MULTIFUNCTION THREE PHASE OVERCURRENT + EARTH FAULT DIGITAL RELAY FOR SELECTIVE PROTECTION OF MEDIUM VOLTAGE AND LOW VOLTAGE POWER DISTRIBUTION SYSTEMS

TYPE DIN31

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 (15 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 alterated 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 four current transformer :

- 3 for phase current measurement rated 5A with burden 2mΩ (≡ 0,05VA @ 5A);
  measurement is linear from 0,1 to 50A with resolution of 0,1A in the calculation of RMS value
  Permissible overload : 10A permanent, 200A for 1s.
  Recommended C.Ts. ≥3VA class 5P10

- 1 for measurement of residual current with taps for rated input Ion = 1 or 5A ;
  measurement is linear from 0,01 to 2 x Ion with resolution 0,004A in the calculation of the RMS value.
  Ion = 1A burden 10mΩ (0,01VA @ 1A)
  Ion = 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 multivoltage 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 - Digital Input (terminals 15-16)

It is electrically connected to power supply and can be operated only by a cold (not energized) contact.
The Digital Input controls the Reset mode of output relays R1, R2.
If terminals 15-16 are shorted, reset after tripping takes place automatically as soon as the input current drops below the minimum pick-up level (I<[I>], Io<[Io>]).
If terminals 15-16 are open, reset after tripping is controlled via the Reset button on relay's front or via closing a N/O contact connected to terminals 15-16 (Remote Reset).

2.4 - Output relays R1 - R2

Relay R1 is operated by phase overcurrent element (tI>).
Relay R2 is operated by earth fault element (tIo>).
Two N/O 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

2.5 - Signalizations and controls (see Fig. 1)

2.5.1 - Phase Overcurrent element F51

I> = $S_1 \bullet K_1$: minimum pick-up current (input Amps) of relay R1

tI> = t_1 : trip time delay (sec) of relay R1

-①- 10-step Rotary Switch for setting the value $\mathbf{S_1}$

-②- 10-step Rotary Switch for setting the coefficient $\mathbf{K_1}$ and select the operation mode of the phase O/C element (F51, I>)
The rotary switch has 5 positions on the right side half of the scale repeated on the left side half of the scale.
When using the settings on the right side the coefficient : $\mathbf{K_1}$ = 5;
When using the settings on the left side the coefficient : $\mathbf{K_1}$ = 1;

The five positions individuate the time current curve of the overcurrent element :

D = standard independent Definite time :
Relay's pick-up takes place when the actual current exceeds the set level [I>] for the set time [tI>] = [t_1]

DL = Long independent Definite time :
Relay's pick-up takes place when the actual current exceeds the set level [I>] for the set time [tI>] = 10 • [t_1]

SI = Standard dependent Inverse time :
Element's operation starts when the actual current exceeds the set level [I>] and relay's pick-up time delay tI> depends on the ratio of the actual current I to the set level [I>] :

$$tI >= \frac{10^{0,02} - 1}{\left(I / [I >]\right)^{0,02} - 1} \bullet [tI >] = \frac{0,047}{\left(I / [I >]\right)^{0,02} - 1} \bullet [tI >]$$

VI = dependent Very Inverse time :
Same as for the setting SI with

$$tI >= \frac{10 - 1}{\left(I / [I >]\right) - 1} \bullet [tI >] = \frac{9}{\left(I / [I >]\right) - 1} \bullet [tI >]$$

EI = dependent Extremely Inverse time :
Same as for the setting SI with

$$tI >= \frac{10^{2} - 1}{\left(I / [I >]\right)^{2} - 1} \bullet [tI >] = \frac{99}{\left(I / [I >]\right)^{2} - 1} \bullet [tI >]$$

-③- 10-step Rotary Switch for setting of the trip time delay of the O/C element [tI>] = $[t_1]$

(*) In the dependent time operation modes SI, VI, EI, the set time $[t_1]$ corresponds to the actual relay's pick-up time delay when the fault current I is ten times the set level [I>]:
$I = 10 \times [I>] \Rightarrow tI>=[t_1]$

-④- Red signal led F51 - I>
Operates when the actual current I≥[I>]; the led is :
a - Flashing during the trip time delay tI>
b - Illuminated on tripping after tI>
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button ①

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

2.5.2 - Earth Fault element F51N

Io> = $S_o \bullet K_o \bullet Ion$: minimum pick-up current (input Amps) of relay R2

tIo> = t_o : trip time delay (sec) of relay R2

-⑤- 10-step Rotary Switch for setting the value **So**

Ko is set via the Rotary Switch ⑥
Ion is the rated input current determined by the connection tap on relay input :

- Input to Terminals 3 - 5 : **Ion** = 1A
- Input to Terminals 4 - 5 : **Ion** = 5A

-⑥- 10-step Rotary Switch for setting the coefficient **Ko** and to select the operation mode of the Earth Fault element (F51N - Io>)
Operation of this Rotary Switch is same as described for item ② referred the Earth Fault element :

- Right side half of the scale : **Ko** = 5
- Left side half of the scale : **Ko** = 1

- Position **D** : [tIo>] = [to]
- Position **DL** : [tIo>] = 10 x [to]

- Position **SI** : $tI_o >= \dfrac{10^{0,02}-1}{\left(Io/[Io>]\right)^{0,02}-1} \bullet \left[tI_o >\right]$

- Position **VI** : $tI_o >= \dfrac{10-1}{\left(Io/[Io>]\right)-1} \bullet \left[tI_o >\right]$

- Position **EI** : $tI_o >= \dfrac{10^{2}-1}{\left(Io/[Io>]\right)^{2}-1} \bullet \left[tI_o >\right]$

-⑦- 10-step Rotary Switch for setting of the trip time delay of the E/F element [tIo>] = [t_o]

(*) In the dependent time operation modes SI, VI, EI, the set time [t_o] corresponds to the actual relay's pick-up time delay when the actual fault current is ten times the set level : Io = 10 x [Io>]⇒tIo>=[to]

-⑧- Red signal led F51N - Io>
Operates when the actual current I≥[Io>]; the led is :
a - Flashing during the trip time delay tIo>
b - Illuminated on tripping after tIo>
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button ①

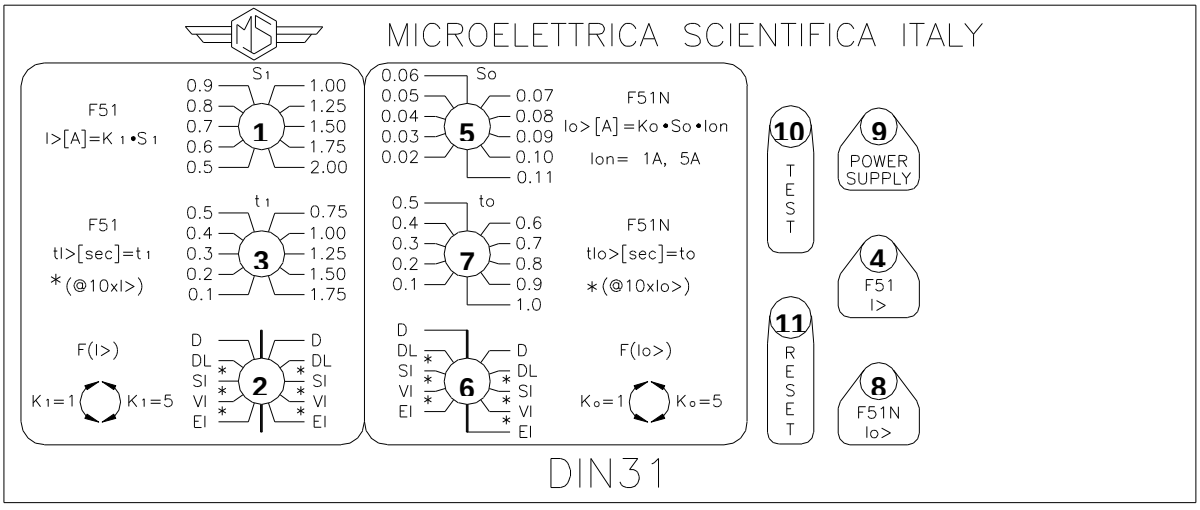
(*) The status of the LEDs is memorized even on failure of power supply

-⑨- 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.

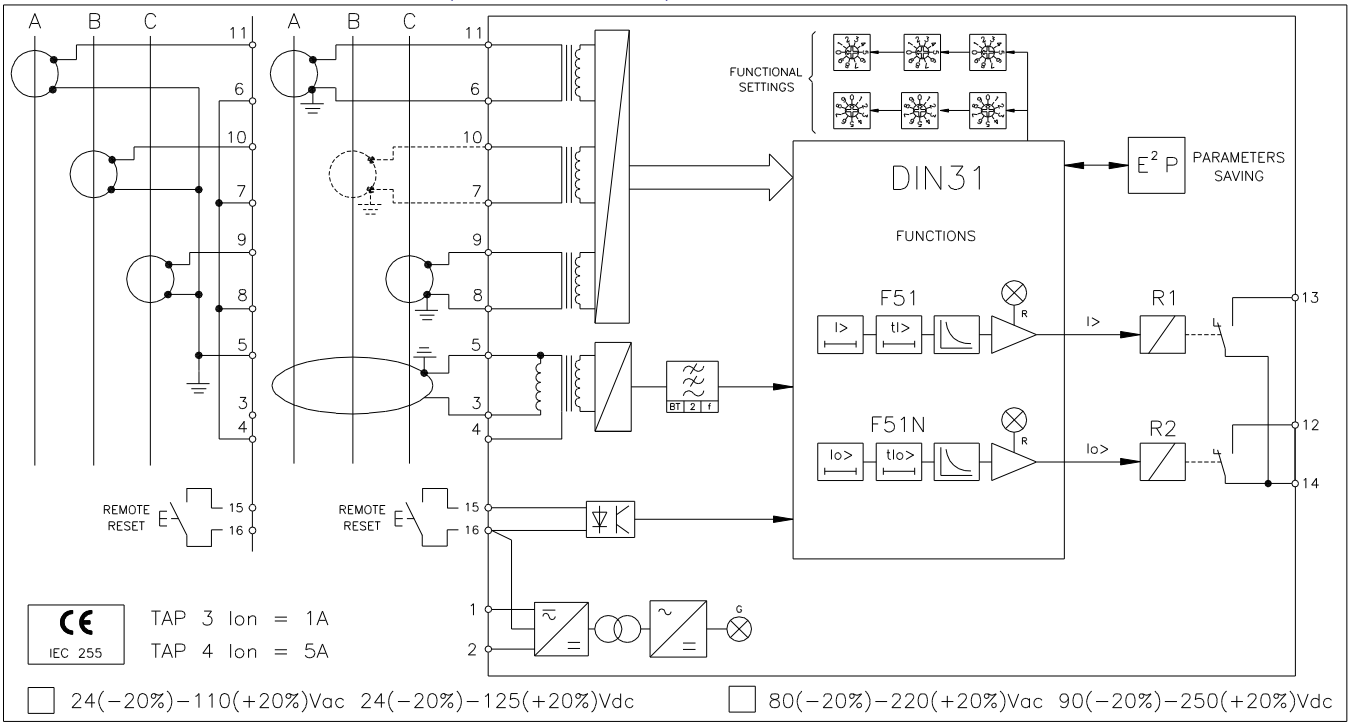
-⑩- Test push button : - When pressed makes all the functions trip and all the leds lit-on

-⑪- Reset push button : - Press to reset after function's tripping the signal led and the output relay (if terminals 15-16 are open)

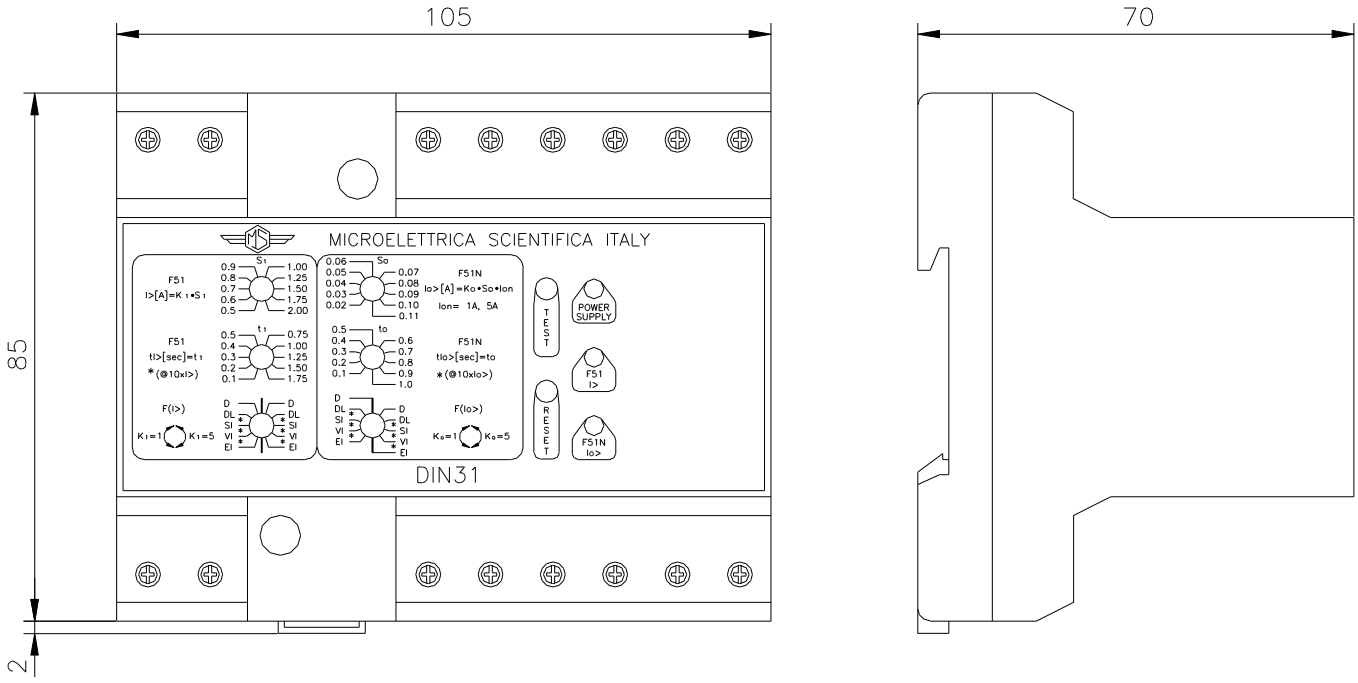
Fig.1



3 - CONNECTION DIAGRAM (SCE1464 Rev.0)



4 - OVERALL DIMENSIONS (D46030 Rev.1)



5 - 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.

6 - 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