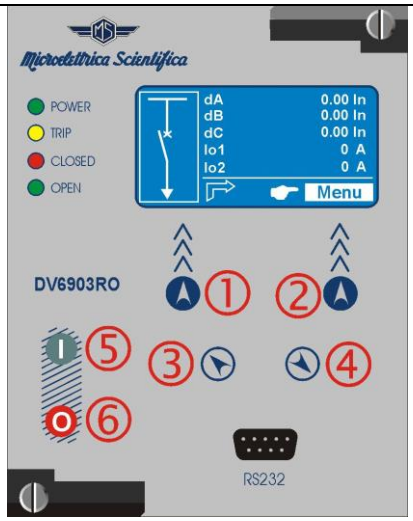
Type 2) - { 80V(-20%) / 220V(+15%) a.c. ; 90V(-20%) / 250V(+20%) d.c.

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

3. Front Panel



4. Keyboard and Display

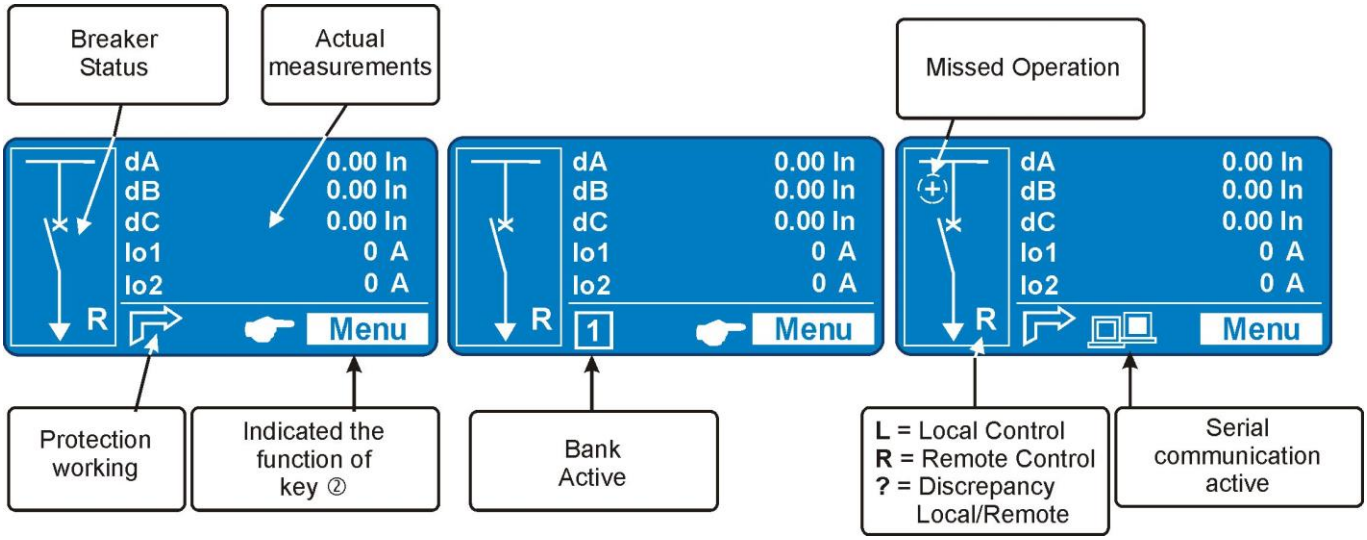


	Navigation menu	By these buttons the options showed in correspondence on the display are selected.
	Increase	These buttons are used to scroll the items of the different menus (Local Control, Measurements, etc).
	Decrease	
	Open	these buttons (when enabled) operate Circuit Breaker Open/Close control (see § C/B Mngn)
	Close	

- By the key ② select the windows showing the ICONS of the available menus.
- By the key ③, ④ select the desired icon and enter by key ①
- The different elements can be selected by the key ③ and ④.
  The details of the individual menus are given in the following paragraphs.

4.1 - Display

The 128x64 pixel LCD display the available information (menu, etc.).

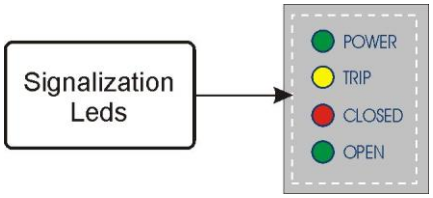


5. Icons of Display

	**Cmd**	Local Commands
	**Measure**	Actual Measurements
	**MaxVal**	Inrush maximum measure values
	**LTrip**	Trips Recorded
	**Cnt**	Overall Counters
	**RCE**	Recorder Chronological Events
	**Setting**	Function Settings
	**Sys**	System Parameters
	**InfoStatus**	Functional Status
	**Osc**	Oscillographic Recorder
	**TimeDate**	Time and Date
	**Healthy**	Diagnostic Information
	**Info**	Info Device

6. Signalization

Four signal leds are provided:



Green Led	POWER	❑ Illuminated ❑ Flashing	- Relay working properly. - Internal Relay Fault
Yellow Led	TRIP	❑ Off ❑ Illuminated ❑ Flashing	- No Trip - Trip occurred - Function Timing
		Reset from Illuminated status is manual	
Red Led	CLOSED	❑ Off ❑ Illuminated	- C/B Open - C/B Close
Green Led	OPEN	❑ Off ❑ Illuminated	- C/B Close - C/B Open

Both Flashing

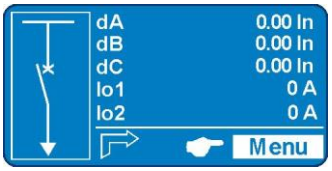
Operation of Trip Circuit Supervision element.

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

6.1 - Leds Manual Reset

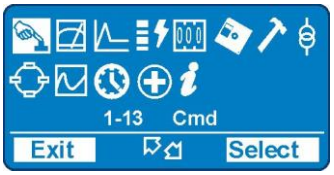
For Leds' manual reset operate as follows:

1



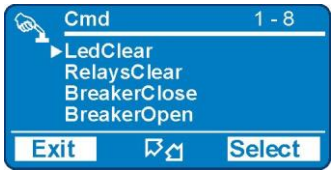
- Press "***Menu***" for access to the main menu with icons.

2



- Select icon "***Cmd***".
- Press "***Select***",

3



- Select "***LedClear***"
- Press "***Select***" to execute the command. (See § Password).

4

- When command has been executed the display shows "***! Command Done***";

6.2 – Display of the last trip

Beside the signalization of the yellow led "Trip", indicating a generic function trip, the display shows a window indicating the last function that was tripped and the number of events that are stored in the memory. The display will show this window until the reset button or external reset are operated.

1

- Press "***Menu***" to access to the main menu with icons.
  Press "***Res.***" to erase visualization.
  Ex. "t1I>" (flashing) is the last trip.

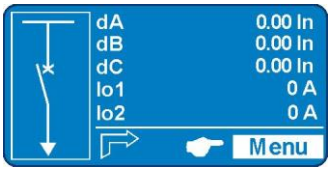
7. Local Commands (Cmd)

"***Cmd***" allow to operate from relay front face controls like Leds reset, Event clear, etc.

Menu		Description	Password
→ **Led**	**Clear**	Reset of signal Leds	*No*
→ **Relays**	**Clear**	Manual reset of output relays	*No*
→ **Breaker**	**Close**	Manual C/B closing	Yes
→ **Breaker**	**Open**	Manual C/B opening	Yes
→ **Breaker2**	**Close**	Manual C/B 2 closing	Yes
→ **Breaker2**	**Open**	Manual C/B 2 opening	Yes
→ **Breaker3**	**Close**	Manual C/B 3 closing	Yes
→ **Breaker3**	**Open**	Manual C/B 3 opening	Yes
→ **Breaker4**	**Close**	Manual C/B 4 closing	Yes
→ **Breaker4**	**Open**	Manual C/B 4 opening	Yes
→ **Event**	**Clear**	Reset of all Events recorded	Yes
→ **HistFail**	**Clear**	Reset of Internal Failure Historic records	Yes
→ **Reset**	**Wi**	Reset Circuit breaker maintenance level	*No*
→ **Leds**	**Test**	Signal Leds test	*No*
→ **Force**	**Osc**	Issue a trigger on oschillographic recording	Yes

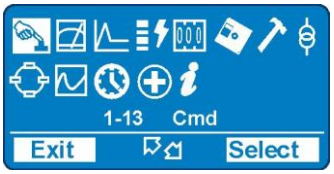
To operate one command by the Front Face Keyboard, proceed as follows (Led Reset in the present example).

1



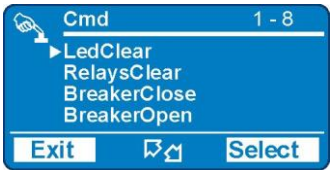
- Press "***Menu***" for access to the main menu with icons.

2



- Select "***Cmd***" *icon with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3



- Select *with pushbutton* "***Increase***" or "***Decrease***" the menu "***LedClear***".
- Press "***Select***" to execute the command.
  (if Password is request, see § Password).

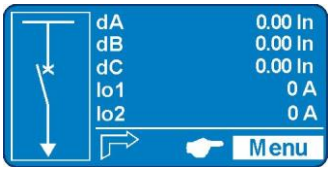
4

- When command has been executed the display shows "***! Command Done***"; go to "*3*".

8. Measure

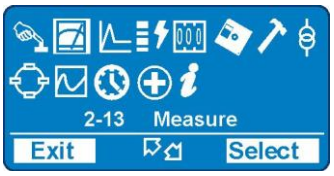
Real time values as measured during the normal operation.

1



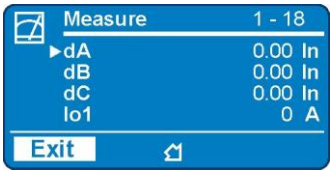
- Press "***Menu***" for access to the main menu with icons.

2



- Select "***Measure***" *icon with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3



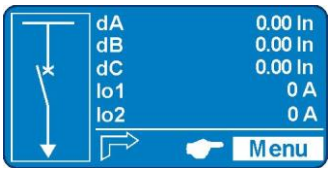
- Scroll the menu "***Measure***" *with pushbutton* "***Increase***" or "***Decrease***" to display the measurement.
- Press "***Exit***" to go to the main menu.

→	**dA**	(0 ÷ 99.99)	**In**	RMS phase A differential value
→	**dB**	(0 ÷ 99.99)	**In**	RMS phase B differential value
→	**dC**	(0 ÷ 99.99)	**In**	RMS phase C differential value
→	**Io1**	(0 ÷ 9999)	**A**	Earth fault current side 1
→	**Io2**	(0 ÷ 9999)	**A**	Earth fault current side 2
→	**1A**	(0 ÷ 9999)	**A**	RMS value of phase A side 1
→	**1B**	(0 ÷ 9999)	**A**	RMS value of phase B side 1
→	**1C**	(0 ÷ 9999)	**A**	RMS value of phase C side 1
→	**2A**	(0 ÷ 9999)	**A**	RMS value of phase A side 2
→	**2B**	(0 ÷ 9999)	**A**	RMS value of phase B side 2
→	**2C**	(0 ÷ 9999)	**A**	RMS value of phase C side 2
→	**d2A**	(0 ÷ 999)	**%**	2nd harmonic phase A
→	**d5A**	(0 ÷ 999)	**%**	5th harmonic phase A
→	**d2B**	(0 ÷ 999)	**%**	2nd harmonic phase B
→	**d5B**	(0 ÷ 999)	**%**	5th harmonic phase B
→	**d2C**	(0 ÷ 999)	**%**	2nd harmonic phase C
→	**d5C**	(0 ÷ 999)	**%**	5th harmonic phase C
→	**IR**	(0 ÷ 99.99)	**In**	Selected bias through current
→	**Wir**	(100 ÷ 0)	**%W**	Amount still remaining of permissible interruption energy before Circuit Breaker maintenance is requested.

9. Maximum Values (Inrush maximum measure values)

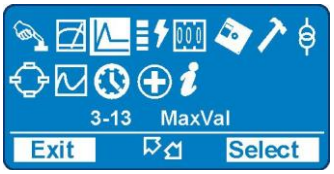
Maximum demand values recorded starting from 100ms after closing of main Circuit Breaker (updated any time the breaker closes).

1



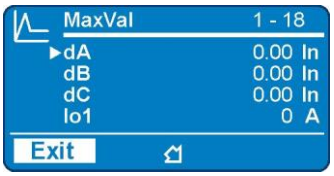
- Press "***Menu***" for access to the main menu with icons.

2



- Select "***MaxVal***" *icon with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3



- Scroll the menu "***MaxVal***" *with pushbutton* "***Increase***" or "***Decrease***" to display the measure
- Press "***Exit***" to go back to the main menu.

→ **dA**	(0 ÷ 99.99)	**In**	RMS phase A differential value
→ **dB**	(0 ÷ 99.99)	**In**	RMS phase B differential value
→ **dC**	(0 ÷ 99.99)	**In**	RMS phase C differential value
→ **Io1**	(0 ÷ 9999)	**A**	Earth fault current side 1
→ **Io2**	(0 ÷ 9999)	**A**	Earth fault current side 2
→ **1A**	(0 ÷ 9999)	**A**	RMS value of phase A side 1
→ **1B**	(0 ÷ 9999)	**A**	RMS value of phase B side 1
→ **1C**	(0 ÷ 9999)	**A**	RMS value of phase C side 1
→ **2A**	(0 ÷ 9999)	**A**	RMS value of phase A side 2
→ **2B**	(0 ÷ 9999)	**A**	RMS value of phase B side 2
→ **2C**	(0 ÷ 9999)	**A**	RMS value of phase C side 2
→ **d2A**	(0 ÷ 999)	**%**	2nd harmonic phase A
→ **d5A**	(0 ÷ 999)	**%**	5th harmonic phase A
→ **d2B**	(0 ÷ 999)	**%**	2nd harmonic phase B
→ **d5B**	(0 ÷ 999)	**%**	5th harmonic phase B
→ **d2C**	(0 ÷ 999)	**%**	2nd harmonic phase C
→ **d5C**	(0 ÷ 999)	**%**	5th harmonic phase C
→ **IR**	(0 ÷ 99.99)	**In**	Selected bias through current
→ **Wir**	(100 ÷ 0)	**%W**	Amount still remaining of permissible interruption energy before Circuit Breaker maintenance is requested.

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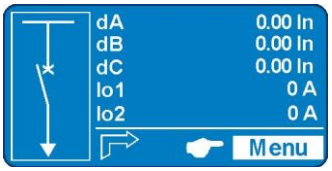
10. Trip Recording (LTrip)

Display of the function which caused the tripping of the relay and values of the measurement at the moment of tripping. The last 10 events are recorded.
The memory buffer is refreshed at each new relay tripping (FIFO logic).

Display	→	Reading of recorded Trips.

Erase	→	Clear all Trip recorded.

1



- Press "***Menu***" for access to the main menu with icons.

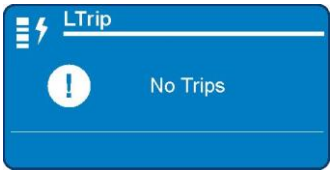
2

- Select "***TripRec.***" *icon with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3

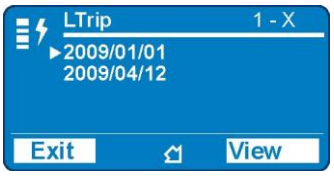
- Select "***Display***" *with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.
- For "***Erase***" go to "8"

4



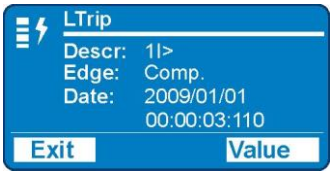
- If no trip is recorded the display shows "***! No Trips***".

5



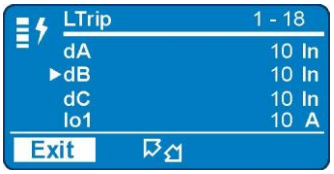
- If any trip was recorded, select "***View***" to display the chronological list of the records.
- By the keys "***Increase***" or "***Decrease***" select the date of the record to be checked.

6



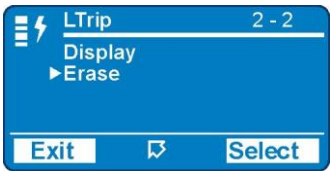
- Will be shown:
  "***Descr***" the function that caused the event (Example: t1I> = Trip)
  "***Edge***" if the function was tripped (Rise) or reset (Fall)
  "***Date***", date of trip, year/month/day, hour:minutes:seconds:milliseconds
- Press "***Value***", for reading the value of input quantities on tripping.

7



- Scroll with pushbuttons "***Increase***" or "***Decrease***" the available measurements.
- Select "***Exit***" to go back to "5" for another selection, or "2" go back to the main menu.

8



- Select "***Erase***" with button "***Decrease***".
- Press "***Select***" to execute the commands; **All** Trips recorded are erased. (if Password is request, see § Password).

9

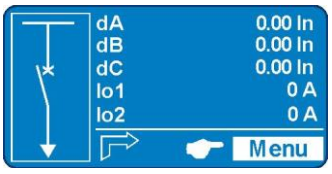
- When command has been executed the display shows "***! Command Done***";
- Press "***Exit***" to go back to the main menu.

11. Cnt (Counters)

Counters of the number of operations for each of the relay functions.
By the interface program “MSCom 2” it is possible to individually reset the counters and set an initial starting value.

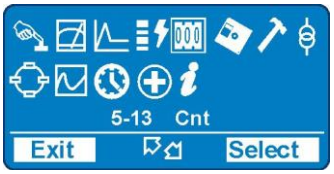
Display				
→	1dA>	0	Operations counters	Low set differential first element phase A
→	1dB>	0	Operations counters	Low set differential first element phase B
→	1dC>	0	Operations counters	Low set differential first element phase C
→	2dA>	0	Operations counters	High set differential first element phase A
→	2dB>	0	Operations counters	High set differential first element phase B
→	2dC>	0	Operations counters	High set differential first element phase C
→	1I>	0	Operations counters	First overcurrent element side 1
→	1I>>	0	Operations counters	Second overcurrent element side 1
→	2I>	0	Operations counters	First overcurrent element side 2
→	2I>>	0	Operations counters	Second overcurrent element side 2
→	do1>	0	Operations counters	Earth fault element side 1
→	do2>	0	Operations counters	Earth fault element side 2
→	IRF	0	Operations counters	Internal Relay Fault
→	TCS	0	Operations counters	Trip Circuit Supervision
→	BrkF	0	Operations counters	Breaker failure to open
→	Wi	0	Operations counters	Circuit Breaker maintenance alarm
→	Aut Op	0	Operations counters	Automatic C/B Openings
→	Aut CL	0	Operations counters	Automatic C/B Closings
→	Man Op	0	Operations counters	Manual C/B Openings
→	Man CL	0	Operations counters	Manual C/B Closings
→	OvrOp	0	Operations counters	Overall C/B Openings total (Man+Aut)
→	OvrCL	0	Operations counters	Overall C/B Closings total (Man+Aut)

1



- Press “***Menu***” for access to the main menu with icons.

2

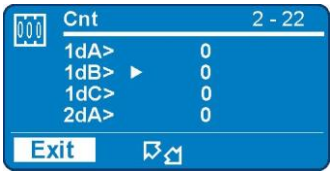


- Press “***Counter***” for access.

3

- Press “***Display***” for access.

4



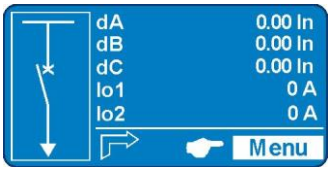
- Display of the number of operations of each individual function.
- With pushbuttons “***Increase***” or “***Decrease***” scroll the parameters
- Press “***Exit***” go back to “*3*”.

12. RCE (Recorder Chronological Events)

Display of the function which caused any of the following events: - *Status change of digital Inputs/Outputs. - Start of protection functions – Trip of protection function – Function reset.*
The last 100 events are recorded.
The memory buffer is updated at each new event.

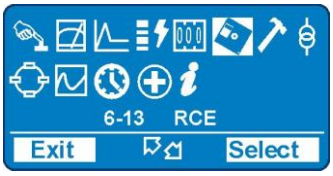
Display	→	Reading events recorded.
Erase	→	Clear all events recorded.

1



- Press "***Menu***" for access to the main menu with icons.

2

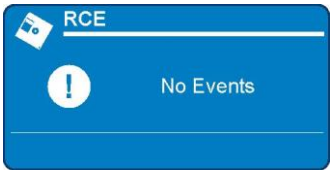


- Select "***Events***" *icon with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3

- Select "***Display***" *with pushbutton* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.
- For "***Erase***" go to "7"

4

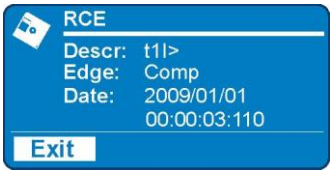


- If no event is recorded the display shows message "***! No Events***".

5

- If any event was recorded, select "***View***" to display the chronological list of the records.
- By the keys "***Increase***" or "***Decrease***" select the date of the record to be checked.

6



- Will be shown:
  "***Descr***" the function that caused the event
  (Example: 1I> = Start, t1I> = Trip)
  "***Edge***" if the function was tripped (Rise) or reset (Fall)
  "***Date***", date of trip, year/month/day, hour:minutes:seconds:milliseconds

7

- Select "***Erase***" with button "***Decrease***".
- Press "***Select***" to execute the commands; **All** Events recorded are erased.
  (if Password is request, see § Password).

8

- When command has been execute the display shows "***! Command Done***";
- Press "***Exit***" to go back to the main menu.

12.1 – Events on display

Functions	Events Displayed	Events Description MScom2			Status	
1d>	R1d>	Start	first differential elelement phase R		Rise	Fall
	tR1d>	Trip	first differential element phase R		Rise	Fall
	S1d>	Start	first differential element phase S		Rise	Fall
	tS1d>	Trip	first differential element phase S		Rise	Fall
	T1d>	Start	first differential element phase T		Rise	Fall
	tT1d>	Trip	first differential element phase T		Rise	Fall
2d>	R2d>	Start	second differenti alelement phase R		Rise	Fall
	tR2d>	Trip	second differential element phase R		Rise	Fall
	S2d>	Start	second differential element phase S		Rise	Fall
	tS2d>	Trip	second differential element phase S		Rise	Fall
	T2d>	Start	second differential element phase T		Rise	Fall
	tT2d>	Trip	second differential element phase T		Rise	Fall
HLock	2HRL	Phase R	second harmonic lock		Rise	Fall
	5HRL	Phase R	fifth harmonic lock		Rise	Fall
	2HSL	Phase S	second harmonic lock		Rise	Fall
	5HSL	Phase S	fifth harmonic lock		Rise	Fall
	2HTL	Phase T	second harmonic lock		Rise	Fall
	5HTL	Phase T	fifth harmonic lock		Rise	Fall
	2HReduct	Second harmonic reduction level			Rise	Fall
	5HReduct	Fifth harmonic reduction level			Rise	Fall
1I>	1I>	Start	First overcurrent element	Side 1	Rise	
	t1I>	Trip	First overcurrent element	Side 1	Rise	Fall
1I>>	1I>>	Start	Second overcurrent element	Side 1	Rise	
	t1I>>	Trip	Second overcurrent element	Side 1	Rise	Fall
2I>	2I>	Start	First overcurrent element	Side 2	Rise	
	t2I>	Trip	First overcurrent element	Side 2	Rise	Fall
2I>>	2I>>	Start	Second overcurrent element	Side 2	Rise	
	t2I>>	Trip	Second overcurrent element	Side 2	Rise	Fall
do1>	do1>	Start	Earth Fault element	Side 1	Rise	
	tdo1>	Trip	Earth Fault element	Side 1	Rise	Fall
do2>	do2>	Start	Earth Fault element	Side 2	Rise	
	tdo2>	Trip	Earth Fault element	Side 2	Rise	Fall
Wi	tWi>	Circuit breaker maintenance level			Rise	
TCS	TCS	Start	trip coil supervision		Rise	
	tTCS	Trip	trip coil supervision		Rise	Fall
IRF	IRF	Start	Internal Relay Failure		Rise	
	tIRF	Trip	Internal Relay Failure		Rise	
BF	tBF	Trip	Breaker Failure		Rise	Fall

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Functions	Events Displayed	Events Description MScom2	Status	
	L/Rdisc.	*Local/Remote signal Discrepancy*	Rise	
	manOpKey	*Circuit Breaker intentional open by Key*	Rise	
	manOpLocC	*Circuit Breaker intentional open by local command*	Rise	
	manOpRemC	*Circuit Breaker intentional open by remote command*	Rise	
	manOpExtIn	*Circuit Breaker intentional open by external input*	Rise	
	ManOpExternal	*Circuit Breaker intentional external open*	Rise	
	manClKey	*Circuit Breaker intentional close by Key*	Rise	
	manClLocC	*Circuit Breaker intentional close by local command*	Rise	
	manClRemC	*Circuit Breaker intentional close by remote command*	Rise	
	manClExtInp	*Circuit Breaker intentional close by external input*	Rise	
	ExterManCh	*Circuit Breaker intentional external close*	Rise	
	CB-Fail	*Circuit Breaker failure*	Rise	Fall
	0.D0 ---- 0.D4	*Digital Input on Main Relay*	Rise	Fall
	1.D1 ---- 1.D15	*Digital input on Expansion Board 1*	Rise	Fall
	2.D1 ---- 2.D15	*Digital input on Expansion Board 2*	Rise	Fall
	0.R1 ---- 0.R6	*Output relay on Main Relay*	Rise	Fall
	1.R1 ---- 1.R14	*Output relay on Expansion Board 1*	Rise	Fall
	2.R1 ---- 2.R14	*Output relay on Expansion Board 2*	Rise	Fall
	UpDateMon	*Monitor Update*	Rise	Fall
	IPU boot	*IPU boot*	Rise	

13. Sys (System parameters)

Setting of system parameters.

CT&PTs	Phase CT Side 1	**Prim.**	→	1000	A	(1 ÷ 9999)	step	1	A	
		Sec.	→	1	A	(1 / 5)				(1)
	Phase CT Side 2	**Prim.**	→	1000	A	(1 ÷ 9999)	step	1	A	
		Sec.	→	1	A	(1 / 5)				(1)
	Neut.CT Side 1	**Prim.**	→	1000	A	(1 ÷ 9999)	step	1	A	
		Sec.	→	1	A	(1 / 5)	step			(1)
	Neut. CT Side 2	**Prim.**	→	1000	A	(1 ÷ 9999)	step	1	A	
		Sec.	→	1	A	(1 / 5)	step			(1)

Nom.Val.	→	**fn**	50	Hz	(50 / 60)	
(System Rated Values)	→	**It2**	1000	A	(1 ÷ 9999)	1 A
	→	**1V**	10.00	kV	(0.10 ÷ 655.00)	0.01 kV
	→	**2V**	10.00	kV	(0.10 ÷ 655.00)	0.01 kV

Sys Options	→	**Alfa**	Yy6	[Yy0 / Yy6 / Yd1 / Yd5 / Yd7 / Yd11 / Ddo / Dd2 / Dd4 / Dd6 / Dd8 / Dd10 / Dy1 / Dy5 / Dy7 / Dy11 / Yz1 / Yz5 / Yz7 / Yz11]
(Vector Goup)				

Setup Group	→	**Group**	1	(1 / 2)

13.1 – Description of variables

❑ **fn**	:	Nominal Frequency
❑ **It2**	:	Primary nominal current side 2
❑ **1V**	:	Nominal Voltage Side 1
❑ **2V**	:	Nominal Voltage Side 2
❑ **Alfa**	:	Vector Group
❑ **Group**	:	Group settings

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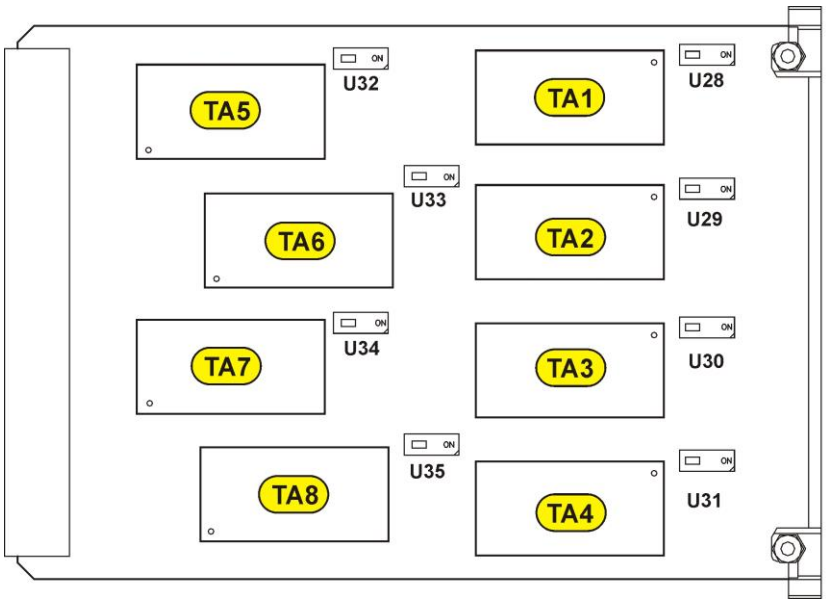
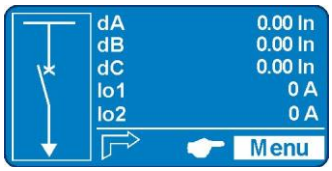
(1) Move the switch in the corresponding founding to the required input current as herebelow shorted.



	SIDE 1		SIDE 2	
TA1	U28 Phase R	RATED CURRENT 1A 5A	TA5	U32 Phase Io	RATED CURRENT 1A 5A
TA2	U29 Phase S	RATED CURRENT 1A 5A	TA6	U33 Phase R	RATED CURRENT 1A 5A
TA3	U30 Phase T	RATED CURRENT 1A 5A	TA7	U34 Phase S	RATED CURRENT 1A 5A
TA4	U31 Phase Io	RATED CURRENT 1A 5A	TA8	U35 Phase T	RATED CURRENT 1A 5A

1



- Press "***Menu***" for access to the main menu with icons.

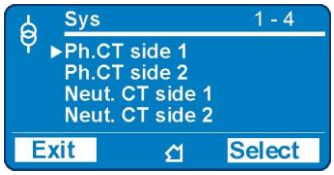
2

- Select "***Sys****" icon with pushbuttons* "***Increase***" or "***Decrease***".
- Press "***Select***" for access.

3

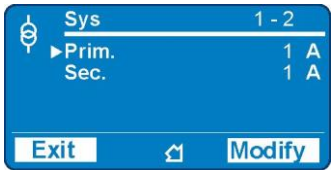
- Select "***CT&PTs****"*.
- Press "***Select***" *for access.*

4



- Select "***Phase CT site 1****"*.
- Press "***Select***" for access.

5



- Select "***Prim.****"* to modify the primary value of Phase CT, or press "***Decrease***" and select "***Sec.****"* to modify the secondary value of Phase CT.
- Press "***Modify***" to modify the parameter.
  (if Password is request, see § Password).

6

- The value appear as bold figure.
- Use pushbuttons "***Increase***" or "***Decrease***" to set the value.
- Press "***Write***" to confirm the value

7

- The value is now set.
- To set a new value return to the point “5”.
- Press “***Exit***”.

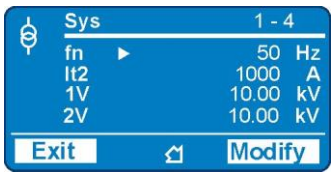
8

- The display show “***Confirm the change?***”.
- Choose “***Yes*** ” to convalidate the changes.
- Choose “***No*** ” to **don’t** confirm the changes.
- After set confirmation (or not confirmation) the display goes back to point “4”.

9

- To modify the input quantities, select with pushbutton “***Decrease***”, “***Nom.Val.***”.
- Press “***Select***” for access.

10



- To set the input quantities see points “5-6-7-8” .

11

- To select the Vector Group press “***Sys.Options***”.
- Press “***Select***” for access.

12

- To set Vector Group see points “5-6-7-8” .

13

- To select the Active Bank of setting press “***SetUp Group***”.

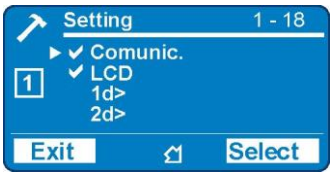
14

- To set the Group active see points “5-6-7-8” .

14.

Two complete Groups of setting of the programmable variables are available in the "***SETTING***" menu. Both "Group 1" and "Group 2" include the here below listed variables.

1



Indicates the Setting Group that is actually being modified.

This symbol indicates that the function is enabled; symbol missing indicates that the function is disabled.

→ **Comunic.**	Serial communication parameters	
→ **LCD**	Visualization parameters	
→ **1d>**	First differential element	
→ **2d>**	Second differential element	
→ **HLock**	2nd and 5th Harmonic block	
→ **1I>**	First overcurrent element	Side 1
→ **1I>>**	Second overcurrent element	Side 1
→ **2I>**	First overcurrent element	Side 2
→ **2I>>**	Second overcurrent element	Side 2
→ **do1>**	Earth Fault element	Side 1
→ **do2>**	Earth Fault element	Side 2
→ **Wi**	Amount of Energy to reach the C/B maintenance level	
→ **TCS**	Setting variables for Trip Circuit Supervision	
→ **IRF**	Internal Relay Fault	
→ **CB Mngm**	C/B command Local / Remote setting	
→ **Oscillo**	Setting variables for Oscillographic recording	
→ **BreakerFail**	Setting variables for Breaker Failure detection	
→ **ExtReset**	Configuration for external reset input	

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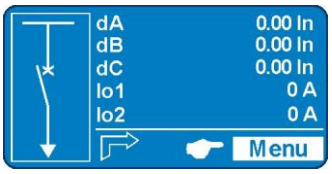
14.1 Modifying the setting of variables

To modify any variable settings by the keyboard proceed as follows:
(example: change setting of element "***1I>***", from "**Is *4.000* In**" to "**Is *3.500* In**")

1



- Press "***Menu***" for access to the main menu with icons.

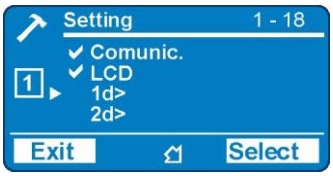
2

- Select icon "***Setting***" by pushbutton "***Increase***" or "***Decrease***".
- Press "***Select***".

3

- Select "***Group***" by pushbuttons "***Increase***" or "***Decrease***".
- Press "***Select***".

4

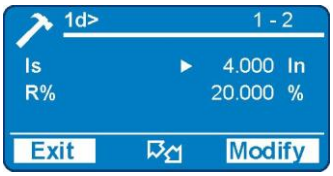


- Select by pushbuttons "***Increase***" or "***Decrease***" the parameter "***1d>***".
- Press "***Select***".

5

- Select by buttons "***Increase***" or "***Decrease***" the menu "***Oper.Levels***".
- Press "***Select***".

6



- The arrow aside "***Is***" shows the parameter selected for changing
- Press "***Modify***".
- If Password is request, see § Password

7

- The value appears as bold figure.

8

- Set new value by "***Increase***" or "***Decrease***" buttons
- Press "***Write***".

9

- If the parameters change is completed, press "***Exit***".

10

- "***Yes***" to confirm all changes.
- "***No***" voids all the changes.

11

- The relay returns to point "**4**".

14.2. Password

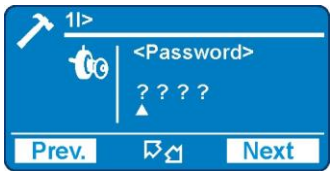
The password is requested every time the user wishes to modify any password protected parameter (example “1I>” menu “Setting”).

The factory default password is “ 1111 “.

The password is only modifiable by “MSCom 2” software (see Manual “MSCom 2”).

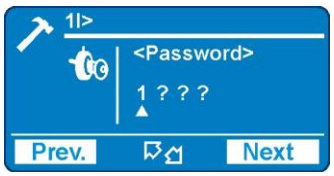
When password is requested, proceed as follows:

1



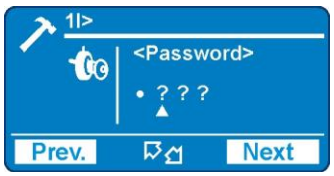
- Use the keys “***Increase***” and “***Decrease***” to set the first digit of password.

2



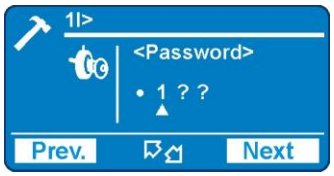
- Press “***Next***” to validate and go to the next digit.

3



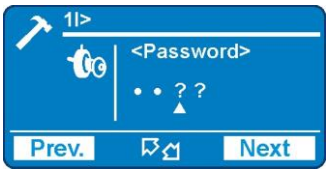
- Use the key “***Increase***” or “***Decrease***” to set second digit.

4



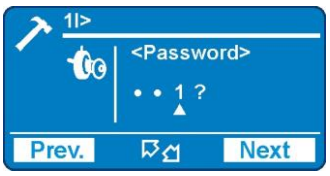
- Press “***Next***” to validate and go to the next digit.

5



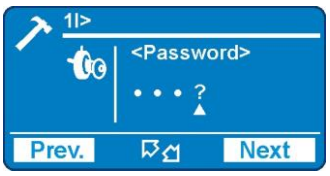
- Use the key “***Increase***” or “***Decrease***” to set the third digit.

6



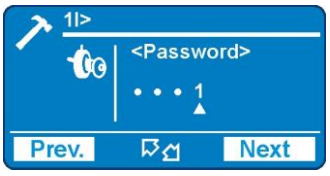
- Press “***Next***” to validate and go to the next digit.

7



- Use the key “***Increase***” or “***Decrease***” to set the fourth digit.

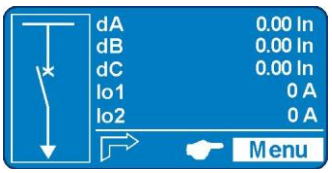
8



- Press “***Next***” to validate and go to modify the next parameter.

By key “***Prev***” go back to previous digit.

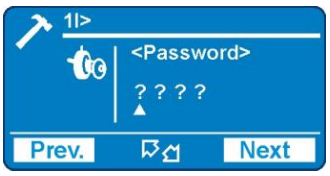
The password validity expires 60 sec after the last setting modification or as soon as you go back to the main menu



1

- If set the incorrect password the display shows “***! Wrong code***”.

2



- The display will repeat the initial interrogation

14.3 – Menu: **Communic. (Communication)**

Options	→	**BRLoc**	38400	[9600 / 19200 / 38400 / 57600]
	→	**BRRem**	19200	[9600 / 19200 / 38400]
	→	**PRRem**	Modbus	[Modbus / IEC103]
Node Address	→	**Indir.**	1	[1 ÷ 255]

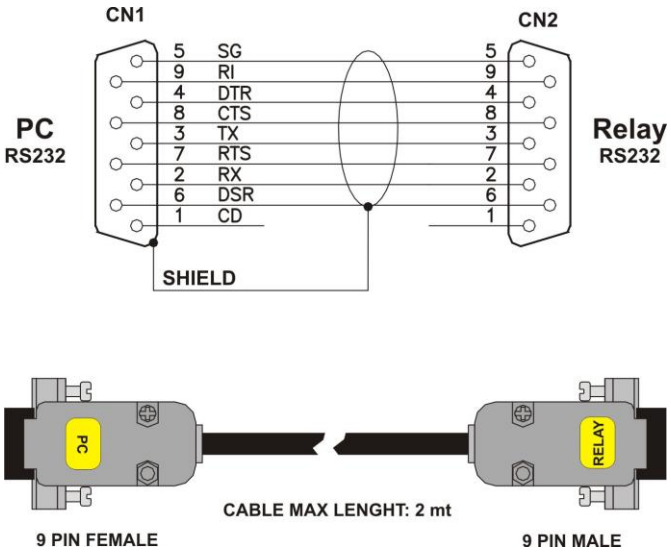
14.3.1 – Description of variables

- **BRLoc** : RS232 local (Front Panel) serial communication speed
- **BRRem** : RS485 remote (Rear terminal block) serial communication speed
- **PRRem** : Protocol for remote (Rear terminal block) serial communication RS485
- **Indir.** : Identification number for the connection on serial communication bus

14.3.2 – Front Panel serial communication port (RS232)

A D-Sub, -pin female socket is available on Relay's front face for connection to the local RS232 serial communication line. Through this port - and by the interface program available from Microelettrica Scientifica (MSCom 2 for Windows 98/ME/2000/XP) – it is possible to connect a Personal Computer to download all available information, operate any control and program the relay; the protocol used is " Modbus RTU".

14.3.3 – Cable for direct connection of Relay to Personal Computer



14.3.4 – Main serial communication port (RS485)

From the Relay's back terminal board, a RS485 ports is available for communication with SCADA system with Protocol Modbus RTU or IEC60870-5-103 (selectable).
The communication interface allows to program all settings, operate all commands and download all informations and records.
The physical connection can be via a normal pair of wires (RS485) or, on request, via fiber optic.

14.4 - Menu: **LCD**

Options			
	→	**Lang**	English
	→	**Light**	On
	→	**Row1**	dA
	→	**Row2**	dB
	→	**Row3**	dC
	→	**Row4**	Io1
	→	**Row5**	Io2

[English / Loc.Lang]
[Autom. / On]
[dA / dB / dC / Io1 / Io2 / 1A / 1B / 1C / 2A / d2A / d5A / d2B / d2C / d5C / IR / Wir/ LocRm / Group / Empty]

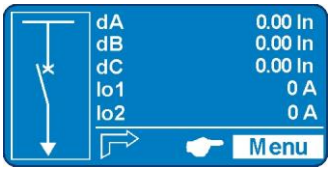
14.4.1 – Description of variables

❑ **Lang**	:	Set Language
❑ **Light**	:	Set Display backlight
❑ **Row1**	:	Choosing the variable to be displayed in the rows on main menu
❑ **Row2**	:	
❑ **Row3**	:	
❑ **Row4**	:	
❑ **Row5**	:	

This menu allows customizing the Language and the Display's backlight.
The standard languages are English and Italian. On request, other languages can be loaded (French, German, etc..).
The Display backlight can be programmed always on "ON" or switched-on "Automatically" for a few second at any operation of the keyboard "Auto".

Example: set Local Language.

1



- Press "***Menu***" for access to the main menu with icons.

2

- Select icon "***Setting***" by pushbutton "***Increase***" or "***Decrease***".
- Press "***Select***".

3

- Select "***Group 1***" or "***Group 2***"
- Select "***LCD***"
- Select "***Options***".
- Press "***Select***".

4

- Select "***Lang***"
- Press "***Modify***".

5

- Select "***Loc.Lang***".
- Press "***Write***"
- If Password is requested, see § Password

6

- Press "***Exit***"

7

- "***Yes***" confirms all changes.
- "***No***" void all changes.

8

- After set confirmation the display shows "***Please Wait***"

14.5 - Function: **1d>** (First differential element)

Status	→	**Enab.**	No		[No / Yes]			
Options	→	**IRSel**	Long		[Long / LatSide1 / LatSide2]			
Oper. Levels	→	**Is**	0.200	**In**	(0.1÷0.5)	step	0.01	**In**
	→	**R%**	20.000	**%**	(10÷50)	step	0.10	%

14.5.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **IRSel** : Bias current selector
  Long = Longitudinal
  LatSide1 = Latitudinal Side 1
  LatSide2 = Latitudinal Side 2
- **Is** : Basic pick-up level of low set phase
- **R%** : Bias

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14.6 - Function: **2d>** (Second differential element)

Status	→	**Enab.**	No		[No / Yes]			
Oper. Levels	→	**Is**	0.200	**In**	(2.0÷20)	step	0.01	**In**

14.6.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **Is** : Basic pick-up level of low set phase

14.7 - Function: **HLock** (2nd – 5th HarmonicLock)

Oper. Levels	→	**2H**	0.100	**Pu**	(0.10÷0.50)	step	0.01	Pu
	→	**5H**	0.200	**Pu**	(0.10÷0.50)	step	0.01	Pu
	→	**R2H**	0.500	**Pu**	(0.10÷1.00)	step	0.01	Pu
	→	**R5H**	0.500	**Pu**	(0.10÷1.00)	step	0.01	Pu
Timers	→	**t2H**	0.05	**s**	(0.01÷90)	step	0.01	s
	→	**t5H**	0.05	**s**	(0.01÷90)	step	0.01	s

14.7.1 - Description of variables

❑	**2H**	:	Second harmonic level p.u. of measured differential current
❑	**5H**	:	Fifth harmonic level p.u. of measured differential current
❑	**R2H**	:	Reduced second harmonic lock level during time [t2H] from transformer
❑	**R5H**	:	Reduced second harmonic lock level during time [t5H] from transformer
❑	**t2H**	:	Time during which 2nd harmonic level lock reduction is active
❑	**t5H**	:	Time during which 5th harmonic level lock reduction is active

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14.8 - Function: **1I>** (First Overcurrent Element side 1)

Status	→ **Enab.**	No		[No / Yes]				
Options	→ **f(t)**	Type - D		[D / A / B / C / I / VI / EI / MI / SI]				
	→ **tBI**	Off		[Off / 2tBO]				
Oper. Levels	→ **Is**	4.000	**In**	(0.10÷4.00)	step	0.01	In	
Timers	→ **ts**	100.00	**s**	(0.02÷100)	step	0.01	s	
	→ **tBO**	0.75	**s**	(0.05÷0.75)	step	0.01	s	

14.8.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **f(t)** : Operation characteristic (Time/Current curve):
  - (D) = Independent definite time
  - (A) = IEC Inverse Curve type A
  - (B) = IEC Very Inverse Curve type B
  - (C) = IEC Extremely Inverse Curve type C
  - (I) = IEEE Inverse Curve
  - (VI) = IEEE Very Inverse Curve
  - (EI) = IEEE Extremely Inverse Curve
  - (MI) = IEEE Moderate Inverse Curve
  - (SI) = IEEE Short Inverse Curve
- **tBI** : Blocking input reset time
  - Off = Permanent block
  - *2tBO* = Set 2xtBO.
- **Is** : Minimum operation level
- **ts** : Trip time delay
- **tBO** : Time to reset of the Blocking Output after expiring of the Trip time delay. “tBO” is also the trip time delay of the Breaker Failure function.

14.8.2 - Algorithm of the time current curves

The Time Current Curves are generally calculated with the following equation

(1) $t(I)\left[\frac{A}{\left(\frac{I}{Is}\right)^{a}-1}+B\right]\cdot K\cdot T_S\cdot+T_r$ where

t(I) = Actual trip time delay when the input current equals "I"

Is = Set minimum pick-up level

$K = \left(\frac{A}{10^{a}-1}+B\right)^{-1}$

T_s = Set time delay: $t(I) = T_s$ when $\frac{I}{I_s}=10$

tr = Operation time of the output relay on pick-up.

The parameters A, B and a have different values for the different Time Current Curves.

Curve Name	Curve Identifier	A	B	a
IEC A Inverse	A	0.14	0	0.02
IEC B Very Inverse	B	13.5	0	1
IEC C Extremely Inverse	C	80	0	2
IEEE Moderate Inverse	MI	0.0104	0.0226	0.02
IEEE Short Inverse	SI	0.00342	0.00262	0.02
IEEE Very Inverse	VI	3.88	0.0963	2
IEEE Inverse	I	5.95	0.18	2
IEEE Extremely Inverse	EI	5.67	0.0352	2

For the IEC curves, being B = 0, the Time/Current equation (1), becomes:

$(1')\quad t(I) = \frac{\left(10^{a}-1\right)Ts}{\left(\frac{I}{Is}\right)^{a}-1} + tr = \frac{Kt}{\left(\frac{I}{Is}\right)^{a}-1} + tr$

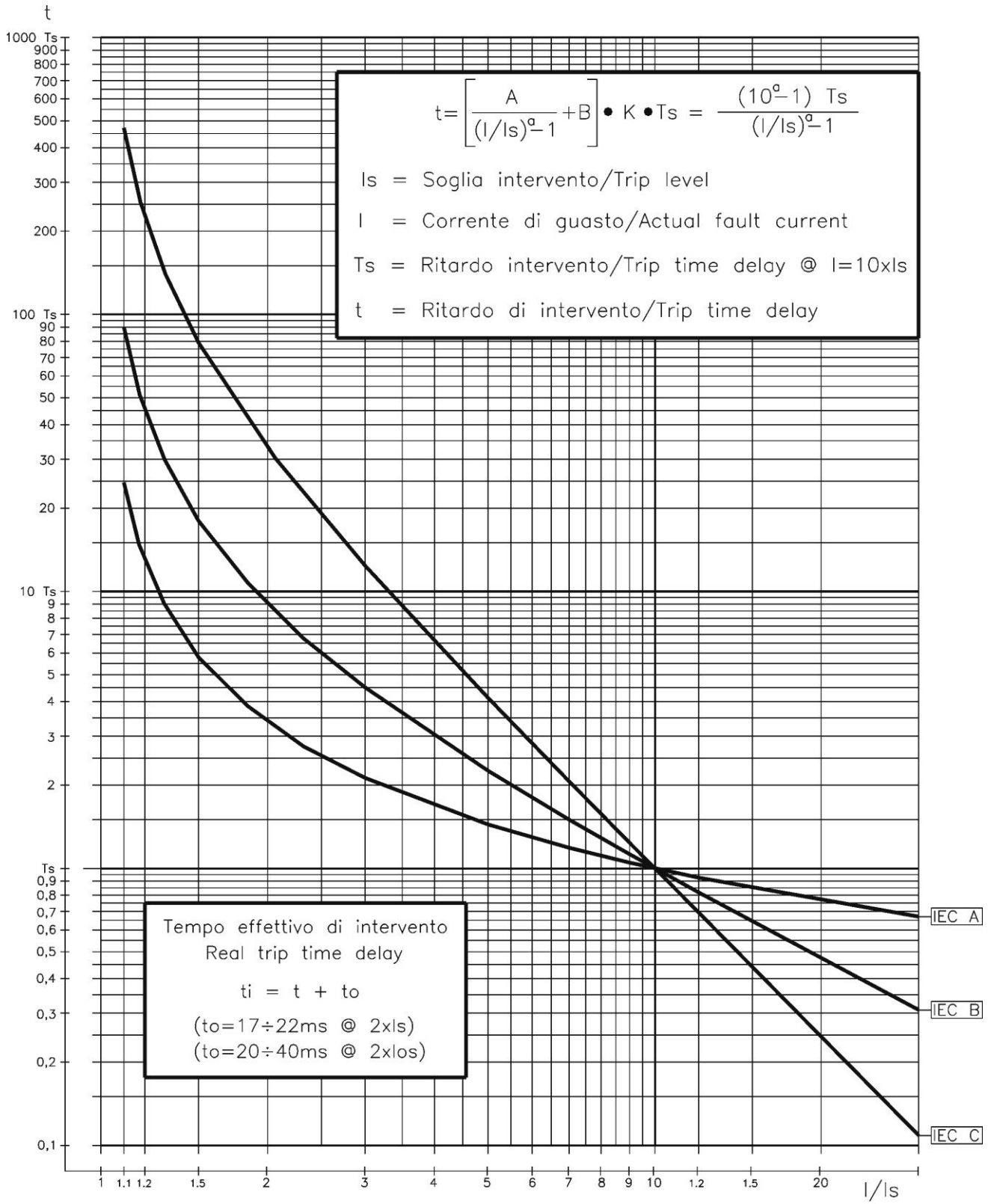
Where $Kt = (10^{a}-1)Ts$ is the time multiplier

When "f(t) = D" is programmed, the trip time delay is Definite and independent from the current: excess "t = ts".

The maximum measuring current is "25xIn" for phase elements and "4xOn" for the neutral elements.

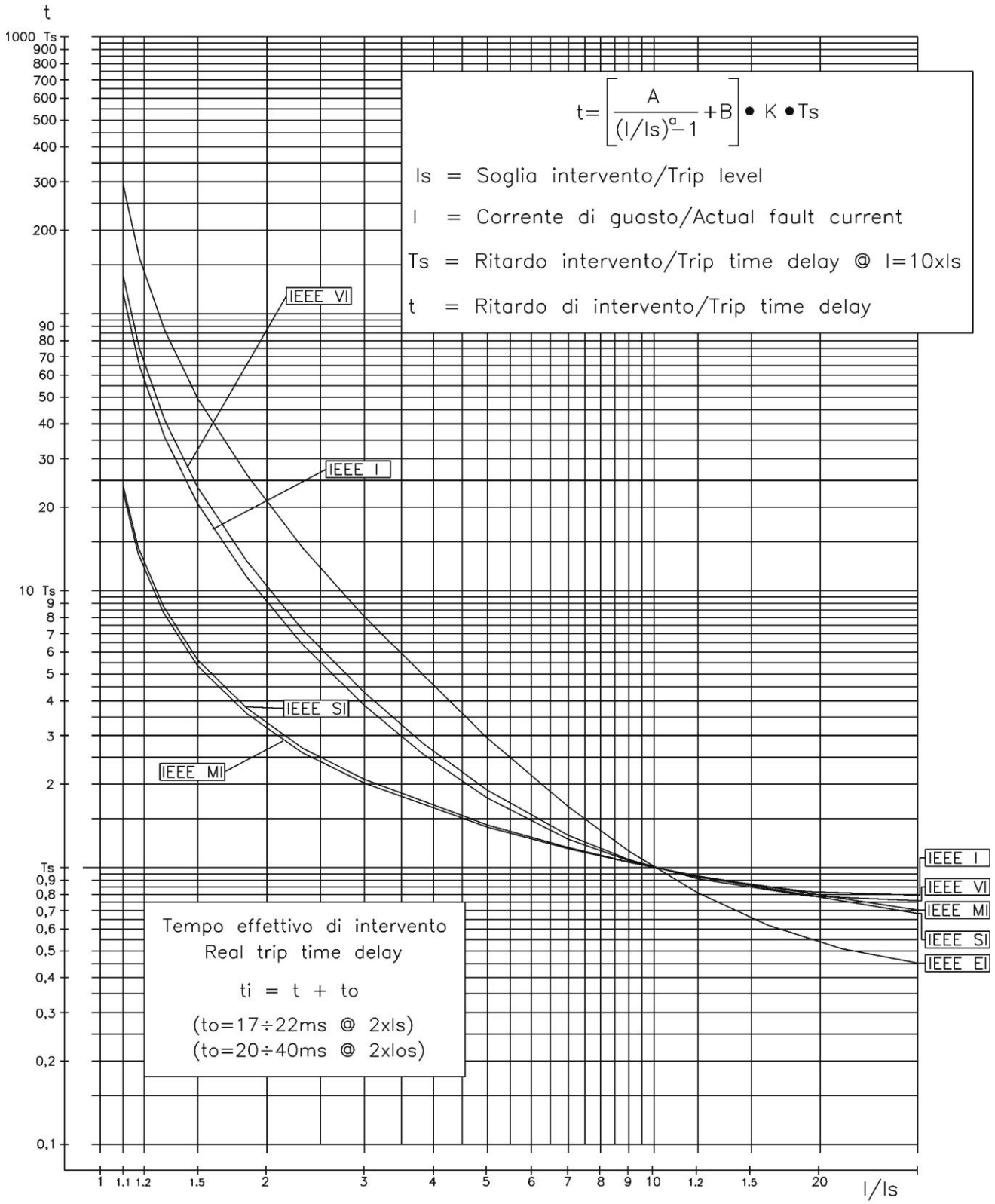
Trip takes place when the current measured exceeds (no matter how much) the set level "Is" for the set time "ts".

14.8.3 - IEC Curves



Curve Type	A	B	K	a
IEC A	0.14	0	0.336632	0.02
IEC B	13.5	0	0.666667	1
IEC C	80	0	1.2375	2

14.8.4 – IEEE Curves



Curve Type	A	B	K	a
MI= IEEE Moderate Inv.	0.0104	0.0226	4.110608	0.02
SI= IEEE Short Inv.	0.00342	0.00262	13.30009	0.02
VI= IEEE Very Inv.	3.88	0.0963	7.380514	2
I= IEEE Inverse	5.95	0.18	4.164914	2
EI= IEEE Extremely Inv.	5.67	0.0352	10.814	2

14.8.5 – Blocking Logic (BO-BI)

For each Protection Function it is possible to activate a Blocking Logic allowing to inhibit their operation by external signals provide to the Digital Input.

14.8.5.1 – Output Blocking signal "BO"

All the protection functions that can be programmed to operate in the blocking logic mode, element, have an instantaneous element (beside the time delayed) which is operated as soon as the controlled quantity exceeds the set trip level (I> [Is] for current, etc..) and it's instantaneously reset when the input quantity drops below the reset level (normally 0.95Is).
The instantaneous element can control one of the user programmable output relays that, by its contacts, makes the signal available for blocking an external element (BO = Blocking Output).
In case, "tBO" sec after the set trip time "ts" has expired, the Protection function is still in operation (current above trip level), the Blocking Output relay (instantaneous element) is anyhow reset to eventually remove the Blocking signal from a back-up protection.

14.6.5.2 – Blocking Input "BI"

For all the functions controllable by the Blocking Logic, it is possible to inhibit the time delayed tripping by an external signal that activates a Digital Input programmed for this functionality.
The programmed Digital Input gets activated by an external dry contact closing across its terminals.
With the variable "tBI" set to "OFF" (tBI=OFF), the tripping of the delayed function is blocked as long as the Blocking Input signal is present at the terminals of the Digital Input.
With the variable "tBI" set to "2xtBI" (tBI=2xtBI), 2xtBI seconds after the set trip time delay of the function has expired the blocking input is anyhow ignored and the function enabled to trip.

14.8.6 - Automatic doubling of Overcurrent thresholds on current inrush

For some of the phase Overcurrent functions it is possible to have the set trip level [Is] automatically doubled when strong inrush current is detected.
If at circuit Breaker switch-on (i.e. when the input current rises from zero to a minimum measurable value) the current increases from 0 to 1.5 times the rated value [In] in less than 60ms, the set minimum pick-up level [Is] is dynamically doubled ([Is]→[2Is]) and keeps this value until the input current drops below 1.25xIn or the set time [t2xI] has elapsed.
This functionality is very useful to avoid spurious tripping of the instantaneous, or short-time delayed Overcurrent elements, that could be experienced at switch-on of reactive loads like Transformer or Capacitors.

14.9 – Function: **1I>>** (Second Overcurrent Element side 1)

Stats	→	**Enab.**	No		[No / Yes]			
Options	→	**tBI**	Off		[Off / 2tBO]			
	→	**2xI**	Disable		[Disable / Enable]			
Oper. Levels	→	**Is**	4.000	**In**	(0.100÷20)	step	0.010	In
Timers	→	**ts**	100.00	**s**	(0.02÷100)	step	0.01	s
	→	**tBO**	0.75	**s**	(0.05÷0.75)	step	0.01	s
	→	**t2xI**	100.00	**s**	(0.02÷100)	step	0.01	s
	→	**td2xI**	0.06	**s**	(0.02÷1.00)	step	0.01	s

14.9.1 – Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **tBI** : Blocking input reset time
  Off = Permanent block
  2tBO = Set 2xtBO.
- **2xI** : Automatic doubling of trip level on inrush
- **Is** : Minimum operation level
- **ts** : Trip time delay
- **tBO** : Time to reset of the Blocking Output after expiring of the Trip time delay. "tBO" is also the trip time delay of the Breaker Failure function.
- **t2xI** : Maximum time of automatic threshold doubling on inrush
- **td2xI** : Time for calculation of current rate of rise.

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14.10 - Function: **2I>** (First Overcurrent Element side 2)

Status	→ **Enab.**	No		[No / Yes]				
Options	→ **f(t)**	Type - D		[D / A / B / C / I / VI / EI / MI / SI]				
	→ **tBI**	Off		[Off / 2tBO]				
Oper. Levels	→ **Is**	4.000	**In**	(0.10÷4.00)	step	0.01	In	
Timers	→ **ts**	100.00	**s**	(0.02÷100)	step	0.01	s	
	→ **tBO**	0.75	**s**	(0.05÷0.75)	step	0.01	s	

14.10.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **f(t)** : Operation characteristic (Time/Current curve):
  - (D) = Independent definite time
  - (A) = IEC Inverse Curve type A
  - (B) = IEC Very Inverse Curve type B
  - (C) = IEC Extremely Inverse Curve type C
  - (I) = IEEE Inverse Curve
  - (VI) = IEEE Very Inverse Curve
  - (EI) = IEEE Extremely Inverse Curve
  - (MI) = IEEE Moderate Inverse Curve
  - (SI) = IEEE Short Inverse Curve
- **tBI** : Blocking input reset time
  - Off = Permanent block
  - *2tBO* = Set 2xtBO.
- **Is** : Minimum operation level
- **ts** : Trip time delay
- **tBO** : Time to reset of the Blocking Output after expiring of the Trip time delay. “tBO” is also the trip time delay of the Breaker Failure function.

14.11 – Function: **2I>>** (Second Overcurrent Element side 2)

Stats	→	**Enab.**	No		[No / Yes]			
Options	→	**tBI**	Off		[Off / 2tBO]			
	→	**2xI**	Disable		[Disable / Enable]			
Oper. Levels	→	**Is**	4.000	**In**	(0.100÷20)	step	0.010	In
Timers	→	**ts**	100.00	**s**	(0.02÷100)	step	0.01	s
	→	**tBO**	0.75	**s**	(0.05÷0.75)	step	0.01	s
	→	**t2xI**	100.00	**s**	(0.02÷100)	step	0.01	s
	→	**td2xI**	0.06	**s**	(0.02÷1.00)	step	0.01	s

14.11.1 – Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **tBI** : Blocking input reset time
  Off = Permanent block
  2tBO = Set 2xtBO.
- **2xI** : Automatic doubling of trip level on inrush
- **Is** : Minimum operation level
- **ts** : Trip time delay
- **tBO** : Time to reset of the Blocking Output after expiring of the Trip time delay. "tBO" is also the trip time delay of the Breaker Failure function.
- **t2xI** : Maximum time of automatic threshold doubling on inrush
- **td2xI** : Time for calculation of current rate of rise.

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14.12 – Function: **do1>** (Earth fault element side 1)

Stats	→ **Enab.**	No		[No / Yes]				
Options	→ **BH**	On		[On / Off]				
Oper. Levels	→ **Is**	0.01	**On**	(0.01÷4)	step	0.01	On	
Timers	→ **ts**	100.00	**s**	(0.02÷100)	step	0.01	s	

14.12.1 – Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **BH** : Blocking function during inrush
  On = function blocked during [tH]
  Off = function not blocked during [tH]
  [tH] = (maximum of [t2H] / [t5H] - see § HLock)
- **Is** : Minimum operation level
- **ts** : Trip time delay

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14.13 – Function: **do2>** (Earth fault element side 2)

Stats	→ **Enab.**	No		[No / Yes]				
Options	→ **BH**	On		[On / Off]				
Oper. Levels	→ **Is**	0.01	**On**	(0.01÷4)	step	0.01	On	
Timers	→ **ts**	100.00	**s**	(0.02÷100)	step	0.01	s	

14.13.1 – Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **BH** : Blocking function during inrush
  On = function blocked during [tH]
  Off = function not blocked during [tH]
  [tH] = (maximum of [t2H] / [t5H] - see § HLock)
- **Is** : Minimum operation level
- **ts** : Trip time delay

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14.14 - Function: **Wi** (Circuit Breaker maintenance level)

Status	→ **Enab.**	No		[No / Yes]			
Oper. Levels	→ **Ii**	1.000	**In**	(0.1÷99)	step	0.1	In
	→ **Wi**	1.000		(1÷9999)	step	1	

14.14.1 - Description of variables

❑	**Enab.**	:	Function enabling (No = Disable / Yes = Enable)
❑	**Ii**	:	Circuit Breaker Rated Current in multiples of the Relay rated input current In
❑	**Wi**	:	Maximum allowed amount of accumulated interruption energy before maintenance as stated by the C/B Manufactured.

14.14.2 - Operation (Accumulation of the interruption Energy)

The relay computes the Arc Energy developed during each interruption of the Circuit Breaker and accumulates these values.
When the amount of the accumulated energy exceeds a settable level the relay gives out an alarm to signalize that maintenance inspection of the Circuit Breaker is needed.
The operation of this function is based on the following parameters:

Ii = Ii = (0.1-99)In

Wi = Wi =(1 - 9999)

“Wi" is set as a multiple of the conventional interruption energy unit.
Any time the Circuit Breaker opens (change of status from closed to open of the digital input connected to the normally open contact 52a of the C/B) the relay decreases the amount of energy corresponding to a number of conventional units:

$$nW_C = \frac{W}{Wc} = \frac{I^2 \cdot t_X}{Ii^2 \cdot t_i}$$

where:

W = $I^2 \bullet t_X$ Interruption Energy during the interruption time “tx” with interruption current “I”.

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

When the set Energy level before maintenance is decreased to zero a user programmable output relay is operated.

Reset to Zero of the Energy accumulation is available in the menu “***Cmd***” (Reset Wi).

14.15 - Function: **TCS** (Trip Circuit Supervision)

Status	→ **Enab.**	No		[No / Yes]			
Timers	→ **ts**	0.10	**s**	(0.1÷100)	step	0.01	s

14.15.1 - Description of variables

❑	**Enab.**	:	Function enabling (No = Disable / Yes = Enable)
❑	**ts**	:	Trip time delay

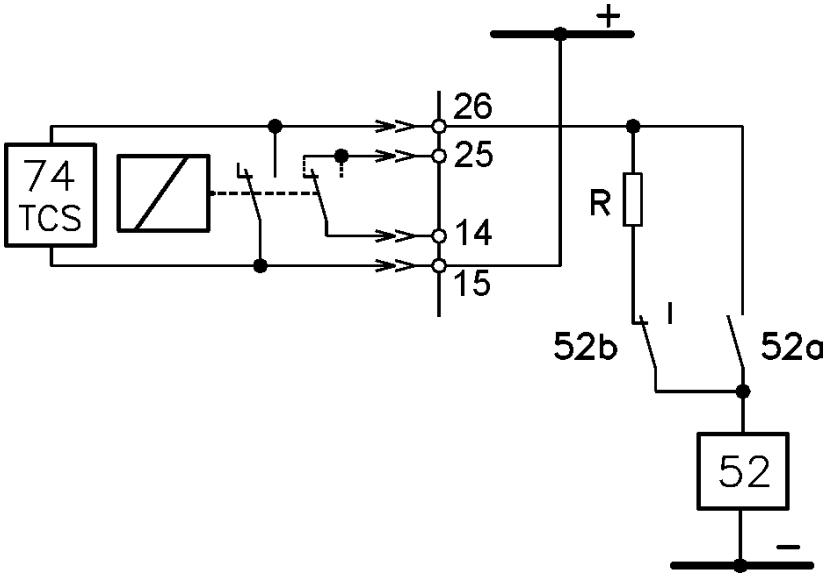
14.15.2 - Operation

The relay includes a complete Circuit Breaker Trip Circuit Supervision unit that is associated to the Contact “15-26” of the “R1” Output Relay.
The contact of “R1” is used to trip the C/B as reported in the drawing here below.
The supervision works when the C/B is closed and recognizes the Trip Circuit as sound as far as the current flowing exceeds “1mA”.
In case of Trip Circuit Fault detection, the diagnostic relay is operated and the Led starts flashing (see § Signalization).
To have Supervision also with the C/B open one N/C contact (52b) from the C/B and an external resistor “R” are needed.

$$R[k\Omega] \le \frac{V}{1mA} - R_{52}$$ where **R_{52}**= Trip Coil internal resistance [kΩ]

V = Trip Circuit Voltage

$$P_R \ge 2 \cdot \frac{V^2}{R}[W]$$ Designe power of external resistance “R”



Tripping of the function operates a user programmable output relay.

14.16 - Function: **IRF** (Internal Relay Fault)

In this menu it is possible to configurate the operation of the Relay Internal Fault detection element

Status	→ **Enab.**	No		[No / Yes]			
Timers	→ **tIRF**	5.00	**s**	(5÷200)	step	0.01	s

14.16.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **tIRF** : Trip time delay

14.16.2 - Operation

Tripping of the function operates a user programmable output relay.

14.17 - Function: **CB Mngn** (Control C/B)

This menu allows to configurate the command for C/B operation.

Options	→	**L/R**	Ignored		[Ignored – Active]			
	→	**Key**	Enable		[Disable – Enable]			
Timers	→	**tL/R**	0.05	**s**	(0.05 ÷ 1.00)	step	0.05	s
	→	**tC/Bs**	0.50	**s**	(0.05 ÷ 1.00)	step	0.05	s

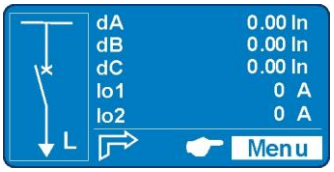
14.17.1 - Description of variables

- **L/R** : Selection of Local/Remote C/B operation mode Ignored or Active
- **Key** : Disable = The pushbuttons on Front Panel are disabled; the operation of the C/B can be controlled by;
  1 - serial bus commands
  2 - commands available in the menu "***Cmd***" (Password protected).
  3 - Digital Inputs.
  Enable = The C/B can be controlled also by the pushbuttons available on Relay's Front Face.

- **tL/R** : Admissible time before detection of the Local/Remote discrepancy alarm.
- **tC/Bs** : Maximum admissible delay for detection of status signal after C/B operation.

14.17.2 - Display Message

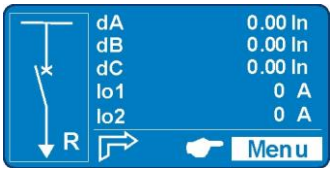
1



- L

• "***L***" the control of C/B is in "Local" mode

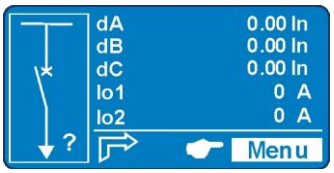
2



- R

• "***R***" the control of C/B is in "Remote" mode

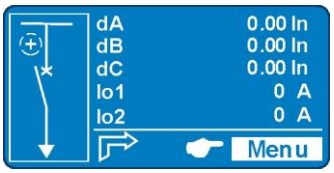
3



- ?

If the symbol "**?**" show up the relay is in discrepancy Local/Remote.
The commands can be send from "Local" or "Remote".

4



- ⊕

This symbol indicates the CB breaker failure (example: C/B closing failure)

14.18 - Function: **Oscillo** (Oscillographic Recording)

Status	→	**Enab.**	No		[No / Yes]			
Options	→	**Trig**	Start		[Start / Trip / OnCmd / REUserLg / REUserLg]			
Timers	→	**tPre**	0.50	**s**	(0.01÷0.50)	step	0.01	s
	→	**tPost**	0.50	**s**	(0.01÷1.50)	step	0.01	s

16.18.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **Trig** : Selection of the Trigger command source (start recording):
  - *Start* = Trigger on time start of protection functions
  - *Trip* = Trigger on trip (time delay end) of protection functions
  - *OnCmd* = On Asynchronous Force trigger command
  - *REUserLg* = On rising edge of "User Logic" (see § "User Trigger Oscillo")
  - *FEUserLg* = On falling edge of "User Logic"
- **tPre** : Recording time before Trigger
- **tPost** : Recording time after Trigger

14.18.2 - Operation

In the options: "Trig = Start" and "Trig = Trip", the oscillographic recording starts respectively when any protection function starts operating or trip (provided the function was programmed "Enab = Yes").

The "Oscillo" Function includes the wave Form Capture of the input quantities and can totally store a record of 3 seconds.
The number of events recorded depends on the duration of each individual recording (tPre + tPost).
In any case the number of event stored can not exceed ten (10 x 0.3 sec).
Any new event beyond the 3 sec capacity of the memory, cancels and overwrites the former records (FIFO Memory).

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14.18.3 – Available on MSCom2

	SCDop	Scada open breaker command		
	SCDcl	Scada close breaker command		
	SCDop2	Scada open breaker 2 command (generic command)		
	SCDcl2	Scada close breaker 2 command (generic command)		
	SCDop3	Scada open breaker 3 command (generic command)		
	SCDcl3	Scada close breaker 3 command (generic command)		
	SCDop4	Scada open breaker 4 command (generic command)		
	SCDcl4	Scada close breaker 5 command (generic command)		
1d>	R1d>	Start	first differential element	phase R
	tR1d>	Trip	first differential element	phase R
	S1d>	Start	first differential element	phase S
	tS1d>	Trip	first differential element	phase S
	T1d>	Start	first differential element	phase T
	tT1d>	Trip	first differential element	phase T
2d>	R2d>	Start	second differenti element	phase R
	tR2d>	Trip	second differential element	phase R
	S2d>	Start	second differential element	phase S
	tS2d>	Trip	second differential element	phase S
	T2d>	Start	second differential element	phase T
	tT2d>	Trip	second differential element	phase T
HLock	2HRL	Phase R	second harmonic lock	
	5HRL	Phase R	fifth harmonic lock	
	2HSL	Phase S	second harmonic lock	
	5HSL	Phase S	fifth harmonic lock	
	2HTL	Phase T	second harmonic lock	
	5HTL	Phase T	fifth harmonic lock	
	2HReduct	Second harmonic reduction level		
	5HReduct	Fifth harmonic reduction level		
1I>	1I>	Start	first overcurrent element	side 1
	t1I>	Trip	first overcurrent element	side 1
1I>>	1I>>	Start	first overcurrent element	side 2
	t1I>>	Trip	first overcurrent element	side 2
2I>	2I>	Start	second overcurrent element	side 1
	t2I>	Trip	second overcurrent element	side 1
2I>>	2I>>	Start	second overcurrent element	side 2
	t2I>>	Trip	second overcurrent element	side 2
do1>	do1>	Start	earth fault element	side 1
	tdo1>	Trip	earth fault element	side 1
do2>	do2>	Start	earth fault element	side 2
	tdo2>	Trip earth	fault element	side 2
Wi	tWi>	Circuit breaker maintenance level		
tTCS	tTCS	Time delayed Trip Circuit Supervision		
IRF	IRF	Instantaneous Internal relay Fault		
	tIRF	Time delayed Internal relay Fault		
	manOpCmd	Manual Open Command		
	CL-Cmd	Close Command		
	C/Bfail	Circuit Breaker failure		
	L/Rdisc	Local/Remote signal Discrepancy		
	BF	Breaker Failure		
	Gen.Start	Start Generic		
	Gen.Trip	Trip Generic		
	UserTriggerOscillo	User Variable for Oscillographic Recording		
	UserVar<0> to UserVar<24>	User Variable		
	Vcc	Reserved		
	Gnd	Reserved		
	ResLog	Reset signal logic		
	P1	Push-button Open		
	P2	Push-button Close		

0.D1	*Digital Input "0.D1"*	*activated*	
0.D1Not	*Digital Input "0.D1"*	*deactivated*	
to			*Digital Input on Main Relay*
0.D4	*Digital Input "0.D4"*	*activated*	
0.D4Not	*Digital Input "0.D4"*	*deactivated*	
1.D1	*Digital Input "1.D1"*	*activated*	
1.D1Not	*Digital Input "1.D1"*	*deactivated*	
to			*Digital input on Expansion Board 1*
1.D15	*Digital Input "1.D15"*	*activated*	
1.D15Not	*Digital Input "1.D15"*	*deactivated*	
2.D1	*Digital Input "2.D1"*	*activated*	
2.D1Not	*Digital Input "2.D1"*	*deactivated*	
to			*Digital input on Expansion Board 2*
2.D15	*Digital Input "2.D15"*	*activated*	
2.D15Not	*Digital Input "2.D15"*	*deactivated*	

14.18.4 – Setting "User Trigger Oscillo"

The "User trigger Oscillo" is a result of a logical operation (Or, AND, ecc...), it can be used like other logical output. This operation is possible only via "MSCom2" software.

Name	User descr.	Linked functions	OpLogic	Timer	Timer type	Logical status

Name

Internal name

User descr.

Fixed

Linked functions

Selection functions

OpLogic

Operation Logic = [None, OR, AND, XOR, NOR, NAND, NOT, Ff-SR]

Timer

Time delay (0-10)s, step 0.01s

Timer type

Delay	=	Add a delay on output activation. The "Timer" is edge triggered on rise edge.
Monostable	=	Activated the output for the time "Timer"

Logical status

"User Trigger Oscillo" Logical status

Example: Setting "User Variable"

Open "MSCom2" program and connect to the relay.

Select "Change Windows" from "Menu" button

Select "User Variable"

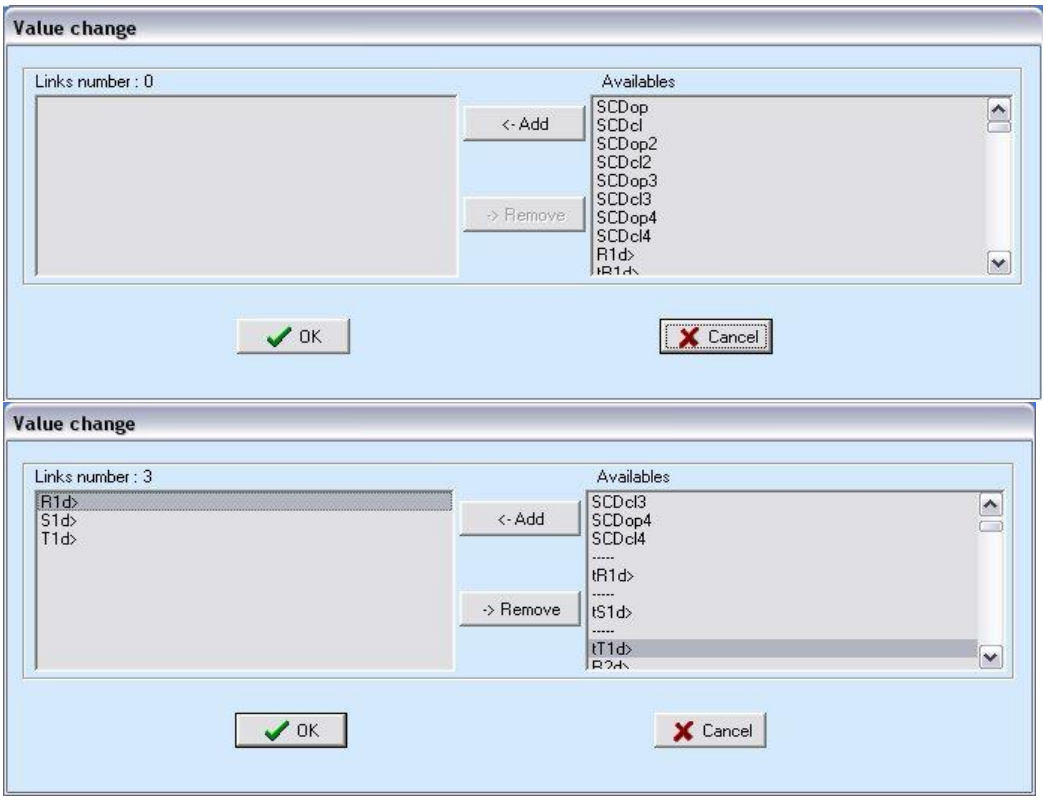
Setting for "User Trigger Oscillo" : "**R1d>, R2d>, R2d>**", "**AND**", "**1**", "**Monostable**".

ID	Name	User descr.	Linked functions	OpLogic	Timer	Timer type	Logical status
1	UserTrigger Oscillo	UserTrigger Oscillo		None (0)	0	Delay (0)	0
2	UserVar <0>	UserVar <0>		None (0)	0	Delay (0)	0

"Linked Functions"

Select "**Linked Functions**" related to "User Trigger Oscillo" and press right button on mouse, select "Value change":

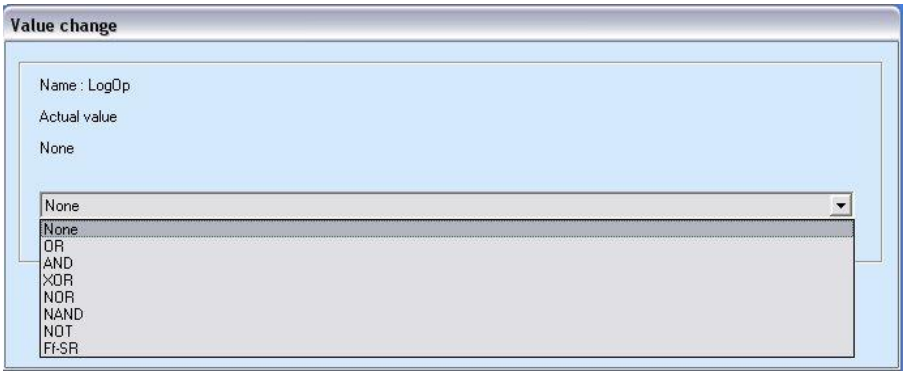
Select "**R1d>, R2d>, R3d>**" from "Available" box via push-button "<Add", and press "OK". For remove functions, use push-button ">Remove".



"Operation Logic" (Oplogic)

Select "**Oper Logic**" related to "User Trigger Oscillo" and press right button on mouse, select "Value change":

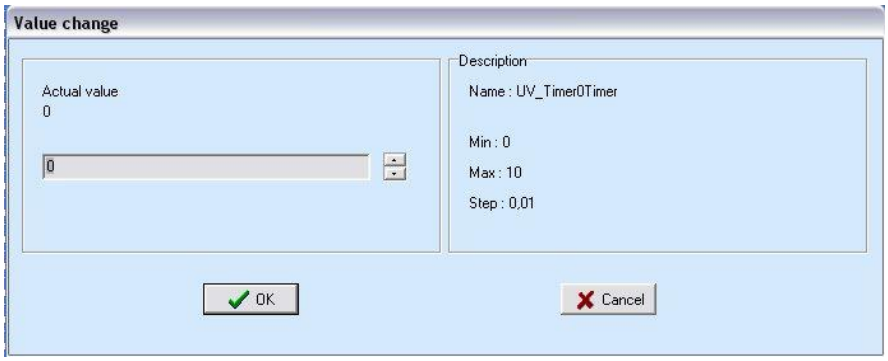
Insert "**AND**" into box and press "OK":



"Timer"

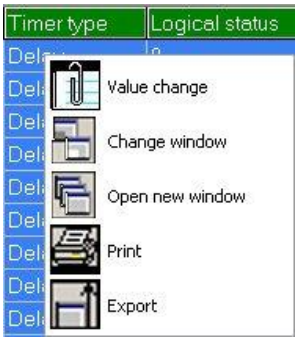
Select "**Timer**" related to "User Trigger Oscillo" and press right button on mouse, select "Value change":

Select "**1**" into box and press "OK":

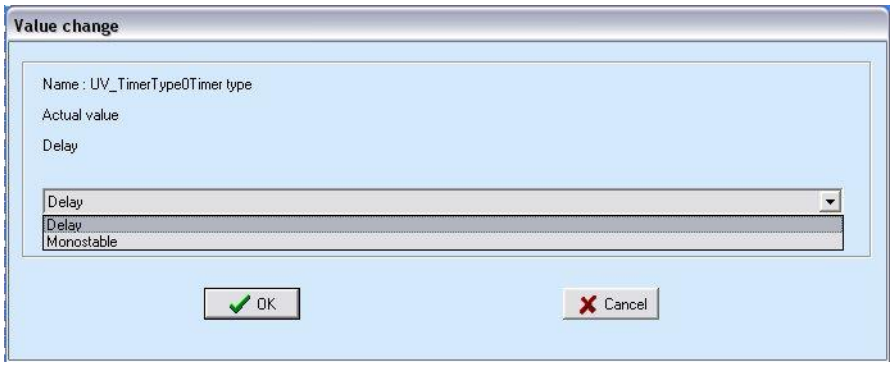


"Timer type"

Select "**Timer**" related to "User Trigger Oscillo" and press right button on mouse, select "Value change":



Select "**Monostable**" into box and press "OK":



14.20 - Function: **BrkFail** (Breaker Failure)

Status	→ **Enab.**	No		[No / Yes]			
Timers	→ **tBF**	0.75	**s**	(0.05÷0.75)	step	0.01	s

16.20.1 - Description of variables

- **Enab.** : Function enabling (No = Disable / Yes = Enable)
- **tBF** : Trip time delay

14.20.2 - Operation

The Breaker Failure detection is started by the operation of the output relay “R1” (programmed to be controlled by the Protection Functions that trip the C/B).
If after [tBF] seconds from operation of the relay “R1”, any input current flow is still detected (>10% In) , the function “BF” trips and operate one user programmable output relay,

14.21 - Function: **ExtReset** (External Reset Configuration)

This menu allows to configurate the edge polarity of the digital input associated to the trip reset function.

Options	→ **ActOn**	RiseEdge	[RiseEdge / FallEdge]

14.21.1 - Description of variables

- **ActOn** : RiseEdge Active on Rise Edge (Digital Input close).
  FallEdge Active on Fall Edge (Digital Input open).

15. User Variables

The “User Variable” is a result of a logical operation (Or, AND, ecc...), it can be used like other logical output. This operation is possible only via “MSCom2” software.

ID	Nome	Descr. utente	Funz. associate	OpLogic	Timer	Tipo timer	Stato logico

Name

Internal progressive name

User Descr.

Custom identification label for user variable

Linked functions

Selection functions

OpLogic

Operation Logic = [None, OR, AND, XOR, NOR, NAND, NOT, Ff-SR]

Timer

Time delay (0-10)s, step 0.01s

Timer type

Delay	=	Add a delay on output activation. The “Timer” is edge triggered on rise edge.
Monostable	=	Activated the output for the time “Timer”

Logical status

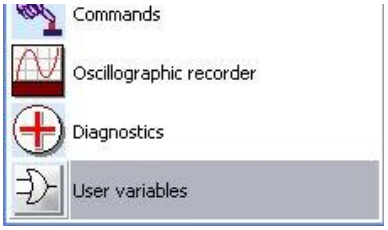
“User Variable” Logical status

Example: Setting "User Variable"

Open "MSCom2" program and connect to the relay.

Select "Change Windows" from "Menu" button

Select "User Variable"



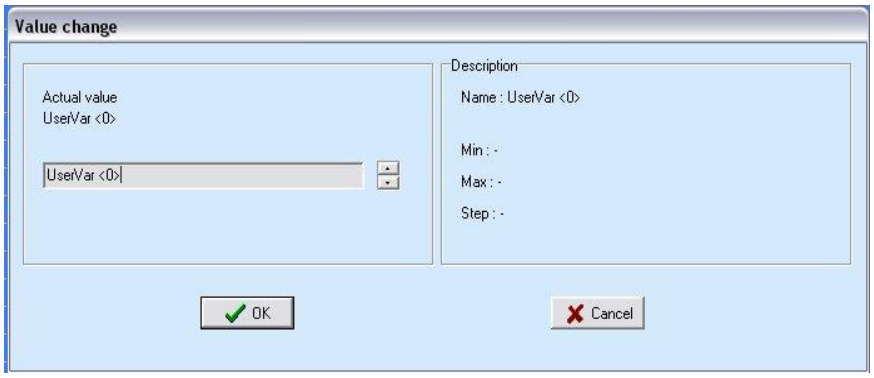
Setting for "**UserVar<0>**" :
"**Start Differential Element**", "**R1d>, R2d>, R3d>**", "**OR**", "**1**", "**Monostable**".

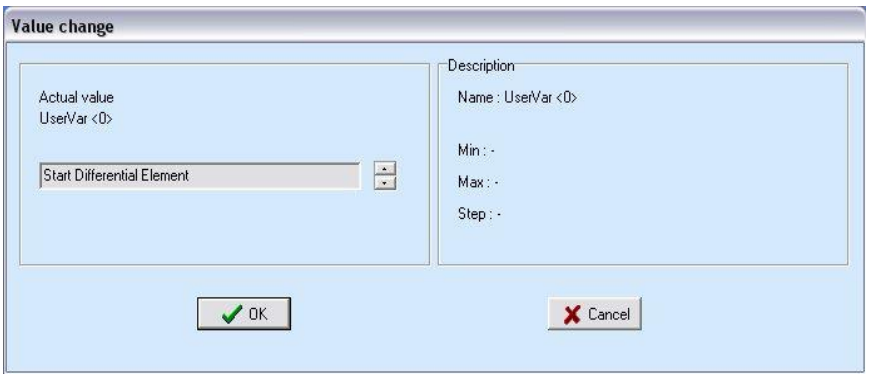
ID	Name	User descr.	Linked functions	OpLogic	Timer	Timer type	Logical status
1	Trigger Oscillo definito da utente	Trigger Oscillo definito da utente		None	0	Ritardo	0
2	UserVar <0>	Start Differential Element	R1d>,S1d>,T1d>,	OR	0	Ritardo	0

"User description" (User descr.)

Select "**User descr**" related to "UserVar<0>" and press right button on mouse, select "Value change":

Insert "**Start Differential Element**" into box and press "OK":

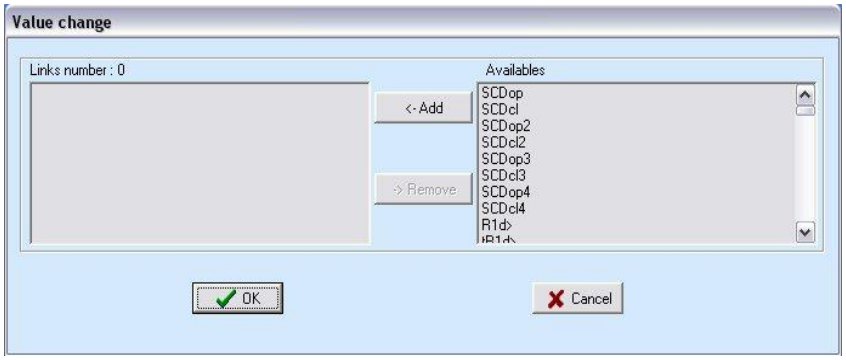


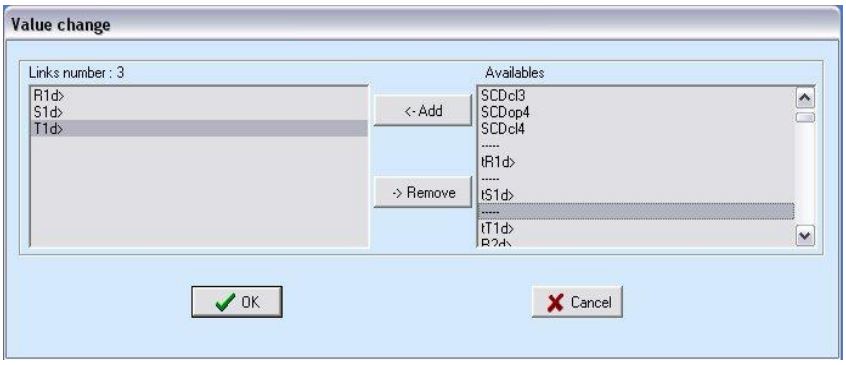


"Linked Functions"

Select "**Linked Functions**" related to "UserVar<0>" and press right button on mouse, select "Value change":

Select "**R1d>, R2d>, R3d>**" from "Available" box via push-button "<Add", and press "OK". For remove functions, use push-button ">Remove".

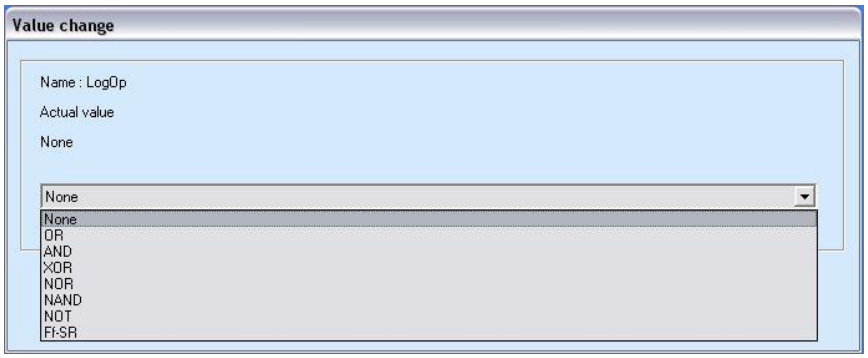




"Operation Logic" (Oplogic)

Select "**Oper Logic**" related to "UserVar<0>" and press right button on mouse, select "Value change":

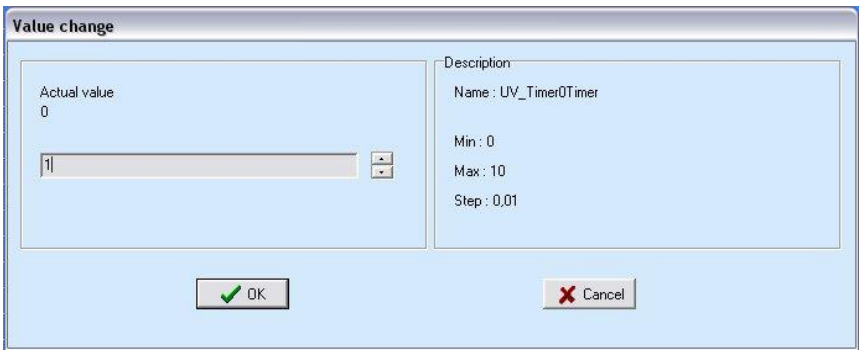
Insert "**OR**" into box and press "OK":



"Timer"

Select "**Timer**" related to "UserVar<0>" and press right button on mouse, select "Value change":

Select "**1**" into box and press "OK":



"Timer type"

Select "**Timer**" related to "UserVar<0>" and press right button on mouse, select "Value change":

Select "**Monostable**" into box and press "OK":

16. Input – Output (via software MSCom2)

The firmware can manage up to 32 digital inputs and 20 output relays; among these, 4 digital inputs and 6 output relays are available on the relay module, the remaining are available on additional expansion modules controlled via the CAN-Bus communication channel.
Can be controlled 1 or 2 additional modules.

14DI	Module	=	14 Digital Inputs
14DO	Module	=	14 Outputs Relay
UX10-4	Module	=	10 Digital Inputs and 4 Outputs Relay

16.1 – Digital Inputs

→ **0.D1**	Programmable (D1)	*Available in the Main Relay*	Any digital input of the expansion modules is active when the relevant terminals (see wiring diagram) are shorted.
→ **0.D2**	Programmable (D2)		
→ **0.D3**	Programmable (D3)		
→ **0.D4**	Programmable (D4)		
→ **1.D1**	Inputs "D8", "D16" not available	*Digital input on Expansion Board*	
→ **1.D--**			
→ **1.D15**			
→ **2.D1**	Inputs "D8", "D16" not available	*Digital input on Expansion Board*	
→ **2.D--**			
→ **2.D15**			

Four Digital Input are available on main relay:

❑	**D1** (0.D1)	(terminals 38 - 28)	:	Programmable
❑	**D2** (0.D2)	(terminals 38 - 18)	:	Programmable
❑	**D3** (0.D3)	(terminals 38 - 29)	:	Programmable
❑	**D4** (0.D4)	(terminals 38 - 19)	:	Programmable (PTC)

Three of them (0.D1, 0.D2, 0.D3) are disactivated, when the relevant terminals are open and get activated when the relevant terminals are shorted by an external cold contact.

The operation of the Input “0.D4” is dependent on the value “R” of resistance of the external circuit connected to its terminals (38-19):

- Activated if “R < 50Ω” or “R > 3000Ω”. - Disactivated if “50Ω ≤ R ≤ 3000Ω”.

Therefore, if the terminals “38-19” are open-circuited, the input “0.D4” is activated; for using “0.D4” as a normal Digital Input simply controlled by an external cold contact, it is necessary to permanently connect across the terminal’s “38-19” (in parallel to the external contact) a load resistor of value between 50 and 3000Ω (example 1000Ω - 0.5W).

The additional inputs “1.D1....1.D15” are available when the first expansion module is present.

The additional inputs “2.D1....2.D15” are available when the second expansion module is present.

Any digital input of the expansion modules is active when the relevant terminals (see wiring diagram) are shorted.

16.2 – "DI" Configuration (via MSCom2 software)

Any of the Digital Inputs can be programmed to control one or more of the following functions.

BiR1d>	Blocking input phase R function 1d>	
BiS1d>	Blocking input phase S function 1d>	Side 1
BiT1d>	Blocking input phase T function 1d>	
BiR1d>	Blocking input phase R function 2d>	
BiS1d>	Blocking input phase S function 2d>	Side 2
BiT1d>	Blocking input phase T function 2d>	
2HrmLock	Logical trigger input 2nd harmonic reduction	
5HrmLock	Logical trigger input 5th harmonic reduction	
Bi1I>	Blocking input function 1I>	Side 1
Bi1I>>	Blocking input function 1I>>	
Bi2I>	Blocking input function 2I>	Side 2
Bi2I>>	Blocking input function 2I>>	
Bido1>	Blocking input function do1>	
Bido2>	Blocking input function do2>	
Group 1-2	Selection of the setting Group 1 or 2.	
Circuit Breaker	Status Circuit Breaker	
ExtR	External Reset input	
Local state	Locate state	
Remote state	Remote state	
C/B open command	Open C/B Command	
C/B close command	Close C/B Command	

Example:

ID	Name	Status	OpLogic	Functions

Name

Logical Input name

Status

Logical Input status

OpLogic

Not Used

Functions

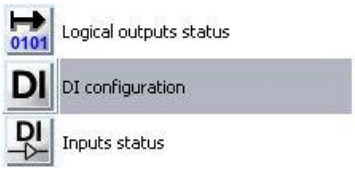
Selection function

Example: Setting “Digital Input”

Open “MSCom2” program and connect to the relay.

Select “Change Windows” from “Menu” button

Select “DI configuration”



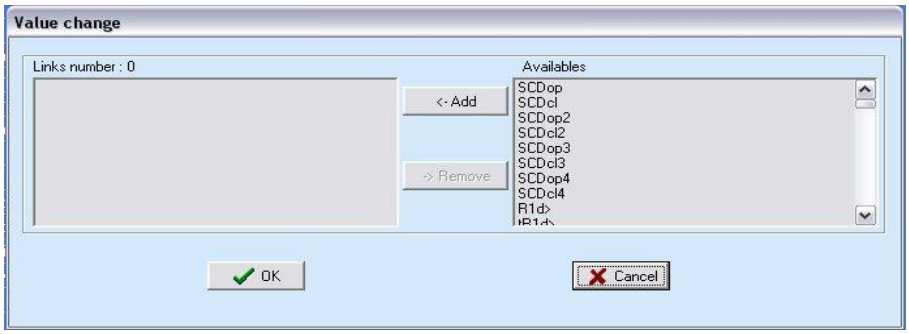
Setting for “**BiR1d>**” : “**R1d>**”.

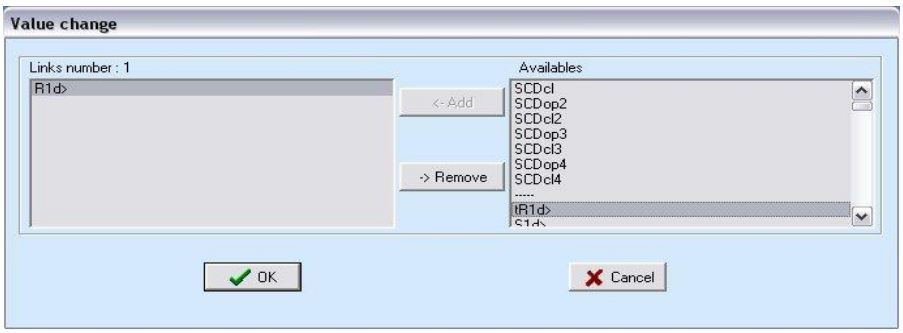
ID	Name	Status	OpLogic	Functions
1	BiR1d> (Blocking Input phase R 1d>)	Not active	None	R1d>,

"Functions"

Select "**Functions**" related to "**BiR1d>**" and press right button on mouse, select "Value change":

From box "Available", select "**R1d>**" and press "Add".
Press "OK" for confirmation. (if Password is request, see § Password)





16.3 – Outputs Relay

The output relay are fully user programmable and controlled by any protection functions and by any digital inputs.

→ 0.R1	Programmable (R1)	*Available in the main relay*
→ 0.R2	Programmable (R2)	
→ 0.R3	Programmable (R3)	
→ 0.R4	Programmable (R4)	
→ 0.R5	Programmable (R5)	
→ 0.R6	Programmable (R6)	
→ 1.R1 → 1.R-- → 1.R14	Programmable	*Output Relays on Expansion Board*
→ 2.R1 → 2.R-- → 2.R14	Programmable	*Output Relays on Expansion Board*

16.4 - "DO" Configuration

Any Output Relay can be programmed to be controlled (energized) by one or more of the following functions or Digital Inputs:

	SCDop	*Scada open breaker command*		
	SCDcl	*Scada close breaker command*		
	SCDop2	*Scada open breaker 2 command (generic command)*		
	SCDcl2	*Scada close breaker 2 command (generic command)*		
	SCDop3	*Scada open breaker 3 command (generic command)*		
	SCDcl3	*Scada close breaker 3 command (generic command)*		
	SCDop4	*Scada open breaker 4 command (generic command)*		
	SCDcl4	*Scada close breaker 5 command (generic command)*		
1d>	**R1d>**	*Start*	*first differential element*	*phase R*
	tR1d>	*Trip*	*first differential element*	*phase R*
	S1d>	*Start*	*first differential element*	*phase S*
	tS1d>	*Trip*	*first differential element*	*phase S*
	T1d>	*Start*	*first differential element*	*phase T*
	tT1d>	*Trip*	*first differential element*	*phase T*
2d>	**R2d>**	*Start*	*second differenti element*	*phase R*
	tR2d>	*Trip*	*second differential element*	*phase R*
	S2d>	*Start*	*second differential element*	*phase S*
	tS2d>	*Trip*	*second differential element*	*phase S*
	T2d>	*Start*	*second differential element*	*phase T*
	tT2d>	*Trip*	*second differential element*	*phase T*
HLock	**2HRL**	*Phase R*	*second harmonic lock*	
	5HRL	*Phase R*	*fifth harmonic lock*	
	2HSL	*Phase S*	*second harmonic lock*	
	5HSL	*Phase S*	*fifth harmonic lock*	
	2HTL	*Phase T*	*second harmonic lock*	
	5HTL	*Phase T*	*fifth harmonic lock*	
	2HReduct	*Second harmonic reduction level*		
	5HReduct	*Fifth harmonic reduction level*		
1I>	**1I>**	*Start*	*first overcurrent element*	*side 1*
	t1I>	*Trip*	*first overcurrent element*	*side 1*
1I>>	**1I>>**	*Start*	*first overcurrent element*	*side 2*
	t1I>>	*Trip*	*first overcurrent element*	*side 2*
2I>	**2I>**	*Start*	*second overcurrent element*	*side 1*
	t2I>	*Trip*	*second overcurrent element*	*side 1*
2I>>	**2I>>**	*Start*	*second overcurrent element*	*side 2*
	t2I>>	*Trip*	*second overcurrent element*	*side 2*

do1>	do1>	Start	earth fault element	side 1
	tdo1>	Trip	earth fault element	side 1
do2>	do2>	Start	earth fault element	side 2
	tdo2>	Trip earth	fault element	side 2
Wi	tWi>	Circuit breaker maintenance level		
tTCS	tTCS	Time delayed Trip Circuit Supervision		
IRF	IRF	Instantaneous Internal relay Fault		
	tIRF	Time delayed Internal relay Fault		
	manOpCmd	Manual Open Command		
	CL-Cmd	Close Command		
	C/Bfail	Circuit Breaker failure		
	L/Rdisc	Local/Remote signal Discrepancy		
	BF	Breaker Failure		
	Gen.Start	Start Generic		
	Gen.Trip	Trip Generic		
	UserTriggerOscillo	User Variable for Oscillographic Recording		
	UserVar<0> to UserVar<24>	User Variable		
	Vcc	Reserved		
	Gnd	Reserved		
	ResLog	Reset signal logic		
	P1	Push-button Open		
	P2	Push-button Close		
	0.D1	Digital Input “0.D1”	activated	Digital Input on Main Relay
	0.D1Not	Digital Input “0.D1”	deactivated	
	to			
	0.D4	Digital Input “0.D4”	activated	
	0.D4Not	Digital Input “0.D4”	deactivated	
	1.D1	Digital Input “1.D1”	activated	Digital input on Expansion Board
	1.D1Not	Digital Input “1.D1”	deactivated	
	to			
	1.D15	Digital Input “1.D15”	activated	
	1.D15Not	Digital Input “1.D15”	deactivated	
	2.D1	Digital Input “2.D1”	activated	Digital input on Expansion Board
	2.D1Not	Digital Input “2.D1”	deactivated	
	to			
	2.D15	Digital Input “2.D15”	activated	
	2.D15Not	Digital Input “2.D15”	deactivated	

Example configuration

ID	Relay	Linked functions	OpLogic	Logical status	Output config	Function	tON	Relay status
1	0.R1 [Master board, R:1]		None	Off	Normally open	Pulse	0,01	Off
2	0.R2 [Master board, R:2]		None	Off	Normally open	Pulse	0,01	Off

Relay

Relay internal name

Linked function

Select the function for tripping the output relay (for multiple association use “User Variable”)

Operation Logic

Not Used

Logical Status

Relay Logical status

Output Configuration

Normally Deenergized	The output relay is deenergized in normal conditions and gets energized on activation of the controlling Functional Output; reset means deenergizing.
Normally Energized	The output relay is energized in normal conditions and gets deenergized on activation of the controlling Functional Output; reset means energizing.

tON (Operation Time)

This timer controls the duration of the activation of the output relay.

tON : 0 (0.01-10)s, step 0.01s

Relay Status

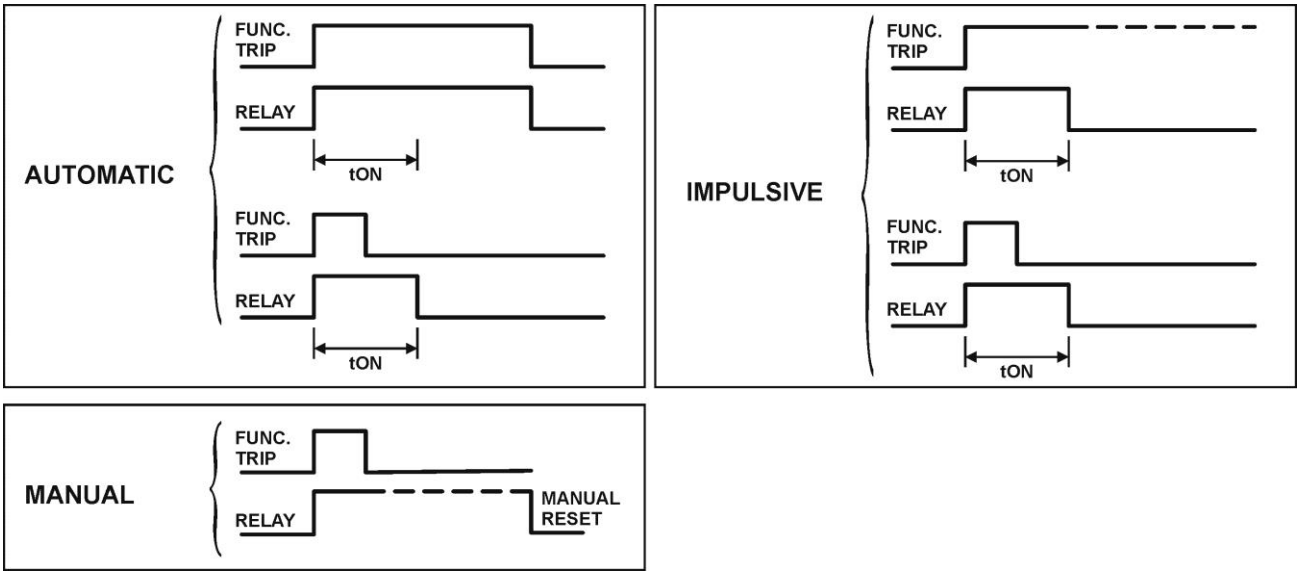
Relay – Physical status

Functions - Operation Mode

Automatic : In this mode the output relay is “operated” (energized if “N.D.”, deenergized if “N.E.”) when the controlling Functional Output is activated and it is reset to the “non operated” condition when the Functional Output gets disactivated but, anyhow, not before the time “tON” has elapsed (minimum duration of the operation time)

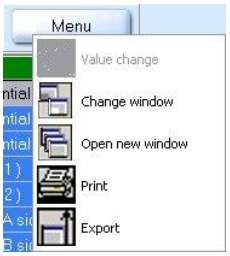
Manual : In this mode the output relay is “operated” when the controlling Functional Output is activated and remains in the operated condition until a manual reset command is issued by the relay keyboard (local commands menu) or via the serial communication. In this mode the timer “tON” has no effect.

Impulsive : In this mode the output relay is “operated” when the controlling Functional Output is activated and it remains in the “operated” condition (energized if “N.D.”, deenergized if “N.E.”) for the set time “tON” independently from the status of the controlling Functional Output.

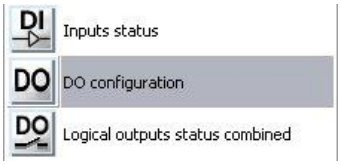


Open “MSCom2” program and connect to the relay.

Select “Change Windows” from “Menu” button



Select “DO Configuration”



Example: Change settings for "0.R1"

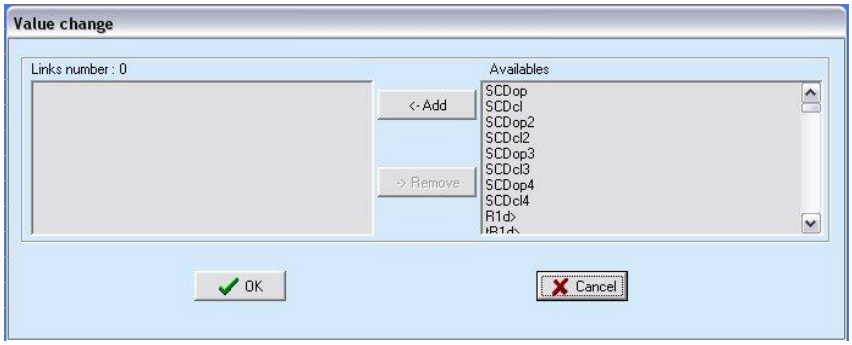
Change settings for "0.R1" : "R1d>", "Normally Close", "Automatic reset", "0.5".

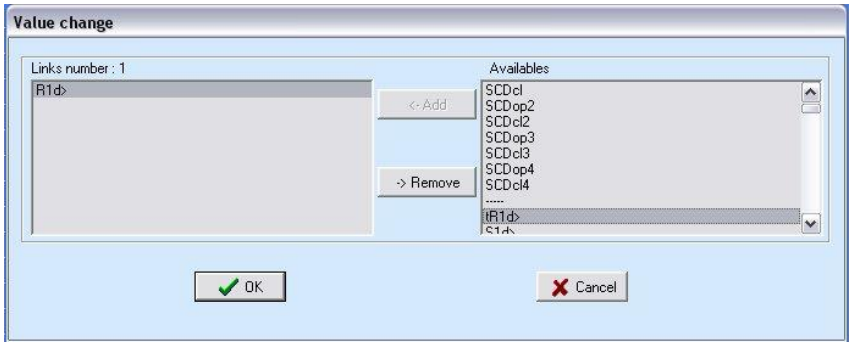
ID	Relay	Linked functions	OpLogic	Logical status	Output config	Function	tON	Relay status
1	0.R1 [Master board, R:1]	R1d>,	None	Off	Normally close	Automatic reset	0,5	Off
2	0.R2 [Master board, R:2]		None	Off	Normally open	Pulse	0,01	Off

"Linked Functions"

Select "**Linked Functions**" related to 0.R1 and press right button on mouse, select "Value change":

From box "Available", select "R1d>" and press "Add".
Press "OK" for confirmation. (if Password is request, see § Password)

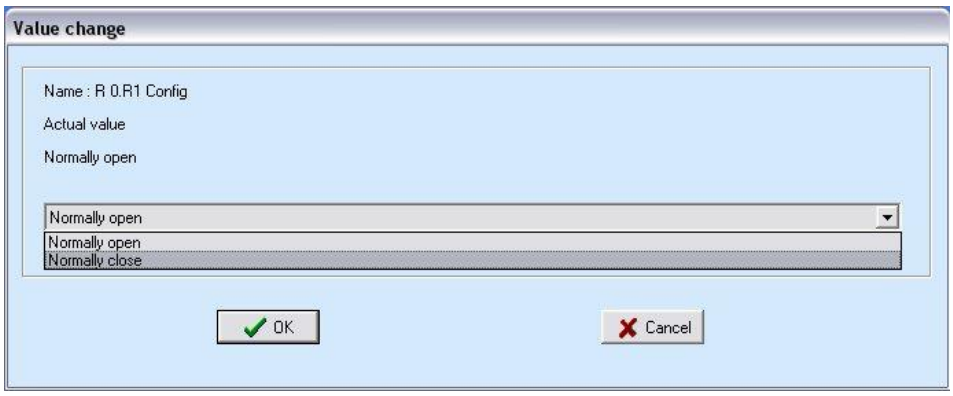




"Output Config"

Select "**Output Config**" related to "0.R1" and press right button on mouse, select "Value change":

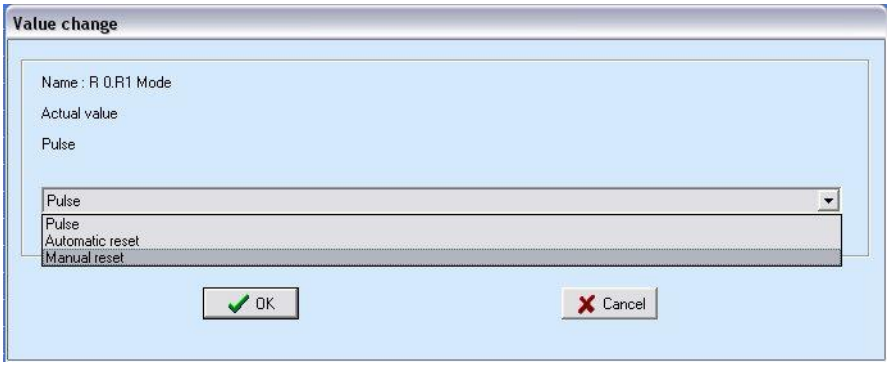
Select "**Normally Close**" from combo box and press "OK"
(if Password is request, see § Password)



"Function"

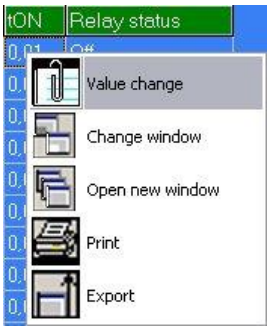
Select "**Function**" related to "0.R1" and press right button on mouse, select "Value change":

Select "**Manual reset**" from combo box and press "OK"
(if Password is request, see § Password):

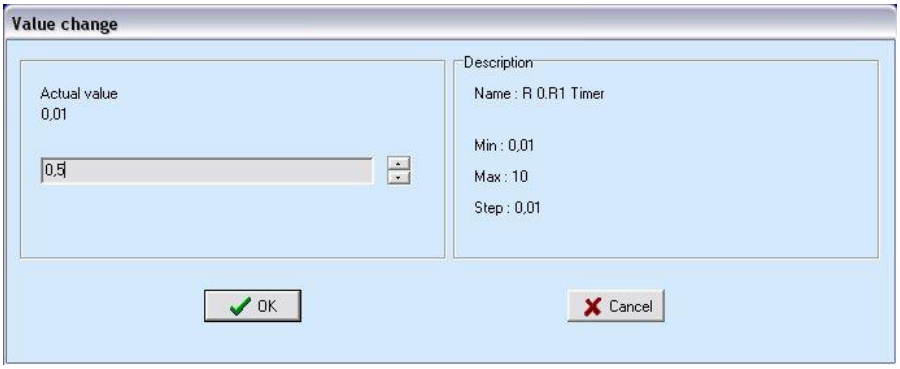


"tON"

Select "**tON**" related to "0.R1" and press right button on mouse, select "Value change":



Set "**0.5**" and press "OK" (if Password is request, see § Password):

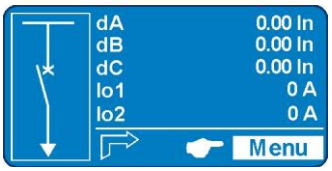


17. Date & Time

In this menu it is possible to configurate the Date and Time

Date:	20YY	/	MM	/	DD	(2000/01/01 ÷ 2099/12/31) YY = Year / MM = Month / DD = Day
Time:	HH	:	MM	:	00	HH = hour / MM = Minutes / 00
DofW:	Day					Es: Wednesday

1



- Press "***Menu***" for access to the main menu with icons.

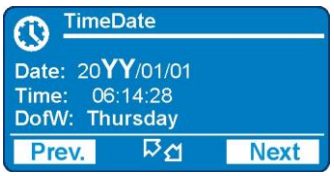
2

- Select icon "***TimeDate***" by pushbuttons "***Increase***" or "***Decrease***".
- Press "***Select***".

3

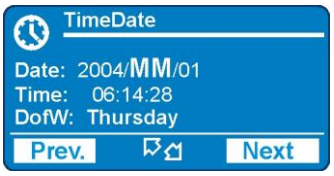
- Press "***Modify***".

4



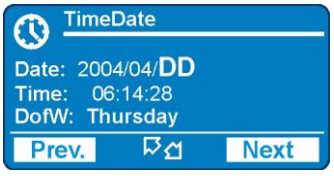
- The last two figures of the Year will appear in bold character; by pushbuttons "***Increase***" or "***Decrease***" set the new figures.
- Press "***Next***" to go to the next setting.

5



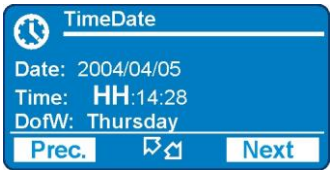
- As above for changing the "Month"
- Press "***Next***" to go to the next setting.

6



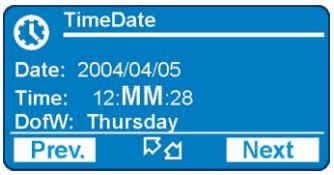
- As above for changing the "Day"
- Press "***Next***" to go to the next setting.

7



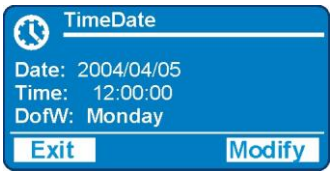
- As above for changing the “Hours”
- Press “***Next***” to go to the next setting.

8



- As above for changing the “Minutes”
- Press “***Next***” to go to the next setting.

9



- The **D**ay **of** the **W**eek is calculated and displayed automatically.
- Press “***Exit***” to go back to the main menu.
- Press “***Modify***” to go back to the step “3”

Press the button “***Next***” to go back to the previous display.

17.1 – Clock synchronization

The internal clock has 1ms resolution and a stability of ±35ppm in the operational temperature range.

It can be synchronized with an external time reference in the following ways:

- Using the standard “Time Synchronization” procedure of the “IEC870-5-103” protocol.
- Using the “MSCom 2” software or from the DCS with the Modbus RTU protocol.

Note: On power supply failure an internal battery supports the internal clock for over two years.

18. Healthy (Diagnostic Information)

The relay operates a continuous checking of the vital functionalities and in case an internal failure is detected, the I.R.F. function (see § I.R.F.) is activated and the Power/IRF led is set to flashing.

Device	→	**No Fail**	→	No Fail
		Fail	→	Fail present
		MinorFail	→	Minor Fail
		HisoricalFail	→	Cleared Fail
		FW not comp.	→	Firmware not compatible

If an internal self-clearing (transient) fault is detected, it is recorded into an historical file without any other action.

19. Dev.Info (Relay Version)

In this menu it is possible to read the information relevant to relay unit.

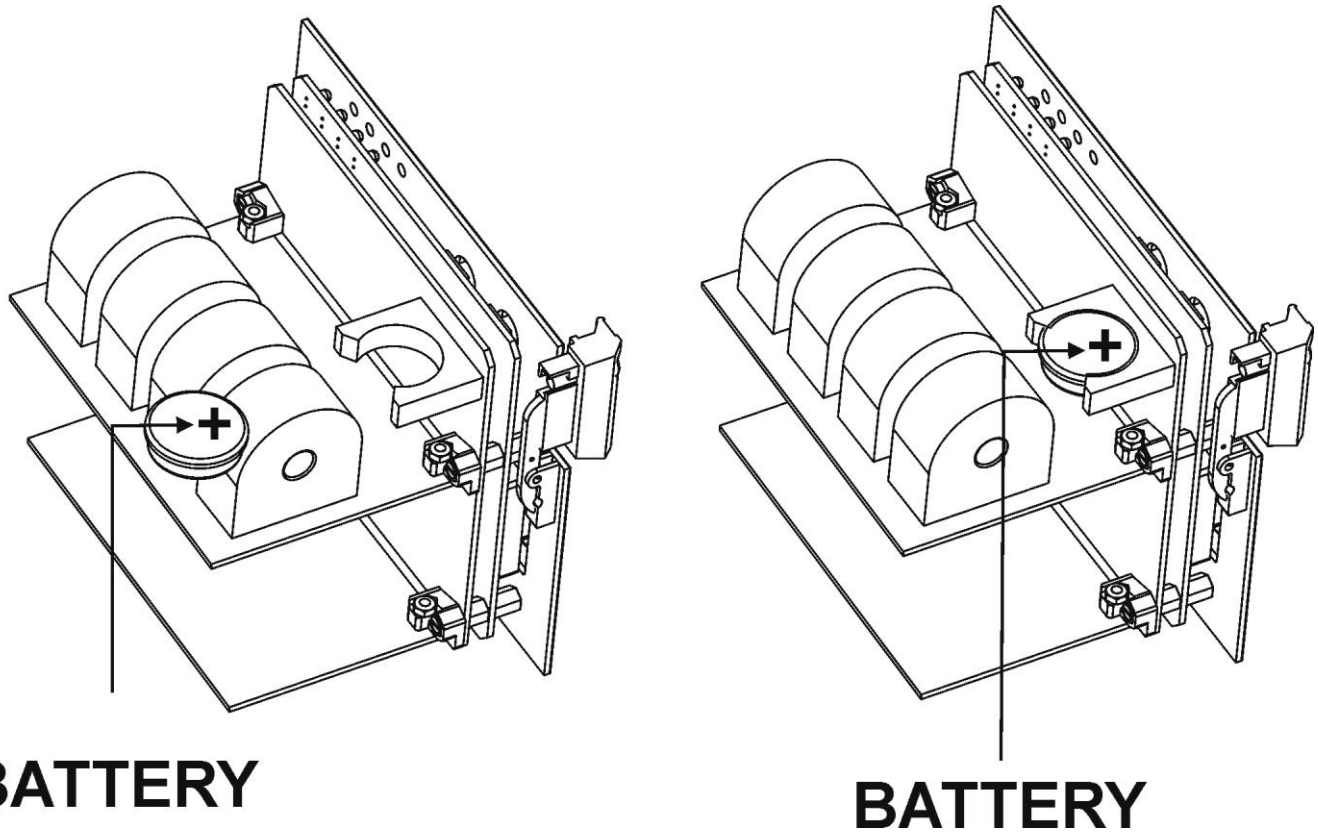
SW Version	**AcqUnit-I/O**	→	####.##.##.#	Firmware version of acquisition unit	This information can only be modified by the interface program "MSCom II" and allows the user to give to the relay any suitable denomination.
	ProtectUnit	→	####.##.##.#	Firmware version of CPU unit	
Protect.Model		→	FeederManager	Protection Type	
Serial Number		→	###I##I##I####	Relay Serial Number	
User Tag		→	DV6903RO	Relay identification label.	
Build		→	############	Build identification label.	
Line		→	############	Line identification label.	

20. Battery

The relay is equipped with a lithium battery type “CR2477N 3V”, to support the internal clock and the oscillographic recording memory in case of programmed lack of power.
The expected minimum duration without power exceed 2 years.

Attention!! Use only battery specified.

Instruction for replacement the battery:



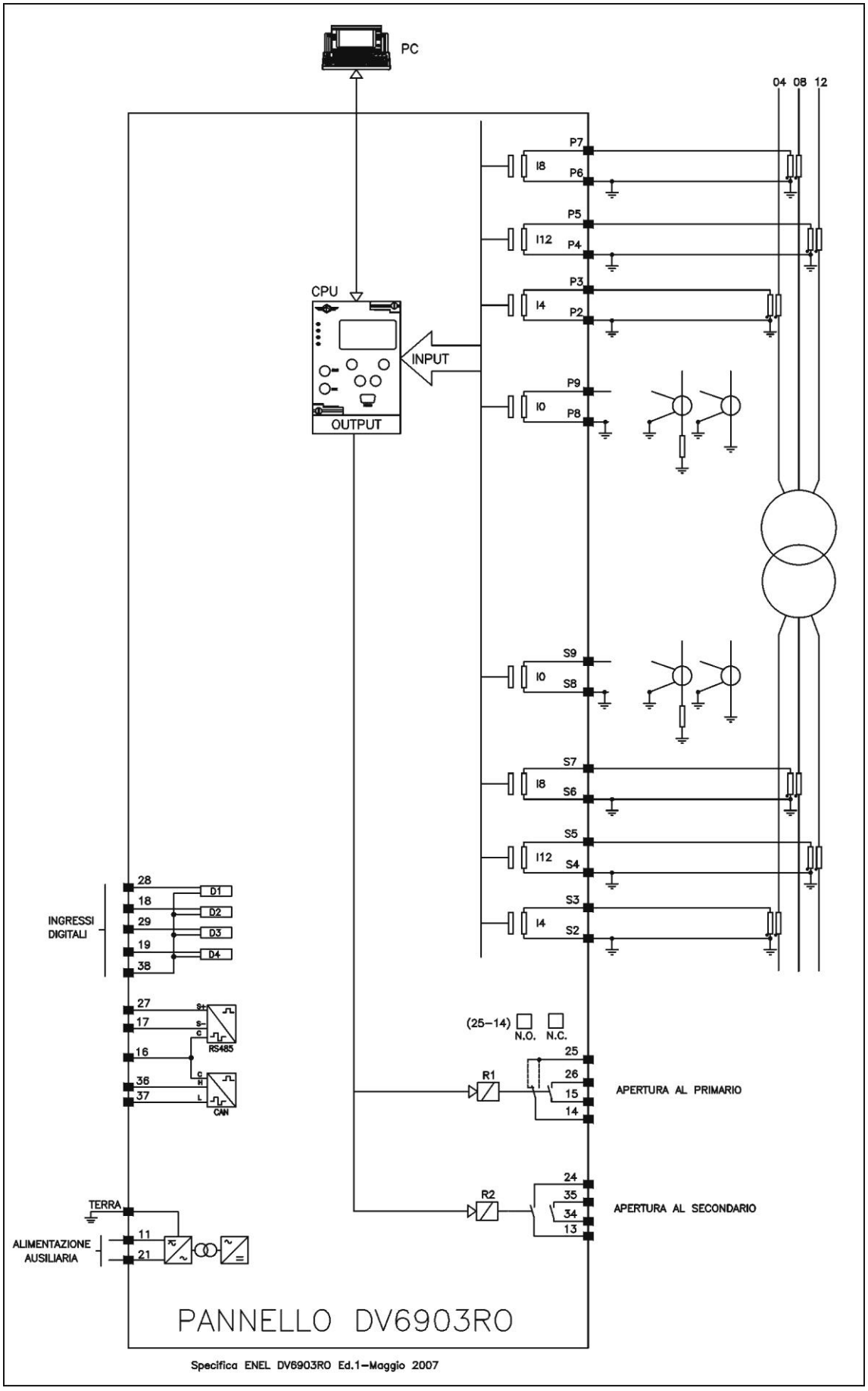
21. Maintenance

No maintenance is required. In case of malfunctioning please contact Microelettrica Scientifica Service or the local Authorized Dealer mentioning the relay's Serial No reported in the label on relays enclosure.

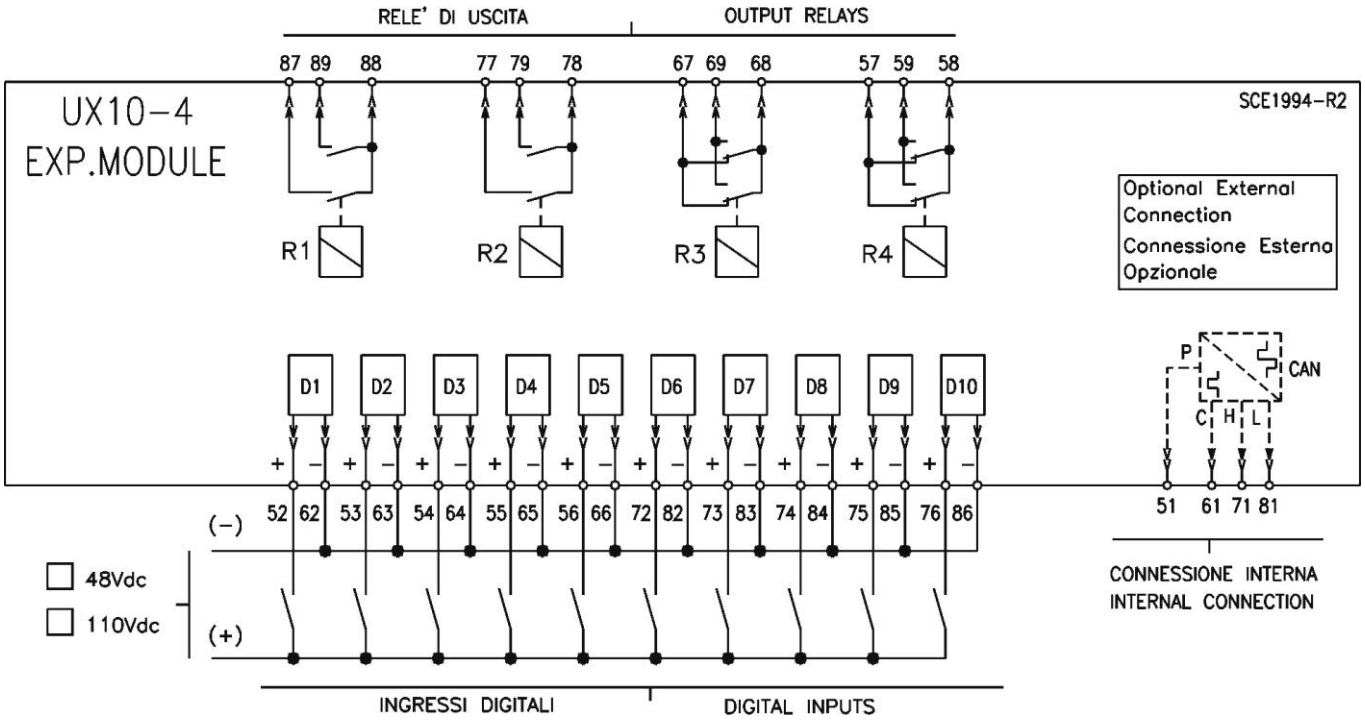
22. Power Frequency Insulation Test

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, digital inputs and RTD input 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 should be isolated. 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.

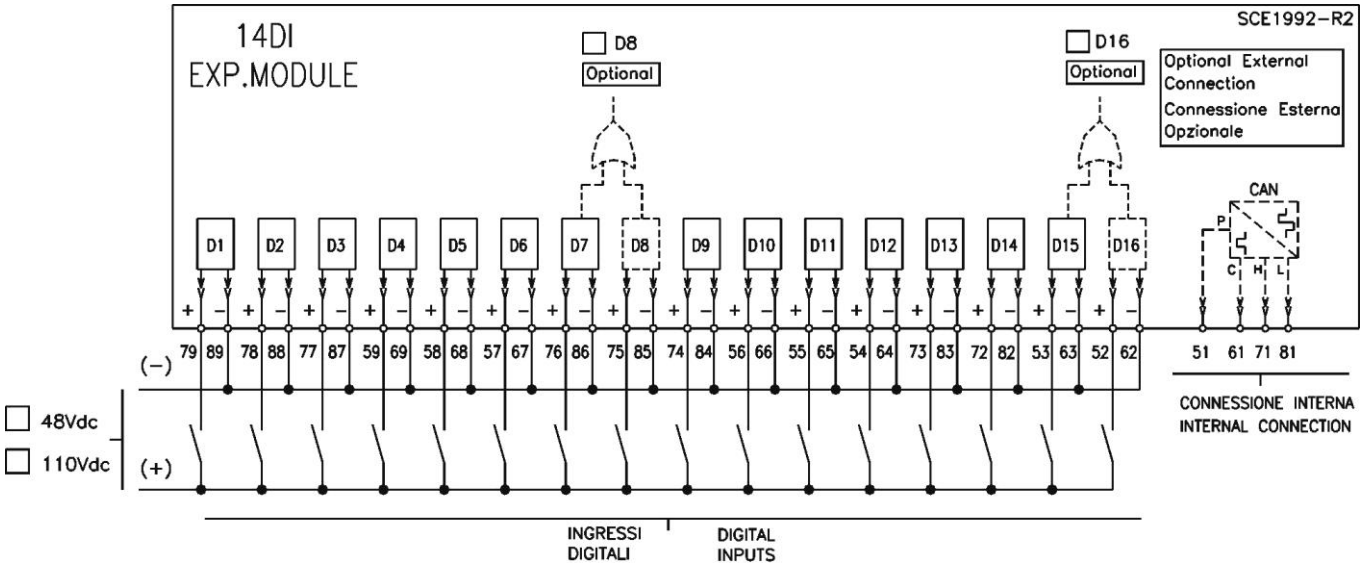
23. Wiring Diagram



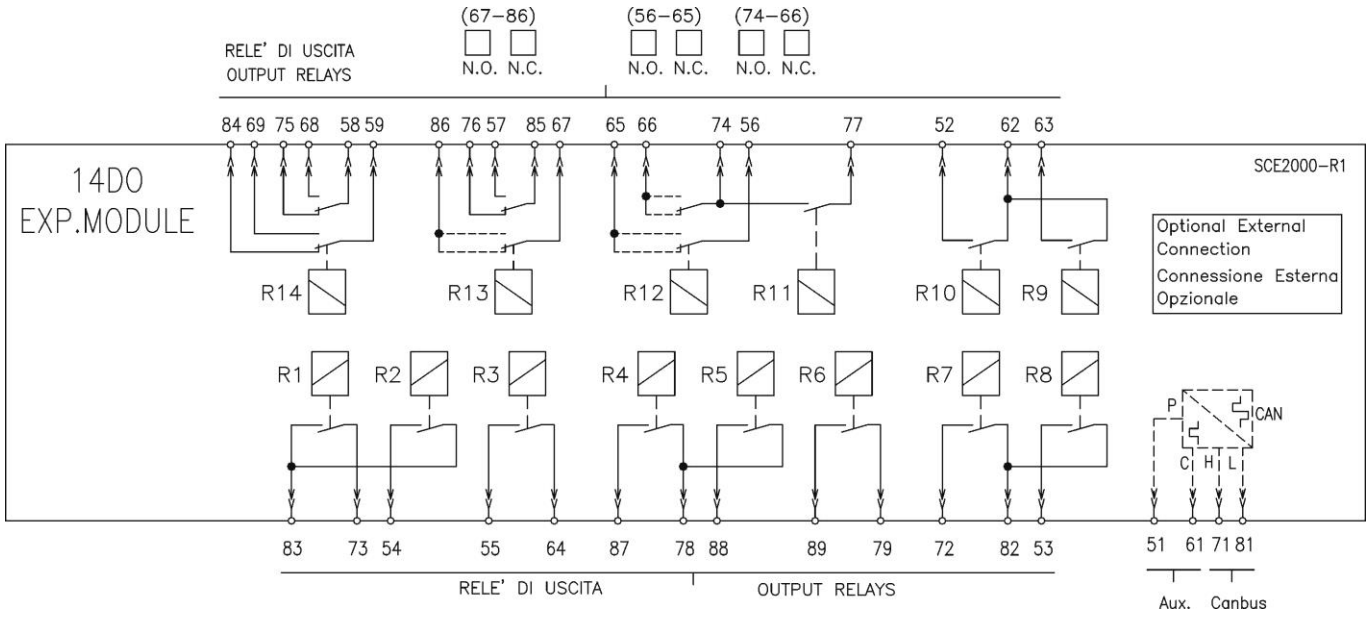
23.1 – **UX10-4** - Expansion Module - Wiring Diagram (10 Digital Inputs + 4 Output Relays)



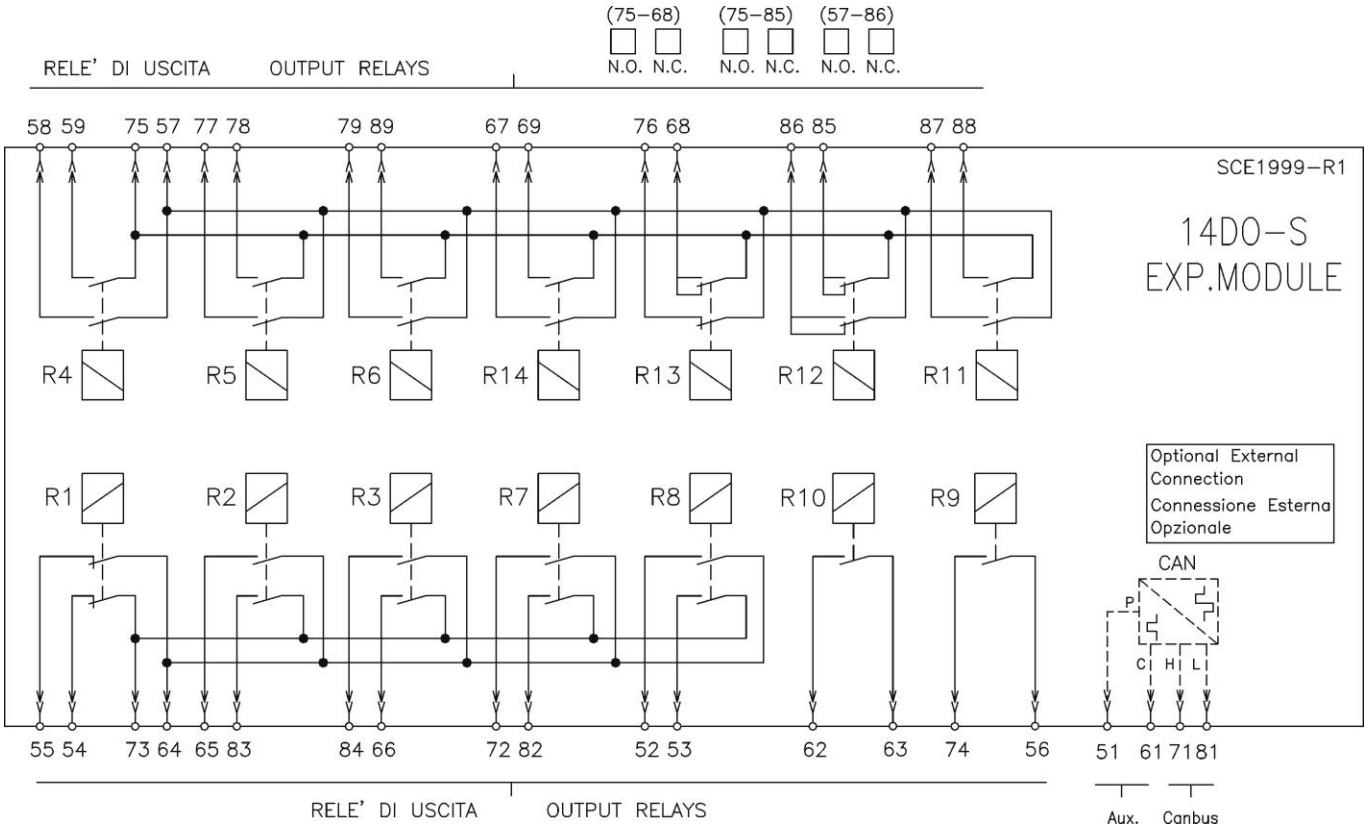
23.2 – **14DI** - Expansion Module - Wiring Diagram (14 Digital Inputs)



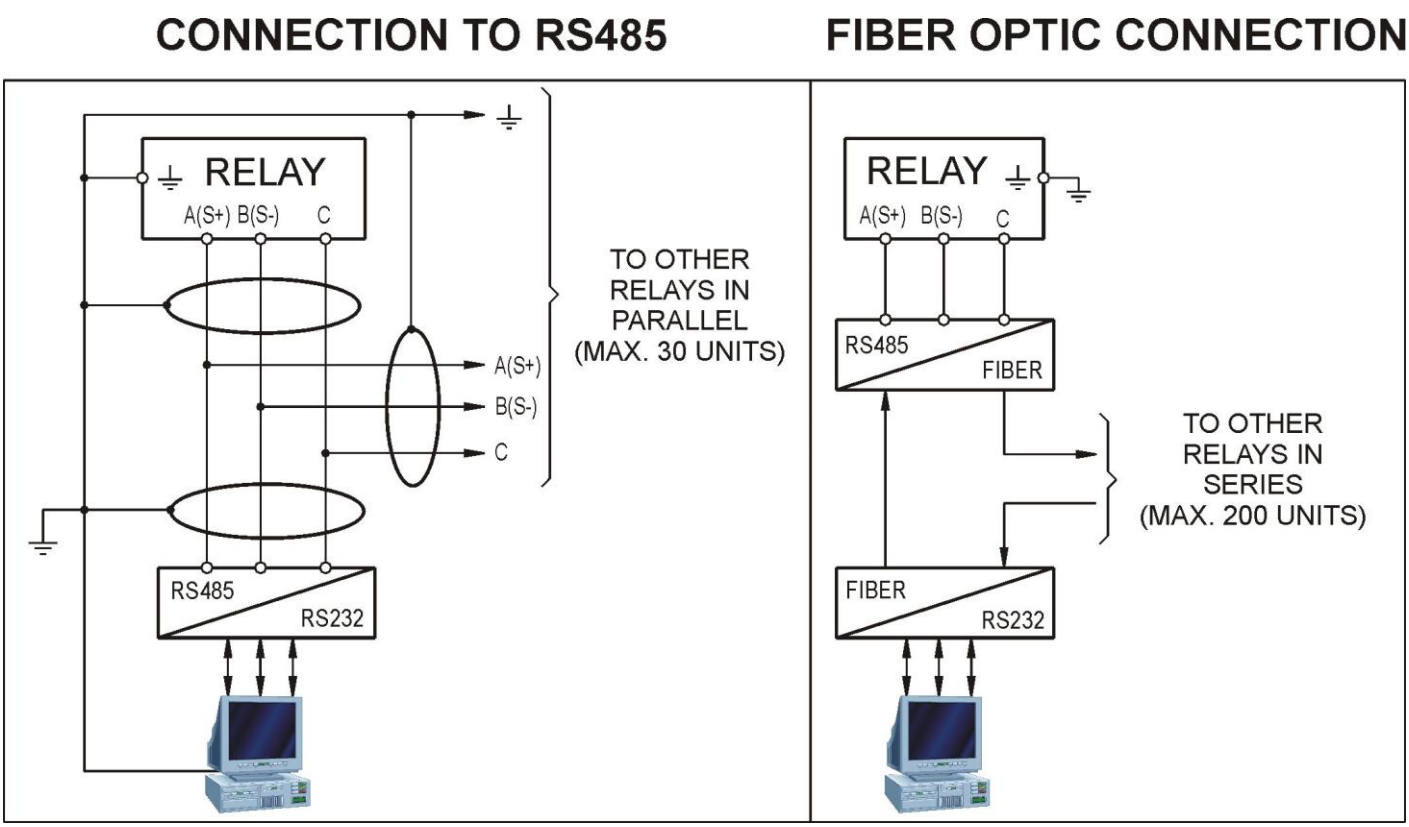
23.3 –**14DO** - Expansion Module - Wiring Diagram (14 Output Relays)



23.4 –**14DO-S** - Expansion Module - Wiring Diagram (14 Output Relays)

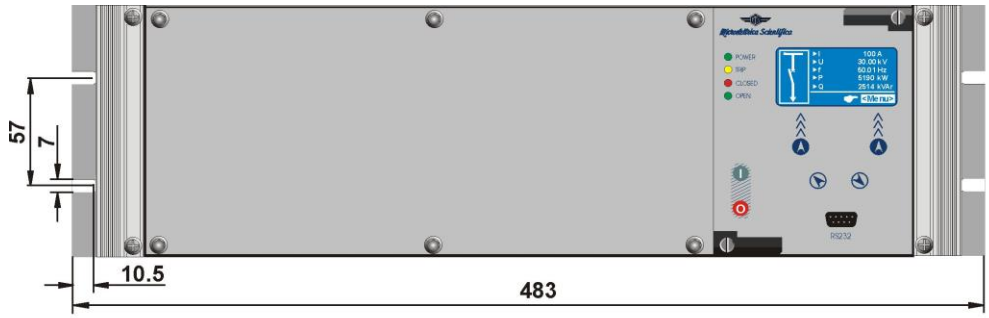


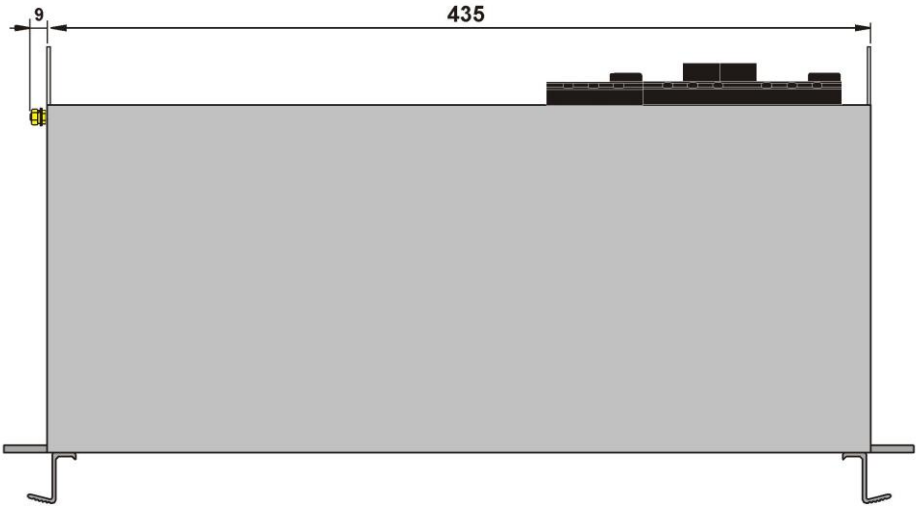
24. Wiring The Serial Communication Bus

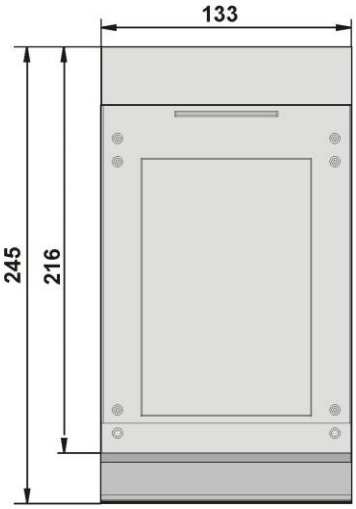


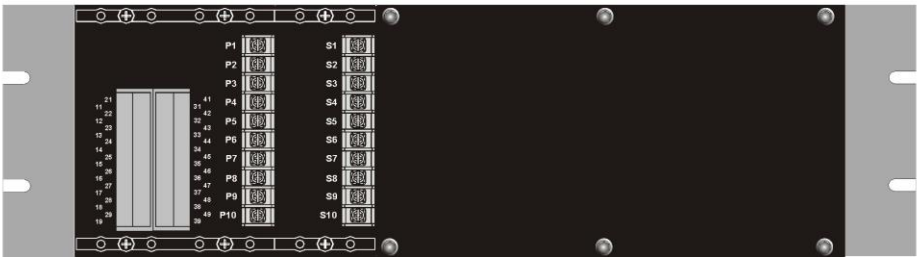
Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C.
A dedicated communication software (MSCom2) for Windows 9x/2000/XP (or later) is available.
Please refer to the MSCom2 instruction manual for more information.
Maximum length of the serial bus can be up to 200m. For longer distance and for connection of up , to 250 Relays, optical interconnection is recommend (please ask Microelettrica for accessories).

25. Overall Dimensions









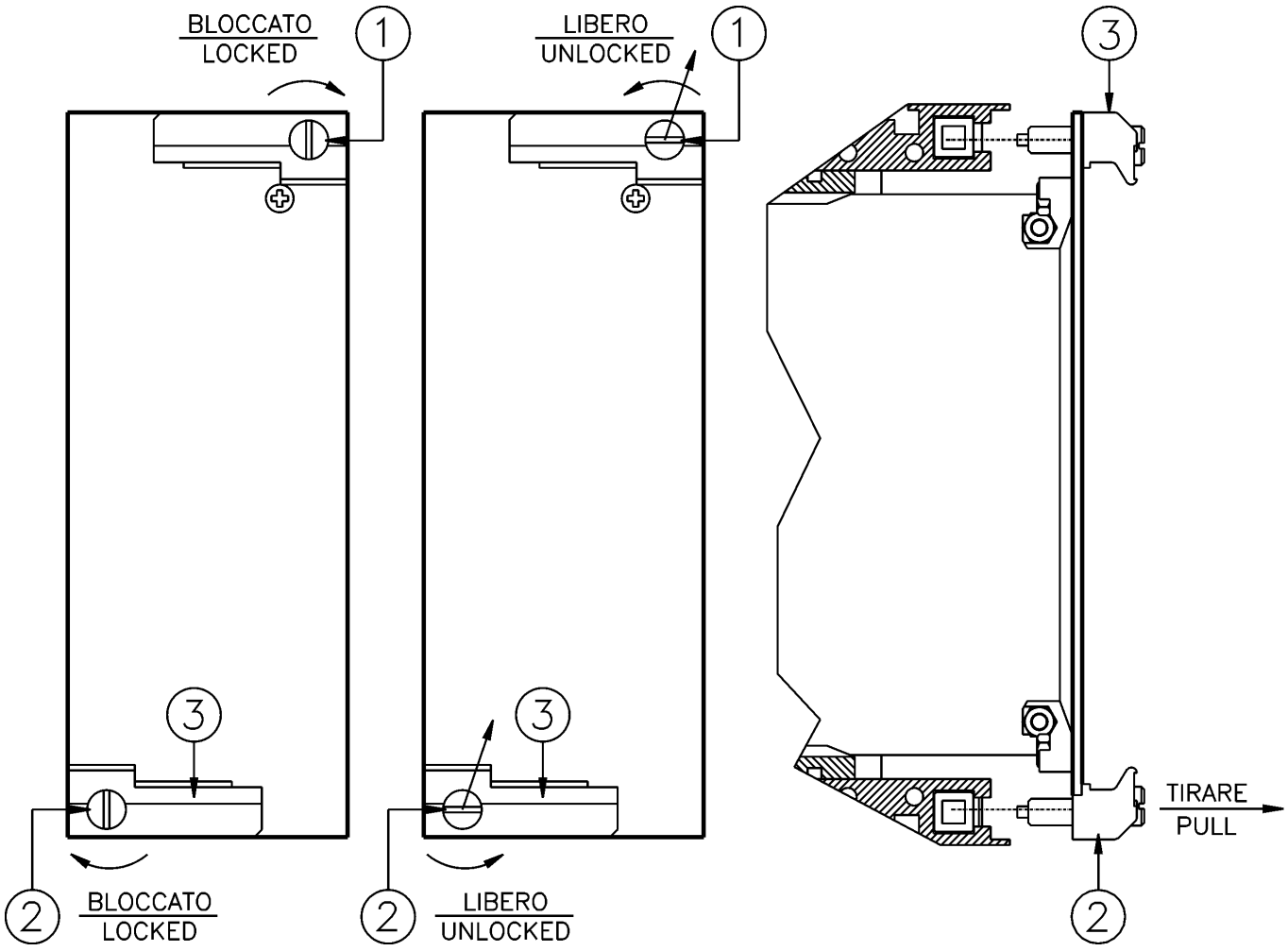
26. Direction For Pcb's Draw-Out And Plug-In

26.1 - Draw-out

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

26.2 – Plug-in

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



27. Electrical Characteristics

APPROVAL: CE

REFERENCE STANDARDS IEC 60255 - 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) (Dry heat) (Change of temperature) (Damp heat, steady state)	IEC60068-2-1 IEC60068-2-2 IEC60068-2-14 IEC60068-2-78	RH 93% Without Condensing AT 40°C	
CE EMC Compatibility (EN61000-6-2 - EN61000-6-4 - EN50263)					
❑	Electromagnetic emission		EN55011	industrial environment	
❑	Radiated electromagnetic field immunity test		IEC61000-4-3 ENV50204	level 3	80-2000MHz 10V/m 900MHz/200Hz 10V/m
❑	Conducted disturbances immunity test		IEC61000-4-6	level 3	0.15-80MHz 10V
❑	Electrostatic discharge test		IEC61000-4-2	level 3	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		

CARATTERISTICHE

❑	Accuracy at reference value of influencing factors	1% In – 0.1%On 2% + to (to=20÷30ms @ 2xIs)	for measure for times
❑	Rated Current	In = 1 or 5A - On = 1 or 5A	
❑	Current overload	80 In for 1 sec; 4 In continuous	
❑	Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A Neutral : 0.01VA at In = 1A ; 0.2VA at In = 5A	
❑	Average power supply consumption	< 10 VA	
❑	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.)	

COMMUNICATION PARAMETER

❑	Rear serial port	RS485 – 9600 to 38400 bps – 8,n,1 – Modbus RTU – IEC60870-5-103
❑	Front serial port	RS232 – 9600 to 57600 bps – 8,n,1 – Modbus RTU

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28. Software & Firmware Version

- **Firmware for version**

  IAU (Intelligent Acquisition Unit)
  IPU (Processor Unit)

- **Application Software**

  MSCom 2 1.03.28 (or later)

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