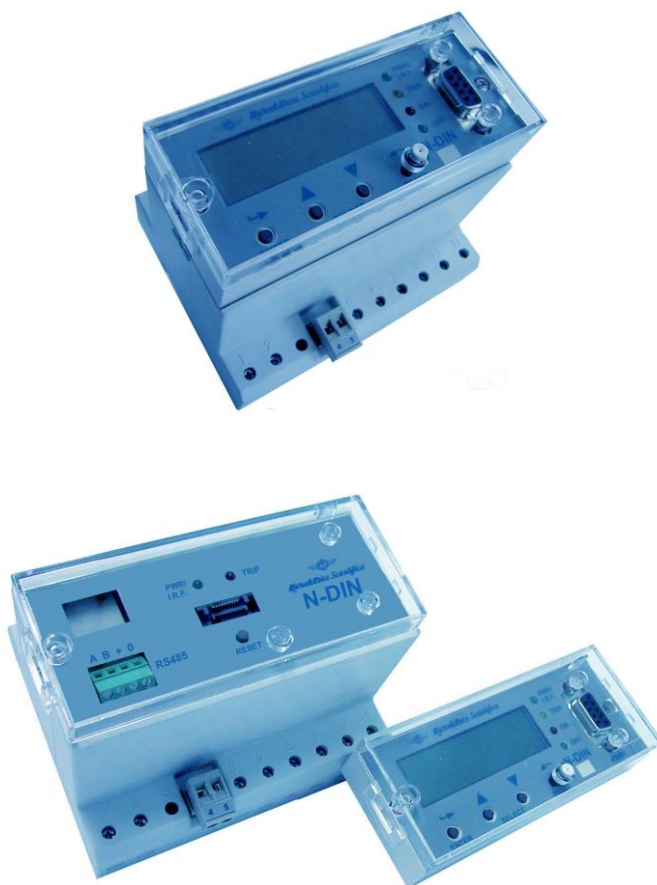


MICROPROCESSOR MOTOR PROTECTION RELAY

TYPE

N-DIN-M₁₉

OPERATION MANUAL



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PROTECTION FUNCTION / PARAMETERS LEGEND

IEC SYMBOL	PROTECTION FUNCTION	TRIP LEVEL	TIME DELAY
F51	Overcurrent	$I >$	$tI >$ [s]
F64	Earth Fault	$I_{o} >^{(1)}$	$tI_{o} >$ [s]
F37	Undercurrent (No load run)	$I <$	$tI <$ [s]
F51LR	Locked Rotor	I_{LR}	tLR [s]
F49	Thermal Image	T_{al}/T_{st}	----
F46	Unbalance	$I_{2} >$	$tI_{2} >$ [s]
F66	Start N° Limitation	$StNo$	$tStNo$ [m]
F48	Start Sequence Control and too long start	$I_{tr}^{(2)}$	tTr [s]

Note 1 : “ $I_{o} >$ ” is the trip level set in “mA” at the secondary of the CTs.
Example : $R_o = 100$
Primary trip level = 1A
Secondary trip level = $I_{o} > = 100mA$

Note 2 : Start Sequence Control works only when the relay is set in “Star/Delta” Operation Mode

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; dismantling 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 - Waste Disposal of Electrical & Electronic Equipment

(Applicable throughout the European Union and other European countries with separate collection program).

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

1.11 - Fault Detection And Repair

Internal calibrations and components should not be altered or replaced.

For repair please ask the Manufacturer or its authorized Dealers.

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

2. GENERAL CHARACTERISTICS

N-DIN is a very versatile and complete Motor Protection Relay suitable for any size of induction motors. 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 Motor 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 (see § 5.3).

This unique feature allows to have all controls and measurements available on the switchboard front panel including local connection to a Lap-top PC (with MSCom software) 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:

- Rated continuous current 5A
 - Overload: 10A continuous – 200A for 1s
 - Phase current measuring dynamic: (0.05-50)A
 - Neutral current measuring dynamic: (0.01-10)A
- Three optoisolated, selfpowered 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 ($R \leq 3k\Omega$); The input RTD is activated when the resistance connected across its terminals exceeds 2900 Ω or is below 30 Ω .
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 and self protected.

Two options are available:

- | | | | |
|--------|-----------------------------|--------|-----------------------------|
| a) - { | 24V(-20%) / 110V(+15%) a.c. | b) - { | 80V(-20%) / 220V(+15%) a.c. |
| | 24V(-20%) / 125V(+20%) d.c. | | 90V(-20%) / 250V(+20%) d.c. |

Before energizing 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
Freq 50 Hz	System rated frequency	50 - 60	10	Hz
RI 100 -	Ratio of the phase C.Ts. (Ip/Is)	1 - 6500	1	-
Rlo 100 -	Ratio of the C.Ts. or of the tore C.T. detecting earth fault current.	1 - 6500	1	-
Im 100 A	Motor full-load current	1 - 6500	1	A
Ist 500 %Im	Motor start-up current (% of motor full load current)	50 - 999	1	%Im
tst 5 s	Motor starting time	1 - 120	1	s
tm 15 m	Motor warming-up time constant	1 - 60	1	m
to/tm 3 -	Steady/Running Motor time constant ratio	1 - 10	1	-
Ib 105 %Im	Maximum admissible continuous overload	100 - 130	1	%Im

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 the value of the Ratio $RI = \frac{I_{n \text{ primary}}}{I_{n \text{ secondary}}}$ of the phase C.Ts must be input (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:

$$(1) \quad \bar{I}_A + \bar{I}_B + \bar{I}_C + \bar{I}_0 = 0$$

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

$$(2) \quad \bar{I}_A + \bar{I}_B + \bar{I}_C = 0 \Rightarrow \bar{I}_B = -(\bar{I}_A + \bar{I}_C)$$

The earth fault protection element is independently supplied by the residual current coming either from the residual connection of the 3 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:

$$\begin{cases} \bar{I}_A = \bar{I}_1 + \bar{I}_2 \\ \bar{I}_C = \alpha \bar{I}_1 + \alpha^2 \bar{I}_2 \end{cases} \Rightarrow \begin{cases} \bar{I}_C - \alpha \bar{I}_A = I_2(\alpha^2 - \alpha) \\ \bar{I}_C - \alpha^2 \bar{I}_A = \bar{I}_1(\alpha - \alpha^2) \end{cases} \Rightarrow \begin{cases} \bar{I}_2 \sqrt{3} = |\bar{I}_C - \bar{I}_A e^{j120}| \\ \bar{I}_1 \sqrt{3} = |\bar{I}_C - \bar{I}_A e^{j120}| \end{cases}$$

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 (*Rlo*)

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 of the Earth Fault element is supplied by the residual connection of the 3 phase C.Ts., we shall set for the ratio “ **Rlo** ” the same value as “ **RI** ”.

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

2.2.2.4 – Motor rated full load current “ *Im* ”

“ **Im** ” is the Motor Rated Current reported on motor data label.

2.2.2.5 – Motor Locked Rotor current “ *Ist* ”

“ **Ist** ” is the current absorbed by the motor at start-up; this value is also reported on motor data label.

2.2.2.6 – Motor Starting Time “ *tst* ”

“ **tst** ” is the time it takes for the motor to accelerate from zero to the rated speed.

If unknown this time can be measured by the N-DIN itself at motor first start.

The figure is displayed in the Real Time as well as in the “Instant Measurement” menus (§6.3).

2.2.2.7 – Running Motor warming-up Time Constant “*t_m*”

“**t_m**” is a characteristic parameter of the motor.

	IEC Class	t _m [min]
IEC Motor Thermal Overload Class corresponds to the following values of the warming-up time constant	5	3
	10	6
	15	9
	20	12
	25	15
	30	18

2.2.2.8 – Ratio of the steady state motor time constant to the running motor time constant “*t_o/t_m*”

When motor is steady its ventilation and cooling conditions may be different from when it is running.

“**t_o/t_m**” takes properly account of this.

2.2.2.9 – Maximum admissible motor continuous overload current “*I_b*”

Setting “**I_b**” corresponds to deciding what level of overload the thermal image protection must continuously tolerate.

Warming-up is proportional to the square of the current.

Example : $I_b = 105\%I_m$

Means that the function F49 will trip when the computed motor warming reaches $1.05^2 \times 100 = 110.25\%$ of the temperature corresponding to the motor continuous full load operation.

2.2.3 – Functions and Settings

2.2.3.1 - F51 - Overcurrent protection

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	Minimum Pick-up Current level in at least one phase : $I_b = (100-999)\%I_m$, step 1% I_m (limited to 50A secondary)	
- Trip time delay	:	$t_{l>} = (0.05-9.99)s$, step 0,01s.	

2.2.3.2 - F64 - Earth Fault protection

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	<i>Minimum Zero Sequence Residual Current Pick-up level :</i> Io> = (20-9999)mAs, step 1mAs	
- Trip time delay	:	tIo> = (0.05-9.99)s, step 0.01s.	

The setting “ Io> “ is given in Secondary Amps (current following through the relay's input terminals).

The set value [Io>] multiplied by the set value [RIo], gives the Primary value of “ Io> “.

$$[Io>] \times [RIo] = (Io> \text{ Primary Amps})$$

Example:

A)

-Set value: Io> = 40 mAs (Secondary Current)

-CT ratio: RIo = 100/1

-Primary Trip Level : $40 \times 100 = 4000 \text{ mAp} = 4 \text{ Ap}$ (Primary Current)

B)

-Required Primary Trip Level: Io> = 4 Ap

-CT ratio: RIo = 100/1

-Io> Set = $4 / 100 = 0.04 \text{ As} = 40 \text{ mAs}$

2.2.3.3 – Too long starting protection and Starting Sequence Control

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	Switch-over (transition) current: $I_{Tr} = (10-999)\%I_m$, step $0.1\%I_m$ (limited to 50A)	
- Trip time delay	:	Maximum switch-over (transition) time delay: $t_{Tr} = (0.1-60)s$, step $0.1s$.	

A – Too long starting (rotor jam) protection

In the “ Direct On Line “ as well as in the “ Reversing “ operation modes, this element operates as follows:

At motor start, counting of “ t_{Tr} “ begins; if the current absorbed by the motor stays above the set level “ I_{Tr} “ for longer than “ t_{Tr} “, the Locked Rotor element is tripped and the motor stopped.

If starting takes place normally, as soon as motor current drops below “ I_{Tr} “, the duration of the starting (t_{St}) is recorded and displayed in the Real Time Measurements menu.

B – Automatic Two-Step starter control (example Star-Delta starter)

When the “ Two-Step “ operation mode is programmed, the N-DIN operates as follows (see § 7):

On start command, R2 output relay is energized and after 0.1s also R1 is energized: the motor starts running (Star condition) and the time “ t_{Tr} “ begins counting.

If within “ t_{Tr} “ the motor current drops below the “ I_{Tr} “ set value, R2 is deenergized and the second step transition (Star to Delta) is operated.

If, after start command, the motor current stays above the set level “ I_{Tr} “ for longer than “ t_{Tr} “, the Locked Rotor element is tripped and the motor stopped.

2.2.3.4 - F37 - No-Load Running protection

This function performs the protection against no-load running: it is activated when the larger of phase currents drops below the set level [$I_{<}$].

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	Under current level: $I_{<} = (10-100)\%I_m$, step $1\%I_m$. When current is below $10\%I_m$ in all phases the function is disactivated.	
- Trip time delay	:	$t_{I_{<}} = (0.1-60)s$, step $0.1s$.	

2.2.3.5 – F51LR – Locked Rotor Protection

At motor starting this function is disabled for twice the set starting time “ **[tSt]** ” : when this time has elapsed, if current exceeds the set level “ **ILR** ”, the relay trips with a delay of “ **tLR** ” sec.

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	<i>Current level</i> : ILR = (50-500)Im, step 1Im.	
- Trip time delay	:	tLR = (1-60)s, step 1s	

- *Inhibition time of the locked rotor function*: **2[tSt]**

tSt = (1-120)s, step 1s = motor start-up time

The function is also instantaneously tripped by “ **Itr** ” (see § 2.2.3.3)

2.2.3.6 - Limitation of the Starts Number of consecutive starting

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	<i>Allowed Number of startings</i> : St No = (1-60), step 1	
- Trip time delay	:	Time interval in which the StNo is counted: tStNo = (1-60)m, step 1m. (m= minutes) <i>Restart Inhibition time</i> : tBst = (1-60)m, step 1m. (m= minutes)	

Each starting is counted and stored into memory for “ **tStNo / StNo** ” minutes.

If the number of counted startings present in the memory exceeds “ **StNo** ”, the restarting is inhibited for the time “ **tBst** ”.

2.2.3.7 – F49 – Thermal Image (See curves)

The current “ I ” producing motor warming-up is computed as a conventional composition of Positive Sequence “ I₁ ” and Negative Sequence “ I₂ ” components of the motor current.

- Computed current: $I = \sqrt{I_1^2 + 3I_2^2}$
- Allowed overloading time (See Curve § 15)

The trip time delay “ t ” of the thermal element, depends on the warming-up time constant “ t_m ” of the motor, on the previous thermal status (I_p/I_m)², on the admissible continuous overload (I_b) and, of course, on the actual load (I)

$$t = t_m \ln \left[\frac{(I/I_m)^2 - (I_p/I_m)^2}{(I/I_m)^2 - (I_b/I_m)^2} \right] \quad \text{where :}$$

t_m	=	Warming up time constant	(1-60)min.
I	=	computed current	
I_p	=	preheating current	
I_b	=	continuously admissible current	(100-130)%I _m , step 1%I _m (§ 9.5)
I_m	=	motor rated current	(10-6500)A, step 1A (§ 9.5)
ln	=	natural logarithm	

- Steady motor *cooling-down* time constant: **t_o** = (1-10)t_m, step 1t_m

The cooling-down time constant of the motor when running is “t_m”; it is automatically changed to “ t_o ” when the motor current drops below 0.1 I_m (running/steady motor discrimination level).

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	<i>Thermal prealarm</i> : Tal = (50-110)%T _n , step 1%T _n <i>Restart inhibition</i> : Tst = (10-100)%T _n , step 1%T _n	
- Trip time delay	:	No Parameters	

An alarm signal is issued when the computed warming exceeds the set percentage “ Tal ” of the motor steady Full Load temperature T_n, and motor restart is inhibited until the motor has cooled down below “ Tst ”.

2.2.3.8 - F46 - Current Unbalance (Negative Sequence Current) protection

Besides its contribution to the thermal image algorithm, current unbalance also controls another time delayed element which can be used for single phasing or unbalance protection

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	<i>Minimum Negative Sequence current operation level</i> : I2> = (10-99)%I _m , step 1%I _m .	
- Trip time delay	:	tI2> = (0.1-60)s, step 0.1s	

N.B.: During Single phase running the ratio of the negative sequence current component to the total current absorbed by the motor is approximately 0.577.

2.2.3.9 – Operation Mode

When programming the “ Functions “ (see page 20) the menu “ OperMode “, includes two submenus:

2.2.3.9.1 – “ OpMode “

For selection of different operation modes of the Output Relays (R1, R2) and of the Digital Inputs (D1, D2).

Operation mode	Relay R1			Relay R2		
	Pick-up	Drop-out	Reset	Pick-up	Drop-out	Reset
D lo>=R2	Power On	Trip of any protection function except lo>	- Close D1 (*) - Reset Button	-Trip lo>	- Close D2 (*) - Reset Button	- Close D2 (*) - Reset Button
D Tal=R2	Power On	Trip of any protection function including lo>	- Close D1 (*) - Reset Button	-Thermal alarm T> [Tal]	- Close D2 (*) - Reset Button	- Close D2 (*) - Reset Button
Two Step	- 0.1s after - D1 & D2= On	- Trip of any prot. function - I<5%Im	Automatic	- D1 & D2= On	- I < [Itr]	-----
Revers.	- D1 = On and - D2 = Off	- Trip of any prot. function - I<5%Im - D2 = On	Automatic	D2 = On and D1 = Off	- Trip of any prot. function - I<5%Im - D1 = On	Automatic

D = Direct-On-Line with external motor control

Two-Step = Automatic control of Reduced-Voltage Starter

Revers. = Control of Reversing motor through N-DIN

(*) In the “ D “ modes, Reset after tripping of a protection function, when the trip cause has been cleared, takes place:

- By closing the Digital Input D1: this only resets the output relay R1; the trip signal led remains ON until the motor is restarted or the reset button is pressed.
If the Digital Input D1 is permanently closed, reset of the output relay R1 takes place automatically as soon as the trip cause is cleared.
- By closing the Digital Input D2: this only resets the output relay R2; the trip signal led remains ON until the motor is restarted or the reset button is pressed.
If the Digital Input D2 is permanently closed, reset of the output relay R2 takes place automatically as soon as the trip cause is cleared.
- Pressing the reset button of the FFP or that on the RMB, either the output relays and the led are reset (if the fault has been cleared).

- Function	:	No Parameters
- Options	:	OpMod <i>D Io>=R2</i> D.O.L. with Io> assigned to R2 <i>D Tal=R2</i> D.O.L. with Ta assigned to R2 <i>Two_Step</i> 2-step reduced voltage start control. <i>Revers.</i> Reversing starter
	Ctrl	<i>For selection between Local/Remote relay control:</i> Local : the Digital Inputs are active and can be controlled on relay RMB. Remote : the Digital Inputs are disactivated and the relay can be controlled via the communication ports or via the front panel FFP. In the [Remote] control mode, the Digital Inputs are ignored: Reset after tripping always manual by the push buttons of FFP and/or RMB or by the communication software control.
- Set level	:	No Parameters
- Trip time delay	:	No Parameters

2.2.3.10 – RTD – F26 – Overtemperature protection

A RTD probe in the motor can be connected to the relevant N-DIN input (terminals 6-7) to stop the motor in case overtemperature is detected.

- Function	:	Status Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters
- Set level	:	No Parameters
- Trip time delay	:	No Parameters

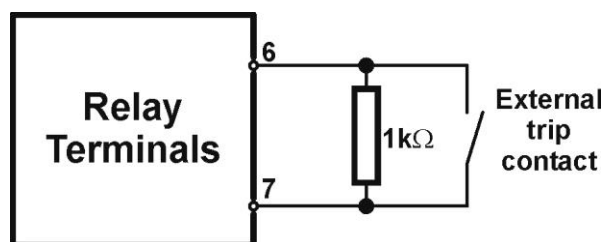
With reference to the resistance value “ R “ of the probe, measured at relay terminals, the operation limits are:

$R < 30\Omega$ = Probe Shorted → Trip

$R > 2900\Omega$ = Overtemperature or Probe Open → Trip

Different probe characteristics require special factory calibration.

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..

2.2.3.11 – Load Profile

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	No Parameters	
- Set level	:	No Parameters	
- Trip time delay	:	tLP = (1-650)m, step 1m	

The Load Profile function, when activated, records the value of current “ I “ (largest of the 3 phase-currents absorbed by the motor) at any motor Start, at every time interval “ tLP “ (tLP programmable 1 – 650 min, step 1min) during run and at motor stop.

Each record is complete with time/date tagging (see § 3.1).

The memory buffer can store up to 100 records.

All the recorded data can be downloaded by the serial communication port and, with MScCom interface program, they are displayed as time/current curve.

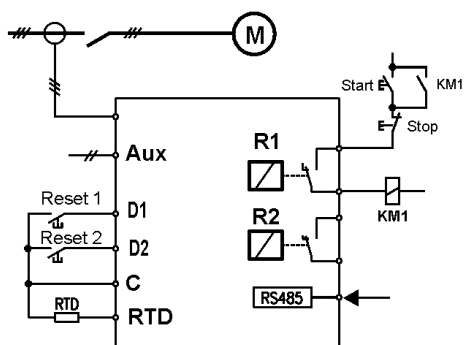
2.2.3.12 – I.R.F. – Internal Relay Failure

- Function	:	Status	Disable/Enable (if disable the function is disactivated)
- Options	:	OpIRF = Trip/NoTrip	
- Set level	:	No Parameters	
- Trip time delay	:	No Parameters	

The variable “ OpIRF “ available in the options of the “ IRF “ function (Internal Relay Failure Diagnostic, see § 2.2.5), 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).

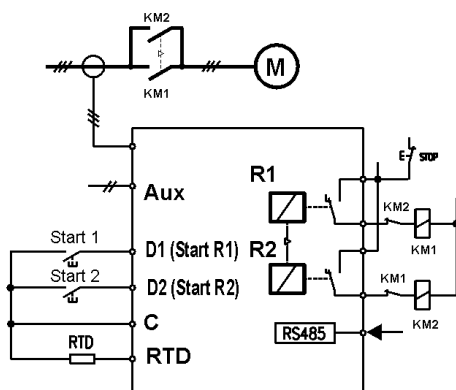
2.2.4 - Application Example

Direct On Line STARTER (Mode D)



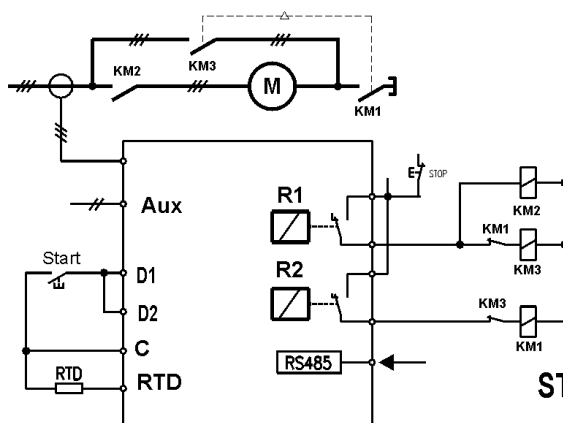
- A) LOCAL RESET CONTROL VIA DIGITAL INPUTS
- B) REMOTE RESET CONTROL VIA RS485

REVERSING STARTER (Mode Revers.)



- A) LOCAL CONTROL VIA DIGITAL INPUTS
- B) REMOTE CONTROL VIA RS485

STAR-DELTA STARTER (Mode Two-step)



START: $\uparrow R2 \dots 0.1s \dots \uparrow R1 \dots t < [T_r] \dots \downarrow R2$

- A) LOCAL CONTROL VIA DIGITAL INPUTS
- B) REMOTE CONTROL VIA RS485

2.2.5 – Selfdiagnostic

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

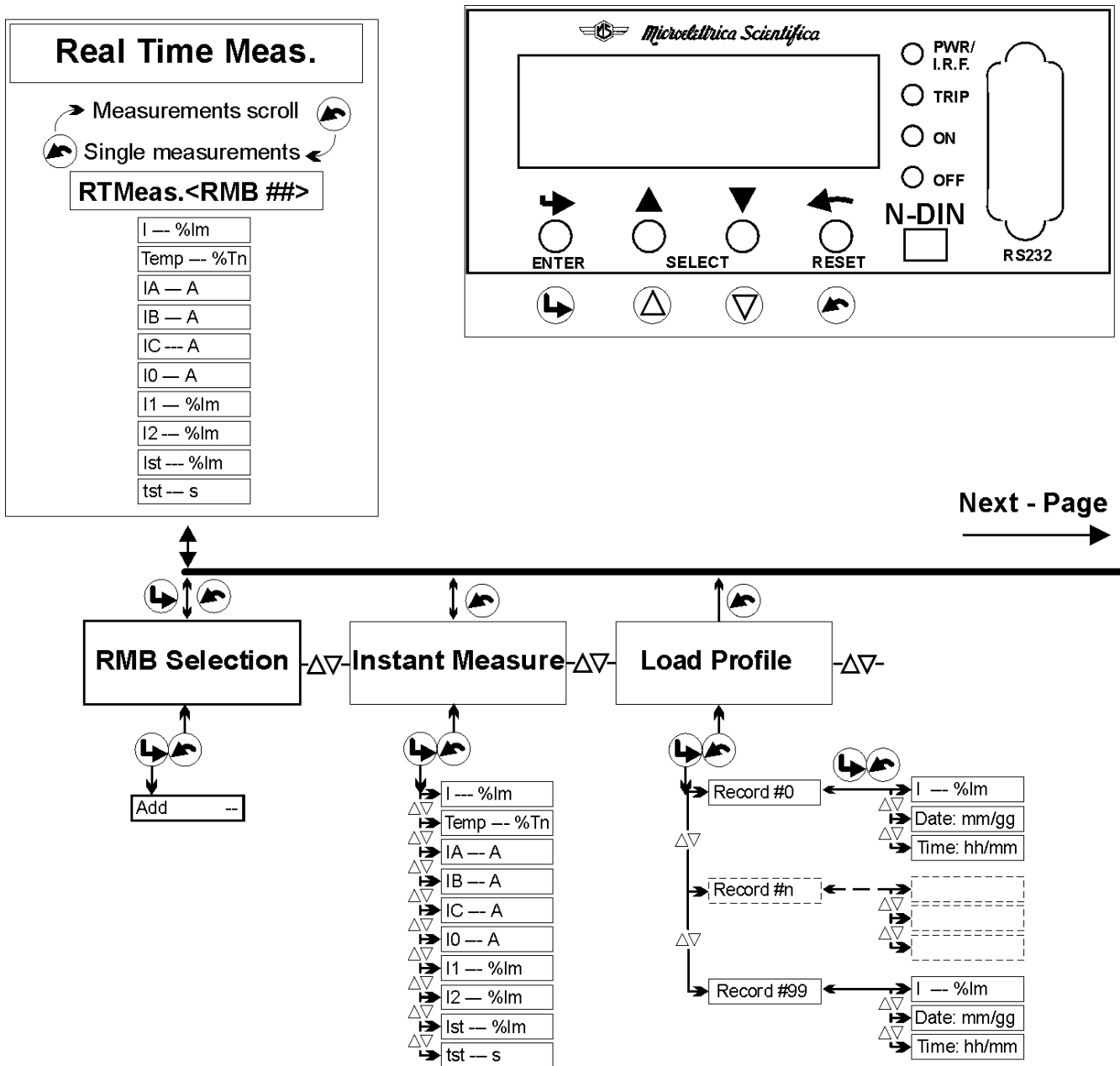
- A/D conversion
- Checksum of the settings stored into E²P.
- DSP general operation (Power, Routines, etc.)
- Lamp test (only on manual test).

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 E²P.

If during the test, any Relay Internal Failure (I.R.F) is detected; “ I.R.F. “ operation is memorized in the “ Event Records “ , “I.R.F.” counter is incremented and, if “ I.R.F. “ is programmed to “ Trip “ (see § 2.2.3.12) the output relays are operated same as on tripping of any protection function.

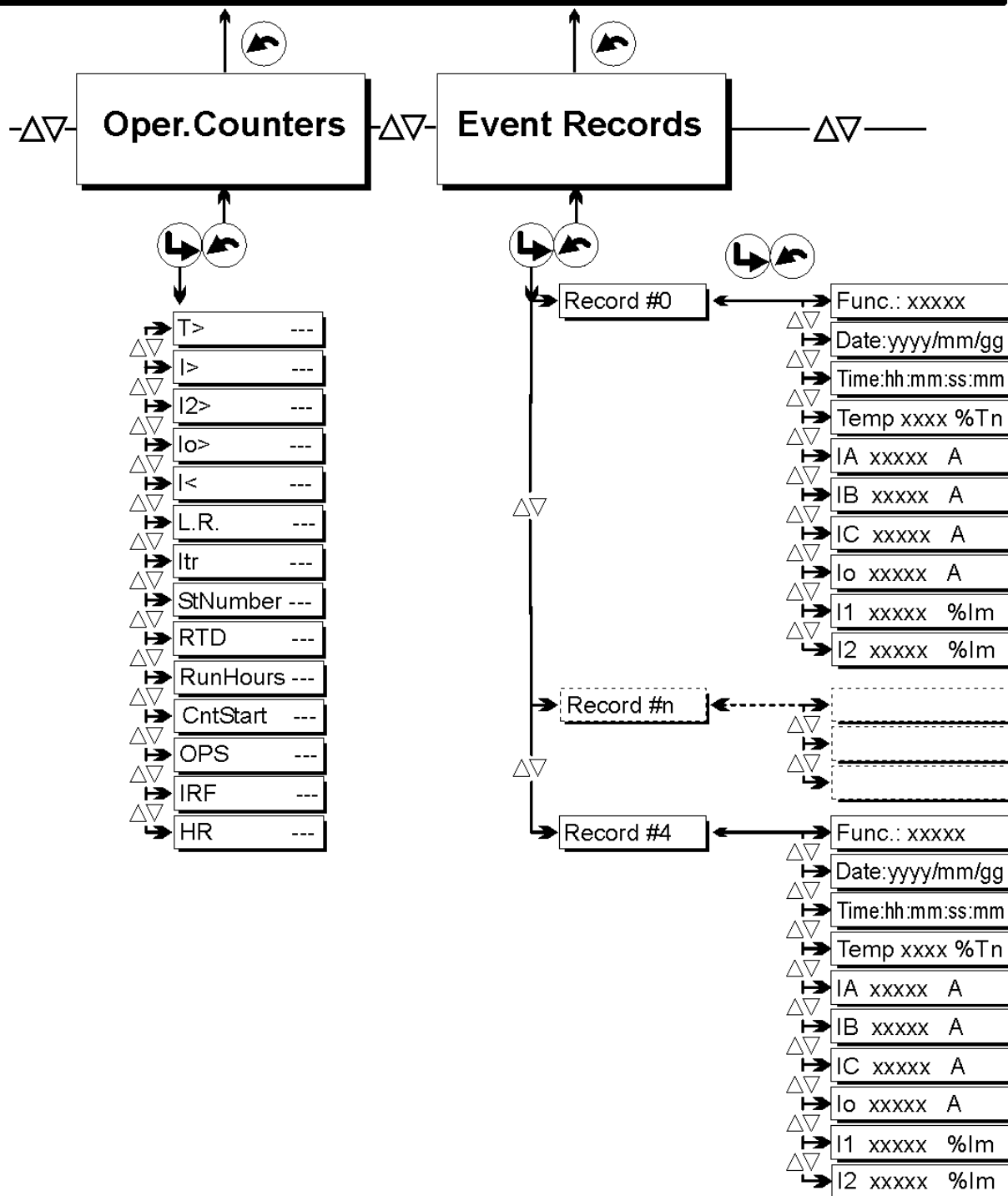
It is also present a supervision circuit that, in case a transient operation anomaly of the DSP is detected, produces a Reset to restore the normal operation and increment the counter “HR” (see § 6.5).

3.1 - KEYBOARD OPERATIONAL DIAGRAM



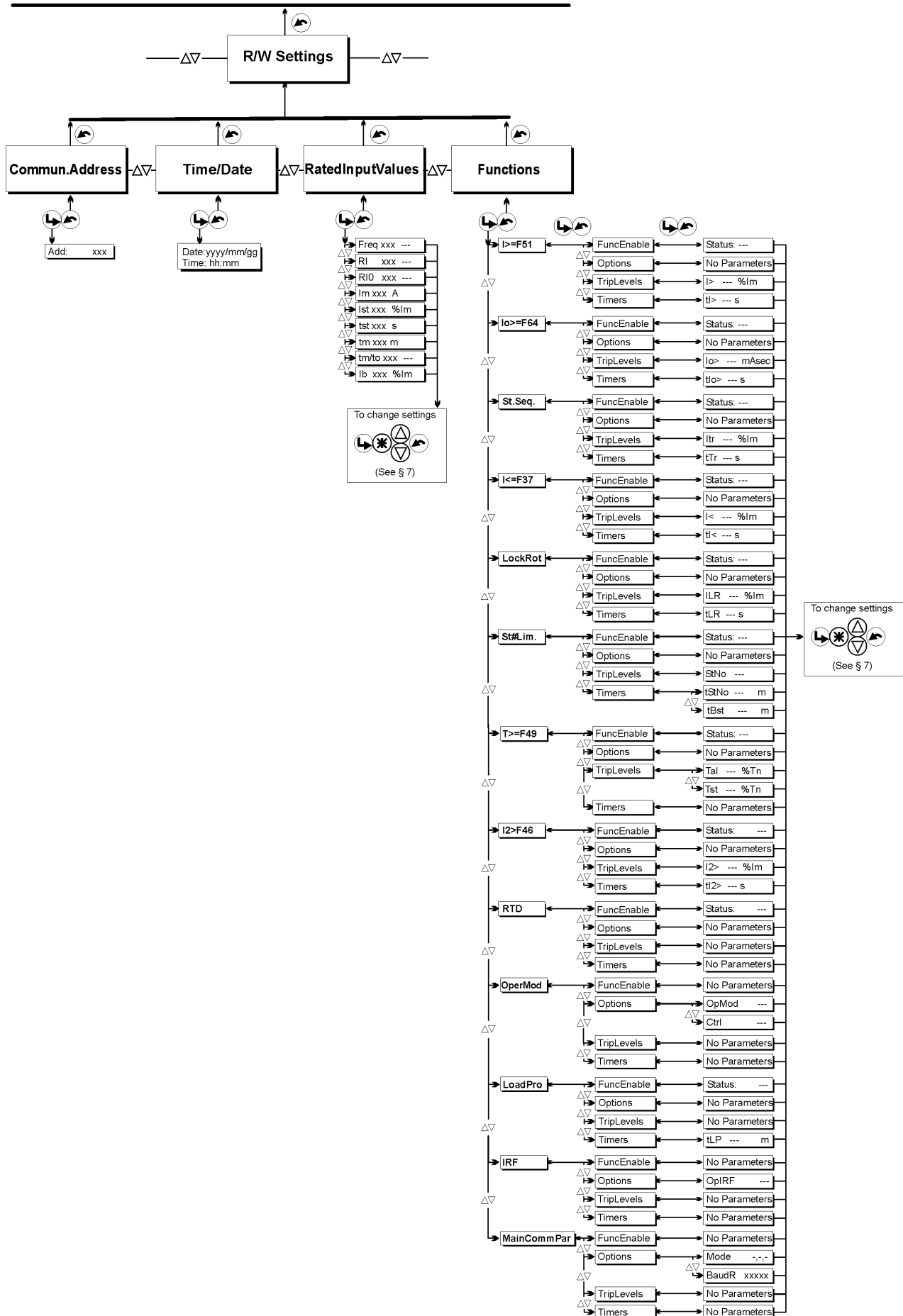
Previous - Page

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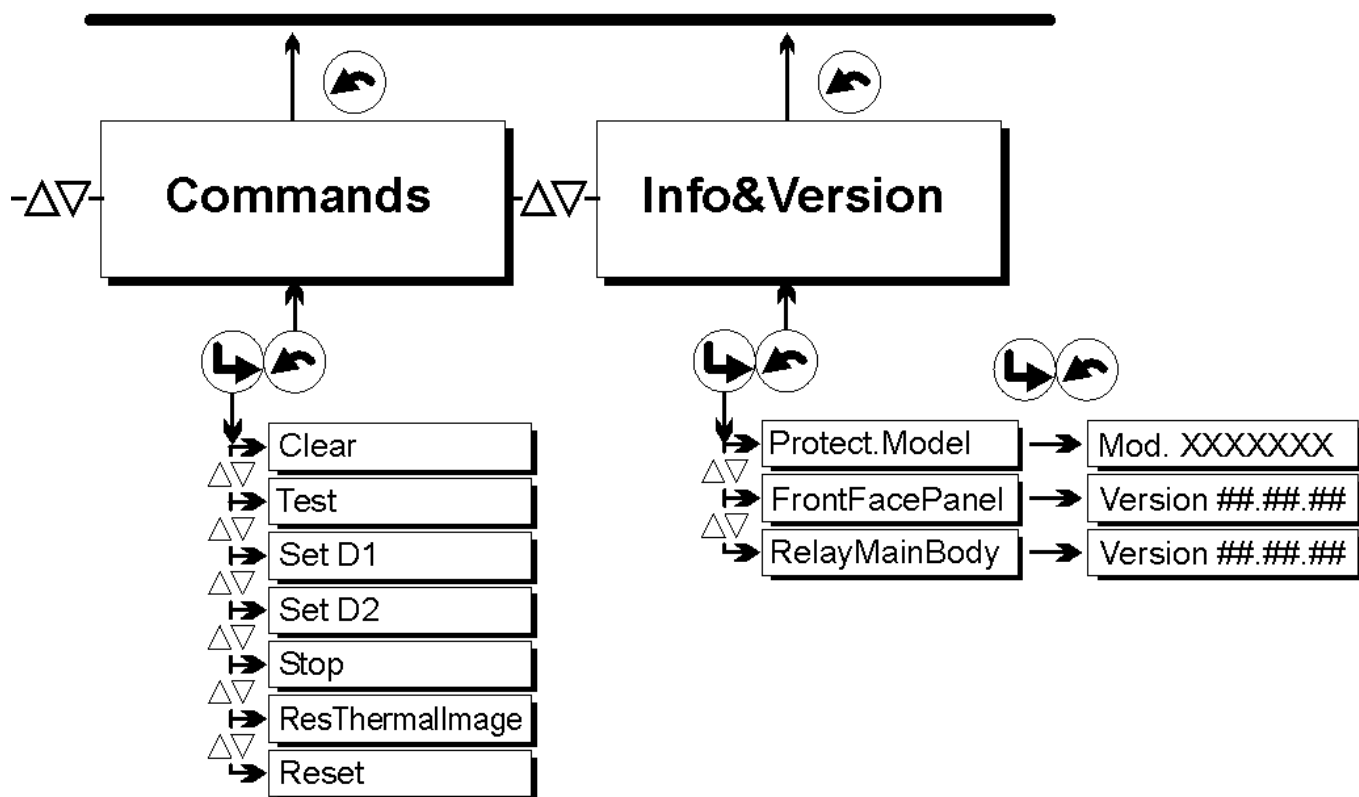


Previous - Page

Next - Page

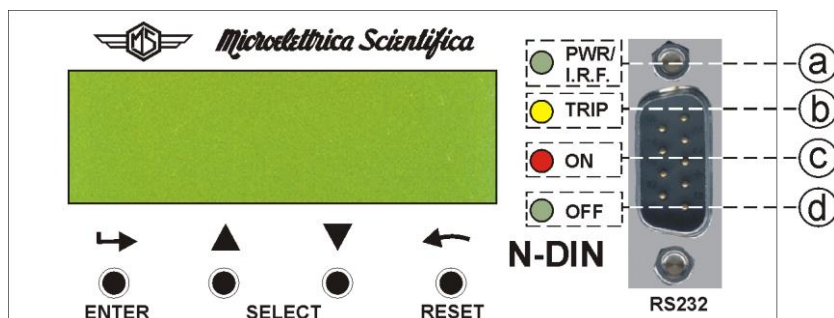


Previous - Page



4. SIGNALIZATIONS

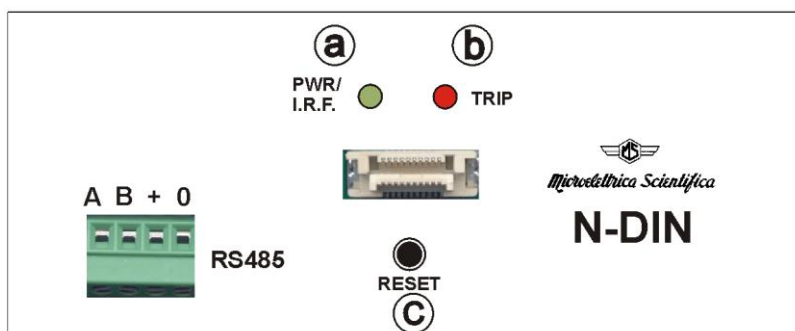
Four signal leds are available on the removable **Front Face Panel (FFP)**:



a)	Green LED	PWR/ I.R.F.	<input type="checkbox"/> Illuminated during normal operation when Power Supply is ON. <input type="checkbox"/> Flashing when a Relay Internal Fault is detected.
b)	Yellow LED	TRIP	<input type="checkbox"/> Flashing when a timed function has started to operate or the motor heating exceeds the pre-alarm level "Tal". <input type="checkbox"/> Illuminated when any function was tripped, until motor is restarted or Reset button is pressed.
c)	Red LED	ON	<input type="checkbox"/> Illuminated when running motor status is detected. <input type="checkbox"/> Flashing during "tBSt" or as long as restart is inhibited.
d)	Green LED	OFF	<input type="checkbox"/> Illuminated when steady motor status is detected.

The reset button on FFP, reset after tripping the Output Relays and the Trip Led when in the "D" operation modes; reset only the Trip Led in the "Two Steps" and "Revers." operation modes.

Other two leds are provided on the **Relay Main Body (RMB)** visible when the front face is removed



a)	Green LED	PWR/ IRF	<input type="checkbox"/> Illuminated during normal operation when Power Supply is ON. <input type="checkbox"/> Flashing when a Relay Internal Fault is detected.
b)	Red LED	TRIP	<input type="checkbox"/> Flashing when a timed function has started to operate or the motor heating exceeds the prealarm level "Tal". <input type="checkbox"/> Illuminated when any function was tripped until motor is restarted or Reset button is pressed.
c)	Button	RESET	<input type="checkbox"/> To Reset after tripping the output relays and the trip signal led in the "D" operation mode (only Led reset in the operation modes "Two Steps" and "Revers.").

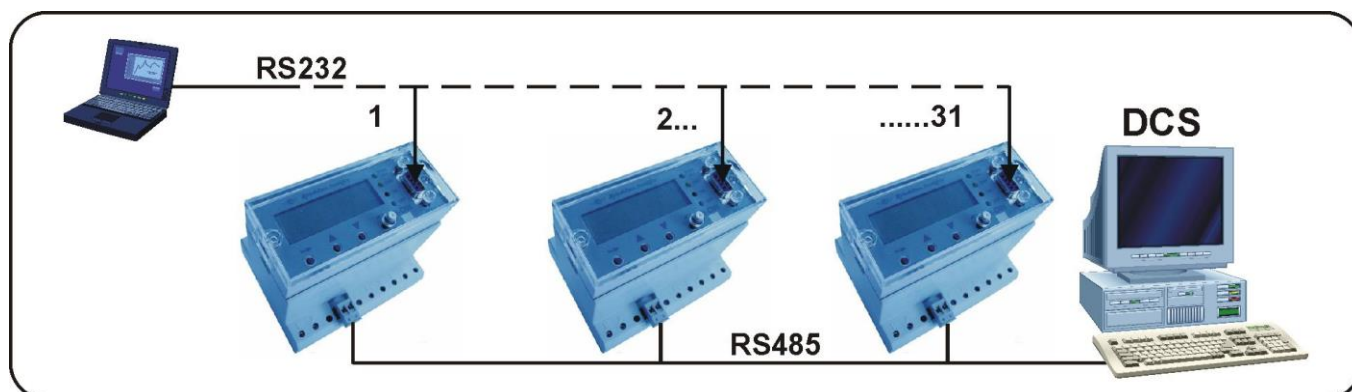
5. SYSTEM CONFIGURATION OPTIONS

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 (see § 11).

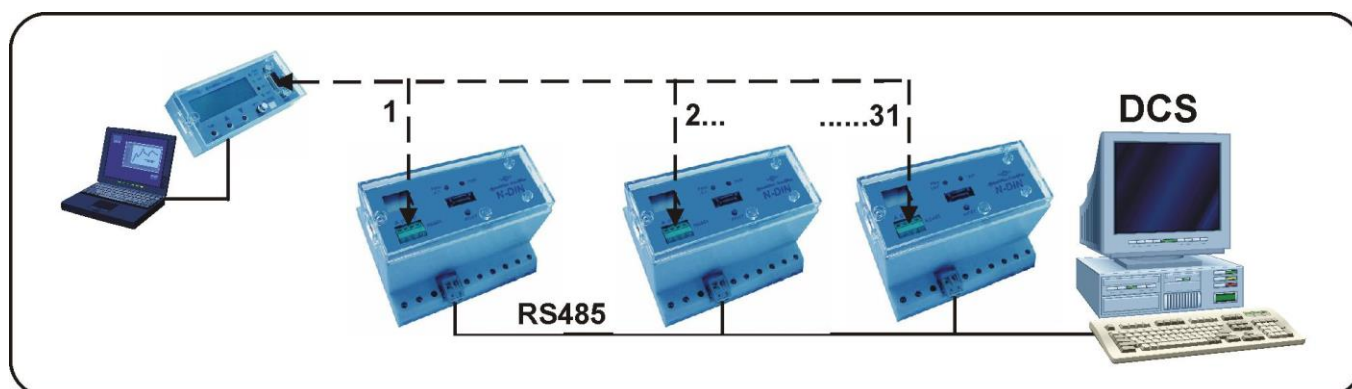
It is recommended to power-off the RMB modules before plug-in/out or connecting the FFP.

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

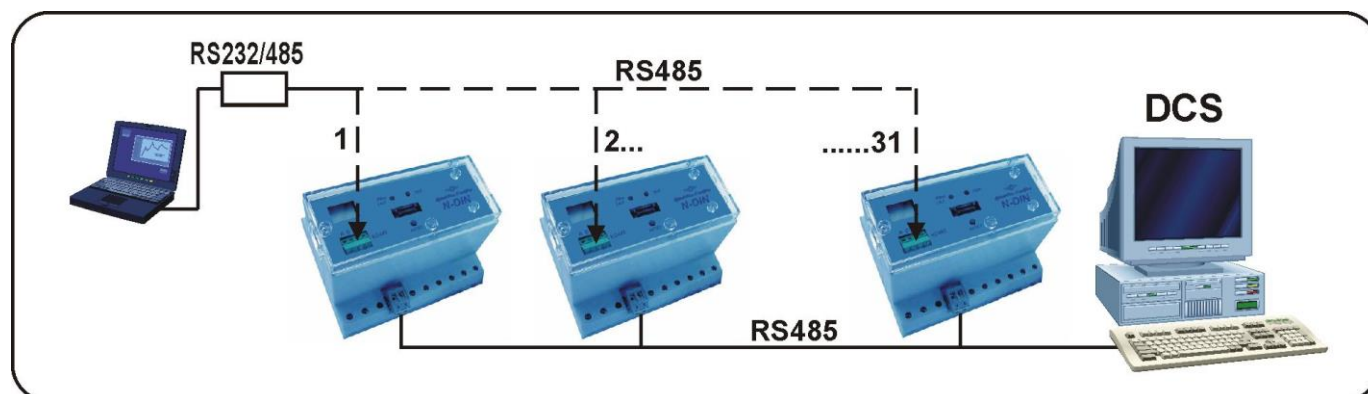


The **FFP** module can be mounted either directly on its **RMB** module or on the front panel of the board connected to the **RMB** by four wires (terminals A, B, +, 0).

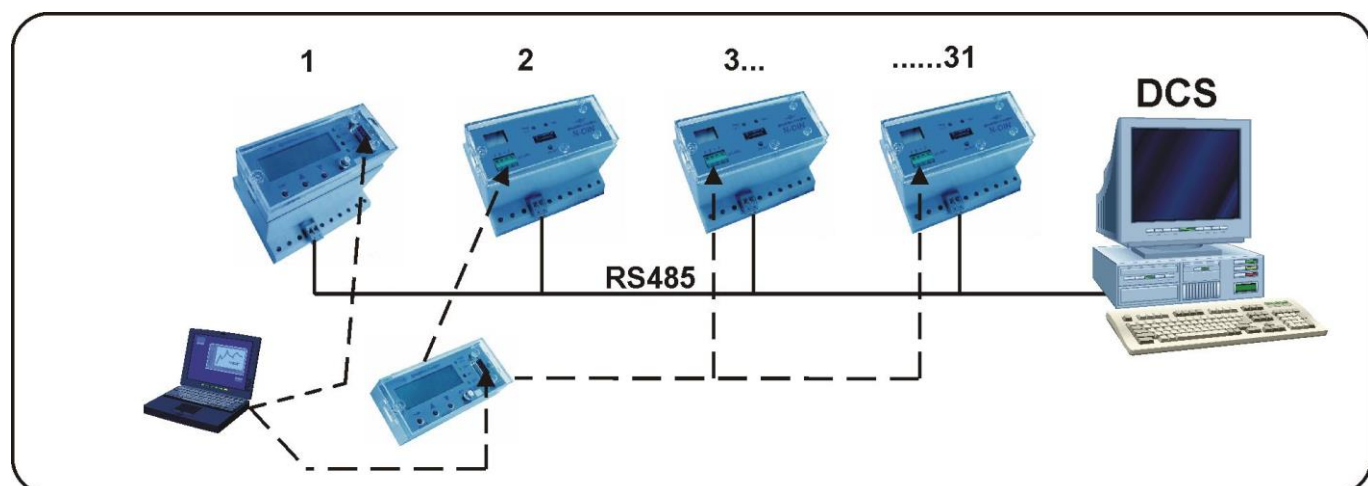
2) Use of up to 31 **RMB** modules managed by only one **FFP**.



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

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 “ **Relay Main Body** “.

The physical link is RS485 and the Communication Protocol is MODBUS/RTU:

The configuration is selectable (see § 6.7.4)

<input type="checkbox"/> Baud Rate	: 9600/19200 bps	9600/19200 bps	9600/19200 bps
<input type="checkbox"/> Start bit	: 1	1	1
<input type="checkbox"/> Data bit	: 8	8	8
<input type="checkbox"/> Parity	: None	Odd	Even
<input type="checkbox"/> Stop bit	: 1	1	1

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

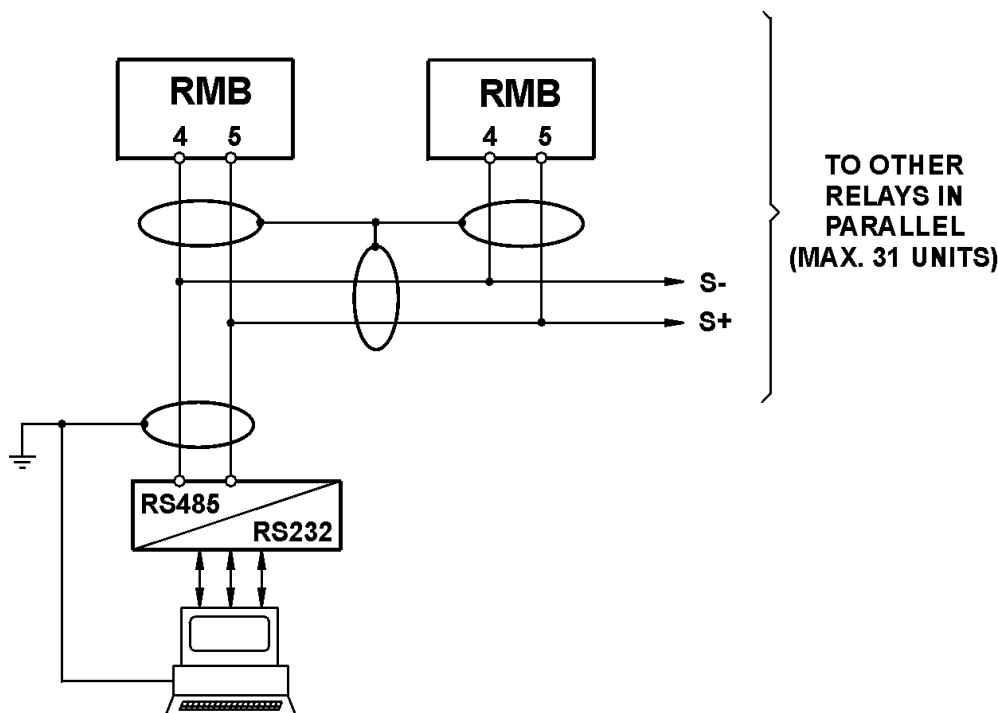
Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C.

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

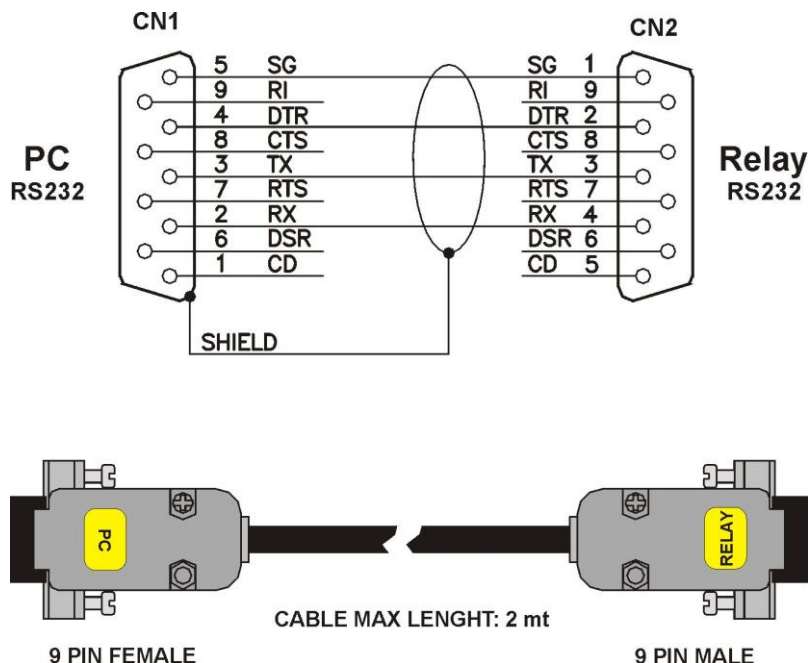


For longer distance and for connection of up , to 250 Relays, optical interconnection is recommend.
(please ask Microelettrica for accessories)

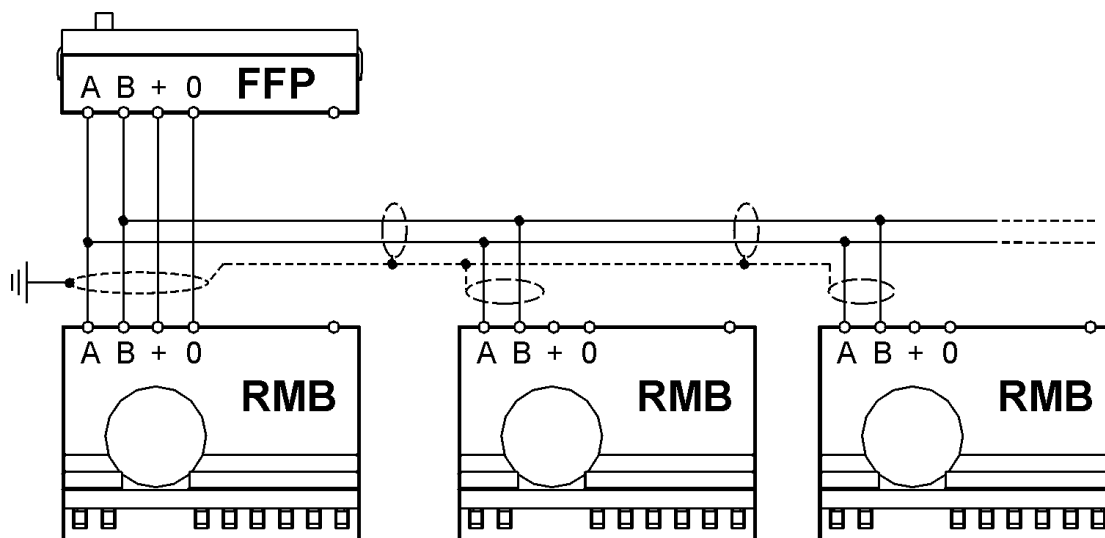
5.2 – Communication Port on Front Face Panel

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 male 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..



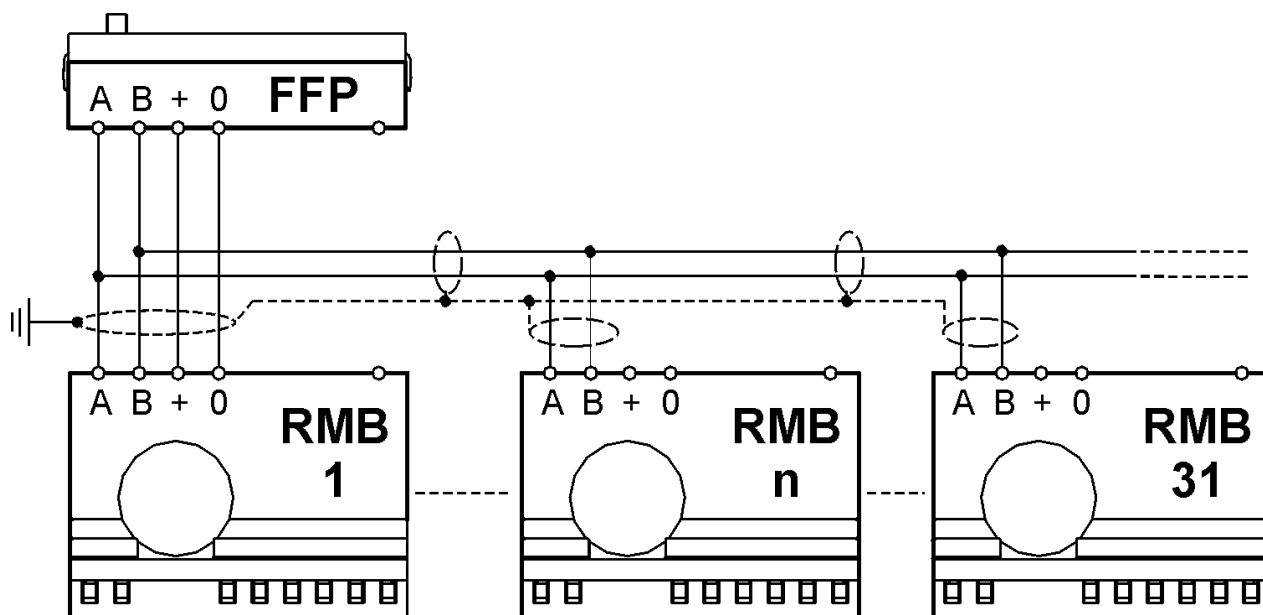
The connection between the “ FFP “ and the “ RMB ” (when FFP is removed) is made by four shielded twisted cables connected to the relevant terminals available on the back of the “ FFP “ and on the front of the “ RMB “.All additional RMBs only need a pair of shielded twisted cables.



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 N° (see § 3.1 and § 6.2).






6. MENU AND VARIABLES

6.1 – Real Time Measurements








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.


6.2 – 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

6.3 – Instantaneous Measurements








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

- "Real Time Meas" 
- "Instant Meas" 
- "1st Measurement"   other measurements
-  to go back to "Real Time Meas".

Display			Description
I	= 0 - 65535	%Im	Largest of the 3 phase-currents (% of motor Full Load Current)
Temp	= 0 - 65535	%Tn	Motor thermal status (% of motor steady F.L.Temp)
IA	= 0 - 65535	A	RMS value of Phase A current
IB	= 0 - 65535	A	RMS value of Phase B current
IC	= 0 - 65535	A	RMS value of Phase C current
Io	= 0.0 - 6553.5	A	RMS value of Zero Sequence Current (RMS Primary Amps)
I1	= 0 - 65535	%Im	Positive Sequence Current (% of motor F.L. current)
I2	= 0 - 65535	%Im	Negative Sequence Current (% of motor F.L. current)
Ist	= 0 - 65535	%Im	Motor start-up current (% of motor F.L. current)
Tst	= 0 - 1000.0	s	Motor start-up time



6.4 - LOAD PROFILE

The relay can record the measurement of the motor current “ I ” (largest of the 3 phase currents) at programmable time intervals “ tLP ”

- “ Real Time Meas ” 
-  “ Load Profile ” 
-  1st 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 %Im	Largest of the 3 phase-currents (% of motor 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 ”.

Once the Load Profile function is programmed (Enable/Disabled and “ tLP ” set) the recording automatically starts and stops any time the motor is started or stopped.
Display of records is available in the menu “ Load Profile”.

6.5 – OPERATION COUNTERS







The operation of any of the function herebelow reported, is counted and recorded in the menu “ Operation Counters ”.

- “ Real Time Meas ” 
- “ Oper. Counters ” 
- “ 1st counters  other counters
-  to go back to “ Real Time Meas ”.



Display			Description
T>	=	0 – 65535	Number of Thermal overload trip
I>	=	0 – 65535	Number of Overcurrent (Short Circuit) trip
I2>	=	0 – 65535	Number of Unbalance / Single Phasing trip
Io>	=	0 – 65535	Number of Earth Fault trip
I<	=	0 – 65535	Number of No Load Running trip
L.R.	=	0 – 65535	Number of Locked Rotor trip
Itr	=	0 – 65535	Number of Start-up time too long trip
StNumber	=	0 – 65535	Number of Excess of consecutive starts trip
RTD	=	0 – 65535	Number of External Termistor trip
Run Hours	=	0 – 65535	Number of Motor running hours
CNTStart	=	0 – 65535	Number of Consecutive Startings accumulated
OPS	=	0 – 65535	Number of Motor starts
I.R.F.	=	0 – 65535	Number of Internal Relay Faults
HR	=	0 – 65535	Number of Hardware Restore (see § 2.2.5 selfdiagnostic)

6.6 – EVENT RECORDING





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:
	<ul style="list-style-type: none"> - T> = Thermal overload - I> = Overcurrent (Short Circuit) - I2> = Unbalance / Single Phasing - Io> = Earth Fault - I< = No Load Running - L.R. = Locked Rotor - Itr = Start-up time too long - StNumber = Excess off consecutive starts - 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
Temp = 0 – 65535 %Tn	Motor thermal status (% of motor steady F.L. Temp)
IA = 0 – 65535 A	RMS value of phase A current (% of motor Full Load Current)
IB = 0 – 65535 A	RMS value of phase B current (% of motor Full Load Current)
IC = 0 – 65535 A	RMS value of phase C current (% of motor Full Load Current)
Io = 0.0 – 6553.5 A	RMS value of Zero Sequence Current
I1 = 0 – 65535 %Im	Positive Sequence Current
I2 = 0 – 65535 %Im	Negative Sequence Current

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

6.7 – Programming / Reading the Relay Settings

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
















6.7.1 – Communication Address

-  " Communication Address " 
- " Add: # " 
- " Password ???? " (if not yet entered; see § 10)
-  to select the Address (1-250)
-  to validate.







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 “  Date: Current Date, Time: Current time
-  “20YY/..... “  to set year,
-  “20XX/MM “  to set month,
-  “20XX/XX/DD “  to set day,
-  “20XX/XX/XX “
-  “hh/mm “  to set hour,
-  “XX/mm “  to set minutes,
-  To validate
-  Exit

6.7.3 – 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 § 10)
-  to set variable value,
-  to validate.

Display	Description	Setting Range	Step	Unit
Freq 50 Hz	System rated frequency	50 - 60	10	Hz
RI 100 -	Ratio of the phase C.Ts. (Ip/Is)	1 - 6500	1	-
Rlo 100 -	Ratio of the C.Ts. or of the tore C.T. detecting earth fault current.	1 - 6500	1	-
Im 100 A	Motor full-load current	1 - 6500	1	A
Ist 500 %Im	Motor start-up current (% of motor full load current)	50 - 999	1	%Im
tst 5 s	Motor starting time	1 - 120	1	s
tm 15 m	Motor warming-up time constant	1 - 60	1	m
to/tm 3 -	Steady/Running Motor time constant ratio	1 - 10	1	-
Ib 105 %Im	Maximum admissible continuous overload	100 - 130	1	%Im

6.7.4 – Functions





-  “Functions “,
-  1st function,
-  to scroll available Functions,
-  to Read/Write setting of the selected function,
-  to select the different definable fields;
 - Function Enable
 - Trip Levels
 - Options
 - 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.

Display						Description	Setting Range	Step
Function	Type		Variable	Def. Value	Unit			
Password		=	0000-9999	1111	-	Password for programming enable (see §7)		
I>=F51	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	I>	900	%Im	Trip level of overcurrent protection	100 – 999	1
	Timers	→	tl>	0.1	s	Trip time delay	0.05 – 9.99	0.01
Io>=F64	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	Io>	50	mAs	Trip level of Earth Fault protection	20-9999	1
	Timers	→	tIo>	0.5	s	Trip time delay	0.05-9.99	0.01

Function	Display					Description	Setting Range	Step
	Type		Variable	Default Value	Unit			
St.Seq.	FuncEnable	→	Status:	Disable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	Itr	100	%In	Switch-over current for two step motor starter control	10-999	0.1
	Timers	→	tTr	7	s	Maximum switch over time delay	0.1-60	0.1
I<=F37	FuncEnable	→	Status:	Disable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	I<	20	%Im	Trip level of the No Load Running protection	10-100	1
	Timers	→	tl<	6	s	Trip time delay	0.1-60	0.1
LockRot	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	ILR	200	%Im	Current level for locked Rotor trip	50-500	1
	Timers	→	tLR	2	s	Trip time delay of Locked Rotor protection	1-60	1
St#Lim.	FuncEnable	→	Status:	Disable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	StNo	10	-	Maximum N° of starting allowed in the time tSt	1-60	1
	Timers	→	tStNo	60	m	Time in to which StNo are counted	1-60	1
			tBst	10	m	Restart inhibition time after StNo is exceeded	1-60	1
T>=F49	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	Tal	90	%Tn	Prealarm Motor Temperature rise (% of Full Load temp. rise)	50-110	1
			Tst	100	%	Motor restart enable temperature	10-100	1
	Timers	→	No Parameters					
I2>=F46	FuncEnable	→	Status:	Enable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	I2>	20	%Im	Trip level of current unbalance protection	10-99	1
	Timers	→	tl2>	6	s	Trip time delay	0-60	0.1
RTD	FuncEnable	→	Status:	Disable		Enable of the protection function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	No Parameters					
	Timers	→	No Parameters					
OperMod	FuncEnable	→	No Parameters					
	Options	→	OpMod	D lo>=R2	D lo>=R2	D.O.L. with lo> assigned to R2	D lo>=R2 D Ta=R2 Two_Step Revers.	-
					D Ta=R2	D.O.L. with Ta assigned to R2		
					Two_Step	2-step reduced voltage start control.		
					Revers.	Reversing starter		
			Ctrl	Local	Control mode Local / Remote (via serial)		Local – Remote	-
LoadPro	FuncEnable	→	Status:	Disable		Enable of the Load Profile function	Enable/Disable	-
	Options	→	No Parameters					
	TripLevels	→	No Parameters					
	Timers	→	tLP	30	m	Interval time	1-650	1
IRF	FuncEnable	→	No Parameters					
	Options	→	OpIRF	NoTrip		Motor stop on detection of relay internal failure	NoTrip – Trip	-
	TripLevels	→	No Parameters					
	Timers	→	No Parameters					
Main Comm Par	FuncEnable	→	No Parameters					
	Options	→	Mode	8,N,1		RMB main RS485 port configuration (see §5.1) 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 “
-  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 D1 :	Remote control of Digital Input D1
Set D2 :	Remote control of Digital Input D2
Stop :	Deenergize Relays R1&R2 in the operation modes “ Two Step “ and or “ Revers. “
Reset Thermal Image :	Erase thermal memory content
Reset :	Reset after trip of R1&R2 in the operation mode “ D “ only

6.9 – Firmware – Info&Version

The menu displays the Model Relay and 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 1 st digit (1-9) |  | to validate |
| - |  | to select 2 nd digit (1-9) |  | to validate |
| - |  | to select 3 rd digit (1-9) |  | to validate |
| - |  | to select 4 th 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

Fig.1

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.2



7.2 - Modbus Password

This Password is requested to a Supervision Sistem 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.

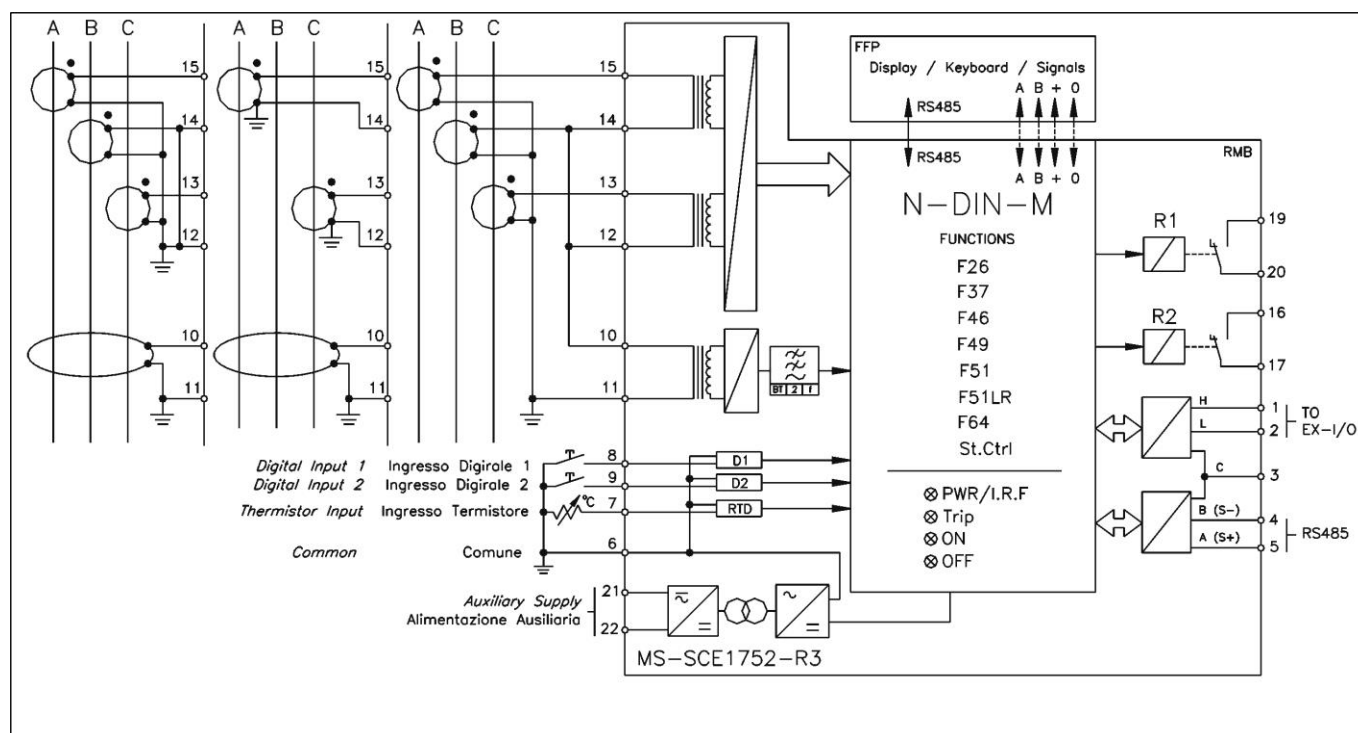
8. MAINTENANCE

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.

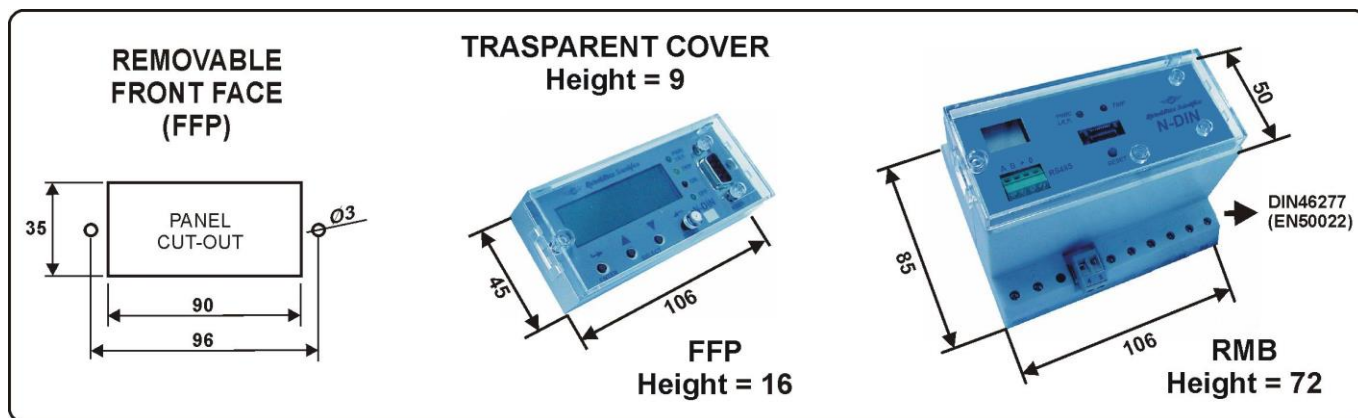
9. POWER FREQUENCY INSULATION TEST

Every relay individually undergoes a factory insulation test according to 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 taking 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. CONNECTION DIAGRAM



11 . Overall dimensions



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

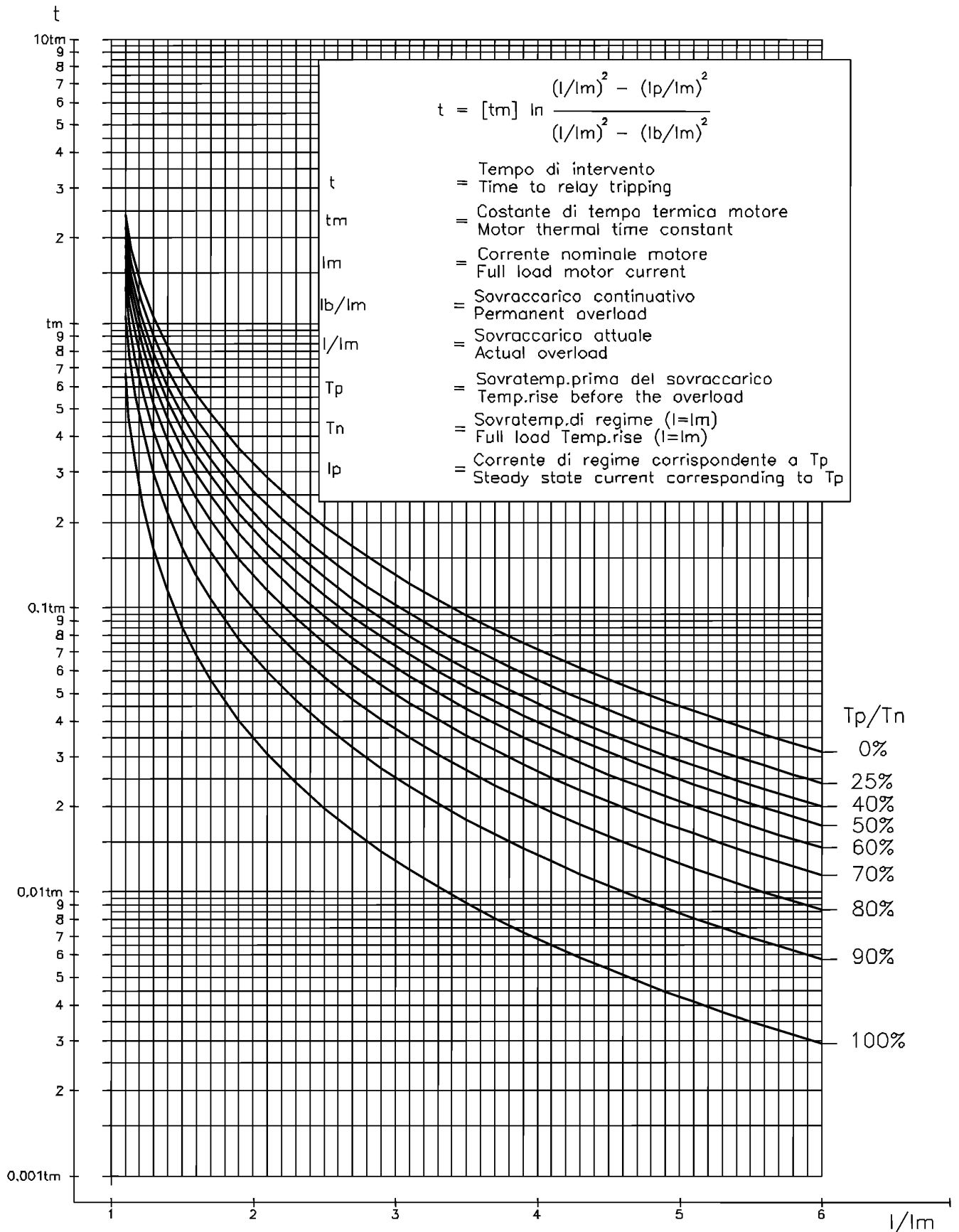
2) To remove FFP from RMB loosen the two screws and pull-out.

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. THERMAL IMAGE CURVES (TU0249 Rev.1)



13. ELECTRICAL CHARACTERISTICS

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

<input type="checkbox"/> Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.
<input type="checkbox"/> Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50µs
<input type="checkbox"/> Insulation resistance	> 100MΩ	

Environmental Std. Ref. (IEC 60068)

<input type="checkbox"/> Operation ambient temperature	-10°C / +55°C	
<input type="checkbox"/> Storage temperature	-25°C / +70°C	
<input type="checkbox"/> Environmental testing	(Cold)	IEC60068-2-1
	(Dry heat)	IEC60068-2-2
	(Change of temperature)	IEC60068-2-14
	(Damp heat, steady state)	IEC60068-2-78 RH 93% Without Condensing AT 40°C

CE EMC Compatibility (EN50081-2 - EN50082-2 - EN50263)

<input type="checkbox"/> Electromagnetic emission	EN55022 industrial environment			
<input type="checkbox"/> Radiated electromagnetic field immunity test	IEC61000-4-3	level 3	80-1000MHz	10V/m
	ENV50204		900MHz/200Hz	10V/m
<input type="checkbox"/> Conducted disturbances immunity test	IEC61000-4-6	level 3	0.15-80MHz	10V
<input type="checkbox"/> Electrostatic discharge test	IEC61000-4-2	level 4	6kV contact / 8kV air	
<input type="checkbox"/> Power frequency magnetic test	IEC61000-4-8		1000A/m	50/60Hz
<input type="checkbox"/> Pulse magnetic field	IEC61000-4-9		1000A/m, 8/20µs	
<input type="checkbox"/> Damped oscillatory magnetic field	IEC61000-4-10		100A/m, 0.1-1MHz	
<input type="checkbox"/> Electrical fast transient/burst	IEC61000-4-4	level 3	2kV, 5kHz	
<input type="checkbox"/> HF disturbance test with damped oscillatory wave (1MHz burst test)	IEC60255-22-1	class 3	400pps, 2,5kV (m.c.), 1kV (d.m.)	
<input type="checkbox"/> Oscillatory waves (Ring waves)	IEC61000-4-12	level 4	4kV(c.m.), 2kV(d.m.)	
<input type="checkbox"/> Surge immunity test	IEC61000-4-5	level 4	2kV(c.m.), 1kV(d.m.)	
<input type="checkbox"/> Voltage interruptions	IEC60255-4-11		50ms	
<input type="checkbox"/> Resistance to vibration and shocks	IEC60255-21-1 - IEC60255-21-2 10-500Hz 1g			

CHARACTERISTICS

<input type="checkbox"/> Accuracy at reference value of influencing factors	2% In for measure 0,2% On 2% +/- 20ms for times
<input type="checkbox"/> Rated Current	In = 5A - On = 5A
<input type="checkbox"/> Current overload	200 A for 1 sec; 10A continuous
<input type="checkbox"/> Burden on current inputs	Phase : 0.05VA at In = 5A Neutral : 0.07VA at On = 5A
<input type="checkbox"/> Average power supply consumption	≤ 7 VA
<input type="checkbox"/> 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 PARAMETER

<input type="checkbox"/> RMB	RS485 – 9600/19200 bps –8,N,1 - 8,O,1 - 8,E,1 – Modbus RTU
<input type="checkbox"/> FFP	RS232 – 9600bps – 8,N,1 – Modbus RTU

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