TYPE

N-DIN-016

(According to CEI 0-16)

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 on the product's instruction or by the applicable IEC standards.

1.2 - Installation

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

1.3 - Electrical Connection

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

1.4 - Measuring Inputs and Power Supply

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

1.5 - Outputs Loading

must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its efficiency.

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 inside can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the cards.
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 when housed in their case; dismounting the cards without proper cautions expose them to the risk of damage and voids any guarantee and relieves the Manufacture of any liability.

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 - Fault Detection and Repair

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

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

2. General Characteristics

N-DIN is a very versatile and complete Feeder Manager Relay with overcurrent end Earth Fault Protection. N-DIN relay is designed for surface mounting inside switchboards or panels on standard DIN-EN 50022 rail, but its Front-Face-Panel (FFP) can be removed (by simply unscrewing the two fastening screws) and flush mounted on the front panel of the Switchboard or on the front of a Power Control Center bay. Connection between the MAIN RELAY BODY (MRB) mounted inside the switchboard and the FFP mounted on the front panel, is made by a shielded double pair of twisted cables connected to the relevant screw terminals available on the front of the MRB and on the back of the FFP.
The max distance between the two parts can be up to 2 meters; for longer distance the connection cables must be laid in proper shielding conduits.
Connection between the two parts when assembled together is made by a plug-in connector provided on each of the two parts.
This unique feature allows to have all controls and measurements available on the switchboard front panel including local connection to a Lap-top PC, while the part connected to the Power Circuit remains inside the panel closed to the C.Ts and to the control devices.
Moreover, where local display of measurements and data is not required, the RMB part can be used as a stand alone relay featuring all protection and communication functions, saving the cost of the FFP.

- Input currents are supplied to 3 current transformers: - two measuring phase current (the third current is computed as vector summation of the two others) - one measuring the earth fault zero-sequence current.

The measuring inputs have the following ratings:

- Phase rated continuous current : 5A
- Neutral rated continuous current : 1A
- Phase current overload : 10A continuous – 200A for 1s
- Neutral current overload : 5A continuous – 50A for 1s
- Phase current measuring dynamic : (0.05-80)A
- Neutral current measuring dynamic : (0.01-5)A

- Three optoisolated, self-powered digital inputs (D1, D2, RTD) are provided.
  The digital inputs D1 and D2 are activated when their input terminals (6-8, 6-9) are shorted by a cold contact (R≤3kΩ); The input RTD is activated when the resistance connected across its terminals exceeds 2900Ω or is below 30Ω.
  The Digital inputs can also be controlled via the serial communication ports or by the FFP when in " Remote " control mode.

- Two output relays (R1, R2), each with one Normally Open 6A rating contact, are available.

Make electric connection in conformity with the diagram reported on relay's enclosure.
Check that input currents are same as reported on the diagram and on the test certificate.

2.1 - Power Supply

The auxiliary power is supplied by a built-in module fully isolated an self protected.

Two options are available:

a) - { 24V(-20%) / 80V(+15%) a.c. ; 24V(-20%) / 90V(+20%) d.c. }

b) - { 80V(-20%) / 230V(+15%) a.c. ; 90V(-20%) / 250V(+20%) d.c. }

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

2.2 - Operation and Algorithms

2.2.1 - Reference Input Values

Display			Description	Setting Range			Step	Unit
Rsrvd			Reserved	-	-	-	-	-
RI	60	-	Ratio of the phase C.Ts. (Ip/Is)	1	-	6500	1	-
RIo	100	-	Ratio of the C.Ts. or of the tore C.T. detecting earth fault current.	1	-	6500	1	-
In	300	**A**	Reference primary current of the relay	1	-	6500	1	A
Freq	50	**Hz**	System rated frequency	50	-	60	10	Hz

2.2.2 - Input quantities

2.2.2.1 - Mains Frequency (Freq)

The relay can operate either in 50Hz or 60Hz systems.
The rated Mains Frequency " Freq " must be set accordingly.

2.2.2.2 - Phase Current inputs (RI)

The relay directly displays the r.m.s. value of the Phase Currents " **IA** ", " **IB** ", " **IC** " flowing in the Primary of the input Current Transformers and refers all its measurements to that value.

To make the relay properly working with any C.T., when programming the relay settings, input the value of the Ratio $RI = \frac{In \quad primary}{In \quad secondary}$ of the phase C.Ts
(In case of direct connection, without C.Ts. RI=1).
Only phase A and C currents are measured, whereas the current of the phase B is computed as vector summation of the currents of the other two phases.
The algorithm is based on the following considerations coming from well-known vector relations among the three-phase currents and the zero sequence current.

- In any circumstance – currents balanced or not, sinusoidal or not – it is always true that:

$$(1) \quad \overline{I_A} + \overline{I_B} + \overline{I_C} + \overline{I_0} = 0$$

- When no Earth Fault exists ($I_0 = 0$)

$$(2) \quad \overline{I_A} + \overline{I_B} + \overline{I_C} = 0 \quad \Rightarrow \quad \overline{I_B} = \left(\overline{I_A} + \overline{I_C}\right)$$

The earth fault protection element is independently supplied by the residual current coming either from the residual connection of the system C.Ts. or from the core balance C.T.

If any Earth Fault is experienced ($I_0 \neq 0$) the Earth Fault Protection Element trips independently from the phase current measuring elements.

If no Earth Fault is present ($I_0 = 0$), the equation (2) is valid, no matter if currents are balanced or not, sinusoidal or not.

The third phase current is calculated, in real time, as vector summation of the other two-phase currents

Similarly, the Positive Sequence Current Component " **I_1** " and the Negative Sequence Component " **I_2** **"**, with no Earth Fault, are computed according to the normal equations of the System Symmetrical Components, using two currents only:

$$\begin{cases} \overline{I_A} = \overline{I_1} + \overline{I_2} \\ \overline{I_C} = \alpha\overline{I_1} + \alpha^2\overline{I_2} \end{cases} \Rightarrow \begin{cases} \overline{I_C} - \alpha\,\overline{I_A} = I_2(\alpha^2 - \alpha) \\ \overline{I_C} - \alpha^2\,\overline{I_A} = \overline{I_1}(\alpha - \alpha^2) \end{cases} \Rightarrow \begin{cases} \overline{I_2}\sqrt{3} = \left|\overline{I_C} - \overline{I_A}e^{j120}\right| \\ \overline{I_1}\sqrt{3} = \left|\overline{I_C} - \overline{I_A}e^{j120}\right| \end{cases}$$

In case of Earth Fault the Earth Fault Element trips before tripping of the unbalance element.

- During Faults:

A) Single phase to earth Fault

Trip of the earth fault element directly measuring the Residual Current.

B) Two Phase Fault

In any case one of the currents directly measured is involved, so the relay trips correctly.

C) Two Phase to Earth Fault

Same as A + B

D) Three Phase Fault

All the three currents are correctly measured (in any case two directly).

2.2.2.3 - Earth Fault Current Input (RIo)

Same as for the Phase Currents, the relay directly displays the r.m.s. value of the Zero Sequence Residual Current flowing at the Primary of the Current Transformers.

If the input to the Earth Fault element is supplied by the residual connection of the 3 phase C.Ts., we shall set for the ratio " **RIo** " the same value as " **RI** ".

If the input to the Earth Fault element is supplied by a separated Core Balance C.T., or by another CT, " **RIo** " value will be the Ratio of this C.T., normally different from " **RI** ".

2.2.2.4 - Phase CT primary rated current " In "

" **In** " is the primary rated current of the feeder;
this is the reference value for all the protection functions.

Es: I>=(10 – 120)%In

2.2.3 – R/W Setting (Functions and Settings)

2.2.3.1 - 1F51(I>) - First overcurrent protection level

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R2		[R1 / R2 / R1 + R2 / None]			
	→	***TCC***	D		[D / A / B / C]			
TripLevels	→	***I>***	120	**%In**	(20 ÷ 120)	step	1	%In
Timers	→	***tI>***	60	**s**	(0.05 ÷ 60.00)	step	0.01	s

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None
- ❑ **TCC** : Time current curves
  [D] = Independent Definite Time
  [A] = IEC A Inverse
  [B] = IEC B Very Inverse
  [C] = IEC C Extremely Inverse
- ❑ **I>** : Minimum operation level
- ❑ **tI>** : Trip time delay

Trip when : the current exceeds the set level [I>] for the time [tI>]

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

Function reset when : the current drops below the 95% I>.
Led reset when : Push-button “Reset” is pressed.

2.2.3.2 - 2F51 (I>>) - Second overcurrent protection level

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R2		[R1 / R2 / R1 + R2 / None]			
TripLevels	→	***I>>***	500	**%In**	(20 ÷ 500)	step	1	%In
Timers	→	***tI>>***	1.00	**s**	(0.05 ÷ 1.00)	step	0.01	s

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None
- ❑ **I>>** : Minimum operation level
- ❑ **tI>>** : Trip time delay

Trip when : the current exceeds the set level [I>>] for the time [tI>>]

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

Function reset when : the current drops below the 95% I>>.
Led reset when : Push-button “Reset” is pressed.

2.2.3.3 - 2F51 (I>>>) - Third overcurrent protection level

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R2		[R1 / R2 / R1 + R2 / None]			
TripLevels	→	***I>>>***	1500	**%In**	(80 ÷ 1500)	step	1	%In
Timers	→	***tI>>>***	0.20	**s**	(0.05 ÷ 0.20)	step	0.01	s

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None
- ❑ **I>>>** : Minimum operation level
- ❑ **tI>>>** : Trip time delay

Trip when : the current exceeds the set level [I>>>] for the time [tI>>>]

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

Function reset when : the current drops below the 95% I>>>.
Led reset when : Push-button “Reset” is pressed.

2.2.3.4 - 1F50N/51N (Io>) - First Earth Fault protection level

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R1		[R1 / R2 / R1 + R2 / None]			
TripLevels	→	***Io>***	200	**mAs**	(10 ÷ 200)	step	1	mAs
Timers	→	***tIo>***	1	**s**	(0.05 ÷ 1.00)	step	0.01	s

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None
- ❑ **Io>** : Minimum operation level
- ❑ **tIo>** : Trip time delay

Trip when : the current exceeds the set level [Io>] for the time [tIo>]

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

Function reset when : the current drops below the 95% Io>.
Led reset when : Push-button “Reset” is pressed.

The set value “Io>” is in secondary Ampere (current flowing thought the input terminals of the relay)
The set value [Io>] multiplied by the [RIo] (CT ratio), gives the primary value of “Io>”.

[Io>] x [RIo] = Io> Primary Amps

Example:

A) Setting value : Io> = 40 mAs (Secondary current)
Ratio of the C.Ts : RIo = 100/1
Primary current trip level : 40 x 100 = 4000 mAp = 4 Ap (Primary Current)

B) Primary current trip level : Io> = 4 Ap
Ratio of the C.Ts : RIo = 100/1
Io> Set = 4 / 100 = 0.04As = 40mAs

2.2.3.5 - 2F50N/51N (Io>>) - Second Earth Fault protection level

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R1		[R1 / R2 / R1 + R2 / None]			
TripLevels	→	***Io>>***	100	**mAs**	(100 ÷ 5000)	step	1	mAs
Timers	→	***tIo>>***	0.20	**s**	(0.05 ÷ 0.20)	step	0.01	s

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None
- ❑ **Io>>** : Minimum operation level
- ❑ **tIo>>** : Trip time delay

Trip when : the current exceeds the set level [Io>>] for the time [tIo>>]

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

Function reset when : the current drops below the 95% Io>>.
Led reset when : Push-button “Reset” is pressed.

2.2.3.6 - BF (F51BF) - (Breaker Failure)

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→	***Out***	R2		[R2 / None]			
TripLevels	→		No Parameters					
Timers	→	***tBF***	0.75	**s**	(0.05 ÷ 0.75)	step	0.01	s

- **Status** : [Disable] = Disabled
  [Enable] = Enabled
- **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R2] = relay R2
  [None] = None
- **tBF** : Trip time delay

Trip when : Mode of operation: If after the time "tBF" from the trip of the relay R1 (the trip of any protection functions programmed to operate on output relay R1) the current measured remains over a 2% In the relay R2 trip.

When the function is tripped : *Signalization* = Led “Trip” is illuminated
Event Recording = is recorded.

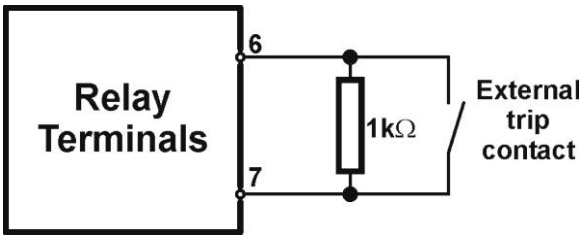
Function reset when : the cause that generate the trip disappeared
Led reset when : Push-button “Reset” is pressed.

2.2.3.7 - RTD -

FunctEnable	→ **Status**	Enable	[Disable / Enable]
Options	→ ***Out***	R1+R2	[R1 / R2 / R1 + R2 / None]
TripLevels	→	No Parameters	
Timers	→	No Parameters	

- **Status** : [Disable] = Disabled
  [Enable] = Enabled
- **OUT** : *Selection of the output relay operated at the end of trip time delay*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None

It is possible to use RTD input as a remote trip input, driven by a cold contact.



Connecting 1KΩ across relay terminals 6 – 7, tripping can be obtained shunting the resistors by an external cold contact.

2.2.3.8 - OperMod – (Operation Mode)

The N-DIN is fitted with 2 output relays R1, R2 and 3 Digital Input D1, D2, RTD:

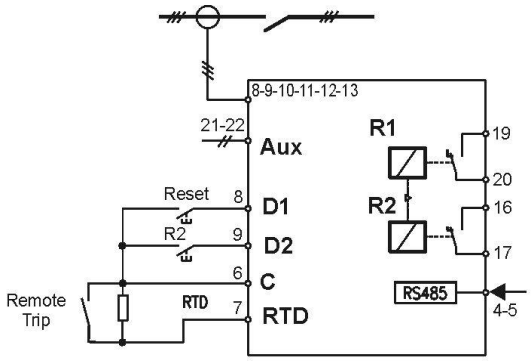
-	**R1**	Can be controlled by anyone N-DIN functions (except Breaker Failure), according to programming. Reset can be operated by the RMB reset button and/or FFP and/or by Digital Input "D1"activation; drop off time 150ms.
-	**R2**	Can be controlled by any of the N-DIN functions according to programming Reset is automatic, drop off time:150ms.
-	**D1** (Terminals 6-8)	Operates the reset after tripping cause is cleared (example: Overcurrent trip – Circuit Breaker Open– Current interrupted – Reset) If "D1" terminals (6-8) are permanently shorted, reset of "R1" after tripping takes place automatically as soon as the tripping cause disappears.
-	**D2** (Terminals 6-9)	Is only enabled in the Local control mode. When activated, "D2" operates the output relay "R2" (energizes "R2" if "R2" operation mode id "N.D."; deenergizes "R2" if "R2" operation mode is "N.E.")
-	**RTD** (Terminals 6-7)	Operates according to § RTD

The menu " OperMode ", includes three submenus (OPTIONS):

FunctEnable	→	**Status**	No Parameters	
Options	→	**Op_R1**	N.D.	[N.D. / N.E.]
		Op_R2	N.D.	[N.D. / N.E.]
		Crtl	Local	[Local / Remote]
TripLevels	→		No Parameters	
Timers	→		No Parameters	

- **Op_R1** : *For selection of different operation modes of the Output Relay "R1":*
  [N.D.] = Normally deenergized, energized on trip
  [N.E.] = Normally energized, deenergized on trip
- **Op_R2** : *For selection of different operation modes of the Output Relay "R2":*
  [N.D.] = Normally deenergized, energized on trip
  [N.E.] = Normally energized, deenergized on trip
- **Crtl** : *For selection between Local/Remote relay control:*
  [Local] = The Digital Inputs "D2" is enabled and can be controlled via terminals (6-9) on relay RMB.
  [Remote] = The Digital Inputs "D2" is only operated by the communication ports or by the commands on the FFP. In the Remote control mode, the status of the terminals (6-9) is ignored.

APPLICATION EXAMPLE



LOCAL CONTROL VIA DIGITAL INPUTS
REMOTE CONTROL VIA RS485

2.2.3.9 - Load Profile

FunctEnable	→	**Status**	Enable		[Disable / Enable]			
Options	→		No Parameters					
TripLevels	→		No Parameters					
Timers	→	***tLP***	1	**m**	(1 ÷ 650)	step	1	m

- ❑ **Status** : [Disable] = Disabled
  [Enable] = Enabled
- ❑ **tLP** : Trip time delay

The Load Profile function, when activated, records the value of current " I " (largest of the 3 phase-currents) at any C/B closure, at every time interval " tLP "and at any C/B opening,
Each record is complete with time/date tagging.
The memory buffer can store up to 100 records.
All the recorded data can be downloaded by the serial communication port and, with MSCom interface program, they are displayed as time/current curve.

2.2.3.10 - I.R.F. – (Internal Relay Failure)

FunctEnable	→		No Parameters	
Options	→	***OpIRF***	NoTrip	[Trip / NoTrip]
	→	***OUT***	None	[R1 / R2 / R1 + R2 / None]
TripLevels	→		No Parameters	
Timers	→		No Parameters	

- ❑ ***OpIRF*** : [Trip] = Trip
  [NoTrip] = NoTrip
- ❑ **OUT** : *Selection of the output relay operated on tripping*
  [R1] = relay R1
  [R2] = relay R2
  [R1+R2] = relay R1 + R2
  [None] = None

The variable " OpIRF " available in the options of the " IRF " function, can be programmed to trip the output relays same as the other protection functions (OpIRF = TRIP), or to only operate the " IRF " signal led without tripping the output relays (OpIRF = NoTRIP).

2.2.3.11 - MainComPar – (Communication Parameters)

FunctEnable	→		No Parameters	
Options	→	***Mode***	8,n,1	[8,n,1 / 8,o,1 / 8,e,1]
	→	***BaudR***	9600	[9600 / 19200]
TripLevels	→		No Parameters	
Timers	→		No Parameters	

- ***Mode*** : *Serial Communication Protocol*
  [8,n,1]
  [8,o,1]
  [8,e,1]
- **BaudR** : Serial Communication Speed
  [9600]
  [19200]

2.2.4 – Self-diagnostic

The N-DIN incorporates a sophisticated self-diagnostic feature that continuously checks the following elements:

- A/D conversion
- Checksum of the settings stored into E^2P.
- DSP general operation (Power, Routines, etc.)
- Lamp test (only on manual test).

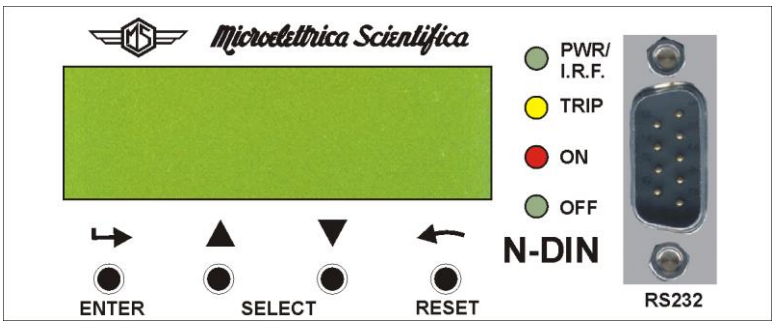
Any time Power is switched on, a complete test is run; then, during normal operation, the test is run continuously and the checksum is done any time a parameter is stored into E^2P.
If during the test any Relay Internal Failure (I.R.F) is detected:

- If " I.R.F. " is programmed to " Trip " the output relays are operated same as on tripping of any protection function

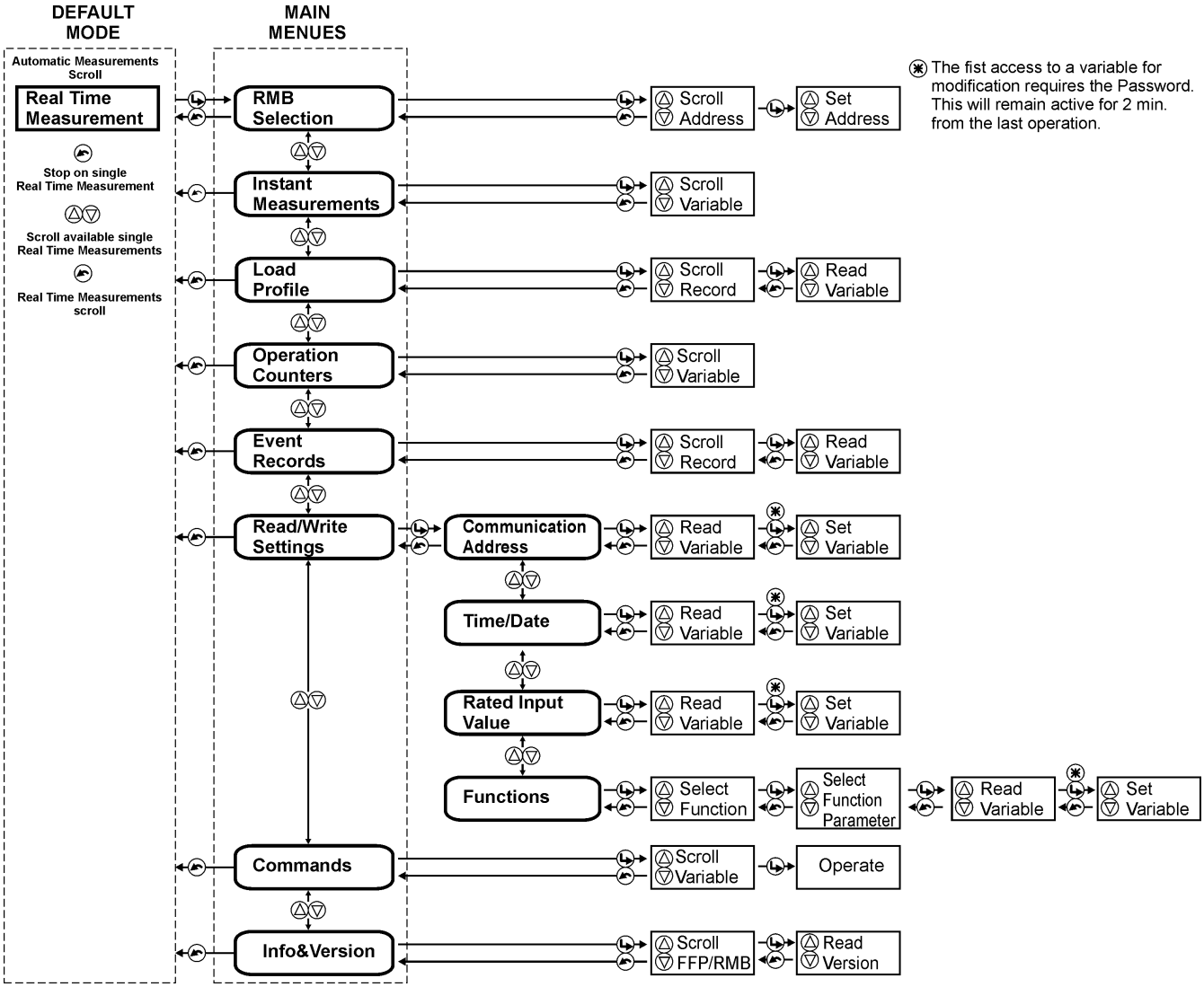
- If " I.R.F. " is programmed "NO Trip", operation is memorized in the " Event Records ".

3. Relay Management

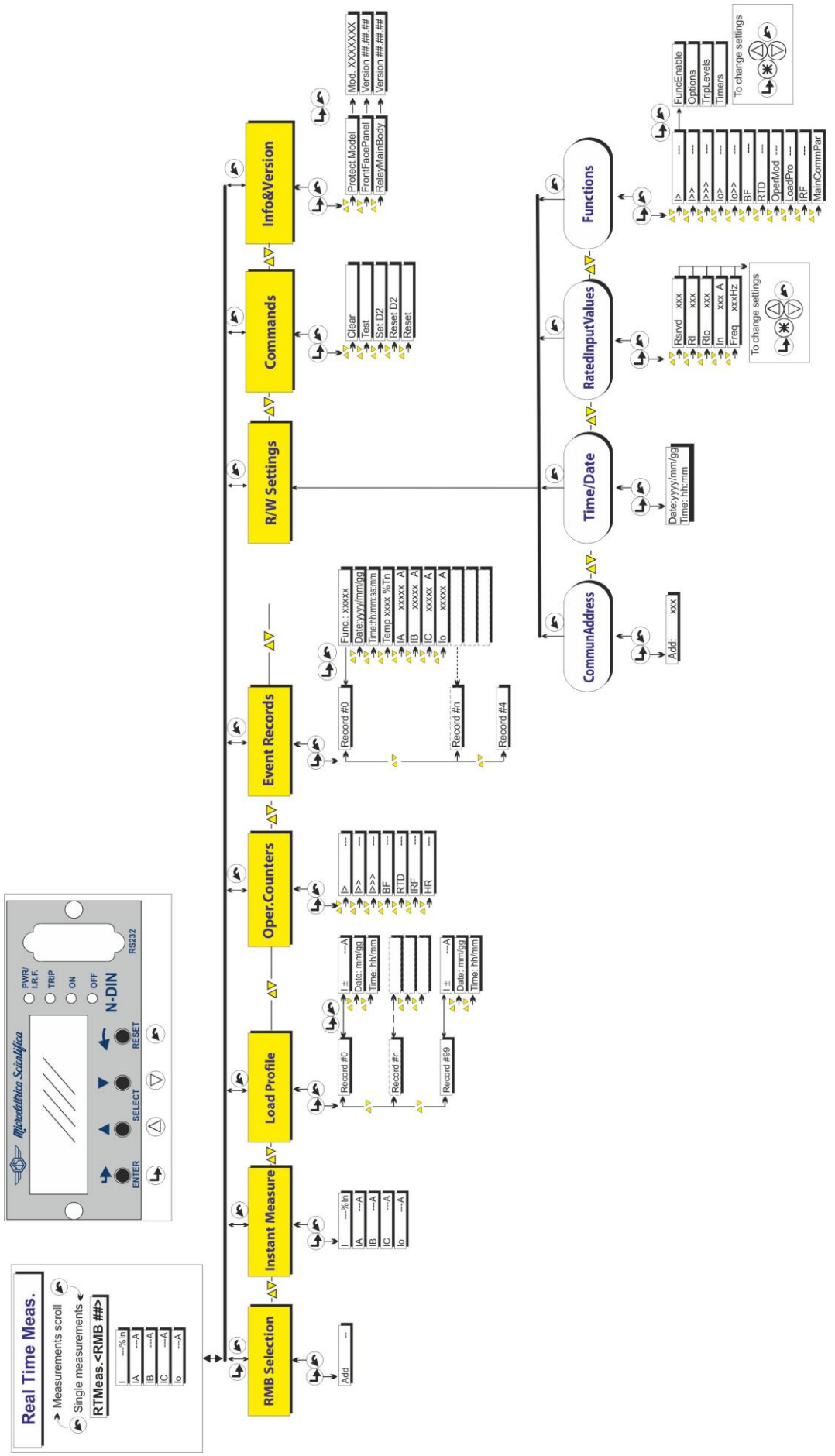
The relay can be totally managed either locally by the 4 key buttons and the LCD display or remotely either by a PC connected to the serial port on Front Face (RS232) and/or by the main serial communication bus RS485 connected to the RMB.
The 2 line x 16 characters LCD display shows the available information.
Key buttons operate according to the flow-chart here below.



The relay can be totally managed either locally by the 4 key buttons and the LCD display or remotely either by a PC connected to the serial port on Front Face (RS232) and/or by the main serial communication bus RS485 connected to the RMB (see §8).
The 2 line x 16 characters LCD display shows the available information.
Key buttons operate according to the flow-chart here below.

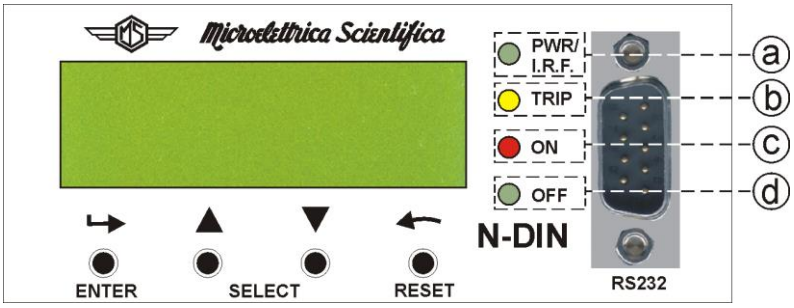


3.1 – Keyboard Operational Diagram



4. Signalizations

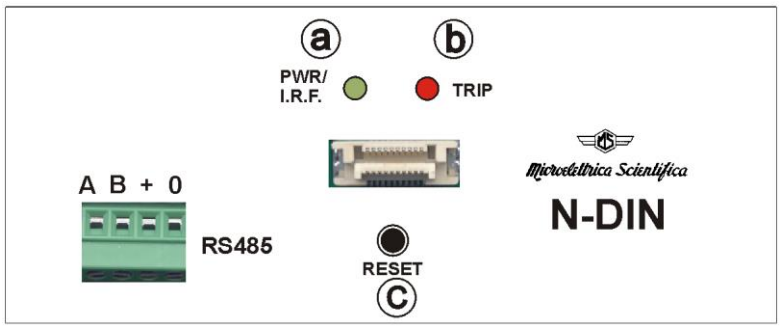
Four signal leds are available on the removable **F**ront **F**ace **P**anel (FFP):



a)	Green LED	**PWR/ I.R.F.**	❑ Illuminated during normal operation when Power Supply is ON. ❑ Flashing when a Relay Internal Fault is detected.
b)	Yellow LED	**TRIP**	❑ Flashing when one of the two time functions I> or I>> is activated. ❑ Illuminated when any function was tripped, reset takes places either by pressing the reset button and as soon as the C/B closed status is detected (Input current ≥ 3%In).
c)	Red LED	**ON**	❑ Flashing when one of the two time functions Io> or Io>> is activated. ❑ Illuminated when any function was tripped, reset takes places either by pressing the reset button and as soon as the C/B closed status is detected (Input current ≥ 3%In).
d)	Green LED	**OFF**	❑ Illuminated when C/B close status is detected. (Input current exceeding 2%In) ❑ Flashing when the Breaker Failure function has tripped.

The reset button on FFP, resets the Output Relays and the Trip Signal Led after tripping.

Other two leds are provided on the **R**elay **M**ain **B**ody (RMB) visible when the front face is removed

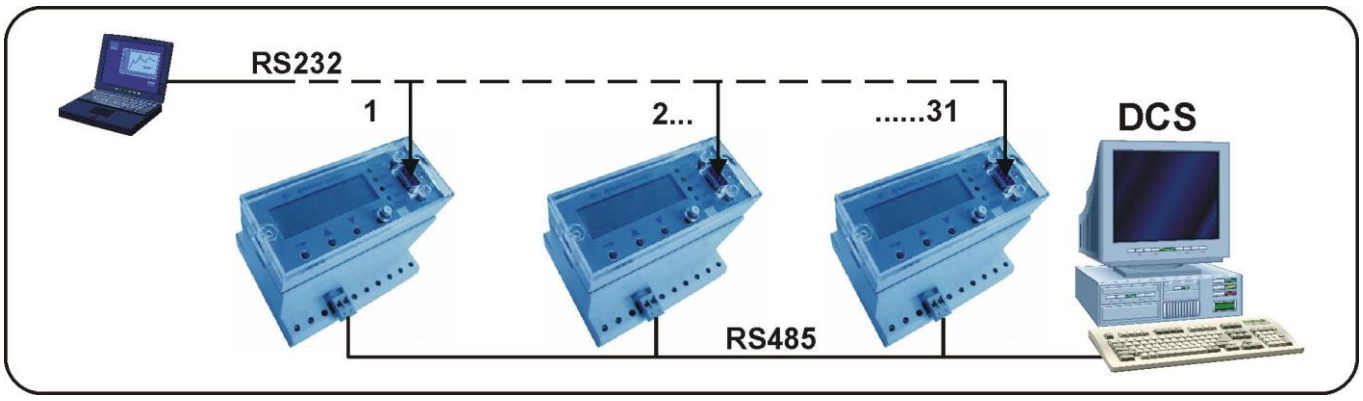


a)	Green LED	**PWR/ I.R.F.**	❑ Illuminated during normal operation when Power Supply is ON. ❑ Flashing when a Relay Internal Fault is detected.
b)	Red LED	**TRIP**	❑ Flashing when a timed function has started to operate. ❑ Illuminated when any function was tripped, reset takes places either by pressing the reset button and as soon as the C/B closed status is detected (Input current ≥ 3%In)
c)	Button	**RESET**	❑ To Reset after tripping the output relays and the trip signal led.

5. System configuration options

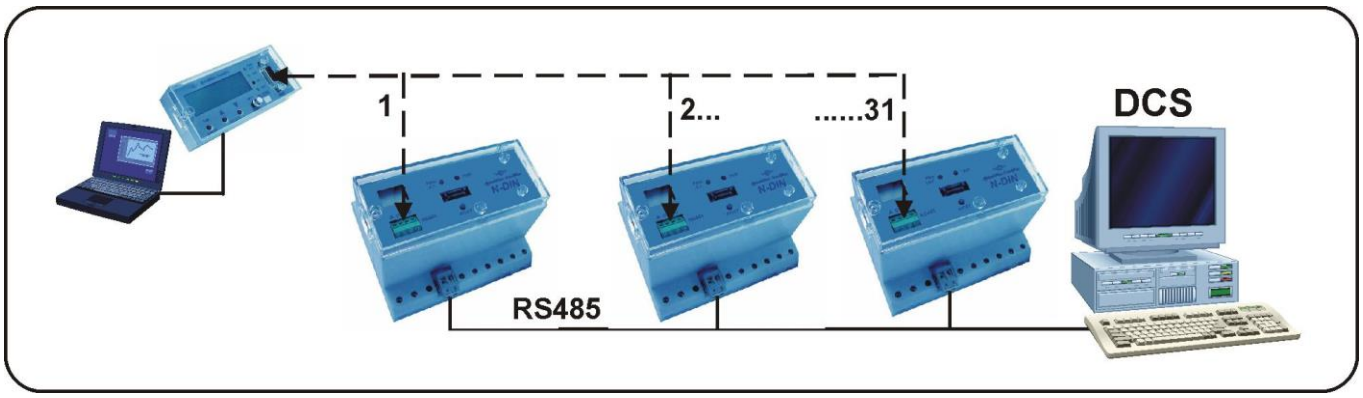
The relay N-DIN is constituted of two independent parts (**RMB** and **FFP**) that can be either used as stand-alone device or combined in different ways.
The FFP can be directly plug-in and fixed by two screws on one RMB or it can be remotely connected to one or more (up to 31) RMB by the relevant terminals.
It is recommended to power-off the RMB modules before plug-in/out or connecting the FFP.

1) Use of one " **RMB** + **FFP** " assembly for each protection unit.

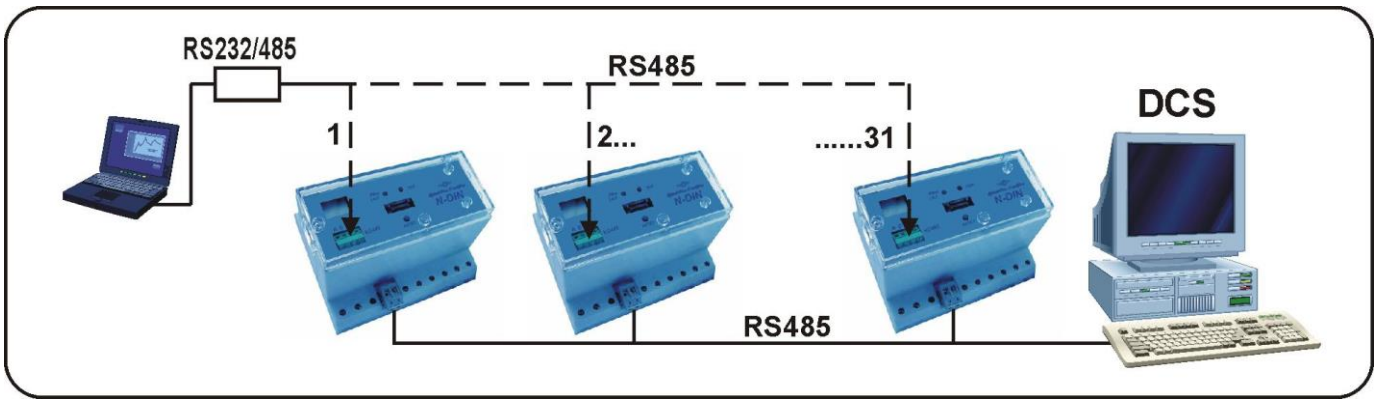


The **FFP** module can be mounted either directly on its **RMB** module or on the front panel of the board connected to the **RMB** by four wires (terminals A, B, +, 0).

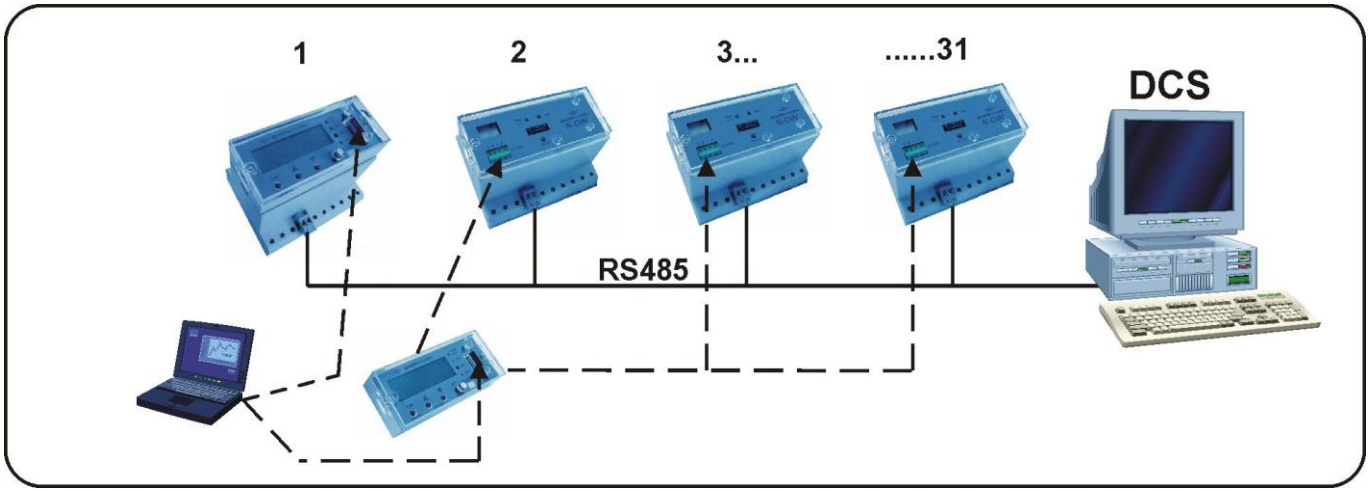
2) Use of up to 31 **RMB** modules managed by only one **FFP**.



3) Use of **RMB** modules only without **FFP**.



4) combination of configuration 1 – 2 – 3.



5.1 - Main communication serial port on the Relay Main Body (RMB)

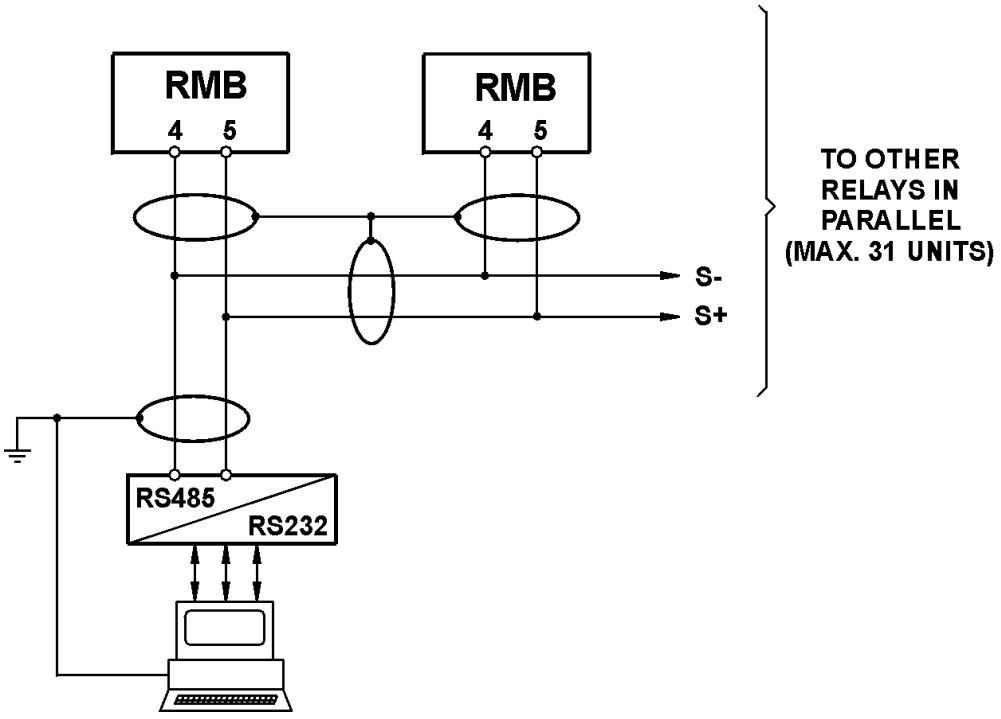
This port is accessible via the plug-in terminals " 4 – 5 " provided on the RMB.
It is used for connection to a serial bus interfacing up to 31 - N-DIN units with the Central Supervision System (SCADA, DCS, ecc).
The serial bus is a shielded pair of twisted cables connecting in parallel (Multi Drop) the different units (slaves) by the relevant terminals available on the " **R**elay **M**ain **B**ody ".
The physical link is RS485 and the Communication Protocol is MODBUS/RTU:
The configuration is selectable:

Baud Rate	:	9600/19200 bps	9600/19200 bps	9600/19200 bps
Start bit	:	1	1	1
Data bit	:	8	8	8
Parity	:	None	Odd	Even
Stop bit	.	1	1	1

Note: any change of this setting became valid at the next power on.

Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C.
A dedicated communication software (MSCom) for windows 95/98/NT4 SP3 (or later) is available.
Please refer to the MSCom instruction manual for more information.
Maximum length of the serial bus can be up to 200m.

CONNECTION TO RS485

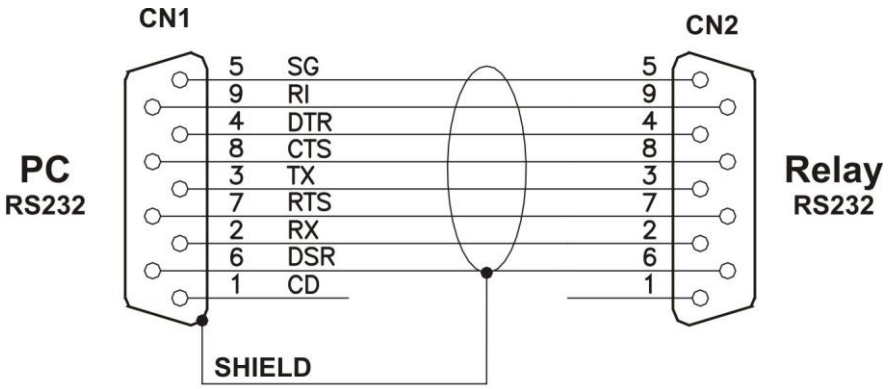


For longer distance and for connection of up to 250 Relays, optical interconnection is recommend.
(please ask Microelettrica for accessories)

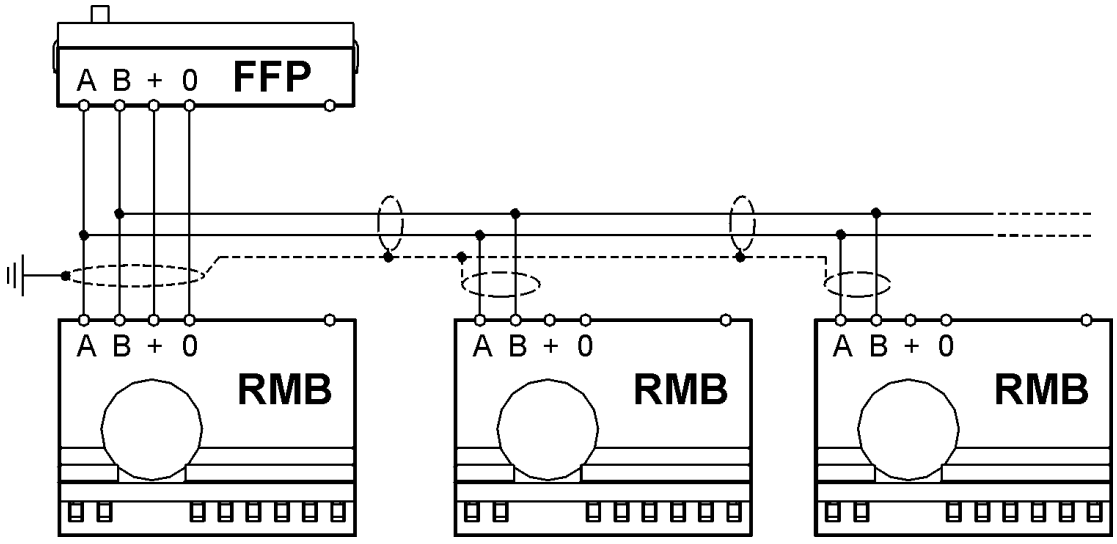
5.2 - Communication Port on Front Face Panel (FFP)

This port is used for communication through the Front Face Panel (FFP) between a local Lap-top PC and any of the RMB connected to the FFP.

The physical link is RS232 by the standard female 9-pin D-sub connector available on the Front Face Panel. Via this Port complete Relay management and data acquisition is possible.
When this serial Port is connected, the Front Face Panel is bypassed, but still in communication with the Relay Main Bodys connected.



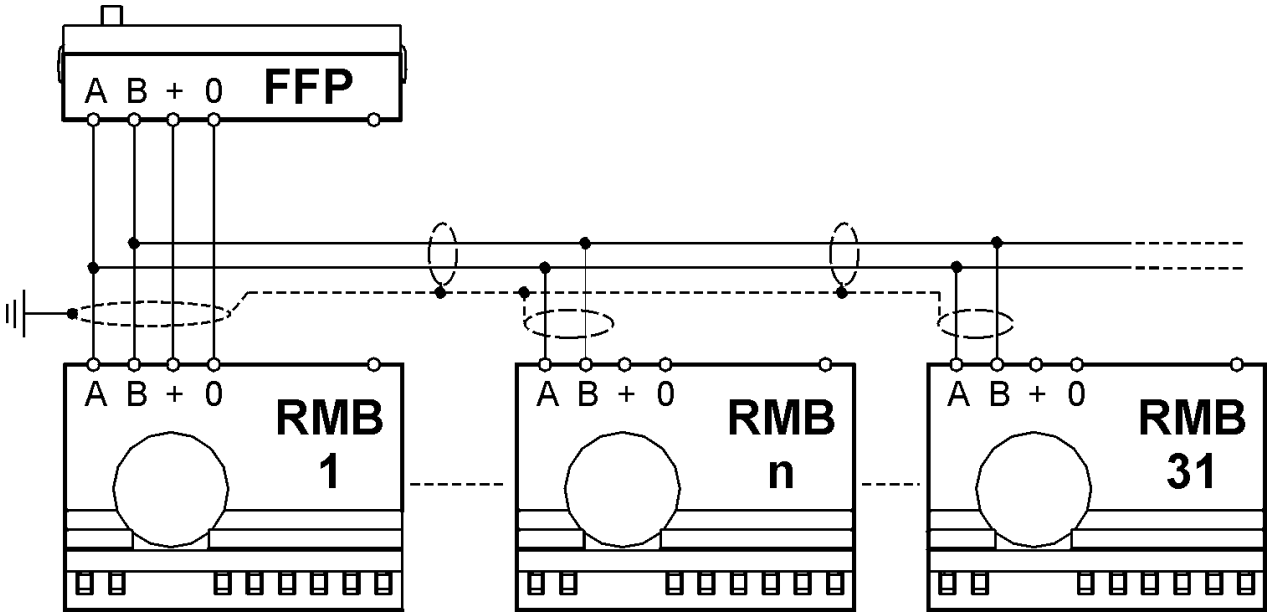
The connection between the " FFP " and the " RMB " (when FFP is removed) is made by four shielded twisted cables connected to the relevant terminals available on the back of the " FFP " and on the front of the " RMB ". All additional RMBs only need a pair of shielded twisted cables.



The terminals on the " RMB "front can also be used for direct connection to a local Lap-top PC through a RS485/232 converter without going through a FFP.

5.3 - Communication between FFP and RMB

As already said, one Front Face Panel can control only one RMB or up to 31 RMB in Multi-Drop connection.



The FFP is powered by one RMB.
Anytime power to " RMB 1 " is switched on, the FFP starts searching the RMBs connected (Scan Network) and, as soon as the first RMB (the one with the lowest address number from 1 to 250) is found the " Scan Network " stops and the RMB starts communicating with the FFP which displays the relevant Real Time Measurement:

- " RTMeas.<RMB ###> "
-
-
-

If communication with another RMB among those connected is required, go to the
" RMB Selection " menu and enter the required address Number.

6. Menu and Variables

6.1 - *Real Time Measurements (Real Time Meas)*

Scrolling display of the Real Time Measurements is the Default operation.
Scrolling can be stopped at any of the measurements and restarted by pressing the Reset button.
When stopped on one variable, ✱ appears aside the measurement and the different available measurements can be selected by the △▽ buttons.

		Display		Description
I	=	0 - 65535	**%In**	Largest of the 3 phase-currents (% of Full Load Current)
IA	=	0 - 65535	**A**	RMS value of Phase A current (RMS Primary Amps)
IB	=	0 - 65535	**A**	RMS value of Phase B current (RMS Primary Amps)
IC	=	0 - 65535	**A**	RMS value of Phase C current (RMS Primary Amps)
Io	=	0.0 - 6553.5	**A**	RMS value of Zero Sequence Current (RMS Secondary Amps)

6.2 - *RMB selection (RMB selection)*

Selection of the Address Number of the RMB to call for communication and Supervision.

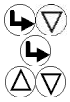
- " Real Time Meas "
- " RMB Selection "
- " Add ### "
- △▽ to input the Address from 1 to 250,
- ↳ to validate,
- ↶ to go back

		Display	Description
Add	=	1 - 250	RMB address number for serial communication

6.3 - *Instantaneous Measurements* (*Instant Measure*)

Real time measurements can be frozen at any moment selecting the menu " Instant Measure ":

- " Real Time Meas "
- " Instant Measure "
- 1st Measurement
- ↶ to go back to " Real Time Meas ".



△▽ other measurements

		Display		Description
I	=	0 - 65535	**%In**	Largest of the 3 phase-currents (% of Full Load Current)
IA	=	0 - 65535	**A**	RMS value of Phase A current (RMS Primary Amps)
IB	=	0 - 65535	**A**	RMS value of Phase B current (RMS Primary Amps)
IC	=	0 - 65535	**A**	RMS value of Phase C current (RMS Primary Amps)
Io	=	0.0 - 6553.5	**A**	RMS value of Zero Sequence Current (RMS Secondary Amps)

6.4 - *Load Profile* (*Load Profile*)

The relay can record the measurement of the feeder current " I " (largest of the 3 phase currents) at programmable time intervals " tLP ".

- " Real Time Meas "
- " Load Profile "
- 1° record,
- to scroll available records,
- to " Record # " selected,
- to select the different fields;

The circular memory (FIFO) can store up to 100 records, each including:

Display				Description
I	=	0 - 65535	**%In**	Largest of the 3 phase-currents (% of Full Load Current)
Date:	=	MM/GG		Record Date
Time:	=	hh/mm		Record Time

- to go back to " Record # ",
- to go back to " Real Time Meas ".

Load profile function can be enabled/disabled and is also possible set a timer "tLP"; the recording is automatic an is done each that the current exceed the 3%In. Recording values are available in "Load Profile" menu.

6.5 - *Operation Counters* (*Oper.Counters*)

The operation of any of the function here below reported, is counted and recorded in the menu " Operation Counters ".

- " Real Time Meas "
- " Oper.Counters "
- 1º counters
- to go back to " Real Time Meas".

other counters

Display			Description
I>	=	0 – 65535	Number of 1st Overcurrent element
I>>	=	0 – 65535	Number of 2nd Overcurrent element
I>>>	=	0 – 65535	Number of 3rd Overcurrent element
Io>	=	0 – 65535	Number of 1st Earth Fault element
Io>>	=	0 – 65535	Number of 2nd Earth Fault element
RTD	=	0 – 65535	Number of External Termistor RTD
BF	=	0 – 65535	Number of operation of Breaker Failure
I.R.F.	=	0 – 65535	Number of Internal Relay Faults
H.R.	=	0 – 65535	Number of Hardware Restore

6.6 - *Event Recording* (*Event Records*)

The N-DIN records any tripping and stores the information relevant to the last five events (FIFO).
Each event recording includes the following information.

- " Real Time Meas "
- " Event Records "
- 1st event,
- to scroll available events,
- to " Record # " selected,
- to select the different fields;

Display				Description
Func		**xxxxx**		Indication of the protection function which caused the relay tripping. For indication of the TRIP Cause the following acronyms are used: - **I>** = 1st Overcurrent element - **I>>** = 2nd Overcurrent element - **I>>>** = 3rd Overcurrent element - **Io>** = 1st Earth Fault element - **Io>>** = 2nd Earth Fault element - **RTD** = External Termistor - **IRF** = Internal Relay Fault
Date	=	YYYY/MM/GG		Date: Year/Month/Day
Time	=	hh:mm:ss:cc		Time: hours/minutes/second/hundredths of seconds
IA	=	0 – 65535	**A**	RMS value of phase A current (Primary Amps)
IB	=	0 – 65535	**A**	RMS value of phase B current (Primary Amps)
IC	=	0 – 65535	**A**	RMS value of phase C current (Primary Amps)
Io	=	0.0 – 6553.5	**A**	RMS value of Zero Sequence Current

- to go back to " Record # ",
- to go back to " Real Time Meas ".

6.7 - *Programming / Reading the Relay Settings* (*R/W Setting*)

- " Main Menu "
- select " R/W Setting "
- select among following sub menus

6.7.1 - Communication Address (Comm. Add.)

- " Communication Address "
- " Add: # "
- " Password ???? "
- to select the Address (1-250)
- to validate.

(if not yet entered; see § Password)

The default address is 1.

Display		Description	Setting Range	Step	Unit
Add:	1	Identification number for connection on serial communication bus	1 - 250	1	-

6.7.2 - Time/Date (Time/Date)

- ▲▼ " Time/Date "
- ↳ " 20YY/…… "
- ↳ " 20XX/MM "
- ↳ " 20XX/XX/DD "
- ↳ " 20XX/XX/XX "
- ↳ " hh/mm "
- ↳ " XX/mm "
- ↳ To validate
- ↶ Exit

↳ Date: Current Date, Time: Current time
▲▼ to set year,
▲▼ to set month,
▲▼ to set day,

▲▼ to set hour,
▲▼ to set minutes,

6.7.3 - Rated Input Values (Rated Input Values)

- ▲▼ " Rated Input Value "
- ↳ 1st Variable
- ▲▼ to scroll variables
- ↳ to modify selected variable
- " Password ???? " (if not yet entered) or #??? (if not yet entered; see § Password)
- ▲▼ to set variable value,
- ↳ to validate.

Display			Description	Setting Range			Step	Unit
Rsrvd			Reserved					
RI	60	-	Ratio of the phase C.Ts. (Ip/Is)	1	-	6500	1	-
RIo	100	-	Ratio of the C.Ts. or of the tore C.T. detecting earth fault current	1	-	6500	1	-
In	300	**A**	Full Load current of the feeder	1	-	6500	1	A
Freq	50	**Hz**	System rated frequency	50	-	60	10	Hz

6.7.4 - Functions (Functions)

- ▲▼ " Functions ",
- ↳ 1st function,
- ▲▼ to scroll available Functions,
- ↳ to Read/Write setting of the selected function,
- ▲▼ to select the different definable fields;
  - Function Enable
  - Options
  - Trip Levels
  - Timers
- ↳ to access the selected field and read the actual setting of the relevant variable
- ↳ to modify the actual setting;
- ▲▼ to set the new value.

Function	Type		Display Variable	Default	Unit	Description	Setting Range	Step
Password		=	0000-9999	1111	-	Password for programming enable		
I>(1F51)	**FuncEnable**	→	**Status:**	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	**OUT**	R2		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
			TCC	D	-	Time Current Curves	D,A,B,C	-
	TripLevels	→	**I>**	120	**%In**	Minimum operation level	20 – 120	1
	Timers	→	**tI>**	60	**s**	Trip time delay	0.05 – 60.00	0.01
I>>(2F51)	**FuncEnable**	→	**Status:**	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	**OUT**	R1		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→	**I>>**	200	**%In**	Minimum operation level	20 – 500	1
	Timers	→	**tI>>**	0.1	**s**	Trip time delay	0.05 – 60.00	0.01

Function	Display Type		Variable	Default	Unit	Description	Setting Range	Step
I>>>(3F51)	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	OUT	R2		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→	I>>>	1500	%In	Minimum operation level	80 – 1500	1
	Timers	→	tI>>>	0.2	s	Trip time delay	0.05 – 0.20	0.01
Io>(1F64)	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	OUT	R1		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→	Io>	200	mAs	Minimum operation level	10-200	1
	Timers	→	tIo>	1	s	Trip time delay	0.05 – 1.00	0.01
Io>>(2F64)	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	OUT	R1		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→	Io>>	100	mAs	Minimum operation level	100-5000	1
	Timers	→	tIo>>	0.2	s	Trip time delay	0.05 – 0.20	0.01
BF(F51BF)	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	OUT	R2		Selection of the output relay operated at the end of trip time delay	R2, None	-
	TripLevels	→		No Parameters				
	Timers	→	tBF	0.75	s	Time delay for Breaker Failure alarm	0.05 - 0.75	0.01
RTD(F26)	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	OUT	R1+R2		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→		No Parameters				
	Timers	→		No Parameters				
OperMod	FuncEnable	→		No Parameters				
	Options	→	Op_R1	N.D.		For selection of different operation	N.E./N.D.	-
			Op_R2	N.D.		For selection of different operation	N.E./N.D.	-
			Ctrl	Local		Control mode Local / Remote (via serial)	Local – Remote	-
	TripLevels	→		No Parameters				
	Timers	→		No Parameters				
LoadPro	FuncEnable	→	Status:	Enable		Enable of the Load Profile function	Enable/Disable	-
	Options	→		No Parameters				
	TripLevels	→		No Parameters				
	Timers	→	tLP	1	m	Interval time	1-650	1
IRF	FuncEnable	→		No Parameters				
	Options	→	OpIRF	NoTrip		Relay internal fault	NoTrip – Trip	-
			Out	None		Selection of the output relay operated at the end of trip time delay	R1, R2, R1 + R2, None	-
	TripLevels	→		No Parameters				
	Timers	→		No Parameters				
Main Comm Par	FuncEnable	→		No Parameters				
	Options	→	Mode	8,n,1		RMB main RS485 port configuration ***Note**: any change of this setting became valid at the next power on*	8,n,1 8,o,1 8,e,1	-
			BaudR	9600		Communication speed	9600 - 19200	-
	TripLevels	→		No Parameters				
	Timers	→		No Parameters				

Settings can also be programmed via the serial communication ports.

6.8 - *Commands (Commands)*

- ↳ " Commands "
- ↳ 1st Control,
- △▽ to select other available control,
- ↳ to operate selected control.

Display		Description
Clear	:	Erase memory of Trip Counters, Event Records, Load Profile
Test	:	Starts a relay diagnostic test
Set D2	:	Operate output relay R2
Reset D2	:	Reset output relay R2
Reset	:	Reset after trip of R1&R2

6.9 - *Firmware - Info&Version - (Version&Info)*

The menu displays the Model Relay and the Firmware Version of the FFP and of the RMB actually in communication.

- " Real Time Meas " ↳
- △▽ " Info&Version ",
- ↳ " Proctect. Model ",
- ↳ " Mod. XXXXXX ",
- ↶ to go back to " Proctect. Model ",
- △▽ to " FrontFacePanel ",
- ↳ " Version ##.##.## ",
- ↶ to go back to "FrontFacePanel ",
- △▽ to " RelayMainBody ",
- ↳ " Version ##.##.## ",
- ↶ to go back to "RelayMainBody ",
- ↶ to go back to " Info&Version ".
- ↶ to go back to " Real Time Meas ".

7. Password

In the system RMB + FFP + MS-Com there are three different passwords:

7.1 - FFP Password

This password is requested anytime the user wants to write in the “R/W Settings” menu of the FFP and/or to issue from the FFP a command of the “Commands” menu.

The default password is “ 1111 “

When password is required, proceed as follows

The Display shows the message “ Password ???? “

- △▽ to select 1st digit (1-9) ↳ to validate
- △▽ to select 2nd digit (1-9) ↳ to validate
- △▽ to select 3rd digit (1-9) ↳ to validate
- △▽ to select 4th digit (1-9) ↳ to complete procedure.

The “ password “ is required any time you attempt to modify one of the programmable variables at the first entrance in the “R/W Settings” and/or “Commands” menus.
The “ password “remains valid for 2 minutes from the last operation of the programming buttons or until the ↩ button is pressed to return to the default display (RT Meas).
Once the FFP Password has been entered, a “ # “ appears before the variable that can be modified.

CHANGE PASSWORD

In order to CHANGE the FFP Password:

- Open the MS-Com software and connect the relay
- Open the “Settings” window
- Digit the new password (different from the default one – Example: 1234) in the “FFP Password” area (see fig. 1).
  Note: Any time the software MSCom is opened, the FFP Password (see §7.3) is not visualized (see fig. 2) and cannot be modified until the MSCom Password is not entered by clicking the button 🔑.
- Click on the “Send” button to confirm the modification to the relay.

Fig.1

Fig.2

7.2 - Modbus Password

This Password is requested to a Supervision System any time the automation is programmed to modified whichever relay parameter and/or to issue commands through the relay itself.

DEFAULT STATUS (DISABLED): Password = 2295 at Address 8001

When set to the value 2295, the password is DISABLED and a DCS or whichever Supervision System can be programmed to both change the relay parameters and to issue commands through the relay itself without writing any password.

ENABLED/DISABLED PASSWORD:

In order to ENABLE the Modbus Password the Supervision System must write the desired password (different from the default one) at the Address 8001.
In order to DISABLE the Modbus Password the Supervision System must write once the DEFAULT Password (2295) at the Address 8001.

7.3 - MS-Com Password

This password is requested anytime the user wants to send to the relay a setting parameters modification or to issue a command through the relay itself using the managing software MSCom.
The user can decide whether inserting his own password (see MS-Com Operational Manual) or keeping the password disabled just clicking on the OK button when the password is requested.

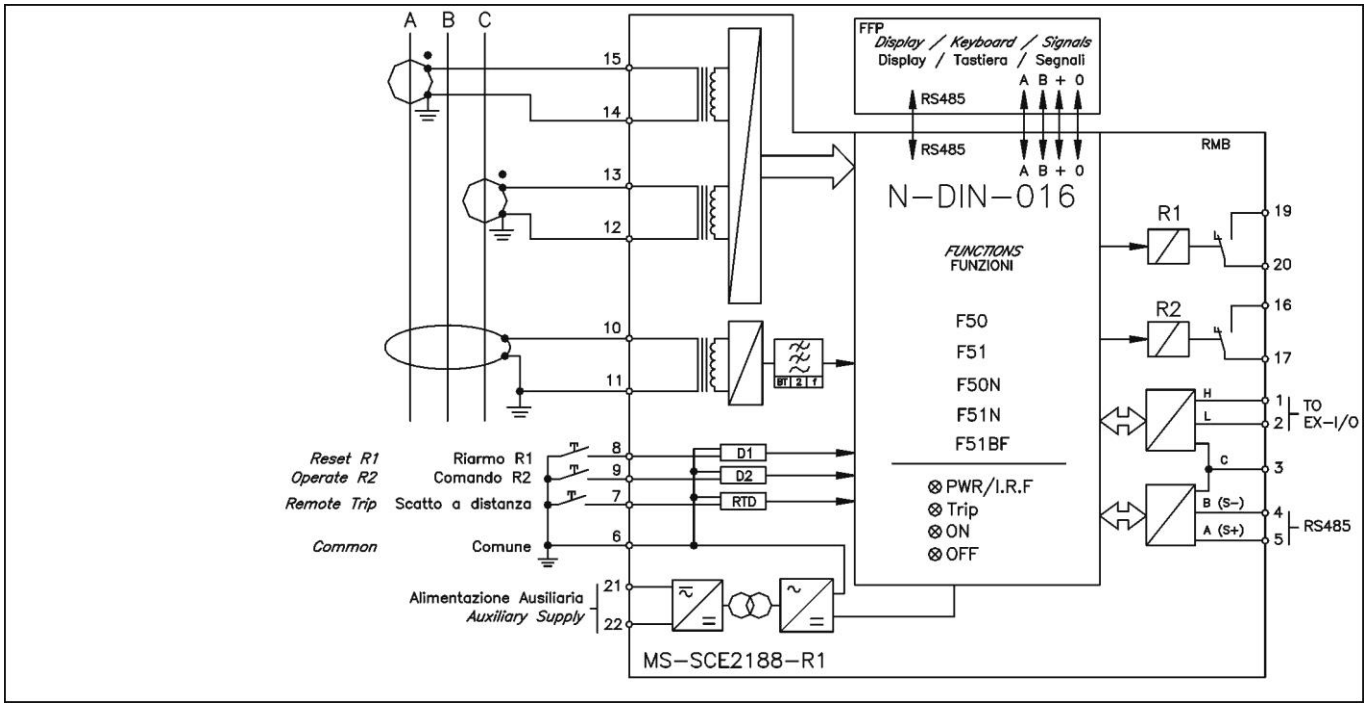
8. Maintenance

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

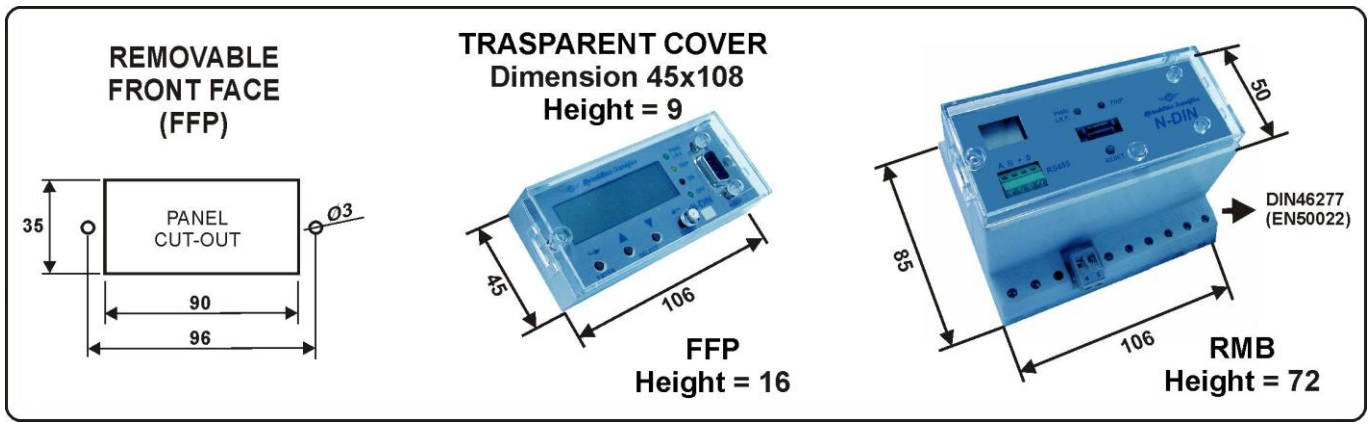
9. Power frequency Insulation Test

Every relay individually undergoes a factory insulation test according to IEC60255-5 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.

10. Wiring Diagram



11. Overall Dimensions



1) To mount FFP on RMB plug-in the connector and tighten the two screws.

2) To remove FFP from RMB loosen the two screws and pull-out.

Note: Before plugging in removing the FFP, the Auxiliary Power Supply must be switched OFF

N.B.

A sealable transparent cover is also available for protection of the controls on the removable Front Panel. – To remove the cover slightly pull the side fastening clips.

12. Electrical Characteristics

Approval: CE
Reference Standards IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

❑	Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.	
❑	Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50μs	
❑	Insulation resistance	> 100MΩ		
Environmental Std. Ref. (IEC 68-2-1 - 68-2-2 - 68-2-33)				
❑	Operation ambient temperature	-10°C / +55°C		
❑	Storage temperature	-25°C / +70°C		
❑	Humidity	IEC68-2-3 RH 93% Without Condensing AT 40°C		
CE EMC Compatibility (EN50081-2 - EN50082-2 - EN50263)				
❑	Electromagnetic emission	EN55022	industrial environment	
❑	Radiated electromagnetic field immunity test	IEC61000-4-3 ENV50204	level 3	80-1000MHz 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 4	6kV contact / 8kV air
❑	Power frequency magnetic test	IEC61000-4-8		1000A/m 50/60Hz
❑	Pulse magnetic field	IEC61000-4-9		1000A/m, 8/20μs
❑	Damped oscillatory magnetic field	IEC61000-4-10		100A/m, 0.1-1MHz
❑	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		50ms
❑	Resistance to vibration and shocks	IEC60255-21-1 - IEC60255-21-2 10-500Hz 1g		
Electric Rated Value				
❑	Accuracy at reference value of influencing factors	2% In 2% On 2% +/- 20ms	for measure for times	
❑	Rated Current	In = 5A - On = 1A		
❑	Phase current measuring dynamic	0.05 – 80 A		
❑	Neutral current measuring dynamic	0.01 – 5 A		
❑	Phase current overload	10A continuous; 200 A for 1 sec		
❑	Neutral current overload	5A continuous; 50 A for 1 sec		
❑	Burden on current inputs	Phase : 0.05VA at In = 5A Neutral : 0.1VA at On = 1A		
❑	Average power supply consumption	≤ 7 VA		
❑	Output relays	rating 6 A; Vn = 250 V A.C. resistive switching = 1500VA (400V max) make = 30 A (peak) 0,5 sec. break = 0.2 A, 110 Vcc, L/R = 40 ms (100.000 op.)		
Communication Parameters				
❑	RMB	RS485 – 9600/19200bps – 8,n,1 - 8,e,1 - 8,o,1 – Modbus RTU		
❑	FFP	RS232 – 9600bps – 8,n,1 – Modbus RTU		

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