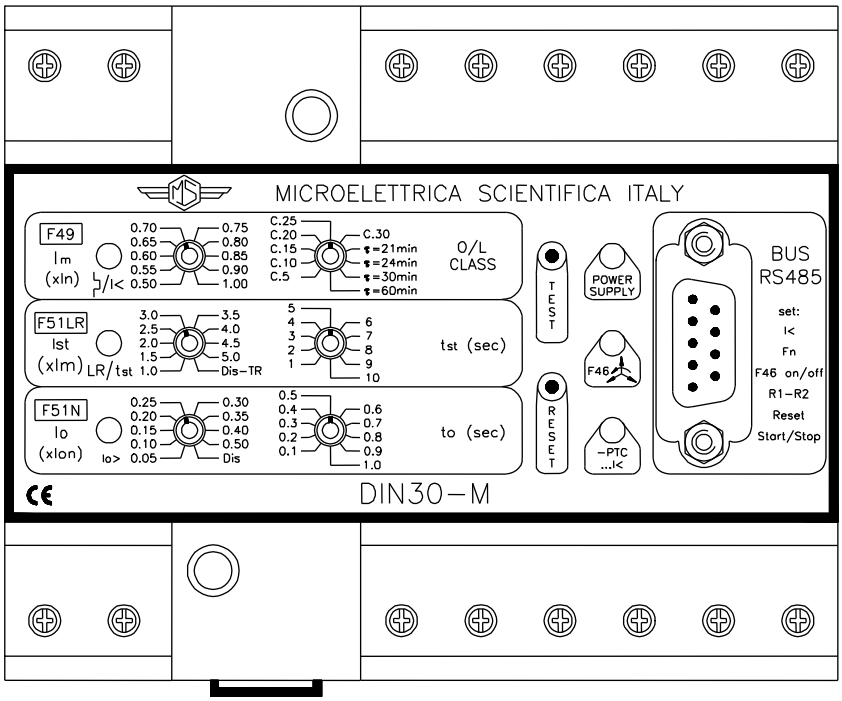
MULTIFUNCTION MOTOR PROTECTION RELAY WITH SERIAL COMMUNICATION PORT

TYPE
DIN30-M

OPERATION MANUAL



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

1.10 MAINTENANCE

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

1.11 FAULT DETECTION AND REPAIR

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

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

2. GENERAL CHARACTERISTICS AND OPERATION

2.1 Input quantities are supplied to three current transformers :

- for phase current measurement with taps for rated input I_n = 1 or 5A;
  measurement is linear from 0.1 to 10I_n with resolution of 0.01I_n in the calculation of RMS value
  In = 1A : burden 10mΩ (0,01VA @ 1A)
  In = 5A : burden 3mΩ (0,075VA @ 5A)
  Permissible overload : 10A permanent, 200A for 1s.
  Recommended C.Ts. ≥3VA class 5P10

- 1 for measurement of residual current with taps for rated input I_{on} = 1 or 5A ;
  measurement is linear from 0,01 to 2 x I_{on} with resolution 0,004 in the calculation of the RMS value.
  I_{on} = 1A : burden 10mΩ (0,01VA @ 1A)
  I_{on} = 5A : burden 3mΩ (0,075VA @ 5A)

  If input is supplied by a core balance CT for high sensitivity Earth Fault detection, it is recommended to select a Ratio 100/1 Burden ≥ 0,1VA.

2.2 Power supply

Power supply input (terminals 1-2) is multi-voltage autoranging 2kV isolated has no polarity and can accept any AC or DC voltage in the range a or b - Consumption ≤3VA.

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

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

2.3 Serial Communication

An RS485/RS232 serial communication port is available on relay's front.
The communication is supported by a Jbus/Modbus compatible protocol.
The relay can be connected either directly to any IBM compatible P.C. via a dedicated cable or to an RS485 serial bus. The latter configuration allows the user to connect more than one relay to a P.C. via the same physical serial line.
A communication software (MS-COM) for Windows 95/98/NT4.0-SP3 is available.
Please refer to the MS-COM instruction manual for more information.
The serial port provides the following functions/information:

- Control the Test and Reset functions
- Read the actual R.M.S. measurement of the input quantities given as a number to be related to input current (see DATA BASE)
- Read the actual motor estimated temperature given as a percentage of the steady state temperature reached when the motor nominal input current is injected.
- Read the value of the different parameters as set on the rotary switches of relay's front face.
- Modify the following settings:
  - F37 tripping level.
  - Nominal frequency (50 or 60Hz).
  - F46 enable/disable.
  - Configuration of output relays (normally energized or normally deenergized).
  - reset mode (auto/man).
- Monitor the status of the protection elements (normal/above set level/tripped).
- Monitor the self diagnostic function (E^2P error, Calibration error)

The above data can be accessed as words whose logical addresses are listed in the following table:

2.3.1 - DIN30-M : DATA BASE

Word number (.Bit Number)	Type (I, O, I/O)	Meaning	Range	Unit	Factory default
67	O	Phase A current	0..65535	1200 => Phase nominal current[1]	//
68	O	Phase B current	0..65535	1200 => Phase nominal current[1]	//
69	O	Phase C current	0..65535	1200 => Phase nominal current[1]	//
70	O	Motor estimated temperature	0..65535	%Tn	//
71	O	Zero sequence current	0..65535	11998 => Zero sequence nominal current[2]	//
78.0	O	E2PROM status	0/1	0 => OK 1 => E2PROM error	//
78.1	O	Calibration status	0/1	0 => calibration completed successfully 1 => error during calibration	//
78.2 => 78.15	//	Reserved	//	//	//
80.0	O	Level of test push button	0/1	0 => test push button is depressed 1 => test push button is pressed	//
80.1	O	Level of reset push button	0/1	0 => reset push button is depressed 1 => reset push button is pressed	//
80.2	O	Status of input 15..16	0/1	0 => 15..16 input is 0 1 => 15..16 input is 1	//
80.3	//	Reserved	//	//	//
80.4 => 80.15	//	Reserved	//	//	//
81.0	O	Trip status, F49	0/1	0 => F49 not tripped 1 => F49 tripped	//
81.1	O	Trip status, F46	0/1	0 => F46 not tripped 1 => F46 tripped	//
81.2	O	Trip status, F37	0/1	0 => F37 not tripped 1 => F37 tripped	//
81.3	O	Trip status, test	0/1	0 => No test trip 1 => Test trip	//
81.4	O	Trip status, F51LR	0/1	0 => F51LR not tripped 1 => F51LR tripped	//
81.5	O	Trip status, F51N	0/1	0 => F51N not tripped 1 => F51N tripped	//
81.6	O	Trip status, PTC	0/1	0 => PTC not tripped 1 => PTC tripped	//
81.7	O	Trip status, F50	0/1	0 => F50 not tripped 1 => F50 tripped	//
81.8 => 81.15	//	Reserved	//	//	//
82.0	O	Thermal overload alarm	0/1	0 => No alarm 1 => Alarm	//
82.1	O	F37 pick up	0/1	0 => no F37 pick up 1 => F37 picked up	//
82.2	O	F51LR pick up	0/1	0 => no F51LR pick up 1 => F51LR picked up	//
82.3	O	F51N pick up	0/1	0 => no F51N pick up 1 => F51N picked up	//
82.4..82.6	//	Reserved	//	//	//
82.7	O	Motor on	0/1	0 => motor off 1 => motor on	//
82.8 => 82.14	//	Reserved	//	//	//
82.15	O	End of transition	0/1	0 => Transition time not expired 1 => Transition time expired	//
84	O	Im : motor nominal current	2119..4238	4238 => In[3]	2119 (0.5In)

Word number (.Bit Number)	Type (I, O, I/O)	Meaning	Range	Unit	Factory default
85	O	τ: motor thermal overload time constant	180..7200	1s	180 (3min), 360 (6min) with motor off
86	O	Ist: starting current	10..50	0.1Im	10 (1Im)
87	O	tst: starting time	10..100	0.1s	10 (1.0s)
88	O	F51N tripping level	2119..21188	42377 => On[4]	2119 (0.05On)
89	O	F51N tripping time	10..100	0.01s	10 (0.1s)
90	I/O	F37 tripping level	2..8	0.1Im	8 (0.8Im)
91	I/O	Nominal frequency	0..1	0 => 50Hz, 1 => 60Hz	0 (50Hz)
106.0	I/O	Remote test command	0/1	0 => No Remote Test 1 => Remote Test	//
106.1	I/O	Remote reset command	0/1	0 => No Remote Reset 1 => Remote Reset	//
106.2	I/O	Load default settings	0/1	0 => Don't load default settings 1 => Load default settings[5]	//
106.3	I/O	R2 status	0/1	0 => no command 1 => R2 start	//
106.4	I/O	R2 status	0/1	0 => no command 1 => R2 stop	//
106.5..106.15	//	Reserved	//	//	//
110.0	I/O	F46 enable	0/1	0 => Disable F46 1 => Enable F46	0 (F46 disabled)
110.1	I/O	F37 enable	0/1	0 => Disable F37 1 => Enable F37	0 (F37 disabled)
110.2	I/O	F50 enable	0/1	0 => Disable F50 1 => Enable F50	0 (F50 disabled)
110.3	I/O	Type of R1 reset	0/1	0 => Manual reset 1 => Automatic reset	0
110.4	I/O	R1 configuration	0/1	0 => R1 normally deenergized 1 => R1 normally energized	0
110.5	I/O	R2 configuration	0/1	0 => R2 normally deenergized 1 => R2 normally energized	0
110.5..110.15	//	Reserved	//	//	//
111	O	Id word #1	//	ASCII	Constant = 'DI'
112	O	Id word #2	//	ASCII	Constant = 'N3'
113	O	Id word #3	//	ASCII	Constant = '0-'
114	O	Id word #4	//	ASCII	Constant = 'M '
115	O	Id word #5	//	ASCII	Constant = ' '
123	I/O	Node address	1..255	1	1

[1] Phase currents are represented using a conventional unit. A value equal to 4238 corresponds to the nominal phase current (In).
[2] Zero sequence current is represented using a conventional unit. A value equal to 42377 corresponds to the nominal zero sequence current (On).
[3] Phase tripping levels are represented using a conventional unit. A value equal to 4238 corresponds to the nominal phase current (In).
[4] Zero sequence tripping levels are represented using a conventional unit. A value equal to 42377 corresponds to the nominal zero sequence current (On).
[5] This bit is enabled only during relay automatic calibration.

2.4 PTC Input (Terminals 15-16)

This input is detected by the relay in the open state when a resistor greater than 1600Ω +/- 5% is connected to it.

2.5 Output relays R1 - R2

Two contacts with a common point are controlled by relays R1 and R2 (one for each relay)

- Maximum continuos rating : 5A - 250V.
- Maximum switching power : 1250VA (5A resistive)
- Maximum switching voltage : 250Vac - 110Vdc.
- Maximum make current : 20A - 0,5s.
- Maximum DC brake current : 0,2A - 110Vdc L/R=40ms.

Relay R1 is operated on tripping of whichever of the relays' elements (F46,F49, F37, F51LR, F50, PTC). R1 can be configured via serial port as Normally Deenergized (energized on trip) or Normally Energized (deenergized on trip).
Relay R2 is operated by the F51N control function.
Just like R1, R2 can be configured as Normally Deenergized or Normally Energized.

2.6 Signalizations and controls (see Fig. 1)

2.6.1 Thermal image element F49

Im = (0.5-1)In : motor nominal current given as p.u. of the relay nominal current.

O/L Class : motor thermal overload class or time constant. IEC classes from 5 up to 30 can be selected. Furthermore the user can choose time constants up to 1h.

Switch Position	IEC Class	Time constant τ = min
C.5	5	3
C.10	10	6
C.15	15	9
C.20	20	12
C.25	25	15
C.30	30	18
τ = 21min	-	21
τ = 24min	-	24
τ = 30min	-	30
τ = 60min	-	60

See fig. 2 for the element's tripping curve. The term *I* in fig. 2 is given by the following formula:

$$I = \sqrt{I_d^2 + 3I_s^2}$$

where I_d and I_s are respectively the R.M.S. values of the positive and negative sequence components of motor current.

① - 10-step Rotary Switch for setting the value [I_m]

② - 10-step Rotary Switch for setting of the thermal overload class [O/L CLASS].

③ - Red signal led F49

The led is:

(a) Flashing in case of thermal overload alarm (actual estimated temperature over 100% full load temperature).

(b) Illuminated on tripping of the F49 or F37 element.

- Reset from status - a - is automatic
- Reset from status - b - is manual by the Reset button or via the serial communication interface

(*)The status of the LEDs is memorized even on failure of power supply

2.6.2 Locked rotor element F51LR

Ist = (1 – 5)In – Dis-Tr : switch-over current (p.u. of motor full load current).

tst = (1 – 10)s : switch-over time

Operation.

- At motor start-up the locked rotor function is disabled for $2*t_{st}$ seconds.
- After $2t_{st}$, if current exceeds $2.5I_m$ form more than 2sec, the locked rotor element trips and operates R1.

④ - 10-step Rotary Switch for setting the value [I_{st}]

⑤ - 10-step Rotary Switch for setting t_{st}

⑥ - Red signal Led F51LR
The led is :

(a) Flashing:
- When motor current is greater than I_{st} during motor starting time [t_{st}].
- During the F51LR trip time delay (2s).

(b) Illuminated on tripping of the F51LR element.:
- Reset from status - a - is automatic
- Reset from status - b - is manual by the Reset button (11) or via the serial communication Interface.

(*)The status of the LEDs is memorized even on failure of power supply

2.6.3 - Earth Fault element F51N

Io = (0.05-0.5)Ion	:	minimum earth fault pick-up current given as p.u. of relay's rated residual input current
to = (0.1-1)s	:	trip time delay (sec) of earth fault

⑦ - 10-step Rotary Switch for setting the value [Ion]

⑧ - 10-step Rotary Switch for setting of the trip time delay [t_o]

⑨ - Red signal Led F51N-I_o>:
Operates when the actual current $I_o \geq [I_o]$; the led is:

(a) Flashing during the trip time delay t_o

(b) Illuminated on tripping after t_o:

- Reset from status - a - is automatic
- Reset from status - b - is manual by the Reset button ⑪ or via the serial communication Interface.

(*)The status of the LEDs is memorized even on failure of power supply

2.6.4 Phase loss or phase reversal F46.

This function can only be enabled or disabled via the serial communication interface. No other settings can affect it. A trip takes place after a 100ms time delay whenever the ratio between the R.M.S. value of the negative sequence component and the R.M.S. value of the positive sequence component is greater than 0.4. This value is largely exceeded in case of Phase Reversal (Is>Id) and in case of single phase running (Is=Id)

⑬ - Yellow signal Led F46/50:

- The led is illuminated on tripping of the F46 element

Reset is manual by the Reset button ⑪ or via the serial communication interface

2.6.5 Overcurrent protection F50.

This function can only be enabled or disabled via the serial communication interface. No other setting can affect it. A trip takes place instantaneously (≈ 50ms) as soon as the current of any phase exceeds $2xI_{st}$. If Ist is not defined (transition control disabled) the trip level for this function is equal to $10I_m$.

⑬ - Yellow signal Led F46/50:

- The led is flashing on tripping of the F50 element.

Reset is manual by the Reset button ⑪ or via the serial communication interface

2.6.6 Undercurrent F37

Imin = (0.2-0.8)Im : F37 tripping level. It can be set via the serial communication interface.

A trip occurs when the maximum among the three phase currents is smaller than I_{min} for more than 3s. This function can also be disabled via the serial communication interface.

2.6.7 PTC

A trip takes place whenever the PTC input is detected in the open state for at least 300ms (see also par. 2.4)

(14) - Red signal Led PTC:

The led is :

(a) Flashing during the F37 trip time delay tI< (3s) and after tripping of the F37 element.

(b) Illuminated on tripping of the PTC element.

In case of overlapping trips of both the PTC and F37 elements, the led is illuminated.

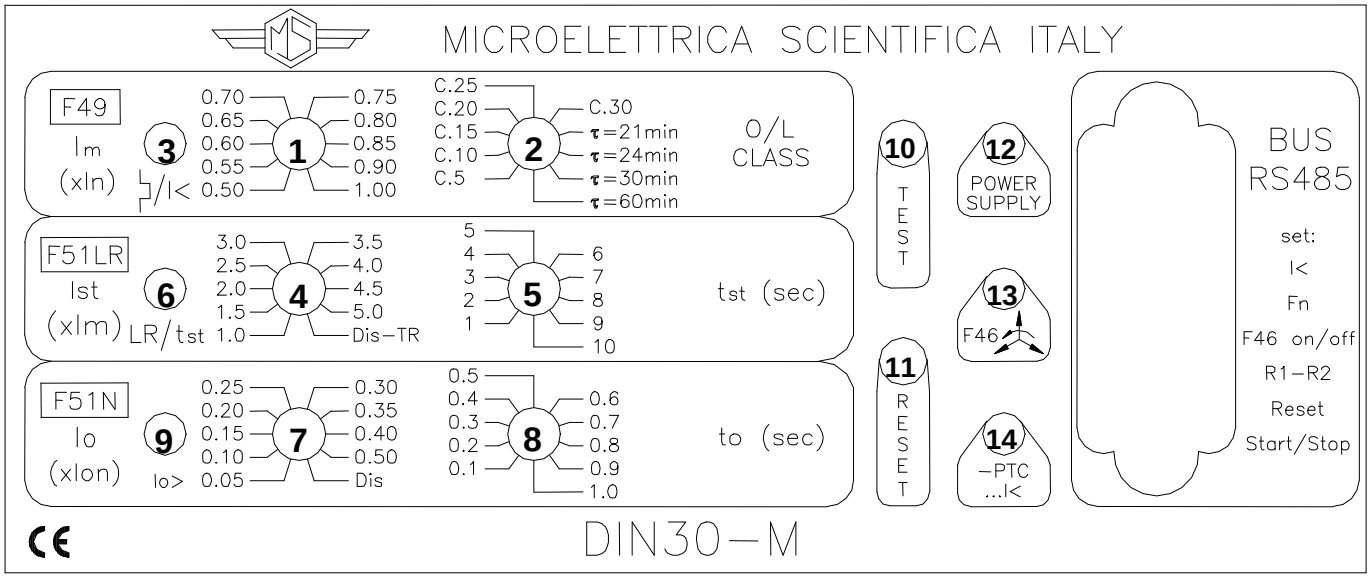
- Reset from status - a - is automatic
- Reset from status - b - is manual by the Reset button (11) or via the serial communication interface

(10) - Test push button : When pressed makes all the functions trip and all the leds lit-on

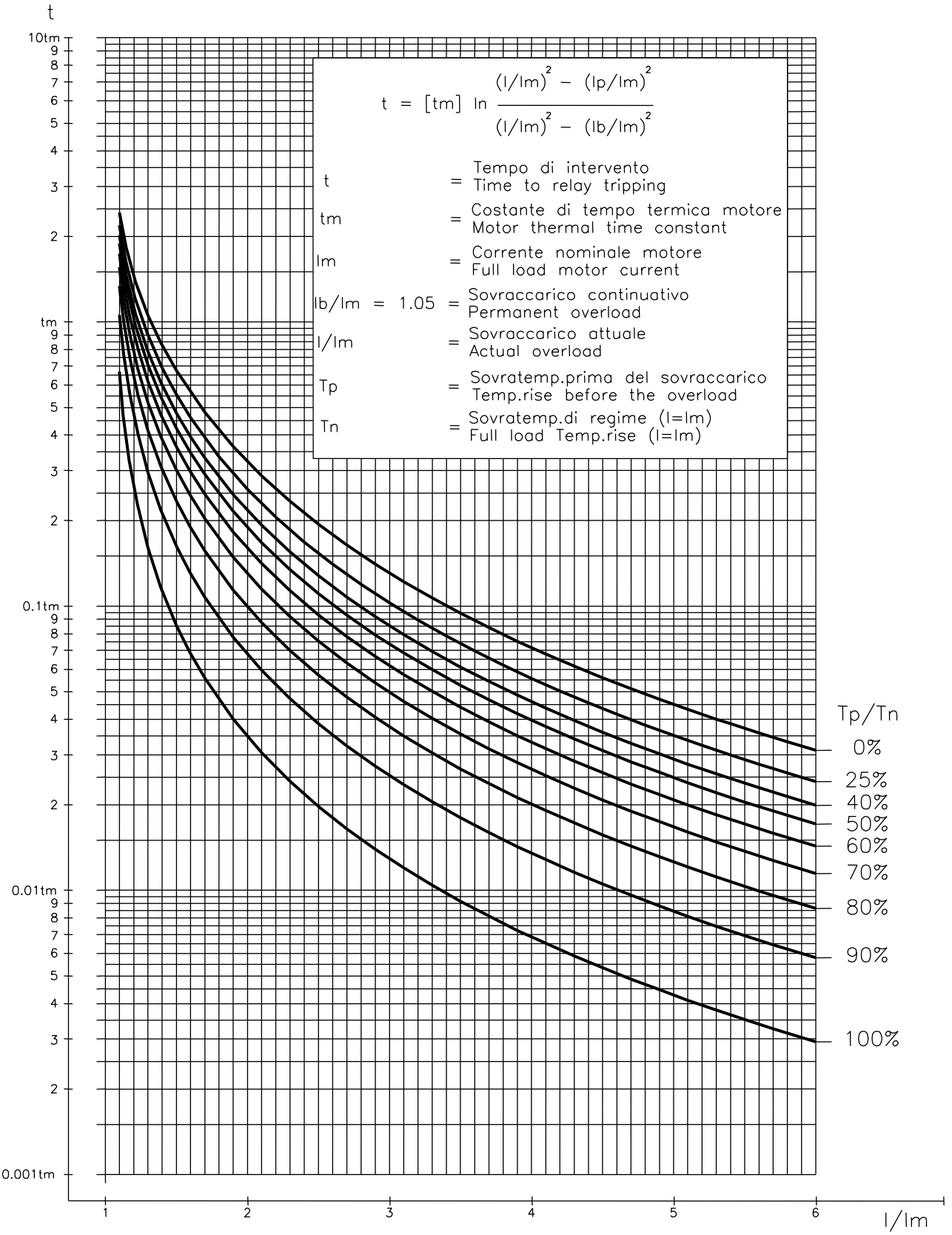
(11) - Reset push button : Press to reset the signal leds after function's tripping. When Manual Reset is programmed, this button also resets the R1 relay.

(12) - Green Led "Power Supply" : Illuminated in normal operation when power input is energized. Flashing when a relay's internal fault is detected by the autodiagnostic function.

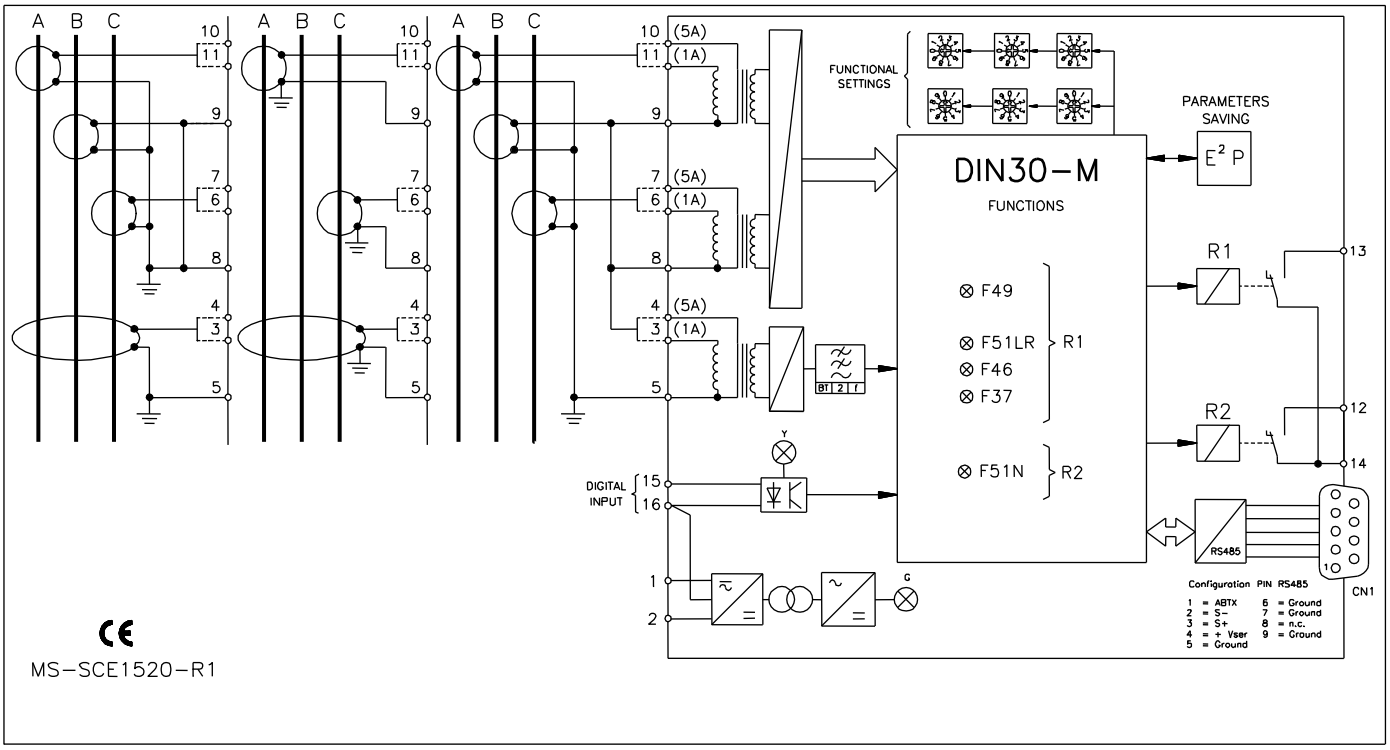
Fig.1



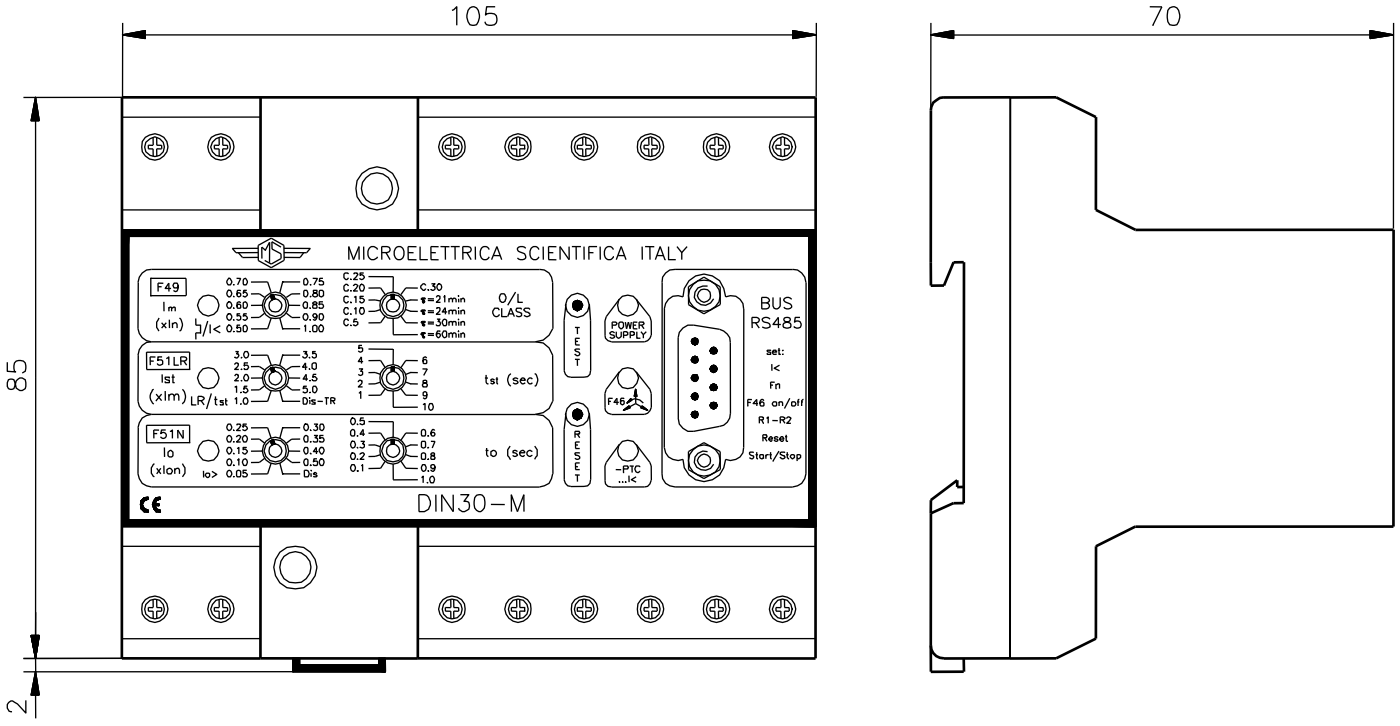
3. THERMAL IMAGE CURVES



4 - CONNECTION DIAGRAM (SCE1520 Rev.1)



5 - OVERALL DIMENSIONS (D46030 Rev.1)



6 - MAINTENANCE

No maintenance is required. Periodically a functional check-out can be made by operating the TEST button on relay's front. 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.

IMPORTANT NOTICE: in case of E^2PROM error (green led (12) flashing after power-up or a test) try the following recover procedure:

1. Push the test button and then the reset button
2. If the error is reset (green led (12) lit-on) turn the relay off and then on again. Check relay's settings via the serial communication interface before restarting normal operation.
3. If the error is not reset repeat the operations listed at point 1.
4. If the error can't be corrected please contact Microelettrica Scientifica Service or the local Authorised Dealer

7 - ELECTRICAL CHARACTERISTICS

Reference standards	IEC 255, 801; CEI 41-1; IEEE C37; CE
Dielectric test voltage	2000 V, 50 Hz, 1 min.
Impulse test voltage	5kV (MC), 1kV (MD) - 1,2/50μs
Immunity to high frequency burst	1 kV (MC), 0,5 kV (MD) - 0,1 MHz 2,5 kV (MC), 1 kV (MD) - 1 MHz
Immunity to electrostatic discharge	15 kV
Immunity to sinusoidal wave burst	100 V - (0,01-1) MHz
Immunity to radiated E.M. field	10 V/m - (20-1000) MHz
Immunity to 50-60 Hz magnetic field	1000 A/m
Immunity to impulse magnetic field	1000 A/m - 8/20μs
Immunity to magnetic burst	100A/m - (0,1-1) MHz
Resistance to vibration and shocks	10-500 Hz - 1 g - 0,075 mm
Rated current phase input	In = 1 or 5 A
Rated current residual current input	On = 1 or 5 A
Current overload	200 a for 1 sec; 10 A continuos
Burden on current inputs	Z_F=2mΩ phase at In; Z_0=3/10mΩ at On = 1/5A
Average power supply consumption	2,5 VA
Output relays	rating 5 A; 250V AC Max switching power = 1250VA Max switching current = 5A (resistive) Max switching voltage = 250V AC - 110V DC Max make current = 0,2A, 110V DC, L/R=40ms
Operation ambient temperature	-20°C / +60°C
Storage temperature	-30°C / +80°C

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