PROTECTION RELAY FOR DOUBLE WYE CONNECTED CAPACITOR BANKS

TYPE DIN30-C

OPERATION MANUAL

INDEX

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 transformers :

- 3 for phase current measurement; measurement is linear from 0.05 to 10A with resolution of 0.01A in the calculation of RMS value.
  Burden: 10mΩ (0,01VA @ 1A)
  Permissible overload : 10A permanent, 200A for 1s.
  Recommended C.Ts. ≥3VA class 5P10

- 1 for measurement of unbalance current with taps for rated input I_{on} = 1 or 5A ;
  measurement is linear from 0.02 to 0.6I_{on} with resolution 0,005A in the calculation of the RMS value.
  I_{on} = 1A : burden 10mΩ (0,01VA @ 1A)
  I_{on} = 5A : burden 3mΩ (0,075VA @ 5A)

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 3.11 and Windows 95 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 and modify all the relay's settings (trip levels/times, protection functions enable/disable, relay's configuration).

- 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-C : DATA BASE

Word number (.Bit Number)	Type (I, O, I/O)	Meaning	Range	Unit	Factory default
67	O	Phase A current	0..65535	4238 => $1A^1$	//
68	O	Phase B current	0..65535	4238 => $1A^1$	//
69	O	Phase C current	0..65535	4238 => $1A^1$	//
70	O	Unbalance current	0..65535	7063 => $0.1I_{on}^2$	//
71	O	Zero sequence current	0..65535	1395 => $1A^3$	//
72	O	Negative sequence current	0..65535	2110 => $1A^4$	//
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 shorted 1 => 15..16 input open	//
80.3 => 80.9	//	Reserved	//	//	//
80.10	O	Status of output relay R1	0/1	0 => relay R1 is deenergized 1 => relay R1 is energized	//
80.11	O	Status of output relay R2	0/1	0 => relay R2 is deenergized 1 => relay R2 is energized	//
80.12..80.15	//	Reserved	0/1	//	//
81.0	O	Trip status, F51	0/1	0 => F51 not tripped 1 => F51 tripped	//
81.1	//	Reserved	//	//	//
81.2	O	Trip status, F51N	0/1	0 => F51N not tripped 1 => F51N tripped	//
81.3	O	Trip status, test	0/1	0 => No test trip 1 => Test trip	//
81.4	O	Trip status, F46	0/1	0 => F46 not tripped 1 => F46 tripped	//
81.5	O	Trip status, F37	0/1	0 => F37 not tripped 1 => F37 tripped	//
81.6	O	Trip status, I_o	0/1	0 => I_o not tripped 1 => I_o tripped	//
81.7 => 81.15	//	Reserved	//	//	//
82.0	O	F51N pick up	0/1	0 => No F51N pick up 1 => F51N pick up	//
82.1	O	F46 pick up	0/1	0 => no F46 pick up 1 => F46 picked up	//
82.2	O	F51 pick up	0/1	0 => no F51 pick up 1 => F51 picked up	//
82.3	O	F37 pick up	0/1	0 => no F37 pick up 1 => F37 picked up	//
82.4	//	Reserved	//	//	//
82.5	O	I_o pick up	0/1	0 => no I_o pick up 1 => I_o picked up	//
82.6..82.15	//	Reserved	//	//	//

Word number (.Bit Number)	Type (I, O, I/O)	Meaning	Range	Unit	Factory default
84	I/O	I >: F51 trip level	1..100	0.1A	1 (=> 0.1A)
85	I/O	tI >: F51 trip delay	10..6000	0.01s	10 (=> 0.1s)
86	I/O	I_2 >: F46 trip level	10..75	0.01A	10 (=> 0.1A)
87	I/O	tI_2 >: F46 trip delay	10..6000	0.01s	10 (=> 0.1s)
88	I/O	I_N >: F51N trip level	10..500	0.01A	10 (=> 0.1A)
89	I/O	tI_N > F51N trip delay	10..6000	0.01s	10 (=> 0.1s)
91	I/O	F_n : mains frequency	0..1	0 => 50Hz 1 => 60Hz	0 (=> 50Hz)
92	I/O	I_o >: unbalance element trip level	2..50	0.01I_{on}	2 (0.02 I_{on})
93	I/O	tI_o >: unbalance element trip delay	10..6000	0.01s	10 (0.1s)
100	I/O	I > => Output relays	0..3	0 => no output relay 1 => R2 2 => R1 3 => R1+R2	2 (I > => R1)
101	I/O	I_2 > => Output relays	0..3	0 => no output relay 1 => R2 2 => R1 3 => R1+R2	2 (I_2 > => R1)
102	I/O	I_N> => Output relays	0..3	0 => no output relay 1 => R2 2 => R1 3 => R1+R2	2 (O> => R1)
103	I/O	I_o> => Output relays	0..3	0 => no output relay 1 => R2 2 => R1 3 => R1+R2	1 (I_o> => R2)
104	I/O	I< => Output relays	0..3	0 => no output relay 1 => R2 2 => R1 3 => R1+R2	1 (I< => R1)
106.0	I/O	Remote test command	0/1	0 => normal operation 1 => remote test requested	0
106.1	I/O	Remote reset command	0/1	0 => normal operation 1 => remote reset requested	0
106.2..106.15	//	Reserved	//	//	//
107	I/O	TBI (see par. 2.4)	0..5	0.1s 0 => Dis.	1 (=> 0.1s)
109.0	I/O	F51 enable	0/1	0 => F51 disabled 1 => F51 enabled	1 (F51 enabled)
109.1	I/O	F51N enable	0/1	0 => F51N disabled 1 => F51N enabled	1 (F51N enabled)
109.2	I/O	F46 enable	0/1	0 => F46 disabled 1 => F46 enabled	1 (F46 enabled)
109.3	I/O	F37 enable	0/1	0 => F37 disabled 1 => F37 enabled	1 (F37 enabled)
109.4	I/O	I_o enable	0/1	0 => I_o disabled 1 => I_o enabled	1 (I_o enabled)
109.5..109.15	//	Reserved	//	//	//
110.0	I/O	15..16 input blocks F51	0/1	0 => 15..16 input doesn't block F51 1 => 15..16 input blocks F51	0 (15..16 input doesn't block F51)
110.1	I/O	15..16 input blocks F51N	0/1	0 => 15..16 input doesn't block F51N 1 => 15..16 input blocks F51N	0 (15..16 input doesn't block F51N)

Word number (.Bit Number)	Type (I, O, I/O)	Meaning	Range	Unit	Factory default
110.2	I/O	15..16 input blocks F46	0/1	0 => 15..16 input doesn't block F46 1 => 15..16 input blocks F46	0 (15..16 input doesn't block F46)
110.3	I/O	15..16 input blocks F37	0/1	0 => 15..16 input doesn't block F37 1 => 15..16 input blocks F37	0 (15..16 input doesn't block F37)
110.4	I/O	15..16 input blocks Io >	0/1	0 => 15..16 input doesn't block I_o > 1 => 15..16 input blocks I_o	0 (15..16 input doesn't block I_o >)
110.5	I/O	15..16 input configured as blocking input	0/1	0 => 15..16 input => blocking input 1 => 15.16 input => auto-reset input	0 (15..16 is an auto-reset input)
110.6	I/O	R1 normally energized	0/1	0 => R1 normally de-energized 1 => R1 normally energized	0 (=> R1 normally de-energized)
110.7	I/O	R2 normally energized	0/1	0 => R2 normally de-energized 1 => R2 normally energized	0 (=> R2 normally de-energized)
110.8..110.15	//	Reserved	//	//	//
111	O	Relay id string	//	//	'DI'
112	O	Relay id string	//	//	'N3'
113	O	Relay id string	//	//	'0-'
114	O	Relay id string	//	//	'C '
123	I/O	Node address	1..255	Node address	1

[1] Phase currents are represented using a conventional unit. A value equal to 4238 corresponds to 1A.
[2] Unbalance current is represented using a conventional unit. A value equal to 7063 corresponds to 1/10th of the nominal unbalance current.
[3] Zero sequence current is represented using a conventional unit. A value equal to 1395 corresponds to 1A.
[4] Negative sequence current is represented using a conventional unit. A value equal to 2110 corresponds to 1A

2.4 - Digital Input (Terminals 15-16)

It is electrically connected to the power supply and can be operated only by a cold (not energized) contact.
The digital input is activated when its the terminals are shorted.
The function of the Digital Input (D.I.) can be programmed via the serial port as follows:

2.4.1 - Programming "AutoReset"

The D.I. is used to control the reset mode of the output relays R1, R2.
If terminals 15-16 are shorted, reset after tripping takes place automatically as soon as the cause of the trip disappears.
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).

2.4.2 - Programming "Block Input"

The D.I. is used to increase the trip time delay of the relay's functions by the additional programmable time TBI (sec)
[TBI] = 0,1 - 0,5 - Dis.
When programmed TBI = Dis, the pick-up of the output relay is blocked as long as the D.I. is active (terminals 15-16 shorted).
This function can control one or more of relay's functions according to the values of bits 110.0..110.4 (see par. 2.3.1)

2.5 - Output relays R1 - R2

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

- Maximum continuous 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

Both R1 and R2 can be configured as Normally Deenergized or Normally Energized.
R1 and R2 are programmable and any of them can be associated to any of the DIN30-C's functions.
Configuration of output relays can be done via the serial communication interface.

2.6 - Signalizations and controls (see § 4)

All settings via serial communication interface software.

2.6.1 – Overcurrent element F51

I > = (0.1-10)•A : Trip level of overcurrent element.
tI > = (0.01 – 60)•sec : Trip delay of overcurrent element.

-③- Red signal led F51
The led is:
a) Flashing during the F51 trip time delay.
b) Illuminated on tripping of the F51 element.
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button (11) or via the serial communication interface

This function can be enabled or disabled via the serial communication interface.

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

2.6.2 - Earth Fault element F51N

$I_N >$ = (0.1-5)•A : earth fault pick-up current
$tI_N >$ = (0.1-1)sec : trip time delay (sec) of earth fault element.

-⑨- Red signal Led F51N-$I_N>$
Operates when the actual current $I_N \geq [I_N>]$; the led is :
a) - Flashing during the trip time delay $tI_N>$
b) - Illuminated on tripping after $tI_N>$
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button (11) or via the serial communication Interface.

This function can be enabled or disabled via the serial communication interface.
Warning: this function is automatically disabled when the maximum among the three phase currents is above 3A.
(*) The status of the LEDs is memorized even on failure of power supply

2.6.3 – Negative sequence element F46.

$I_2 > = (0.1 – 0.75)\bullet A$: negative sequence pick-up current
$tI_2 > = (0.1\text{-}60)sec$: trip time delay (sec) of negative sequence element.

-(9)- Red signal Led F46
Operates when the actual current $I_2 \geq [I_2>]$; the led is :
a) - Flashing during the trip time delay $tI_2>$
b) - Illuminated on tripping after $tI_2>$
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button (11) or via the serial communication Interface.

This function can be enabled or disabled via the serial communication interface.

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

2.6.5 – Undercurrent F37

I< = 0.1A : trip level of the undercurrent element.
tI< = 3s : trip delay of the undercurrent element.

-(13) - Yellow signal Led F37
Operates when all the phase currents are lower than [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 (11) or via the serial communication Interface.

A trip takes place when all the three phase currents drop below 0.1A for more than 3s.
This function can be enabled or disabled via the serial communication interface.

2.6.6 – Unbalance element Io >

I_o = 1A or 5A (selectable tap on terminals).

$I_o > = (0.02\text{-}0.5)\bullet I_{on}$: pick-up level of the unbalance element.
$tI_o > = (0.1\text{-}60)sec$: trip time delay (sec) of the unbalance element.

-(14) - Red signal Led Io >

Operates when the actual current $I_o \geq [I_o>]$; the led is :
a) - Flashing during the trip time delay $tI_o>$
b) - Illuminated on tripping after $tI_o>$
Reset from status - a - is automatic
Reset from status - b - is manual by the Reset button (11) or via the serial communication Interface.

This function can be enabled or disabled via the serial communication interface.

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

-⑩- Test push button : - When pressed makes all the functions with relevant relays 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 ouput relays.

-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

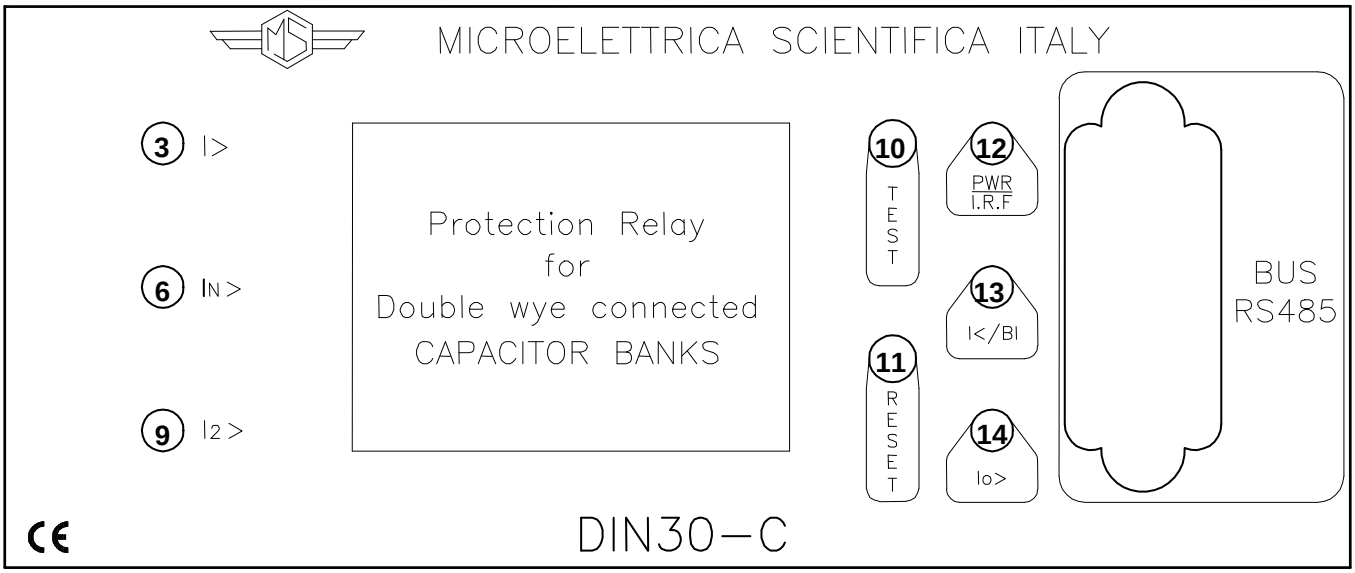
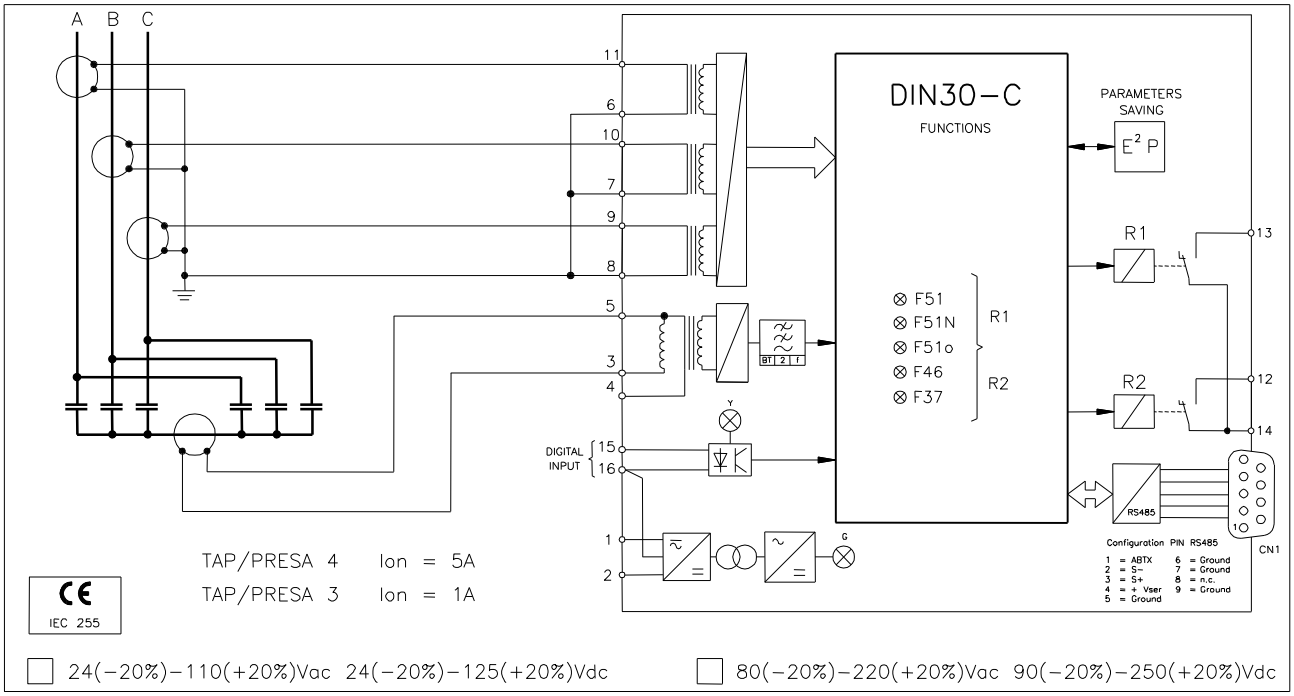
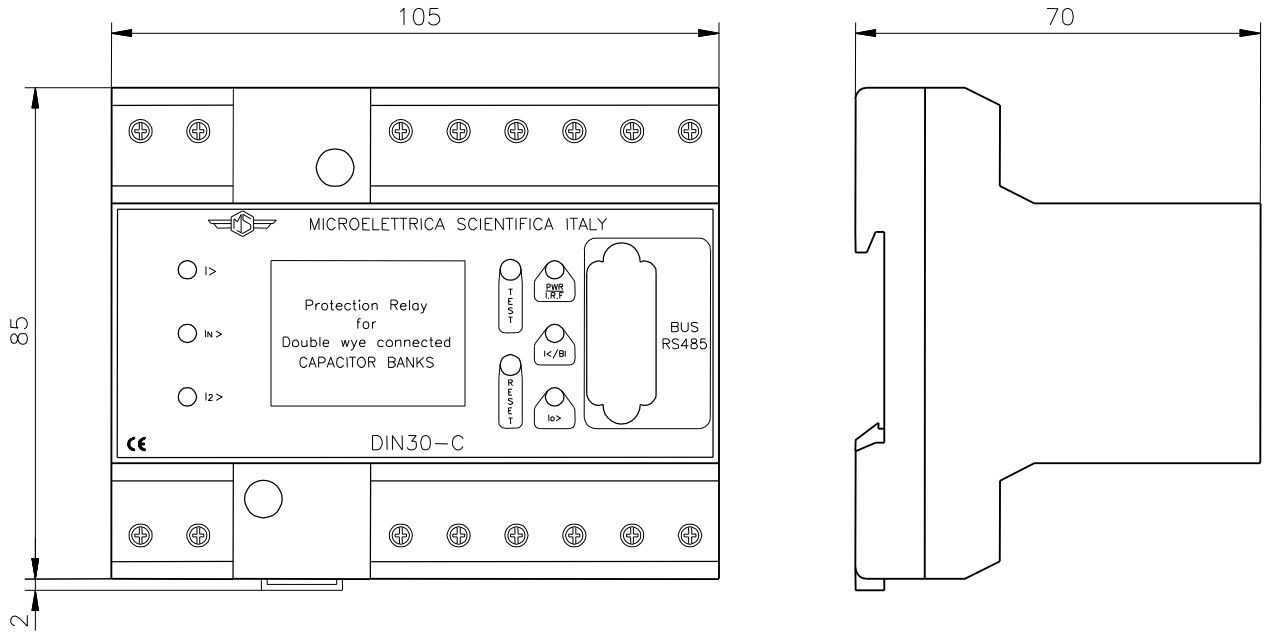


Fig. 2

3 - CONNECTION DIAGRAM (SCE1557 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.

IMPORTANT NOTICE: in case of E2PROM 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) 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

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) - 1,2/50μμs
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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