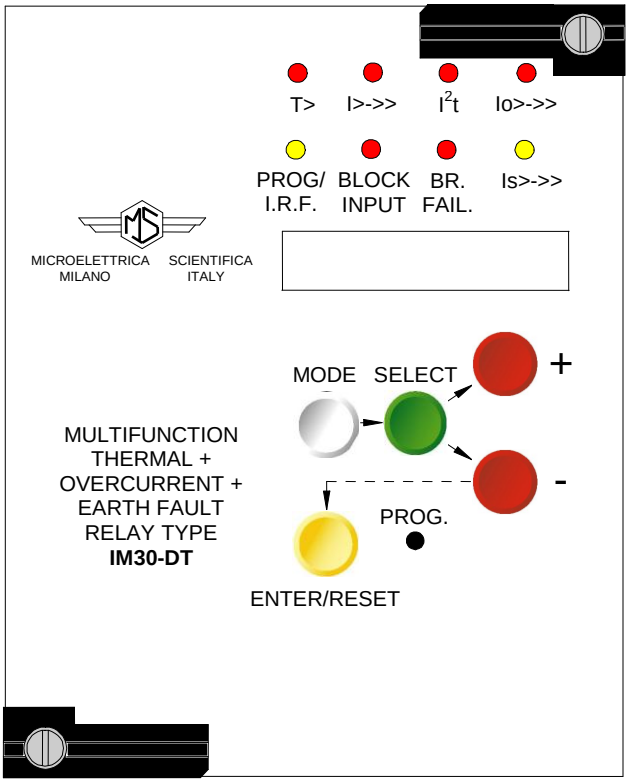
MICROPROCESSOR OVERCURRENT AND UNBALANCE + DIRECTIONAL EARTH FAULT PROTECTION RELAY

TYPE

IM30-DT

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 effectiveness.

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 reduced 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.

a. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.

b. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit tracks or connectors.

c. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.

d. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.

e. Store or transport the module in a conductive bag.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF.

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

Input currents are supplied to 4 Current Transformers: - three measuring phase current - one measuring the earth fault zero-sequence current. Phase current rated input can be 1 or 5A
For zero-sequence current, taps for 1A and 5A input are provided on relay's terminal board.
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.
The auxiliary power is supplied by a built-in interchangeable module fully isolated and self protected.

2.1 - POWER SUPPLY

The relay can be fitted with two different types of **power supply** module :

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

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

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

2.2 - OPERATION OF THE DIRECTIONAL EARTH FAULT ELEMENT

It is assumed :

- **Is** = Set current trip level (O>. O>>)
- **Uo** = Set voltage enable level
- **α** = Set characteristic angle
- **Io** = Actual zero-sequence fault current
- **Vo** = Actual zero-sequence fault voltage
- **φo** = Actual Io/Vo phase displacement
- **Ios** = Component of Io in the direction α

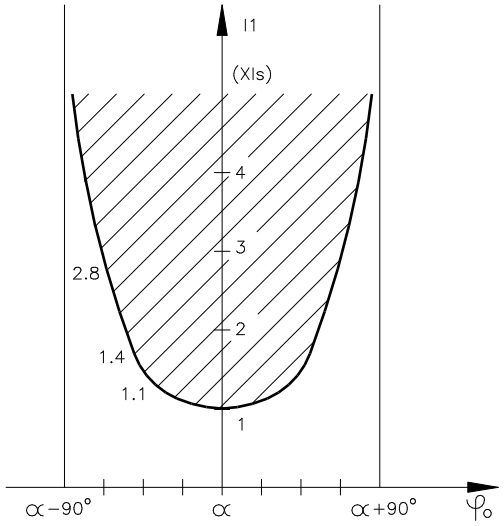


Fig 1

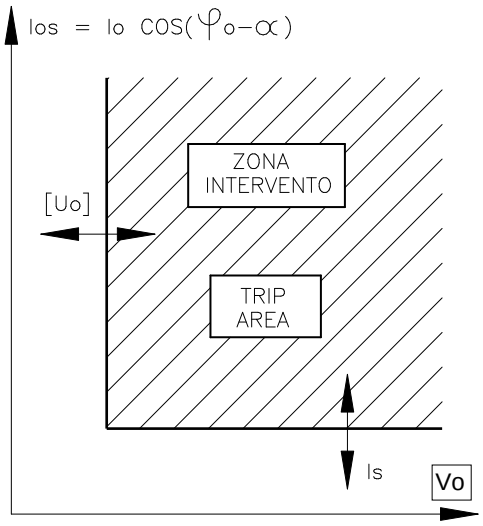


Fig.2

The relay measurement is:

Io x cos(φo -α) = Ios

The relay trips (if Vo>Uo) when **Ios>Is (fig.2)** i.e, when the component of the input current in the measuring direction of the relay overcomes the set trip level Is.(Is = O>, O>>)

Operation is enabled only if the input zero-sequence voltage Vo is above the set level Vs (Vs = Uo<)

The sensitivity of the relay is then proportional to cos(φo -α), it is maximum when φo =α
and its the operation field is limited within the range:

(α - 90°) < φo < (α + 90) **(fig.1)**

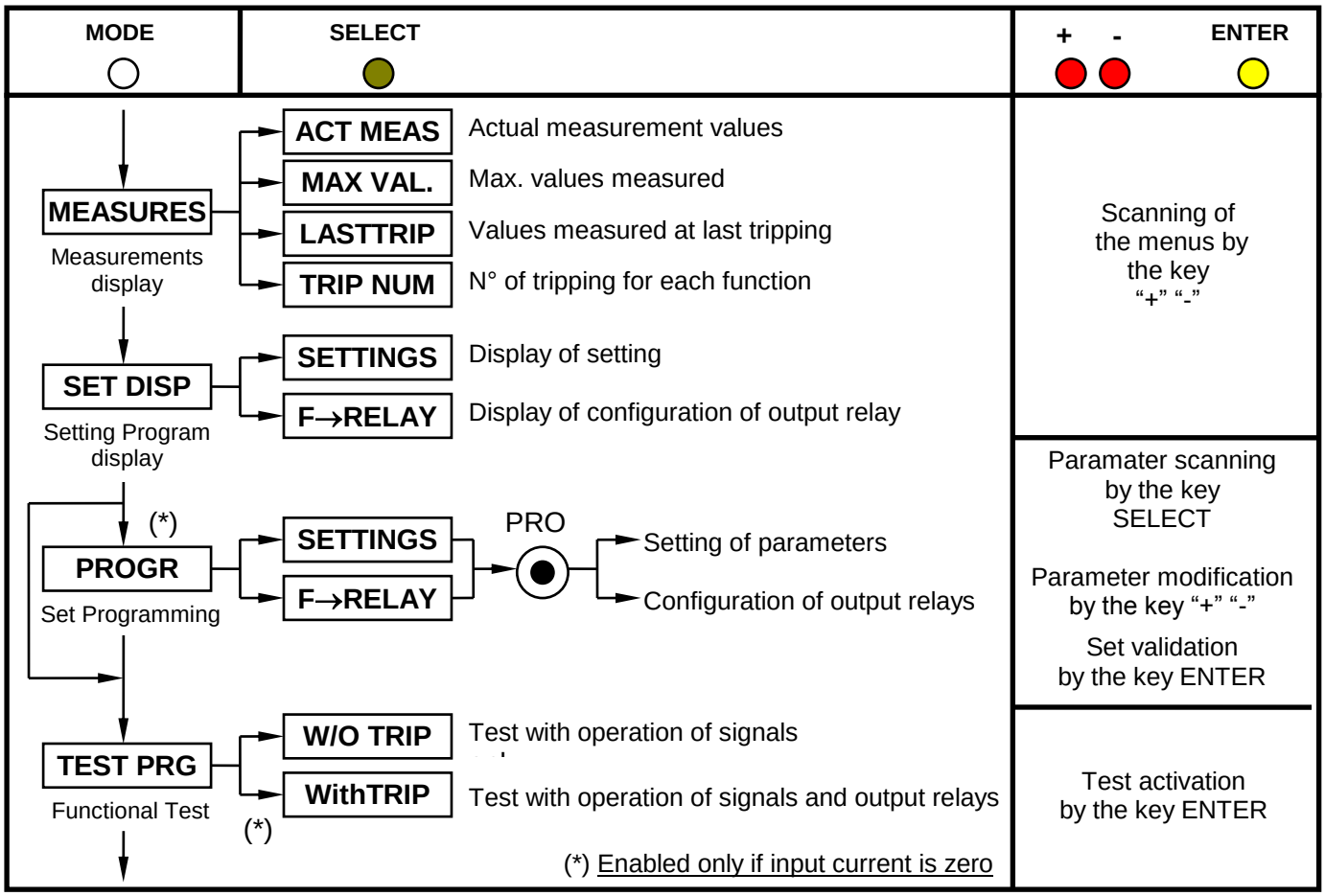
The characteristic angle of the relay must be selected according to the kind of earthing of the installation which has to be protected against earth fault; typical setting are:

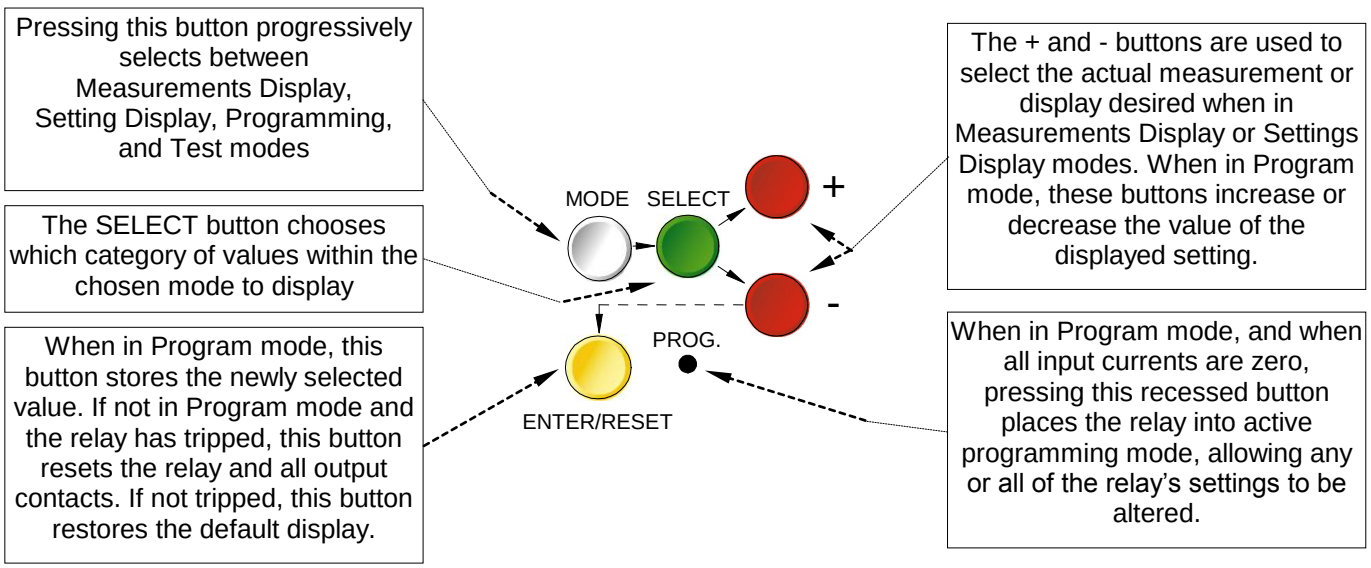
- **UNEARTHED NEUTRAL** **α= 90°**
- **NEUTRAL EARTHED VIA RESISTOR** **α= 0°**
- **SOLIDLY EARTHED NEUTRAL** **α= 60°**

3. CONTROLS AND MEASUREMENTS

Five key buttons allow for local management of all relay's functions.
A 8-digit high brightness alphanumerical display shows the relevant readings **(xxxxxxxx)**
(see synoptic table fig.1)

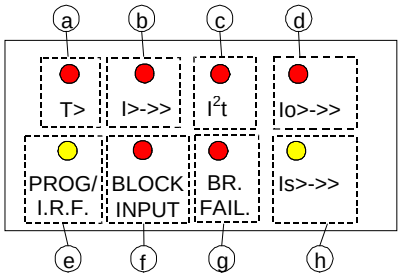
FIG.1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**T>**	❑ Flashing when the level of the oil/iron thermal element reaches the set alarm temperature [Ta]. ❑ Illuminated when the oil / iron's temperature reaches 125% or the windings' temperature reaches 200%
b)	Red LED	**I>->>**	❑ Flashing when the measured current reaches the set current level[I>] or [I>>]. ❑ Illuminated on trip after expire of the set trip time delay [tI>] or [tI>>]
c)	Red LED	**I^2t**	❑ Flashing when current overcomes 2 x [It] ❑ Illuminated when $I^2 \cdot t \geq [2It] * [t2]$.
d)	Red LED	**Io>->>**	❑ Flashing when the measured current reaches the set current level[Io>] or [Io>>] ❑ Illuminated on trip after expire of the set trip time delay [tIo>] or [tIo>>]
e)	Yellow LED	**PROG/ I.R.F.**	❑ Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**BLOCK INPUT**	❑ Flashing when a blocking signal is present at the relevant input terminals. ❑ Lit-on when a Remote Trip has been operated by the RT input (terminals 1-14)
g)	Red LED	**BR. FAIL.**	❑ Lit-on when the BREAKER FAILURE function is activated.
h)	Yellow LED	**Is>->>**	❑ Flashing when the measured current reaches the set current level[1Is] or [2Is]. ❑ Illuminated on trip after expire of the set trip time delay [t1Is] or [t2Is]

The reset of the leds takes place as follows:

- Leds (a,b,c,d,g,h) : - From flashing to off, automatically when the lit-on cause disappears.
  - From ON to OFF, by "ENTER/RESET" push button only if the tripping cause has disappeared.

- Leds (e,f) : - From ON to OFF, automatically when the lit-on cause disappears.

In case of auxiliary power supply failure the status of the leds is recorded and reproduced when power supply is restored.

5. OUTPUT RELAYS

Five output relays are available (R1, R2, R3, R4, R5)

- The relays **R1,R2,R3,R4** are normally deenergized (energized on trip): these output relays are user programmable and any of them can be associated to one of the IM30-TD's functions. One relay eventually associated to the instantaneous element of one of the functions, picks-up and drops-out instantaneously as soon as current comes respectively above or below the set level. If the current remains above the trip level longer then the time delay programmed for the relevant function, the drop-out of the instantaneous relay is anyhow forced after an adjustable waiting time [tBO].(Breaker failure protection control). It has to be remarked that the programming structure does not allow to associate the same relay to instantaneous and delayed elements. Therefore any relay already associated to any time delayed element or to Remote Trip RT cannot be associated to any instantaneous element and viceversa.

- The relay **R5**, normally energized, is not programmable and it is deenergized on:
  - internal fault
  - power supply failure
  - during the programming

6. SERIAL COMMUNICATION

The relays fitted with the serial communication option can be connected via a cable bus a fiber optic bus for interfacing with a Personal Computer (type IBM or compatible).
All the functionalities that can be operated locally (for example reading of input measurement and changing of relay's settings) are also possible via the serial communication interface.
Furthermore the serial port allows the user to read event recording and stored data.
The unit has a RS232 / RS485 interface and can be connected either directly to a P.C. via a dedicated cable or to a RS485 serial bus, allowing having many relays to exchange data with a single master P.C. using the same physical serial line. A RS485/232 converter is available on request.
The communication protocol is MODBUS RTU (only functions 3, 4 and 16 are implemented).
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 Microelettrica Scientifica.

7. DIGITAL INPUTS

Three inputs active when the relevant terminals are shorted are provided:

- **Bf** (terminals 1 - 2) : it blocks the operation of the of the time delayed elements relevant to phase fault detection

- **Bo** (terminals 1 - 3) : it blocks the operation of the time delayed elements relevant to earth fault detection.

When a function is blocked the pick-up of its output is inhibited. Programming allows to have the inhibition either permanent as long as the blocking input is active or automatically removed with a programmable wait-time (see page 11 : tBf , tBo) after the operation of the time delayed function. By proper interconnection of the blocking inputs output among different relays it is possible to configurate very efficient arrangements of logic fault discrimination as well as to feature a safe and quick breaker back-up protection.

- **RT** (terminals 1 - 14) : energized the output relay programmed for Remote Trip.

8. TEST

Besides the normal "WATCHDOG" and "POWERFAIL" functions, a comprehensive program of self-test and self-diagnostic provides:

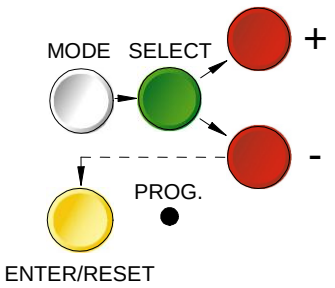
- Diagnostic and functional test, with checking of program routines and memory's content, run every time the aux. power is switched-on: the display shows the type of relay and its version number.

- Dynamic functional test run during normal operation every 15 min. (relay's operation is suspended for less than 4 ms). If any internal fault is detected, the display shows a fault message, the Led "PROG/IRF" illuminates and the relay R5 is deenergized.

- Complete test activated by the keyboard or via the communication bus either with or without tripping of the output relays.

9. KEYBOARD AND DISPLAY OPERATION

All controls can be operated from relay's front or via serial communication bus.
The keyboard includes five hand operable buttons **(MODE) - (SELECT) - (+) - (-) - (ENTER/RESET)** plus one indirect operable key **(PROG)** (see synoptic table a fig.1):



a) - White key **MODE** : when operated it enters one of the following operation modes indicated on the display :

MEASURES	=	Reading of all the parameters measured and of those recorded in the memory
SET DISP	=	Reading of the settings and of the configuration of the output relays as programmed.
PROG	=	Access to the programming of the settings and of relay configuration.
TEST PROG	=	Access to the manual test routines.

b) - Green key **SELECT** : When operated it selects one of the menus available in the actual operation MODE

c) - Red key "**+**" AND "**-**" : When operated they allow to scroll the different information available in the menu entered by the key SELECT

d) - Yellow key **ENTER/RESET** : It allows the validation of the programmed settings
- the actuation of test programs
- the forcing of the default display indication
- the reset of signal Leds.

e) - Indirect key ● : Enables access to the programming.

10. READING OF MEASUREMENTS AND RECORDED PARAMETERS

Enter the MODE "MEASURE", SELECT the menus "ACT.MEAS"-"MAX VAL"-"LASTTRIP"-
-"TRIP NUM", scroll available information by key "+" or "-" .

10.1 - ACT.MEAS

Actual values as measured during the normal operation.
The values displayed are continuously refreshed.

Display	Description
I/Inxxx**%**	Highest among the 3 phase-currents displayed as % of the rated current of phase C.Ts
IAxxxxx**A**	True R.M.S. value of the current of phase A displayed as primary Amps.(0-99999)A
IBxxxxx**A**	As above, phase B.
ICxxxxx**A**	As above, phase C.
Ioxxxxx**A**	As above, earth fault current.
Twxxx**%Tn**	Actual windings' temperature rise displayed as % of full load (I = [It]) steady state temp.Tn
Tfxxx**%Tn**	Actual oil/iron temperature rise displayed as % of full load (I = [It]) steady state temp.Tn
Id/txxx**%**	Positive sequence component of currents systems, displayed as % of full load current [It].
Is/txxx**%**	Negative sequence component of currents system, displayed as % of full load current [It].
Uoxxxxx**V**	True R.M.S. value of the zero-sequence voltage displayed as secondary voltage of main V.Ts. (1-210)V
φoxxxxx°	Io/Uo phase displacement angle in degrees.

10.2 - MAX VAL

Highest values recorded starting from 1sec after closing of main Circuit Breaker plus inrush values recorded within the first 1sec from Breaker closing, (refreshed any time the breaker closes).

Display	Description
IAxx.x**In**	Highest value recorder for R.M.S current of phase A
IBxx.x**In**	As above for phase B.
ICxx.x**In**	As above for phase C.
Iox.xx**On**	As above for Earth Fault current.
Uoxxxxx**V**	As above for Uo recorded after the first 100ms
Twxxx**%Tn**	As above for windings'
Tfxxx**%Tn**	As above for oil/iron
Is/txxx**%**	As above for negative sequence component of current
SAxx.x**In**	Inrush value recorded for R.M.S. current of phase A
SBxx.x**In**	As above for phase B.
SCxx.x**In**	As above for phase C.
Soxx.x**On**	As above for Earth Fault current.
SIsxxxx**%**	As above for negative sequence component of current
SUoxxxx**V**	Peak value of Uo recorded during the first 100ms

10.3 - LASTTRIP

Display of the function which caused the last timed tripping of the relay plus values of the parameters at the moment of tripping. The memory buffer is refreshed at each new relay tripping.

Display	Description
Causexxx	Display of the function which caused the last tripping: **I>; I>>; O>; O>>; I^2t; 1Is; 2Is; T>**
IAxx.x**In**	Current of phase A.
IBxx.x**In**	Current of phase B.
ICxx.x**In**	Current of phase C.
Iox.xx**On**	Earth fault current.
Twxxx**%Tn**	Temperature windings'
Tfxxx**%Tn**	Temperature oil/iron
Id/txxx**%**	Positive sequence component of current
Is/txxx**%**	Negative sequence component of current
Uoxxxxx**V**	Zero-sequence voltage
φoxxxxx**°**	Io/Uo phase displacement

10.4 - TRIP NUM

Counters of the number of operations for each of the relay functions.
The memory is non-volatile and can be cancelled only with a secret procedure.

Display	Description
I> xxxx	Time delayed low set overcurrent
I>> xxxx	Time delayed high set overcurrent
O> xxxx	Time delayed low set earth fault
O>> xxxx	Time delayed high set earth fault
Tw> xxxx	Thermal windings'
Tf> xxxx	Thermal oil/iron
I2t xxxxx	Inrush energy
1Is xxxxx	Inverse time low set negative sequence overcurrent
2Is xxxxx	Time delayed high set negative sequence overcurrent
RT xxxxx	Remote Trip

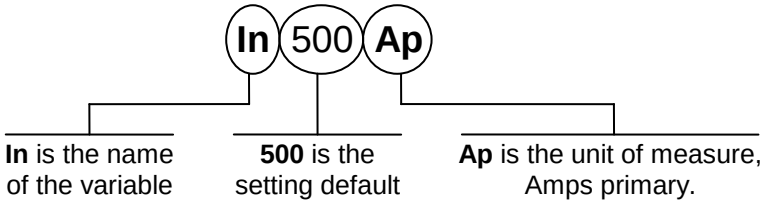
11. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

Enter the mode "SET DISP", select the menu "SETTINGS" or "F→RELAY", scroll information available in the menu by keys "+" or "-".
SETTINGS= values of relay's operation parameters as programmed
F→RELAY= output relay associated to the different functions as programmed.

12. PROGRAMMING

The relay is supplied with the standard default programming used for factory test. [Values here below reported in the " Display " column].
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
Local Programming by the front face key board is enabled only if no input current is detected (main switch open). Programming via the serial port is always enabled but a password is required to access the programming mode. The default password is the null string; in the standard application program for communication "MS-COM" it is also provided an emergency password which can be disclosed on request only.
As soon as programming is enabled, the Led PRG/IRF flashes and the reclosing lock-out relay R5 is deenergized.
Enter MODE "PROG" and SELECT either "SETTINGS" for programming the setting of parameters or "F→RELAY" for programming the configuration of output relays.
Enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT while "+" or "-" are pressed. Press key "ENTER/RESET" to validate the new set values.

12.1 - PROGRAMMING OF FUNCTIONS SETTINGS



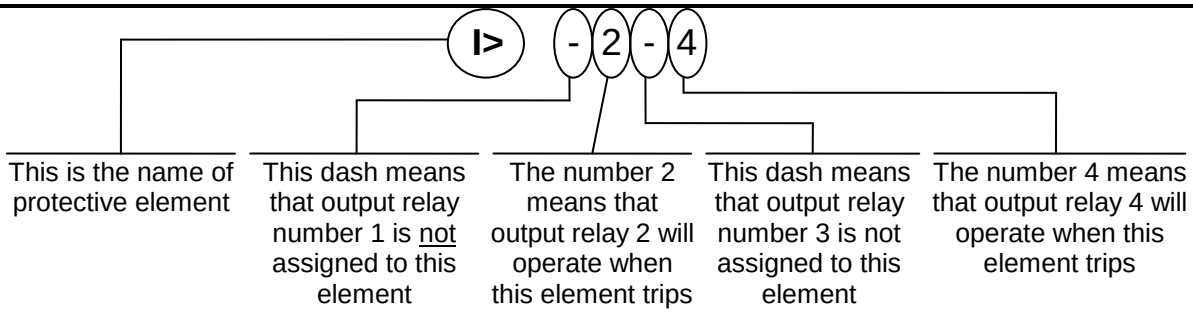
Mode PROG menu SETTINGS. (Production standard settings here under shown).

Display	Description	Setting Range	Step	Unit
Fn 50**Hz**	Mains frequency	50 - 60	-	Hz
In 500**Ap**	Rated primary current of the phase C.Ts.	0 - 9999	1	A
On 500**Ap**	Rated primary current of the C.Ts. or of the tore C.T. supplying the zero sequence current	0 - 9999	1	A
It 0.5**In**	Rated current of the thermal element as p.u. of rated current of phase C.Ts	0,50 - 2,00	0.01	In
tw 3**min**	Warming-up time constant of the windings' thermal element	1 - 400	1	min
Ibw 1.41**It**	Continuous admissible overload	1.05 – 1.50	0.01	It
tf 10 **min**	Warming-up time constant of the oil/iron thermal element	10 – 400 - Dis	1	min
t2 0.1 **s**	Trip time delay of the I^2t element when I = 2[It]	0.1 – 10 - Dis	0.1	s
Ta/n 50**%**	Thermal prealarm temperature as % of full load (I = It) steady state temperature Tn	50 - 120	1	%

Display	Description	Setting Range	Step	Unit
I> 0.5**In**	Trip level of low-set overcurrent element as p.u. of the rated current of the phase C.Ts	0.50 – 20 - Dis	0.01	In
tI> 0.05**s**	Trip time delay of the low-set overcurrent element	0.05 - 30	0.01	s
I>> 0.5**In**	Trip level of high-set overcurrent element as p.u. of the rated current of the phase C.Ts	0.5 - 40 - Dis	0.1	In
tI>>0.05**s**	Trip time delay of the high-set overcurrent element	0.05 - 3	0.01	s
Uo> 25**V**	Starting level of the zero-sequence polarizing input voltage	2 - 25	1	V
α= 0°	Characteristic direction of trip current	0 – 359 - Dis	1	°
O>0.02**On**	Trip level of low-set earth fault element as p.u. of the rated current of the C.Ts. for zero sequence detection	0.02 – 0.4 - Dis	0.01	On
tO> 0.05**s**	Trip time delay of low-set earth fault element	0.05 - 30	0.01	s
O>>0.04**On**	Trip level of high-set earth fault element as p.u. of the rated current of the C.Ts. for zero sequence detection	0.02 - 2.0 - Dis	0.01	On
tO>>0.05**s**	Trip time delay of low-set earth fault element	0.05 - 3	0.01	s
1Is 0.2**It**	Trip level of low-set negative sequence o.c. element as p.u.of It	0.2 - 0.8 - Dis	0.1	It
t1Is 1 **s**	Inverse time delay of element 1Is when Is = It (see curves)	1 - 8	1	s
2Is 0.2**It**	Trip level of high set negative sequence o.c. element as p.u. of It	0.2 - 2.0 - Dis	0.1	It
t2Is0.05**s**	Trip time delay of high set negative sequence o.c. element	0.05 - 3	0.01	s
tBO0.05**s**	Max reset time delay of the instantaneous element after tripping of the delayed element	0.05 - 0.25	0.01	s
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	1

The setting Dis. indicates that the function is disactivated

12.2 - PROGRAMMING THE CONFIGURATION OF OUTPUT RELAYS



Mode PROG menu F→RELAY (Production standard configuration here under shown).
The key "**+**" operates as cursor; it moves through the digits corresponding to the four programmable relays in the sequence 1,2,3,4 (1= relay R1, etc.) and makes start flashing the information actually present in the digit. The information present in the digit can be either the number of the relay (if this was already associated to the function actually on programming) or a dot (-) if the relay was not yet addressed.
The key "**-**" changes the existing status from the dot to the relay number or viceversa.
After having programmed all the four relay, press " ENTER " to validate the programmed configuration.

Display		Description	
I>	----	Instantaneous element of low-set overcurrent	operates relay R1, R2, R3, R4.
tI>	1---	As above, time delayed element	operates relay R1, R2, R3, R4.
I>>	----	Instantaneous element of high-set overcurrent	operates relay R1, R2, R3, R4.
tI>>	1---	As above time delayed element	operates relay R1, R2, R3, R4.
O>	----	Instantaneous element of low-set earth fault element	operates relay R1, R2, R3, R4.
tO>	-2--	As above time delayed element	operates relay R1, R2, R3, R4.
O>>	----	Instantaneous element of high-set earth fault element	operates relay R1, R2, R3, R4.
tO>>	-2--	As above time delayed element	operates relay R1, R2, R3, R4
T>	1---	Thermal overload element	operates relay R1, R2, R3, R4.
Ta	-2--	Thermal prealarm	operates relay R1, R2, R3, R4.
I²t	1---	Energy inrush element	operates relay R1, R2, R3, R4.
t1Is	1---	Inverse time low-set negative sequence o.c. element	operates relay R1, R2, R3, R4.
t2Is	-2--	Definite time high-set negative sequence o.c. element	operates relay R1, R2, R3, R4.
RT	1---	Remote Trip input (cannot be associated to a relay controlled by an instantaneous element).	operates relay R1, R2, R3, R4.
TFRES: A		The reset after tripping of the relays associated to the time delayed elements (tI>, tI>>, tO>, tO>>, T>, Ta, I^2t, t1Is, t2Is) can take place: **(A)** automatically when current drops below the trip level. **(M)** manually by the operation of the "ENTER/RESET" key.	
Bf I>>I>		The input (Bf) for blocking the operation of the time delayed elements relevant to functions I>, I>> can act on the function (I>) only or (I>>) only, or on both (I>, I>>)	
BoO>>O>		The input (Bo) for blocking the operation of the time delayed elements relevant to functions O>, O>> can act on the function (O>) only or (O>>) only, or on both (O>,O>>).	
tBf 2tB0		The blocking of the elements I>, I>> can be programmed so that it lasts as long as the blocking input signal is present (tBf Dis) or so that, even with the blocking still present, it only lasts for the set trip time delay (tI>, tI>>) of the function plus an additional time 2xtBO (tBf 2tBO).	
tBo 2tB0		As above, for the earth fault elements.	

13. MANUAL TEST OPERATION

13.1 - Mode "TESTPROG" subprogram "W/O TRIP"

Operation of the yellow key activates a complete test of the electronics and the process routines. All the leds are lit-on and the display shows (TEST RUN). If the test routine is successfully completed the display switches-over to the default reading (I/Inxxx%).
If an internal fault is detected, the display shows the fault identification code and the relay R5 is deenergized. This test can be carried-out even during the operation of the relay without affecting the relay tripping in case a fault takes place during the test itself.

13.2 - Mode "TESTPROG" subprogram "WithTRIP"

Access to this program is enabled only if the current detected is zero (breaker open).
Pressing the yellow key the display shows "TEST RUN?". A second operation of the yellow key starts a complete test which also includes the activation of all the output relays.
The display shows (TEST RUN) with the same procedure as for the test with W/O TRIP.
Every 15 min during the normal operation the relay automatically initiates an auto test procedure (duration ≤ 10ms). If any internal fault is detected during the auto test, the relay R5 is deenergized, the relevant led is activated and the fault code is displayed.

WARNING

Running the **WithTRIP** test will operate all of the output relays. Care must be taken to ensure that no unexpected or harmful equipment operations will occur as a result of running this test.
It is generally recommended that this test be run only in a bench test environment or after all dangerous output connections are removed.

14. MAINTENANCE

No maintenance is required. Periodically a functional check-out can be made with the test procedures described under MANUAL TEST chapter. 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.

WARNING

In case of Internal Relay Fault detection, proceed as here-below indicated :

- If the error message displayed is one of the following “DSP Err”, “ALU Err” ,”KBD Err” ,”ADC Err”, switch off power supply and switch-on again. If the message does not disappear send the relay to Microelettrica Scientifica (or its local dealer) for repair.
- If the error message displayed is “E2P Err”, try to program any parameter and then run “W/OTRIP”.
- If message disappear please check all the parameters.
- If message remains send the relay to Microelettrica Scientifica (or its local dealer) for repair.

15. ELECTRICAL CHARACTERISTICS

APPROVAL : CE - RINA - UL and CSA approval File : E202083
REFERENCE STANDARDS IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

❑ Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.		
❑ Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50μs		
❑ Climatic tests	IEC 68-2-1	68-2-2	68-2-33	

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

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

CHARACTERISTICS

❑ Accuracy at reference value of influencing factors	2% In for measure 0,2% On 2% +/- 10ms for times
❑ Rated Current	In = 1 or 5A - On = 1 or 5A
❑ Current overload	200 A for 1 sec; 10A continuos
❑ Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A Neutral : 0.03VA at On = 1A ; 0.2VA at On = 5A
❑ Rated Voltage	Un = 100V (different on request)
❑ Voltage overload	2 Un continuous
❑ Burden on voltage inputs	0.04VA at Un
❑ Average power supply consumption	8.5 VA
❑ Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)
❑ Operation ambient temperature	-10°C / +55°C
❑ Storage temperature	-25°C / +70°C
❑ Humidity	IEC 68-2-3 RH 93% Without Condensing at 40°C

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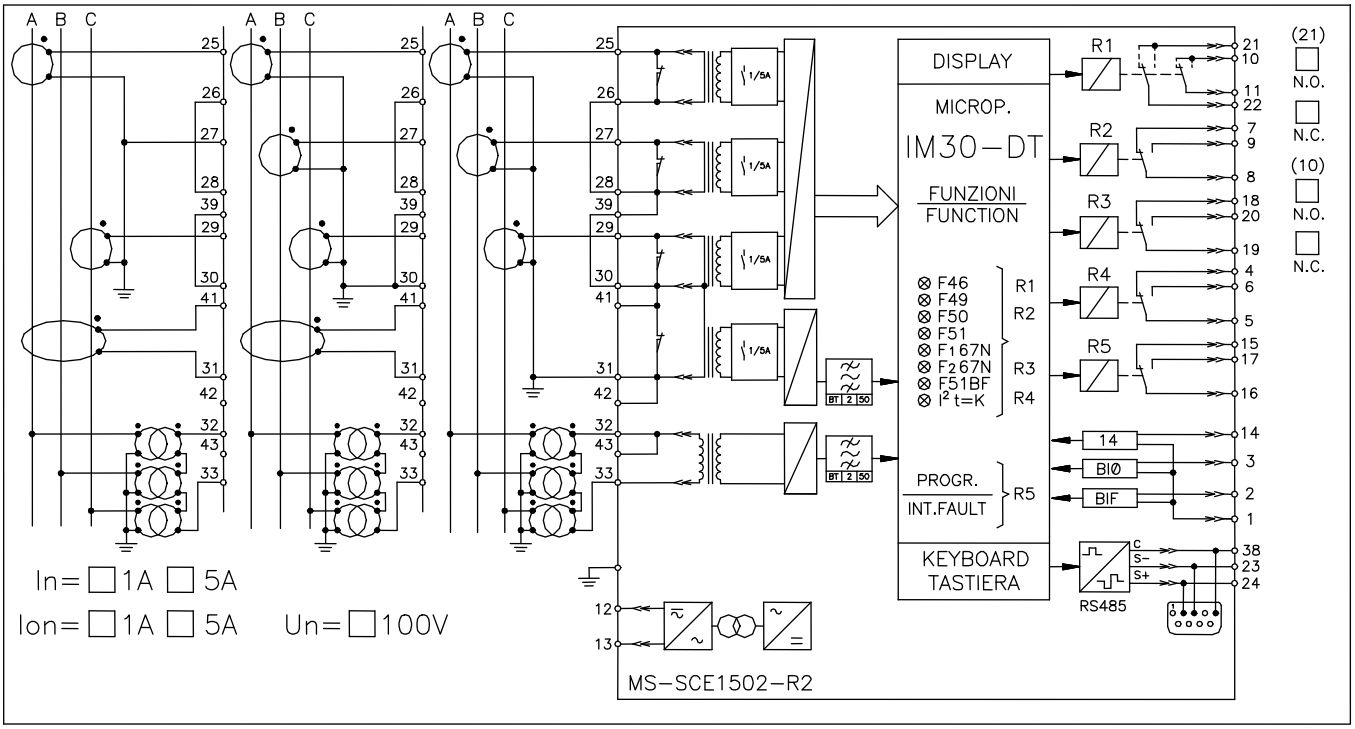
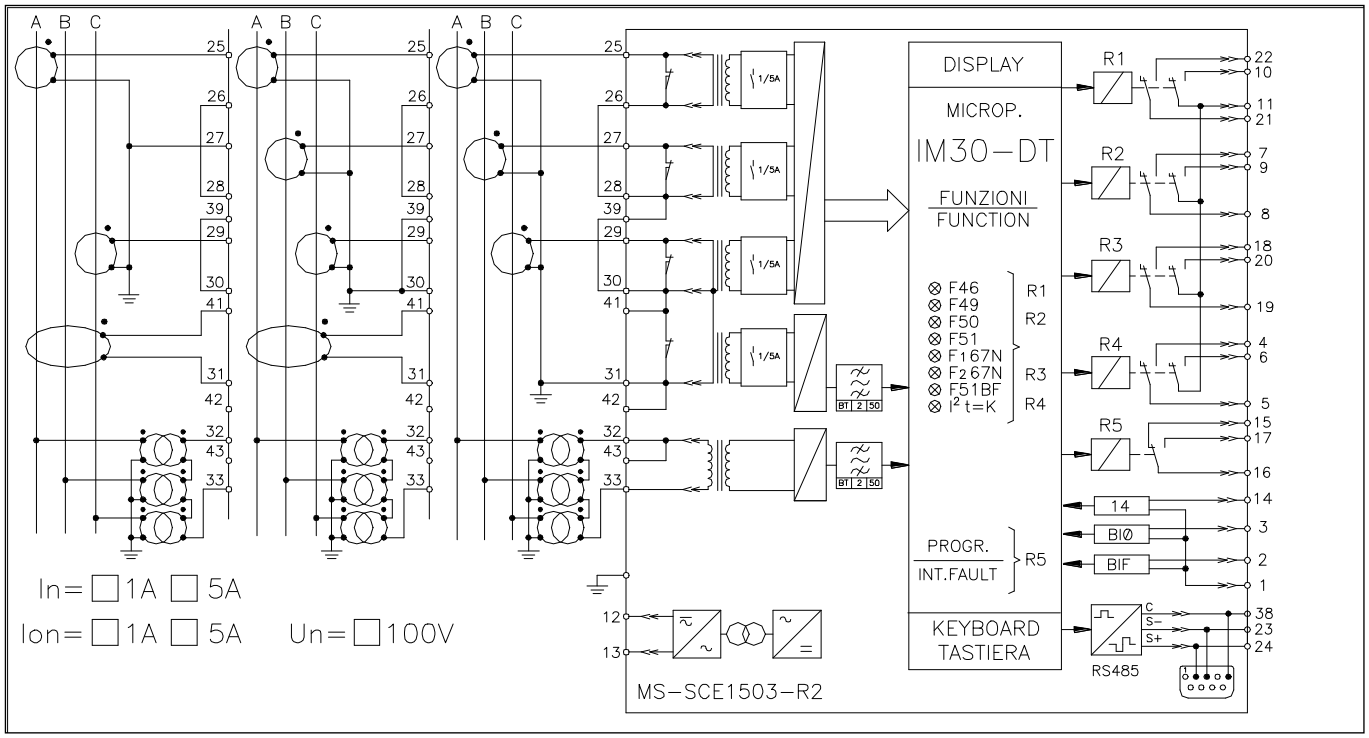
http://www.microelettrica.com **e-mail :** ute@microelettrica.com

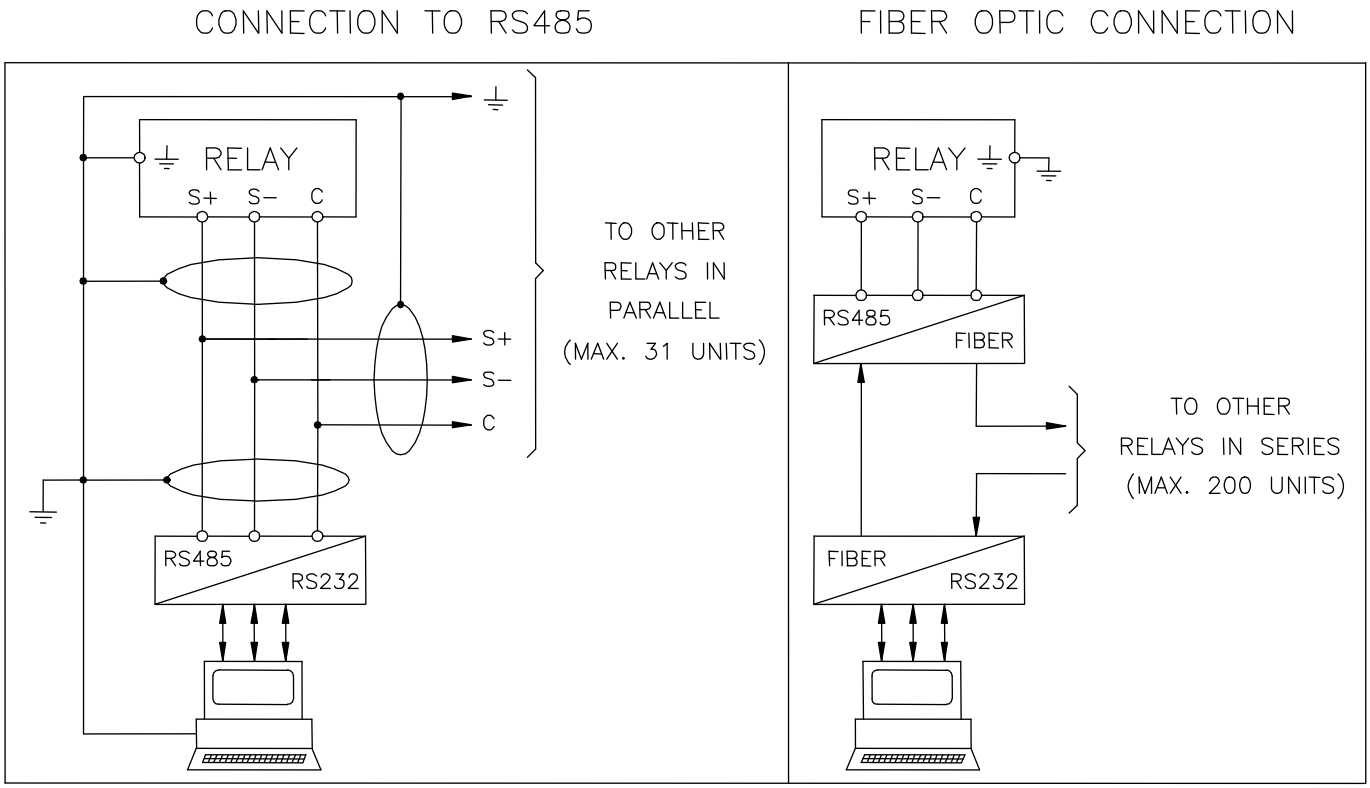
16. CONNECTION DIAGRAM (SCE1502 Rev.2 Standard Output)



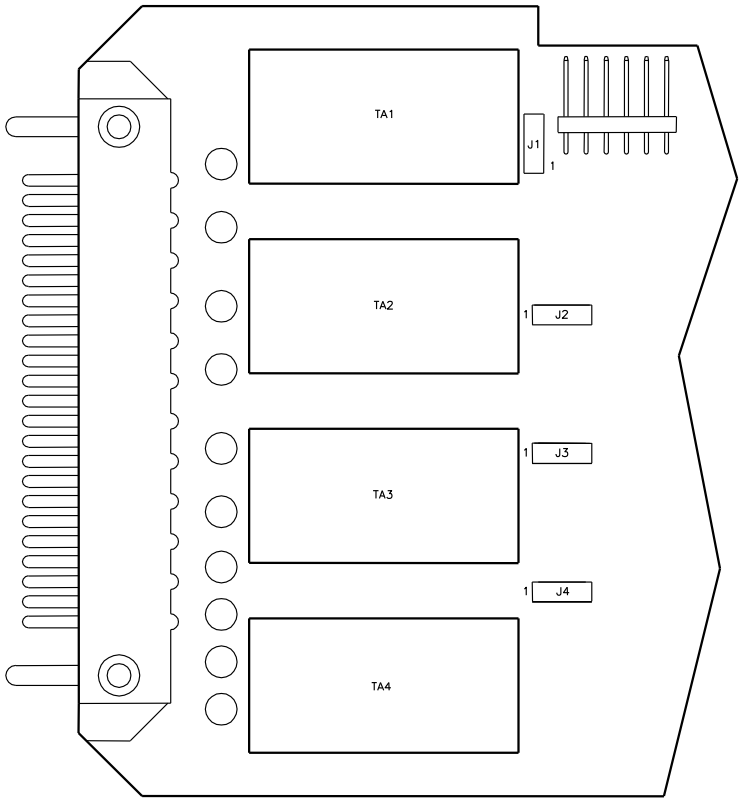
16.1 - CONNECTION DIAGRAM (SCE1503 Rev.2 Double Output)



17. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

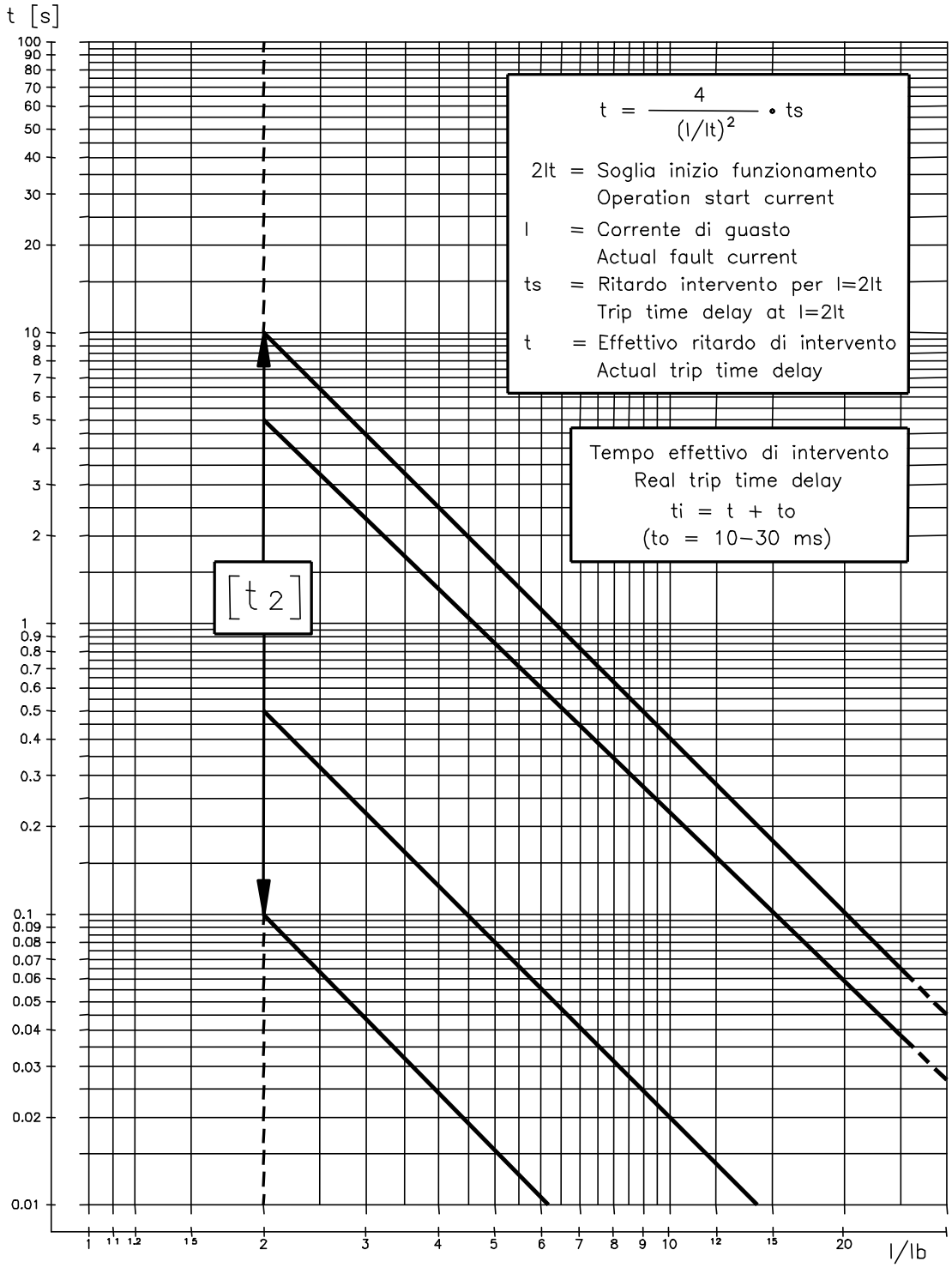


18. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A



Connector	Jumper
J1 Phase A	5A / 1A Rated Input Current
J2 Phase B	Rated Input Current 5A 1A
J3 Phase C	Rated Input Current 5A 1A
J4 Neutral	Rated Input Current 5A 1A

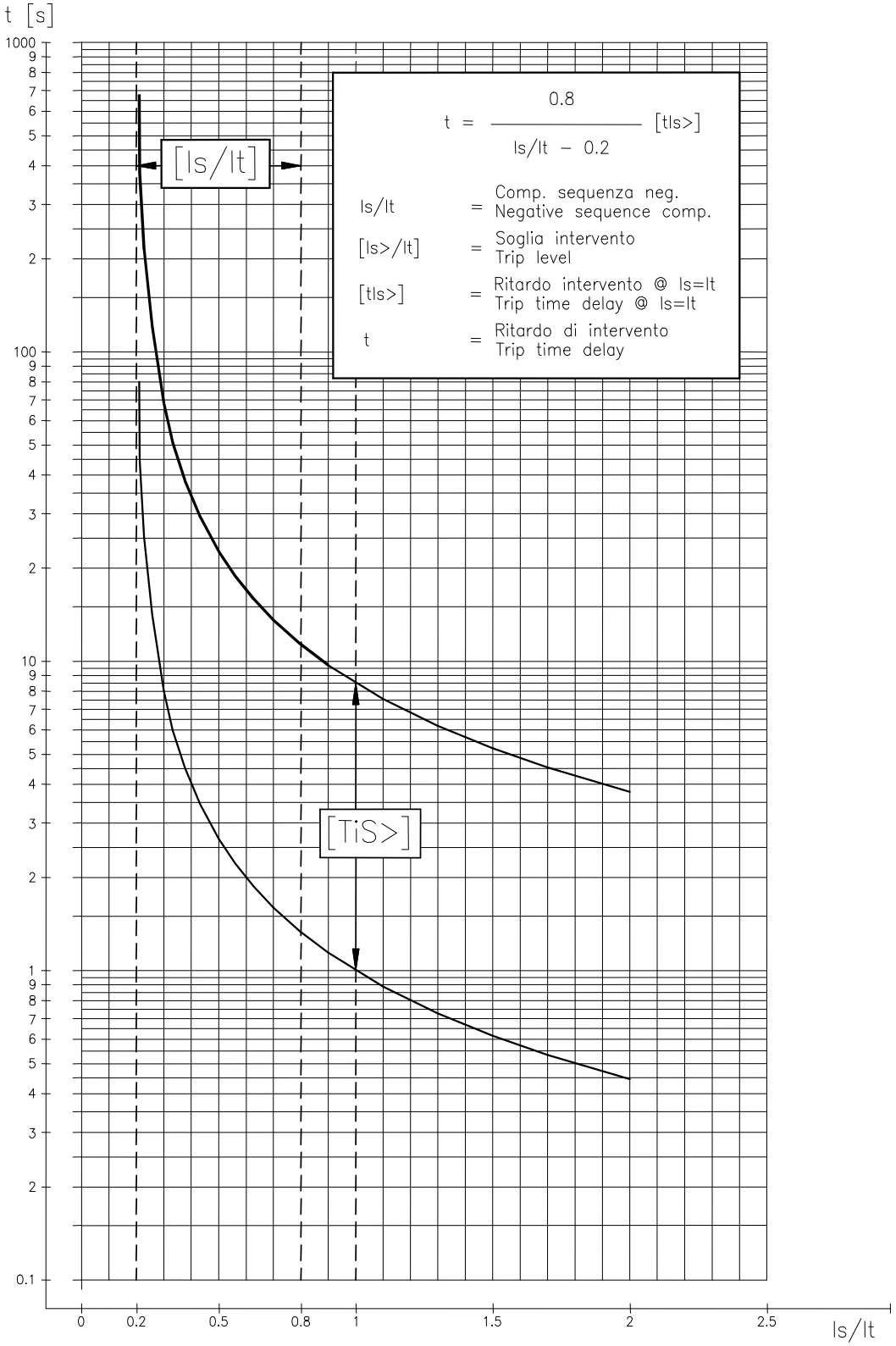
19. I^2t = constant ELEMENT (TU0285 Rev.0)



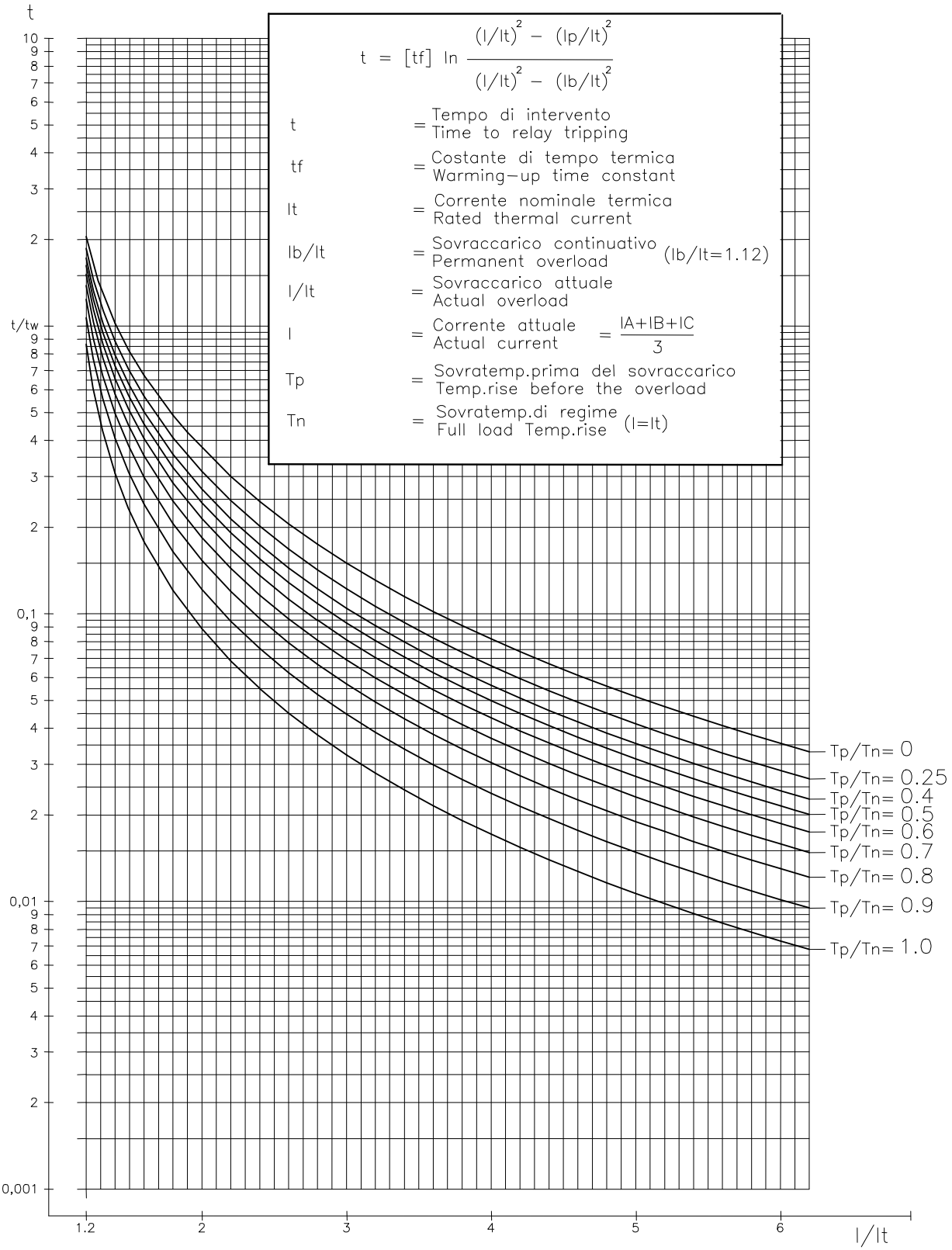
It = (0.5 – 2)In step 0.01In

t = (0.1 – 10)sec. @ I = 2It step 0.1sec.

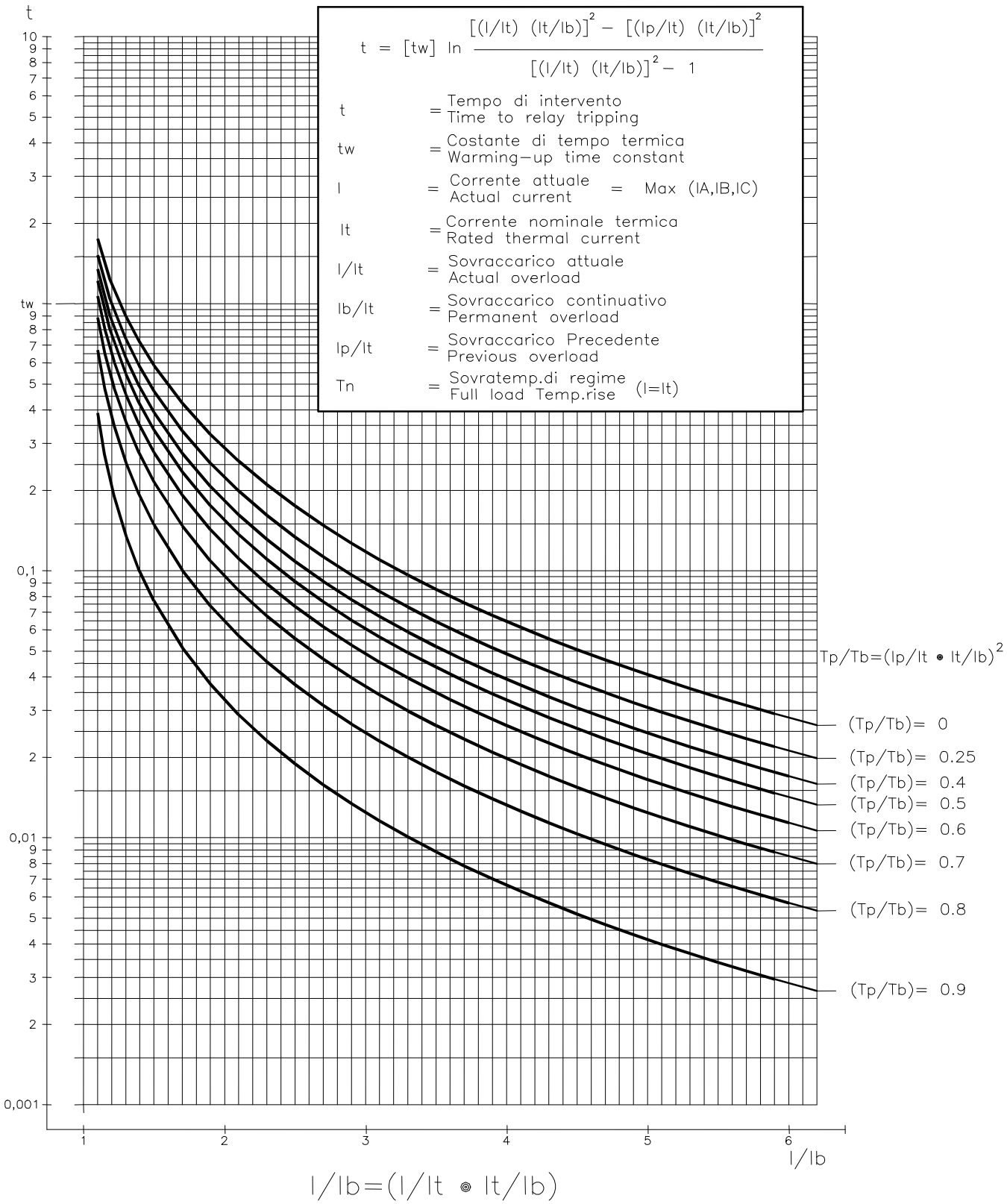
20. INVERSE TIME UNBALANCE PROTECTION (TU0286 Rev.0)



21. OIL/IRON THERMAL IMAGE CURVES (TU0332 Rev.1)



22. WINDINGS' THERMAL IMAGE CURVES (TU0342 Rev.0)



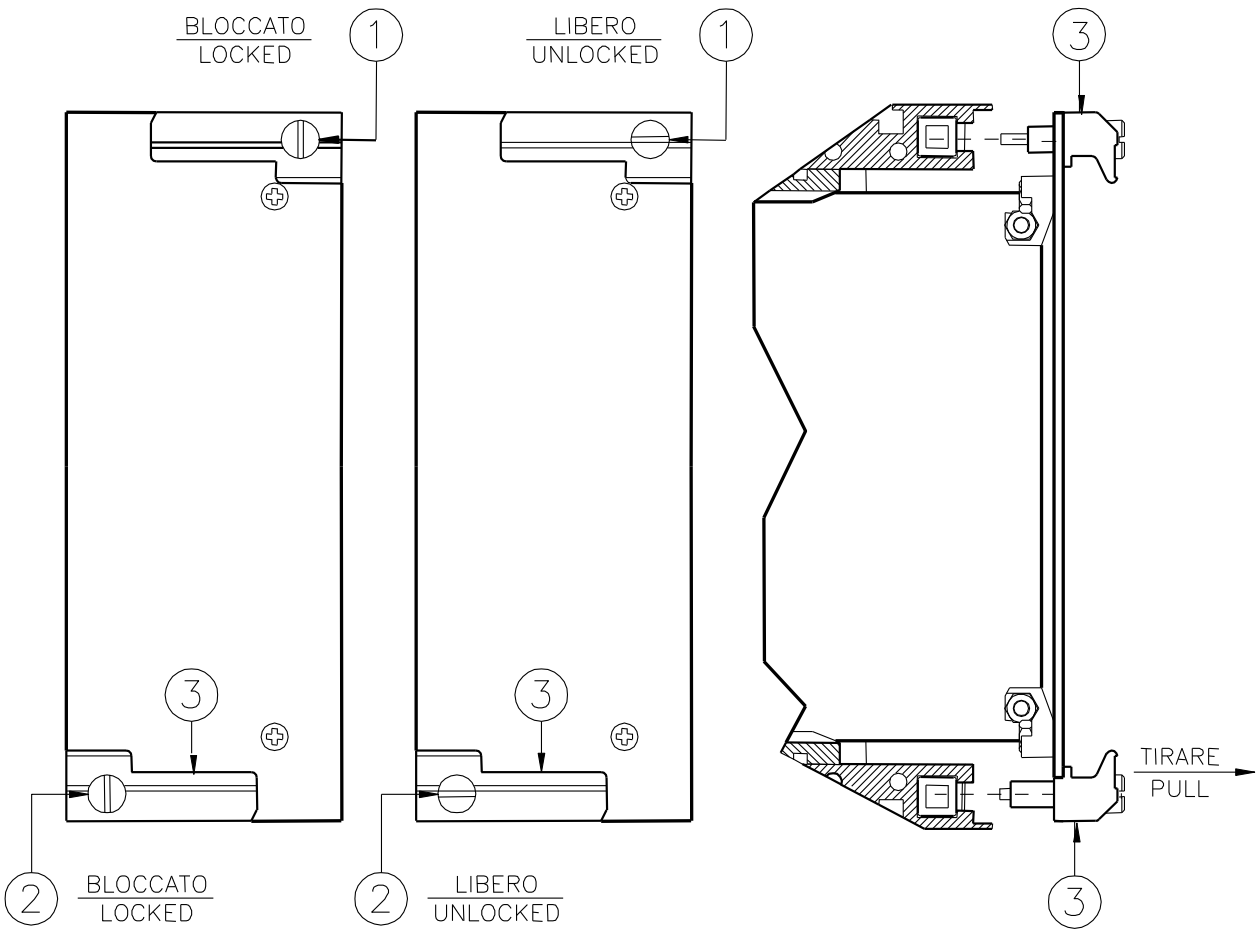
23. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

23.1 Draw-out

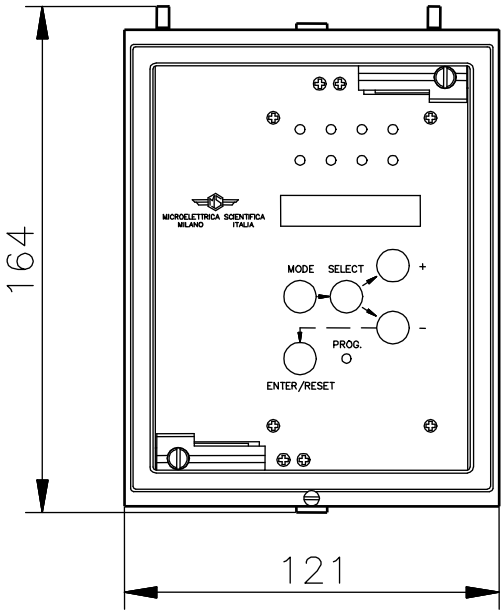
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

23.2 Plug-in

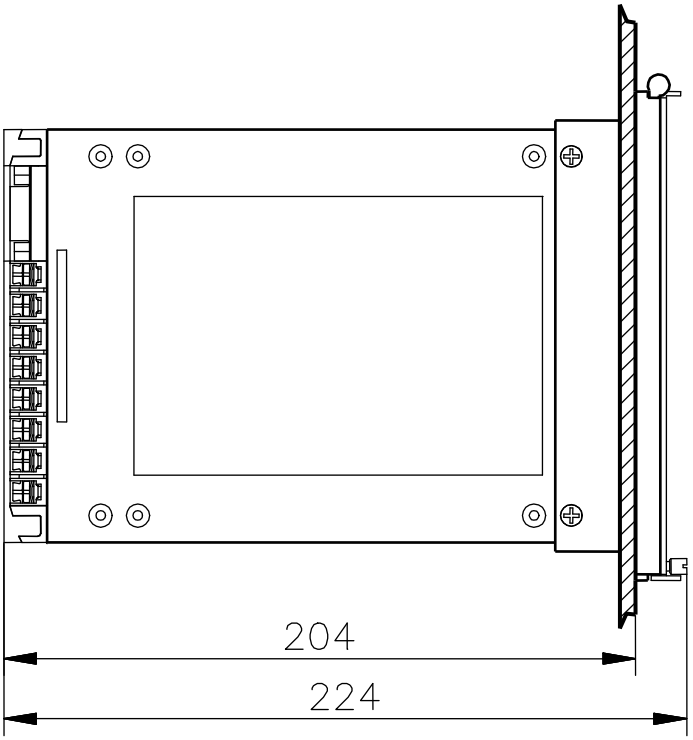
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position (locked).

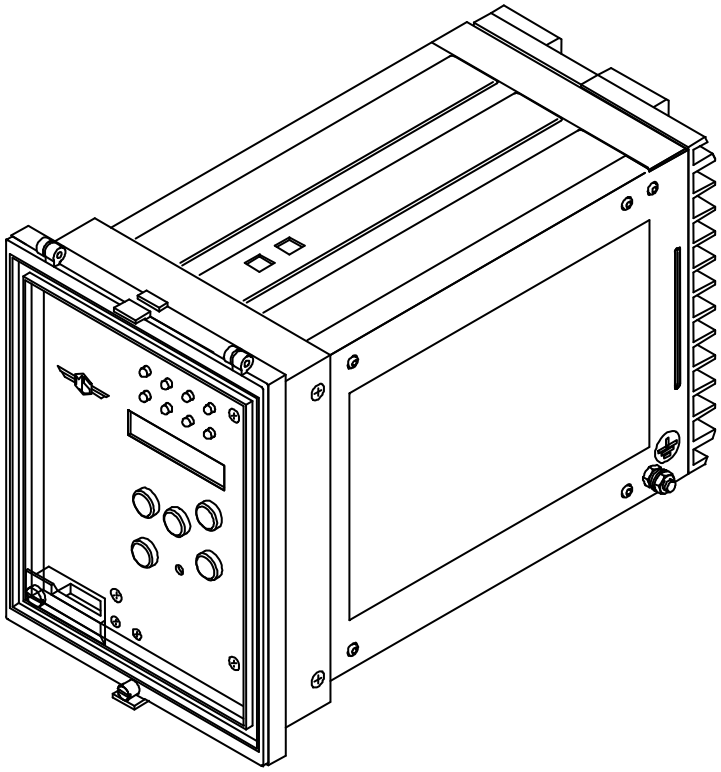


24. OVERALL DIMENSIONS

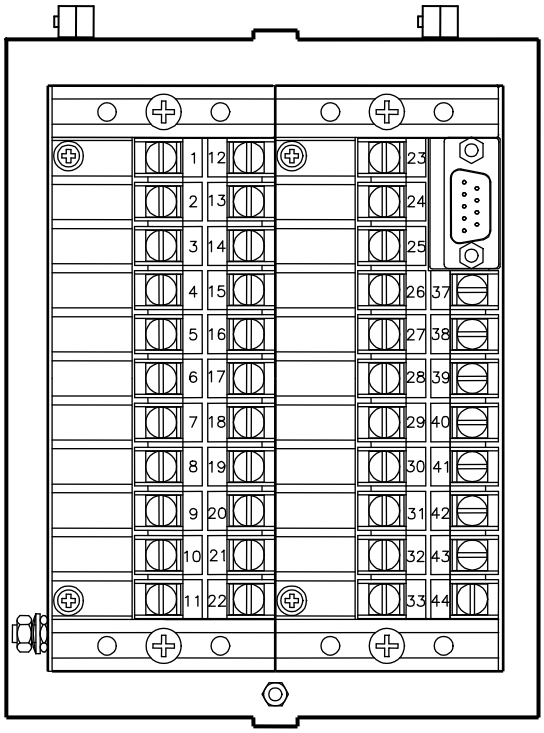


PANEL CUT-OUT 113x142 (LxH)

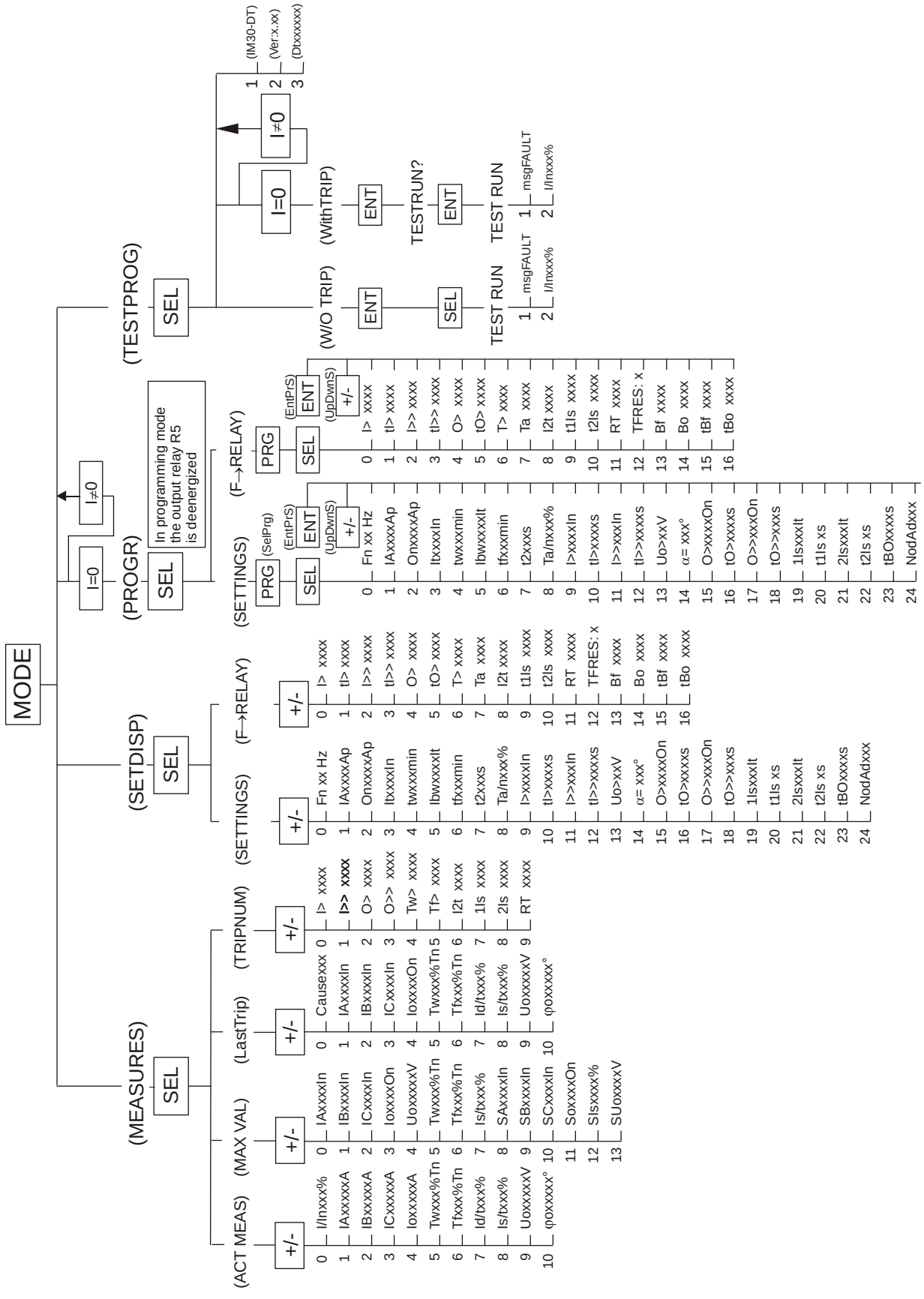




View of Rear Terminal Connection



25. KEYBOARD OPERATIONAL DIAGRAM



26. SETTING'S FORM

Date :		Number Relay:	

RELAY PROGRAMMING

Default Setting				Actual Setting		
Variable	Value	Units	Description	Variable	Value	Units
Fn	50	Hz	Mains frequency	Fn		Hz
In	500	Ap	Rated primary current of the phase C.Ts.	In		Ap
On	500	Ap	Rated primary current of the C.Ts. supplying the zero sequence current	On		Ap
It	0.5	In	Rated current of the thermal element as p.u. of rated current of phase C.Ts	It		In
tw	3	min	Warming-up time constant of the windings' thermal element	tw		min
Ibw	1.41	It	Continuous admissible overload	Ibw		It
tf	10	min	Warming-up time constant of the oil/iron thermal element	tf		min
t2	0.1	s	Trip time delay of the I^2t element when I = 2[It]	t2		s
Ta/n	50	%	Thermal prealarm temperature as % of full load (I = It) steady state temperature Tn	Ta/n		%
I>	0.5	In	Trip level of low-set overcurrent element	I>		In
tI>	0.05	s	Trip time delay of the low-set overcurrent element	tI>		s
I>>	0.5	In	Trip level of high-set overcurrent element	I>>		In
tI>>	0.05	s	Trip time delay of the high-set overcurrent element	tI>>		s
Uo>	25	V	Starting level of the zero-sequence polarizing input voltage	Uo>		V
α=	0	°	Characteristic direction of trip current	α=		°
O>	0.02	On	Trip level of low-set earth fault element	O>		On
tO>	0.05	s	Trip time delay of low-set earth fault element	tO>		s
O>>	0.04	On	Trip level of high-set earth fault element	O>>		On
tO>>	0.05	s	Trip time delay of low-set earth fault element	tO>>		s
1Is	0.2	It	Trip level of low-set negative sequence o.c. element as p.u. of It	1Is		It
t1Is	1	s	Inverse time delay of element 1Is when Is = It	t1Is		s
2Is	0.2	It	Trip level of high set negative sequence o.c. element as p.u. of It	2Is		It
t2Is	0.05	s	Trip time delay of high set negative sequence o.c. element	t2Is		s
tBO	0.05	s	Max reset time delay of the instantaneous element	tBO		s
NodAd	1	-	Identification number for connection on serial communication bus	NodAd		-

CONFIGURATION OF OUTPUT RELAYS

Default Setting						Actual Setting					
Protect. Element	Output Relays				Description	Protect. Element	Output Relays				
I>	-	-	3	-	Instantaneous element of low-set overcurrent operates relay R1 →R4	I>					
tI>	1	-	-	-	As above, time delayed element operates relay R1 →R4	tI>					
I>>	-	-	3	-	Instantaneous element of high-set overcurrent operates relay R1 →R4	I>>					
tI>>	1	-	-	-	As above time delayed element operates relay R1 →R4	tI>>					
O>	-	-	-	4	Instantaneous element of low-set earth fault element operates relay R1 →R4	O>					
tO>	-	2	-	-	As above time delayed element operates relay R1 →R4	tO>					
O>>	-	-	-	4	Instantaneous element of high-set earth fault element operates relay R1 →R4	O>>					
tO>>	-	2	-	-	As above time delayed element operates relay R1 →R4	tO>>					
T>	1	-	-	-	Thermal overload element operates relay R1 →R4	T>					
Ta	-	2	-	-	Thermal prealarm operates relay R1 →R4	Ta					
I²t	1	-	-	-	Energy inrush element operates relay R1 →R4	I²t					
t1Is	1	-	-	-	Inverse time low-set negative sequence o.c. element operates relay R1 →R4	t1Is					
t2Is	-	2	-	-	Definite time high-set negative sequence o.c. element operates relay R1 →R4	t2Is					
RT	1	-	-	-	Remote Trip input operates relay R1 →R4	RT					
TFRES:	A				The reset after tripping of the relays associated to the time delayed elements can take place: **(A)** automatically **(M)** manually	TFRES:					
Bf	I>>I>				The input (Bf) for blocking the operation of the time delayed elements relevant to functions I>, I>> can act on the function (I>) only or (I>>) only, or on both (I>, I>>)	Bf					
Bo	O>>O>				The input (Bo) for blocking the operation of the time delayed elements relevant to functions O>, O>> . (O>) only or (O>>) only, or on both (O>,O>>).	Bo					
tBf	2tB0				The blocking of the elements I>, I>>.	tBf					
tBo	2tB0				As above, for the earth fault elements.	tBo					