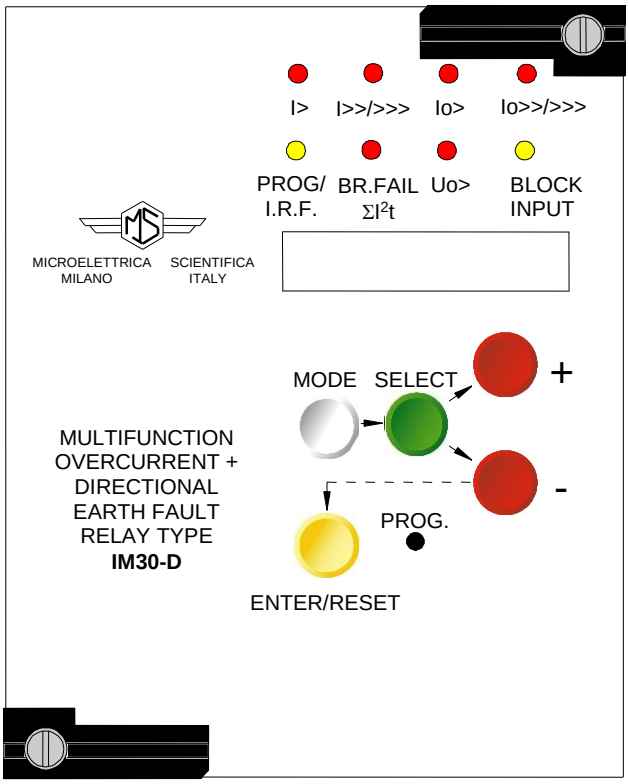
MICROPROCESSOR OVERCURRENT AND DIRECTIONAL EARTH FAULT PROTECTION RELAY

TYPE

IM30-D

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 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 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

Input quantities are supplied to 1 Potential Transformer and to 4 Current Transformers (- three measuring phase current - one measuring the earth fault zero-sequence current).
Rated current input can be 1 or 5A. The zero sequence polarizing voltage input is rated 100V (from V1:√3/100:3 V open delta connected V.Ts.).
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 an 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 and Algorithms

2.2.1 – Input Quantities

System Frequency

The system frequency Fn can be set to 50 or 60 Hz

Current inputs (See Connection Diagram § 16)

The relay directly displays the r.m.s. value of 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 we have to load the value of the Rated Primary Current " **In** " of the phase CTs:
In = (1-9999)A, adjustable in steps of 1A.
Similarly for the Residual (Zero Sequence) Current, we have to load the value of the Rated Primary Current **On**=(1-9999)A, adjustable in steps of 1A.

If the input of the Earth Fault element is supplied by the Residual connection of the 3 phase CTs, we shall set for " **On** " the same value as " **In** ".

If the input of the Earth Fault element is supplied by a separated Core Balance CT, or by another CT, " On " value will be the Rated Primary Current of this CT, normally different from " In ".

The Rated Secondary Current of the CTs, can be either 1A of 5A.

For the Phase Current inputs, 1A or 5A configuration can be selected by moving the jumpers provided on the CT input card (see § 18).

For the Earth Fault Current input, configuration is obtained by the jumper "J4".

Example :

- Phase CTs 1500/5A and Core Balance CT 100/1A
- Load In = 1500A and On = 100A
- Configure CT input card with jumpers J1, J2, J3 in the 5A position.
- Configure Earth Fault input in the 1A position by the jumper "J4".

2.2.2 - ALGORITHM OF THE TIME CURRENT CURVES (see § 19 and 20)

For the function “1I” (first overcurrent level F51) and “1O” (first Earth Fault level F51/67N) it is possible to program either an Independent Definite Time operation or a Dependent Inverse Time operation selectable among 8 different types.
Each Inverse time operation type offers a family of TCC definable by the relevant programmable variable.
For the other functions (2I, 3I, 2O, 3O, Uo) the operation is Independent Definite Time only with adjustable time delay.

The Time Current Curves are generally calculated with the following equation:

$$(1)\ t(I) = \left[\frac{A}{\left(\frac{I}{I_S}\right)^a - 1} + B \right] \cdot K \cdot T_S + t_r \qquad \text{where}$$

t(I) = Actual trip time delay when the input current equals I

Is = Set minimum pick-up level

$$K = \left(\frac{A}{10^a - 1} + B \right)^{-1}$$

T_s = Set time delay : $t(I) = T_s$ when $\frac{I}{I_s} = 10$

tr = Operation time of the output relay on pick-up

The constant “ A “ , “ B “ and “ a “, have different values for the different Time Current Curves

Curve Name	Curve Identifier	A	B	a
IEC A Inverse	A	0.14	0	0.02
IEC B Very Inverse	B	13.5	0	1
IEC C Extr. Inverse	C	80	0	2
IEEE Moderate Inverse	MI	0.0104	0.0226	0.02
IEEE Short Inverse	SI	0.00342	0.00262	0.02
IEEE Very Inverse	VI	3.88	0.0963	2
IEEE Normally Inverse	I	5.95	0.18	2
IEEE Extr. Inverse	EI	5.67	0.0352	2

For the IEC curves, being B = 0, the Time/Current equation (1), becomes:

$$(1')\ t(I) = \frac{\left(10^a - 1\right) Ts}{\left(\frac{I}{Is}\right)^a - 1} + tr = \frac{Kt}{\left(\frac{I}{Is}\right)^a - 1} + tr$$

Where $Kt = (10^a-1)Ts$ is the time multiplier

2.2.3 – Automatic doubling of the overcurrent pick-up level

For the second “2I” and third “3I” overcurrent elements, it is possible to have a temporary doubling of the set minimum pick-up level during current inrush.
If at C/B closure the current rises from 0 to 1.5 times the relay rated input current “In” in less than 60ms (dI/dt > 25 In/s), the set pick-up level “2I” and/or “3I” is automatically doubled (example: 2I = 10In becomes 20In).
As soon as the current drops below 1.25xIn the duplicated pick-up level comes back to its original setting.
The doubling function is activated by programming the variables “2Ix2” an “3Ix2”.

2Ix2	=	ON	Doubling of the pick-up level 2I
2Ix2	=	OFF	No doubling for 2I

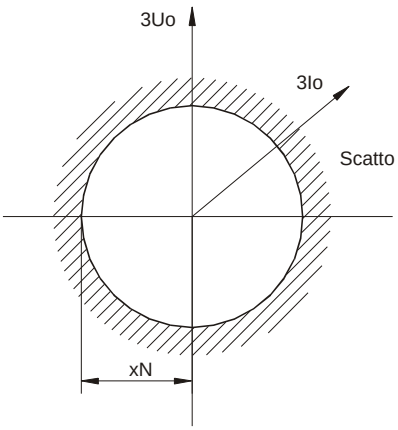
3Ix2	=	ON	Doubling of the pick-up level 3I
3Ix2	=	OFF	No doubling for 3I

2.3 - OPERATION OF THE DIRECTIONAL EARTH FAULT ELEMENT

It is assumed

xO	=	Set minimum pick-up residual current : 3Io ≥ xO (three adjustable pick-up levels 1O, 2O, 3O)
xUO	=	Set minimum residual voltage (3Uo) to enable Is pick-up (three adjustable pick-up levels 1UO, 2UO, 3UO)
α	=	Set characteristic angle (max. torque angle) of displacement of residual current 3Io from residual voltage 3Uo.
3Io	=	Actual earth fault relay's input current
3Uo	=	Actual earth fault relay's input voltage
φo	=	Displacement of 3Io from 3Uo
Ioα	=	Component of 3Io in the direction α Ioα = 3Io cos(φo-α)

The earth fault element can operate in three different ways according to the programming of the variable Fα:



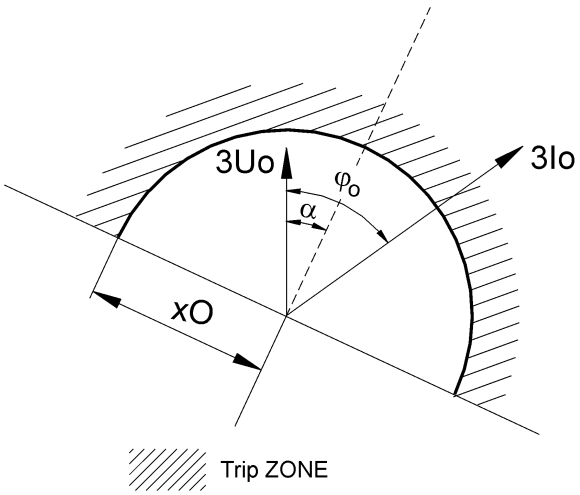
Fα = Dis

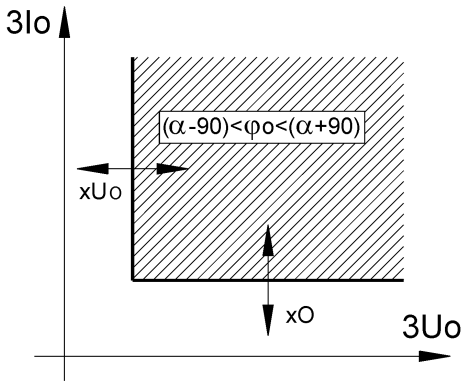
The element just operates as a normal overcurrent element without either residual voltage control (3 Uo) and directional control
- The element operates if: 3Io ≥ [xO]

Fα = Sup

The element just operates with supervision of the current flow direction.
The element operates if the following 3 conditions are present:

- The input residual voltage 3Uo exceeds the set [xUO]: 3Uo ≥ [xUO]
- The input residual current 3Io exceeds the set [xO] : 3Io ≥ [xO]
- The displacement φo of 3Io from 3Uo is within ±90° from the set direction [α] : α-90 ≤ φo ≤ α-90

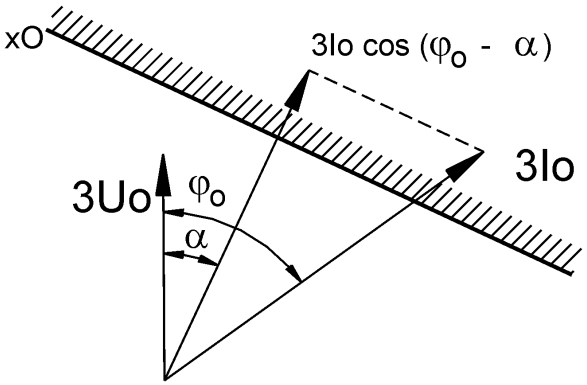


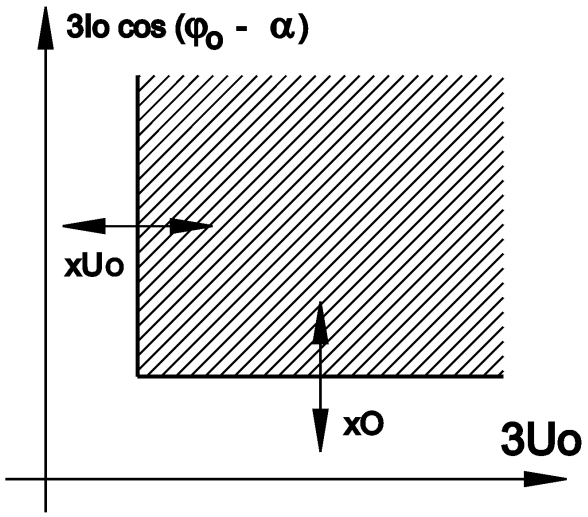


Fα = Dir

The element performs a complete directional operation; pick-up takes place if the following conditions are present:

- The input residual voltage 3Uo exceeds the set level [xUO] : 3Uo ≥ [xUO]
- The component of the input residual current 3Io in the direction α exceeds the set level [xO] : 3Io cos(φo - α) ≥ [xO]





The characteristic angle α must be selected according to the kind of earthing of the installation.

Typical setting are:

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

2.4 – Interlocking logic

Different relays can be each-other interlocked thus allowing to implement accelerated selectivity scheems with all time delay set at the same level.

2.4.1 – Instantaneous outputs and lock-out logic

Generally one instantaneous and one time delayed elements are provided for each Protection Function. Programming of the configuration of the output relays allows to have any of them controlled either by the time delayed element or by the instantaneous element of one or more Protection Functions. The output relays controlled by instantaneous elements pick-up as soon as the current exceeds the set trip level and drop-off as soon as the current drops below the reset level.
If the relay was energized by the instantaneous element and after tripping of the time delayed element of the same function (even if this is programmed to control a different output relay) the current does not drop below the set level (Circuit Breaker did not open) the output relay is any-how deenergized after an additional time delay “tBF”. If this relay was used to block the operation of another Protection Relay, this will be released and will then trip a back-up C/B.

2.4.2 – Function Blocking Inputs

When the terminals 1-2 of the digital input B2 are shorted, it is possible to block the operation of the time delayed element of the function according to the programming of the corresponding parameter:

B2	→	1I	=	ON/OFF (If set to ON, the activation of the input B2 blocks the time delayed element of the function)
B2	→	2I	=	ON/OFF
B2	→	3I	=	ON/OFF
B2	→	1O	=	ON/OFF
B2	→	2O	=	ON/OFF
B2	→	3O	=	ON/OFF

2.5 – Breaker Failure Protection

The Breaker Failure function is related to the functions programmed to operate the output relay R1.
If, after R1 has been energized, the input current does not drop to zero within the set time “tBF”, another output relay is energized for giving an alarm of tripping a back-up C/B.

2.6 – Breaking Energy Accumulation

The relay computes the Arc Energy developed during each interruption of the Circuit Breaker and accumulates these values.
The operation of this function is based on the following parameters:

Ii = Circuit Breaker Rated Current in multiples of the relay rated input current In; Ii = (0.10 - 9.99)In

Wc = $Ii^2 \bullet t_X$ = Conventional unit of interruption energy corresponding to C/B rated current and rated interruption time.

W = $I^2 \bullet t_X$ = Conventional interruption energy corresponding to interrupted current I and rated interruption time t_x

Wi = (1 – 9999)Wc = Maximum allowed amount of accumulated interruption energy before maintenance as stated by the C/B Manufactured. “Wi” is set as multiple of the conventional interruption energy unit “Wc”.

Any time the Circuit Breaker opens (terminals 1-3 of the digital input B3 closed by C/B Normally Close contact 52b) the relay accumulates the energy corresponding to a number of conventional interruption units:

$$nWc = \frac{I^2 t_x}{I_i^2 t_x} = \frac{I^2}{I_i^2}$$

When the amount of the accumulated energy exceeds the set value [Wi] the relay energized a user programmable output relay.

This relay can not be reset unless a “ CLEAR “ procedure is entered.

The “CLEAR” procedure is accomplished via the relay front panel face keyboard as follows:

- Press white button “ MODE ” to show the “PROGR” mode displayed

- Press the green button “ SELECT “ to show the “ SETTINGS “ mode displayed

- Operate the in direct access button “ PROG “ and, while keeping this button pressed, also press the red buttons “ + “ and “ – “ and the green button “ SELECT “.
  As all the four button are pressed at the same time, the display shows “CLEAR? “, press the yellow button “ ENTER “ to clear all relay recorded values (last trip – trip counters, energy accumulated)

Example:

- C/B rated current = 630A
- CT rated current = 500A
- Number of conventional interruptions that the C/B can perform before maintenance is needed NWc=500

The relay variables are set accordingly: $\text{Ii} = \frac{630}{500} = 1.26; \quad \text{Wi} = 500\text{Wc}$

An interruption with current, for example, 2000A produces an accumulation $\frac{2000^2}{630^2} = 10\text{Wc}$.

When the summation of the accumulations exceeds the set limit Wi = 500Wc the maintenance alarm is issued.

In the menu “TRIPNUM” exists a measurement “%Wi” that, at any interruption, is decremented by the amount of energy relevant to the interruption computed as % of the value set for “Wi”.

In the above example, the accumulation relevant to the interruption of 2000A was 10Wc corresponding to:

$$\frac{10}{500} \cdot 100 = 2\%\,\text{Wi}$$

This 2% is subtracted from the existing measurement “%Wi” so that the actual value “%Wi” shows the percent of the C/B utilization still remaining before maintenance is needed.

2.7 - CLOCK AND CALENDAR

The unit features a built in clock calendar with Years, Months, Days, Hours, Minutes, Seconds, Tenths of seconds and Hundredths of seconds.

2.7.1 - Clock synchronization.

The clock can be synchronized via the serial communication interface.
The following synchronization periods can be set: 5, 10, 15, 30, 60 minutes.
Synchronization can also be disabled, in which case the relay ignores the serial broadcast signal.
In case synchronization is enabled, the unit expects to receive a sync signal at the beginning of every hour and once every T_{syn} minutes. When a sync signal is received, the clock is automatically set to the nearest expected synchronization time.
For example: if T_{syn} is 10min and a sync signal is received at 20:03:10 January the 10th, 98, then the clock is set to 20:00:00 January the 10th, 1998.
On the other hand, if the same sync signal were received at 20:06:34, the clock would be set to 20:10:00, January the 10th 98.
Note that if a sync signal is received exactly in the middle of a T_{syn} period, the clock is set to the previous expected synchronization time.

2.7.2 - Date and time setting.

When the PROG/SETTINGS menu is entered, the current date is displayed with one of the groups of digits (YY, MMM or DD) blinking.
The DOWN key operates as a cursor. It moves through the groups of digits in the sequence YY => MMM => DD => YY => …
The UP key allows the user to modify the currently blinking group of digits.
If the ENTER button is pressed the currently displayed date is set.
Pressing the SELECT button the current time is displayed which can be modified using the same procedure as for the date.
If synchronization is enabled and the date (or time) is modified, the clock is stopped until a sync signal is received via the serial port. This allows the user to manually set many units and have them to start their clocks in a synchronized fashion.
If synchronization is disabled the clock is never stopped.
Note that the setting of a new time always clears 10ths and 100ths of sec.

2.7.3 - Time resolution.

The clock has a 10ms resolution. This means that any event can be time-stamped with a 10ms accuracy, although the information concerning 10ths and 100ths of sec. can be accessed only via the serial communication interface.

2.7.4 - Operation during power off.

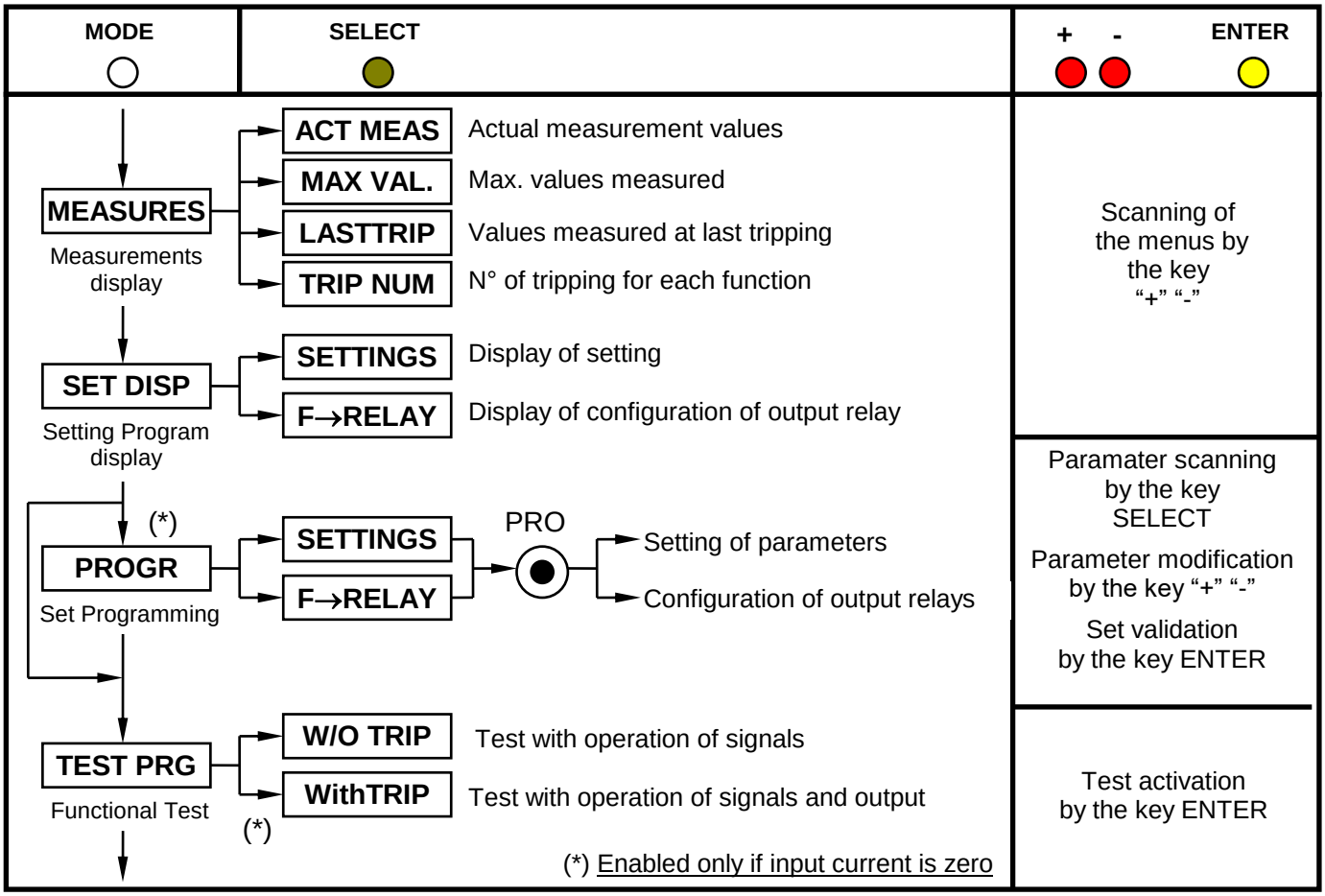
The unit has an on board Real Time Clock which maintains time information for at least 1 hour in case of power supply failure.

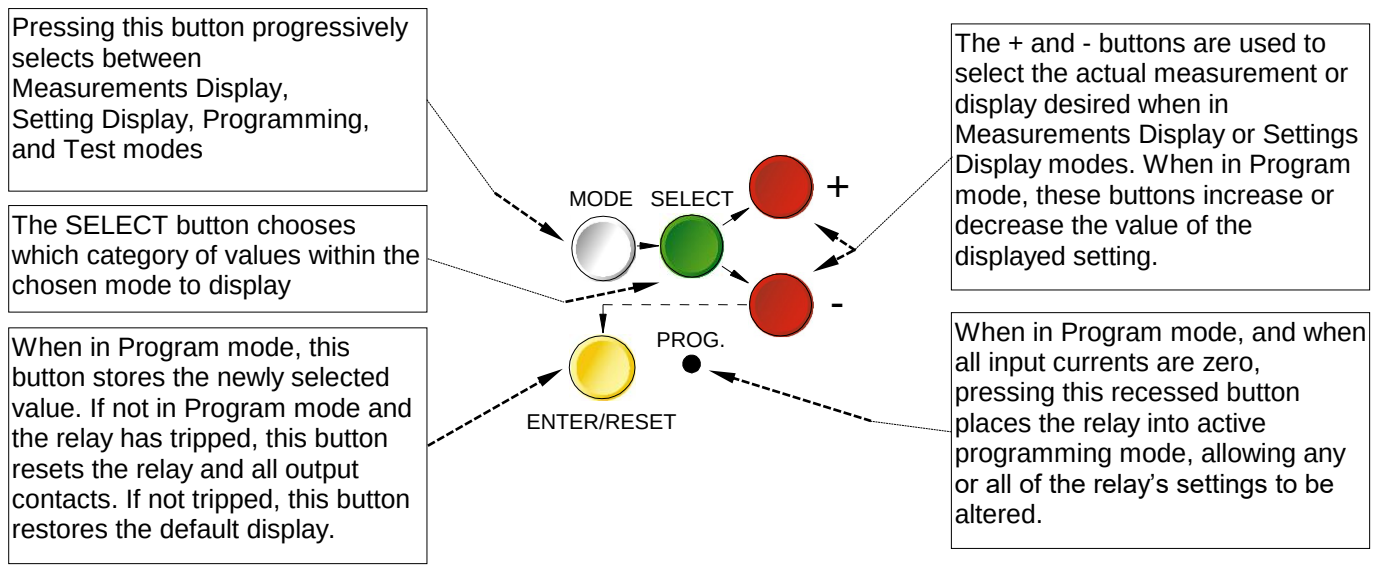
2.7.5 - Time tolerance.

During power on, time tolerance depends on the on board crystal (+/-50ppm typ, +/-100ppm max. over full temperature range).
During power off, time tolerance depends on the RTC's oscillator (+65 /–270 ppm max over full temperature range).

3. CONTROLS AND MEASUREMENTS

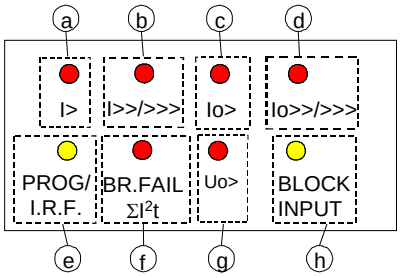
Five key buttons allow for local management of all relay's functions.
A 8-digit high brightness alphanumerical display shows the relevant readings **(xxxxxxxx)**
(see synoptic table fig.1)
Fig.1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**I>**	❑ Flashing when measured current exceeds the set trip level 1I. ❑ Illuminated on trip after expiry of the set trip time delay t1I.
b)	Red LED	**I>>/>>>**	❑ Same as above related to 2I and t2I, 3I and t3I
c)	Red LED	**Io>**	❑ Same as above related to 1O and t2O
d)	Red LED	**Io>>/>>>**	❑ Same, as above related to 2O and t2O, 3O and t3O
e)	Yellow LED	**PROG/ I.R.F.**	❑ Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**BR.FAIL ΣI^2t**	❑ Illuminated when the " Breaker Failure Element " is tripped. ❑ Flashing when alarm **ΣI^2t** is issued.
g)	Red LED	**Uo>**	❑ Flashing when the voltage Uo exceeds the set level Uo. ❑ Illuminated after expiry of the set trip time delay tU_o
h)	Yellow LED	**BLOCK INPUT**	❑ Flashing when a blocking signal is present at the relevant input terminals.

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 or via serial communication 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)

a) - The relays **R1,R2,R3,R4** are normally deenergized (energised on trip); these output relays are user programmable and any of them can be associated to any (one or more) of the IM30-AB functions.
One relay eventually associated to the instantaneous element of one of the functions, after pick-up, normally drops-out as soon as the tripping cause disappears (current below the set trip level).
If the current remains above the trip level longer than the time delay programmed for the time delayed element of the some function, the drop-out of the instantaneous relay is anyhow forced after an adjustable waiting time [tBF].(Diasactivation of the blocking output eventually used to block a relay upstream in the distribution system). The timer tBF is also started at any time the relay R1 picks-up and any relays R2, R3, R4 can be programmed to be energized at the end of the delay tBF (Breaker Failure functions).
Reset of the output relays associated to any time delayed function can be programmed to take place "Automatically" (tFRes= A) as soon as the tripping cause has disappeared, or "Manually" (tFRes= M) only by operating the ENTER/RESET key on relay's front or via the serial bus.
It has to be remarked that the programming structure does not allow to associate the same relay at the same time to instantaneous and delayed elements. Therefore any relay already associated to any time delayed element cannot be associated to any instantaneous element and viceversa.

b) - The relay **R5**, normally energised, 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 digital inputs are provided: they are active when the relevant terminals are shorted:

- **B2** (terminals 1 – 2) : it blocks the operation of the of the time delayed elements relevant to phase 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 [tB2 = Dis] or automatically removed with a programmable wait-time 2xtBF [tB2 = 2tBF] after the operation of the time delayed function.
By proper interconnection of the blocking inputs and output among different relays, it is possible to configure very efficient arrangements of logic fault discrimination.

- **B3** (terminals 1 - 3) : Indication of C/B status (N/C contact of the C/B) and - if the variable ExTrig is set to ON – external trigger of the oscillography wave-form capture at any C/B opening.

- **B14** (terminals 1 - 14) : Switching-over from Setting Program 1 (SP1) to Setting Program 2 (SP2)
  - Terminals 1 –14 open = SP1 active
  - Terminals 1 – 14 shorted = SP2 active

  The input B4 can also be activated via the serial communication port: in this case the switching-back from SP2 to SP1 can only be made via serial port.
  Viceversa if the terminals 1 – 14 are shorted, the switching back from SP2 to SP1 cannot be made via the serial port.

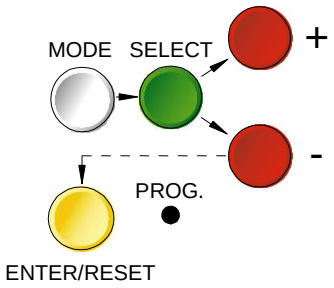
8. TEST

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
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds
IAxxxxx**A**	True R.M.S. value of the current of phase A displayed as primary Amps.(0 - 99999)
IBxxxxx**A**	As above, phase B
ICxxxxx**A**	As above, phase C
Ioxxxxx**A**	As above, earth fault current
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 100ms after closing of main Circuit Breaker plus inrush values recorded within the first 100ms from Breaker closing, (refreshed any time the breaker closes).

Display	Description
IAxx.x**In**	Peak value of phase A current after the first 100ms, displayed as p.u. of C.Ts rated current
IBxx.x**In**	As above, phase B
ICxx.x**In**	As above, phase C
Iox.xx**On**	As above, earth fault current
Uoxxxxx**V**	Peak value of Uo recorded after the first 100ms
SAxx.x**In**	Peak current of phase A during the first 100ms
SBxx.x**In**	As above, phase B
SCxx.x**In**	As above, phase C
SOx.xx**On**	As above, earth fault current
SUoxxxx**V**	Peak value of Uo recorded during the first 100ms

10.3 - LASTTRIP

Display of the function which caused the last 10 trippings 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
LastTr-x	Indication of the recorded event (x= 0 to 9) Example: Last event (LastTr -0) Last but one event (LastTr-1) etc...
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds
F:xxxxxx	Display of the function which caused the last tripping: : **1IphA,B,C ; 2IphA,B,C ; 3IphA,B,C ; 1N ; 2N ; 3N ; UR ;Wi**
IAxxxx**In**	Current of phase A
IBxxxx**In**	Current of phase B
ICxxxx**In**	Current of phase C
Ioxxxx**On**	Earth fault 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
1I	xxxxx	Trip number of first overcurrent element 50/51.
2I	xxxxx	As above, second element 50/51.
3I	xxxxx	As above, third element 50/51.
1N	xxxxx	As above, first element 67N.
2N	xxxxx	As above, second element 67N.
3N	xxxxx	As above, third element 67N.
Uo	xxxxx	As above, element Uo
OP	xxxxx	Number of C/B mechanical operations
%Wi	xxxx	% Maximum allowed amount of accumulated interruption energy before alarm

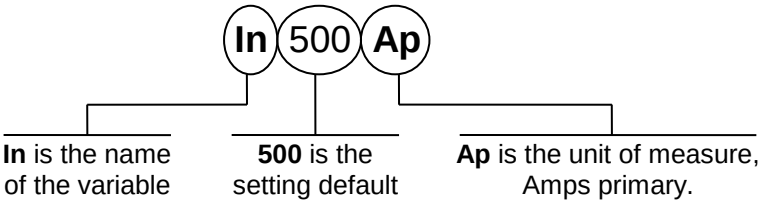
11. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

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 alarm relay R5 is deenergized..
Enter MODE "PROG" and SELECT either "SETTING1" or "SETTING2" for programming of parameters or "F→RELAY" for programming of output relays configuration; 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 set values.

12. 1 - PROGRAMMING OF FUNCTIONS SETTINGS



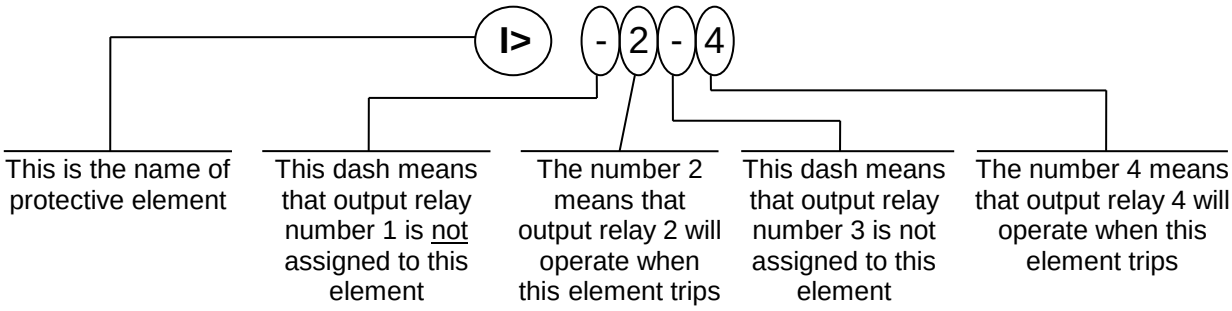
Mode PROG menu SETTINGS. (Production standard settings here under shown).

Display	Description	Setting Range	Step	Unit
xxxxxxx	Current date	DDMMMYY	-	-
xx:xx:xx	Current time	HH:MM:SS	-	-
Fn 50 **Hz**	Mains frequency: setting range	50 - 60	10	Hz
In 500**Ap**	Rated primary current of the phase C.Ts.	1 - 9999	1	A
On 500**Ap**	Rated primary current of the C.Ts. or of the tore C.T. supplying the zero sequence current	1 - 9999	1	A
F(1I) D	Operation characteristic of the first element 50/51: (D) = Independent definite time (A) = IEC Inverse Curve type A (B) = IEC Very Inverse Curve type B (C) = IEC Extremely Inverse Curve type C (MI) = IEEE Moderate Inverse Curve (SI) = IEEE Short Inverse Curve (VI) = IEEE Very Inverse Curve (I) = IEEE Inverse Curve (EI) = IEEE Extremely Inverse Curve	D A B C MI SI VI I EI	-	-
1I 0.5**In**	Trip level of first element 50/51 (p.u. of the rated current of the phase C.Ts.)	0.1 - 4 - Dis	0.01	In
t1I 0.05**s**	Trip time delay of the first element 50/51. In the inverse time operation [t1I] is the trip time delay at I = 10x[1I].	0.02 - 42	0.01/0.1	s
B2→1I OFF	B2 blocks function 1I	ON / OFF	-	-
1I Trg OFF	Trip of t1I triggers oscillographic recording	ON / OFF	-	-
2I 0.5**In**	Trip level of second element 50/51 (p.u. of the rated current of the phase C.Ts.)	0.1 – 40 – Dis	0.1	In
2Ix2 ON	Automatic doubling of level 2I	ON / OFF	-	-
t2I 0.05**s**	Trip time delay of the second element 50/51	0.02 - 60	0,01/0.1	s
B2→2I OFF	B2 blocks function 2I	ON / OFF	-	-
2I Trg OFF	Trip of t2I triggers oscillographic recording	ON / OFF	-	-

Display	Description	Setting Range	Step	Unit
3I 0.5**In**	Trip level of third element 50/51 (p.u. of the rated current of the phase C.Ts.)	0,1 - 40- Dis	0,1	In
3Ix2 ON	Automatic doubling of level 3I	ON / OFF	-	-
t3I 0.05**s**	Trip time delay of the third element 50/51	0.02 - 60	0,01/0.1	s
B2→3I OFF	B2 blocks function 3I	ON / OFF	-	-
3I Trg OFF	Trip of t3I triggers oscillographic recording	ON / OFF	-	-
F(1O) D	Operation characteristic of the first element 67N: (D) = Independent definite time (A) = IEC Inverse Curve type A (B) = IEC Very Inverse Curve type B (C) = IEC Extremely Inverse Curve type C (MI) = IEEE Moderate Inverse Curve (SI) = IEEE Short Inverse Curve (VI) = IEEE Very Inverse Curve (I) = IEEE Inverse Curve (EI) = IEEE Extremely Inverse Curve	D A B C MI SI VI I EI	-	-
1Uo 10**V**	Minimum level of residual voltage for directional operation of the element 1O	1 - 50	1	V
F1α o Dir	Operation mode of 1O	Dir – Sup - Dis	-	-
1αo= 90°	Characteristic angle of directional element 1O	0 – 359	1	°
1O 0.02**On**	Trip level of first element 67N (p.u. of the rated current of the C.Ts. for zero sequence detection)	0,02 – 0,4 - Dis	0,01	On
t1O 0.05**s**	Trip time delay of first element 67N In the dependent time operation it is the trip time delay at I = 10x[1O].	0,02 - 42	0,01/0.1	s
B2→1O OFF	B2 blocks function 1O	ON / OFF	-	-
1O Trg OFF	Trip of t1O triggers oscillographic recording	ON / OFF	-	-
2Uo 12**V**	Minimum level of residual voltage for directional operation of the element 2O	1 - 50	1	V
F2α Sup	Operation mode of element 2O	Dir – Sup - Dis	-	-
2αo= 90°	Characteristic angle of directional element 2O	0 – 359	1	°
2O 0.02**On**	Trip level of second element 67N (p.u. of the rated current of the C.Ts. for zero sequence detection)	0,02 – 2 - Dis	0,01	On
t2O 0.05**s**	Trip time delay of second element 67N	0,02 - 60	0,01/0.1	s
B2→2O OFF	B2 blocks function 1O	ON / OFF	-	-
2O Trg OFF	Trip of t2O triggers oscillographic recording	ON / OFF	-	-
3Uo 15**V**	Minimum level of residual voltage for directional operation of the element 3O	1 - 50	1	V
F3α Dis	Operation mode of element 3O	Dir – Sup - Dis	-	-
3αo= 90°	Characteristic angle of directional element 3O	0 – 359	1	°
3O 0.02**On**	Trip level of third element 67N (p.u. of the rated current of the C.Ts. for zero sequence detection)	0,02 – 2 - Dis	0,01	On
t3O 0.05**s**	Trip time delay of third element 67N	0,02 - 60	0,01/0.1	s
B2→3O OFF	B2 blocks function 3O	ON / OFF	-	-
3O Trg OFF	Trip of t3O triggers oscillographic recording	ON / OFF	-	-
tB2 Dis	Duration of blocking of the input B2 (See § 7)	Dis – 2tBF	-	-
Uo 20**V**	Trip level of maximum residual voltage element	1 – 50 - Dis	1	V
tUo 1.0**s**	Trip time delay of function Uo	0,02 - 65	0,01/0.1	s
Uo Trg OFF	Trip of tUo triggers oscillographic recording	ON / OFF	-	-
tBF 0.05**s**	Time delay for Breaker Failure alarm	0.05 – 0.75	0,01	s
Ii 1.0**In**	C/B rated current	0.1 – 9.99	0.01	In
WI 100**Wc**	Maximum amount of accumulated interruption energy (see § 2.6)	1 – 9999	1	Wc
Tsyn Dis **m**	Synchronisation Time Expected time interval between sync. pulses.	5 - 60 - Dis	5-10 15-30 60-Dis	m
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	1
Ex Trg ON	External trigger of oscillographic recording (input B3)	ON / OFF	-	-

The setting Dis indicates that the function is disactivated.

12.2 PROGRAMMING THE CONFIGURATION OF OUTPUT RELAYS



Mode PROG menu F→RELAY (Production standard settings 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.

Display		Description		
1I	--3-	Instantaneous element of first element	50/51	operates relay R1,R2,R3,R4
t1I	1---	As above, time delayed element	50/51	operates relay R1,R2,R3,R4
2I	--3-	Instantaneous element of second element	50/51	operates relay R1,R2,R3,R4
t2I	1---	As above, time delayed element	50/51	operates relay R1,R2,R3,R4
3I	----	Instantaneous element of third element	50/51	operates relay R1,R2,R3,R4
t3I	----	As above, time delayed element	50/51	operates relay R1,R2,R3,R4
1O	---4	Instantaneous element of first element	67N	operates relay R1,R2,R3,R4
t1O	-2--	As above, time delayed element	67N	operates relay R1,R2,R3,R4
2O	---4	Instantaneous element of second element	67N	operates relay R1,R2,R3,R4
t2O	-2--	As above, time delayed element	67N	operates relay R1,R2,R3,R4
3O	----	Instantaneous element of third element	67N	operates relay R1,R2,R3,R4
t3O	----	As above, time delayed element	67N	operates relay R1,R2,R3,R4
tBF	----	Breaker Failure alarm		operates relay ,R2,R3,R4
Uo	----	Instantaneous element of function	59Uo	operates relay R1,R2,R3,R4
tUo	----	As above, time delayed element of function	59Uo	operates relay R1,R2,R3,R4
KA2s	----	C/B Breaking Energy maintenance level alarm		operates relay R1,R2,R3,R4
tFRes: A		The reset after tripping of the relays associated to the time delayed elements can take place: **(A)** automatically when current drops below the trip level. **(M)** manually by the operation of the "ENTER/RESET" key.		

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 (xx:xx:xx).
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. 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 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 modules must be drawn-out of their enclosures and the test must only include the fixed part of the relay with its terminals and the relevant connections.
This is extremely important as discharges eventually tacking place in other parts or components of the board can severely damage the relays or cause damages, not immediately evident to the electronic components.

16. 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
❑ Insulation resistance	> 100MΩ	

Environmental Std. Ref. (IEC 68-2-1 - 68-2-2 - 68-2-33)

❑ Operation ambient temperature	-10°C / +55°C
❑ Storage temperature	-25°C / +70°C
❑ Humidity	IEC68-2-3 RH 93% Without Condensing AT 40°C

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

❑ Electromagnetic emission	EN55022 industrial environment			
❑ 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 3	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			
❑ 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 continuous
❑ Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A Neutral : 0.03VA at In = 1A ; 0.6VA at In = 5A
❑ Rated Voltage	Un = 100V (different on request)
❑ Voltage Overload	2 Un permanent
❑ Burden on voltage inputs	0.2 VA 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.)

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Tel. (##39) 02 575731 - Fax (##39) 02 57510940

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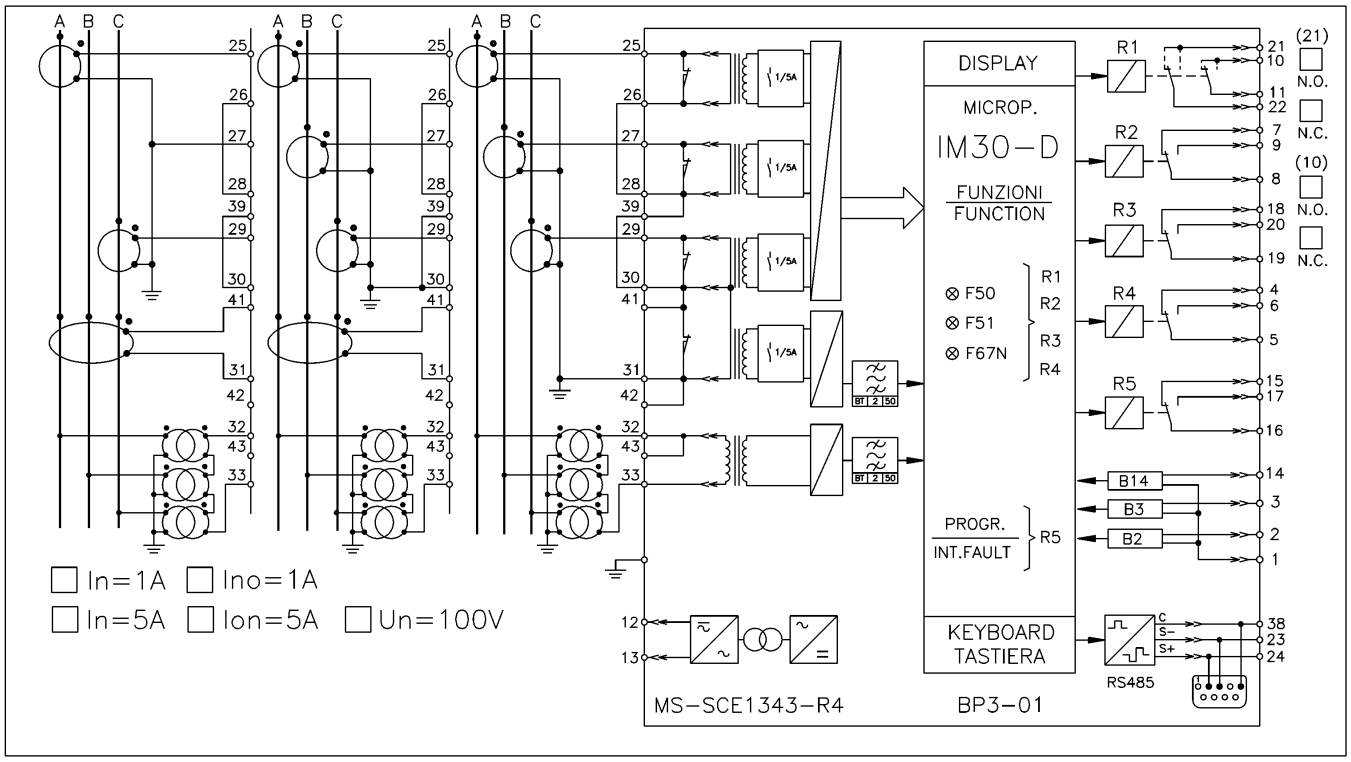
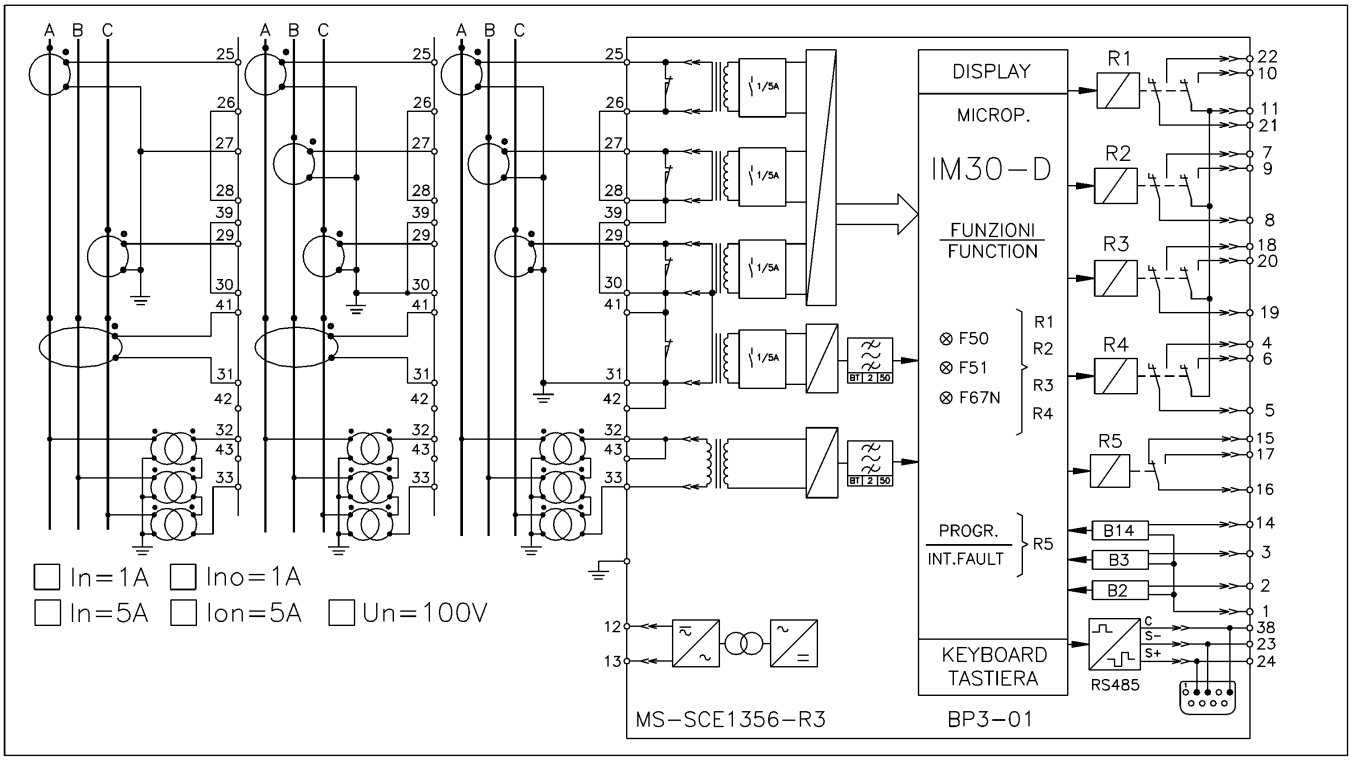
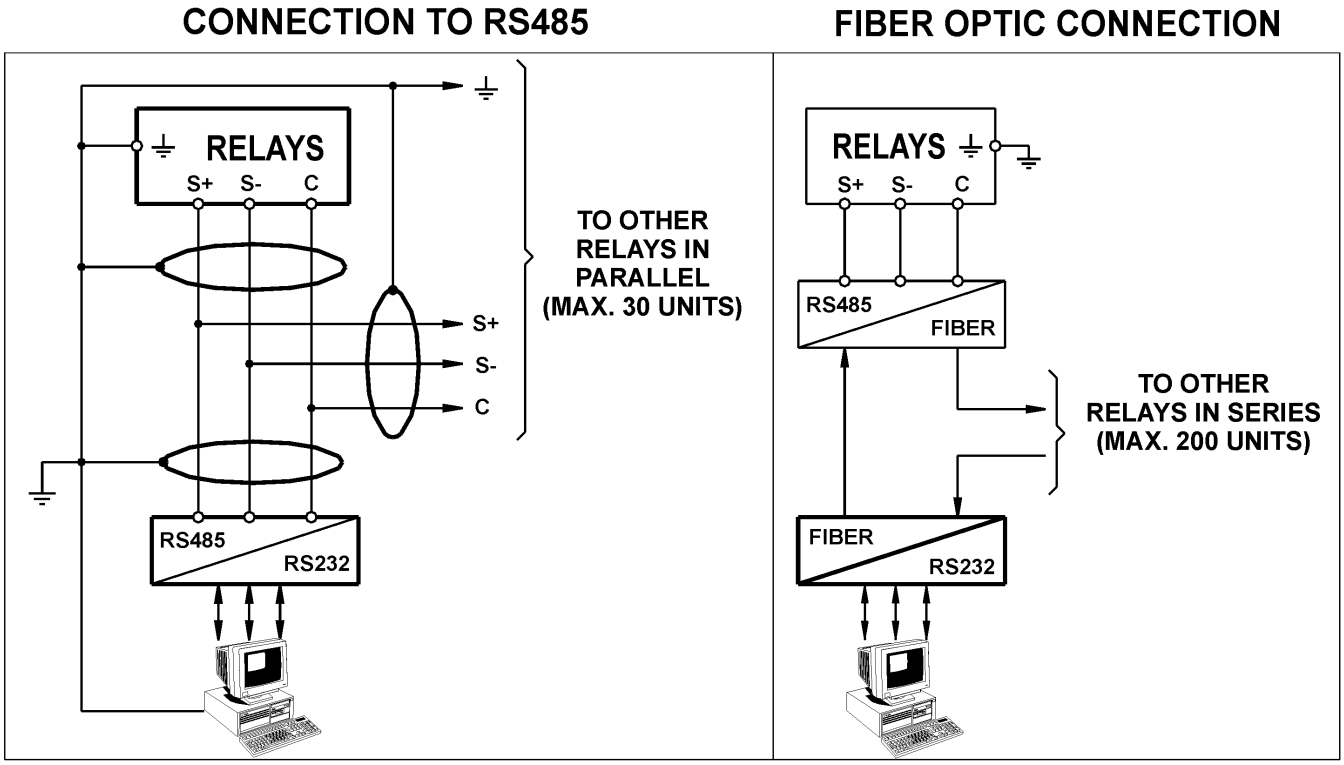
17. CONNECTION DIAGRAM (SCE1343 Rev.4 - Standard Output)



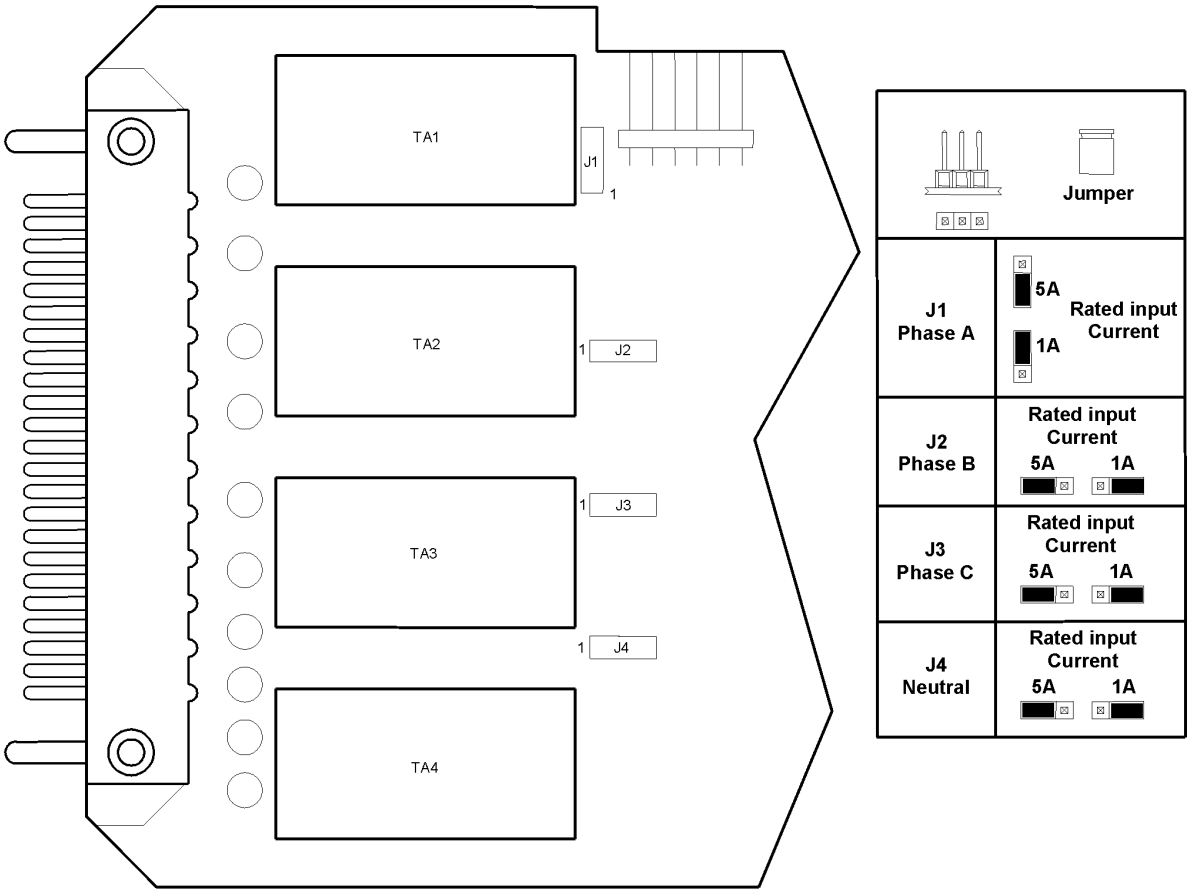
17.1 - CONNECTION DIAGRAM (SCE1356 Rev.3 - Double Output)



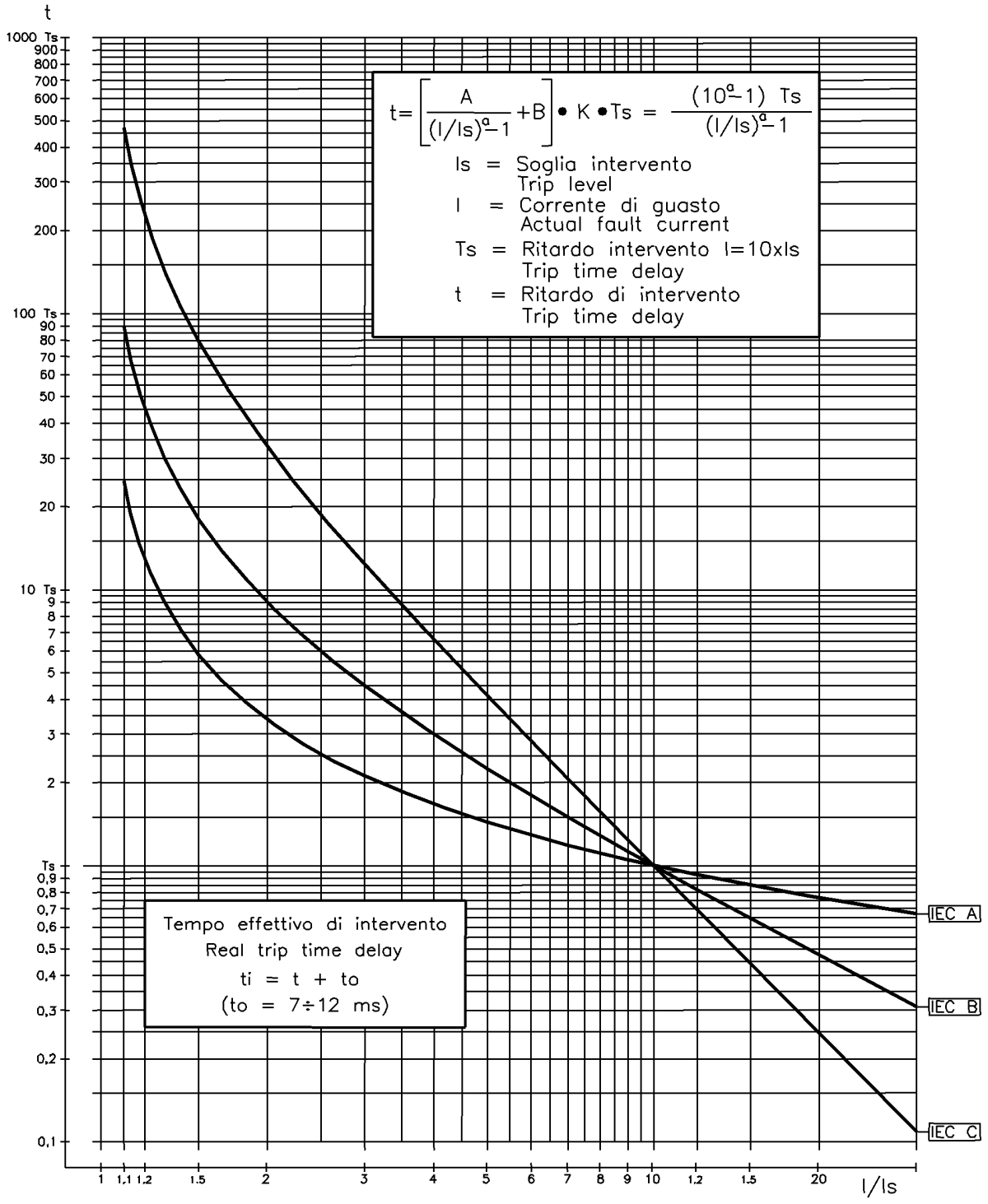
18. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)



19. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A



20. TIME CURRENT CURVES (TU0388 Rev.0)

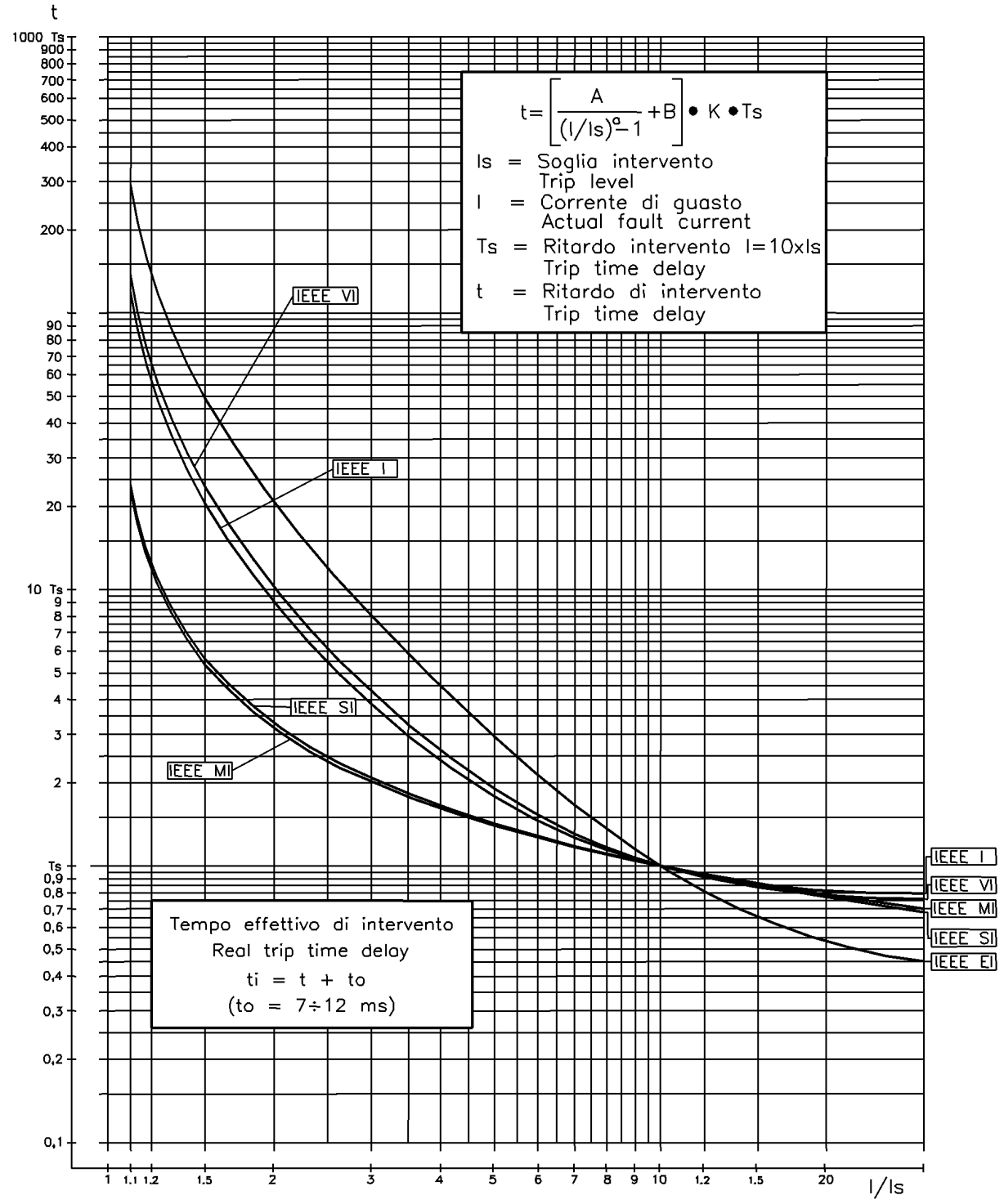


Curve Tipo	A	B	K	a
IEC A	0.14	0	0.336632	0.02
IEC B	13.5	0	0.666667	1
IEC C	80	0	1.2375	2

F51
- **Is = 1I = (0.1 - 4)In**
- **Ts = t1I = (0.02 - 42)s**

F51N
- **Is = 1N = (0.02 - 0.4)On**
- **Ts = t1N = (0.02 - 42)s**

21. TIME CURRENT CURVES (TU0388 Rev.0)



Curve Tipo	A	B	K	a
MI= IEEE Moderato Inv.	0.0104	0.0226	4.110608	0.02
SI= IEEE Breve Inv.	0.00342	0.00262	13.30009	0.02
VI= IEEE Molto Inv.	3.88	0.0963	7.380514	2
I= IEEE Normalm. Inv.	5.95	0.18	4.164914	2
EI= IEEE Estrem. Inv.	5.67	0.0352	10.814	2

F51
- **Is = 1I = (0.1 - 4)In**
- **Ts = t1I = (0.02 - 42)s**

F51N
- **Is = 1N = (0.02 - 0.4)On**
- **Ts = t1N = (0.02 - 42)s**

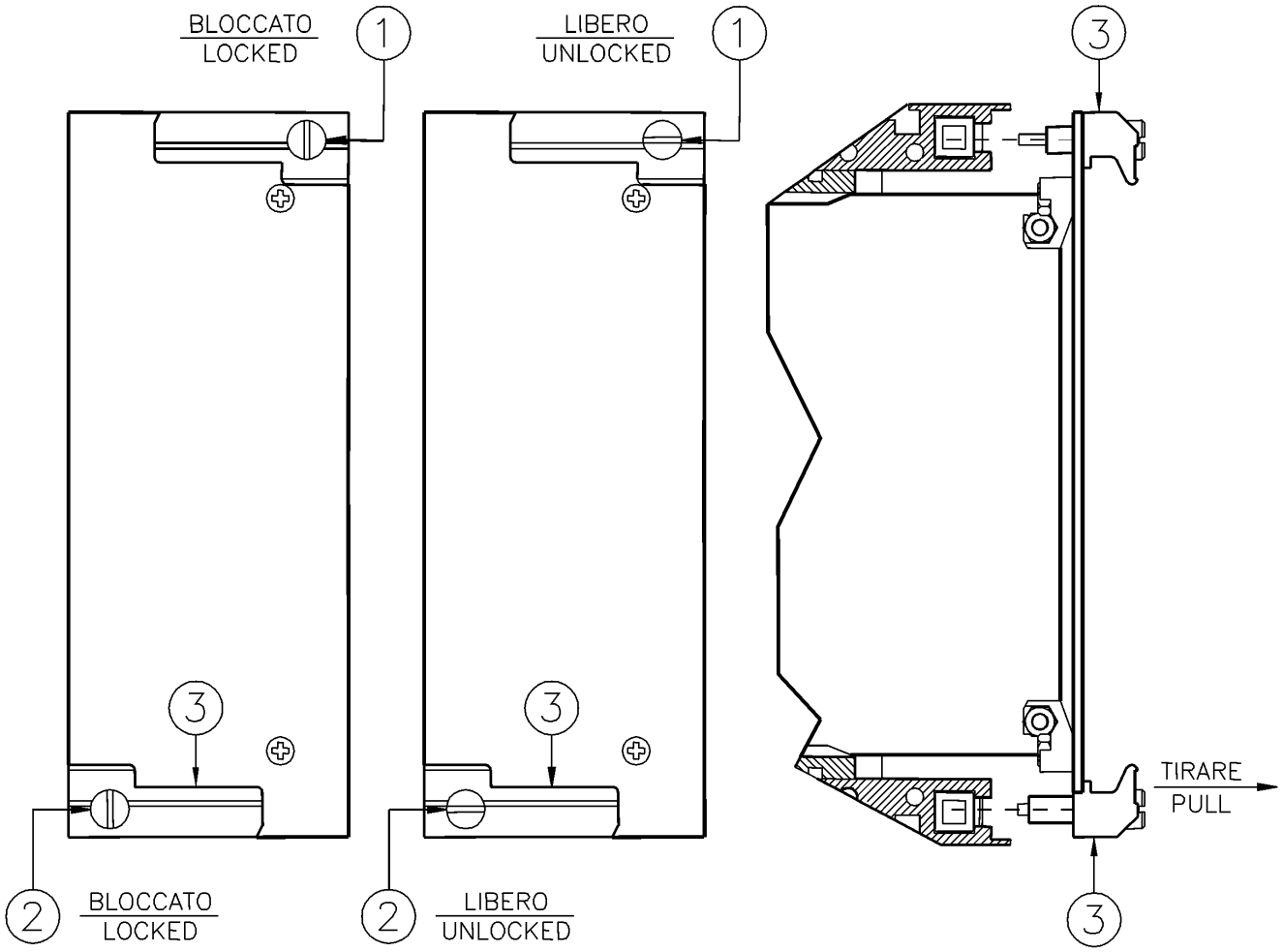
22. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

22.1 - Draw-out

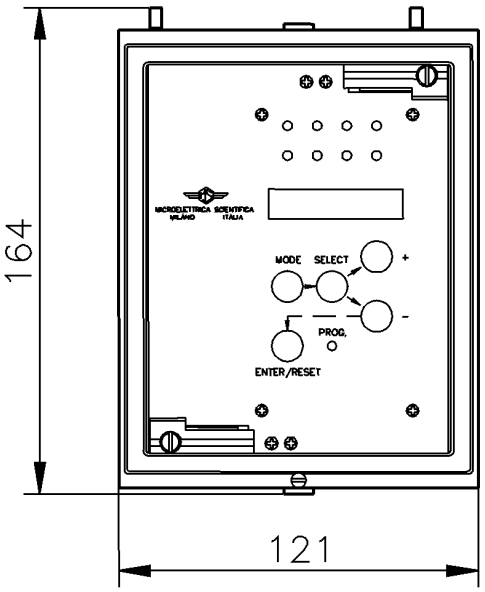
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

22.2 - Plug-in

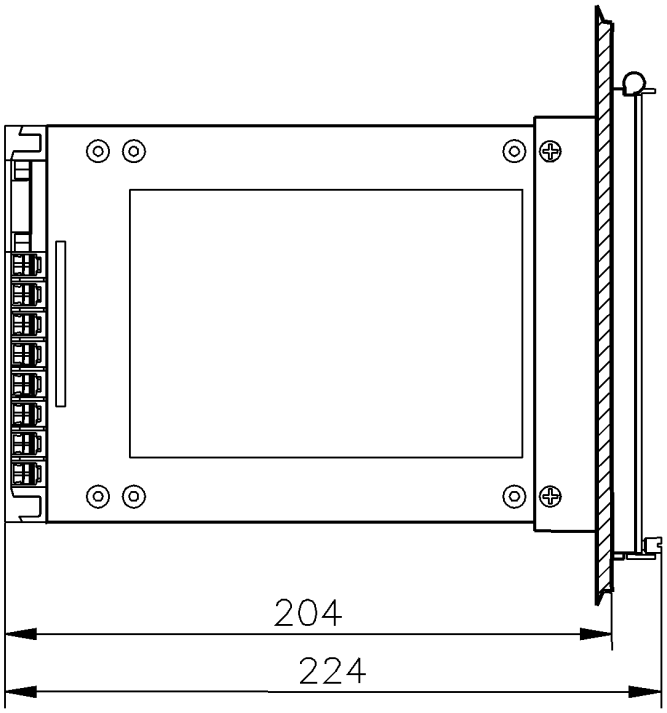
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position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

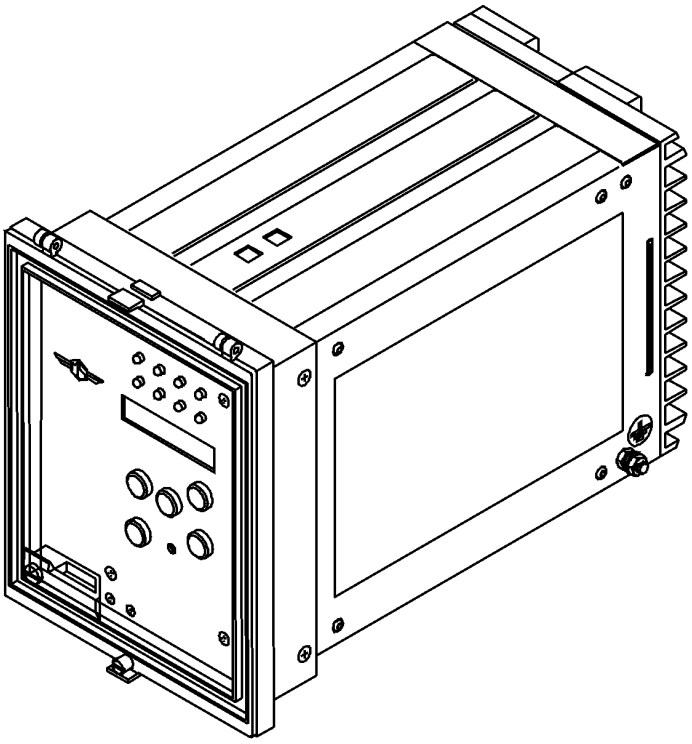


23. MOUNTING

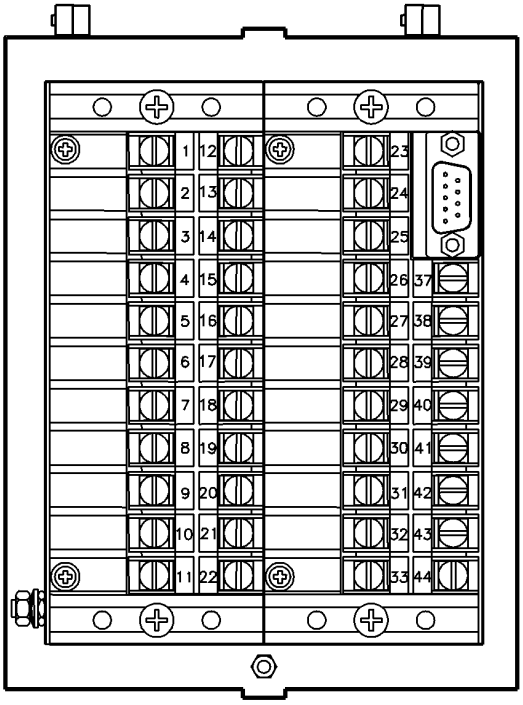


PANEL CUT OUT 113x142 (LxH)

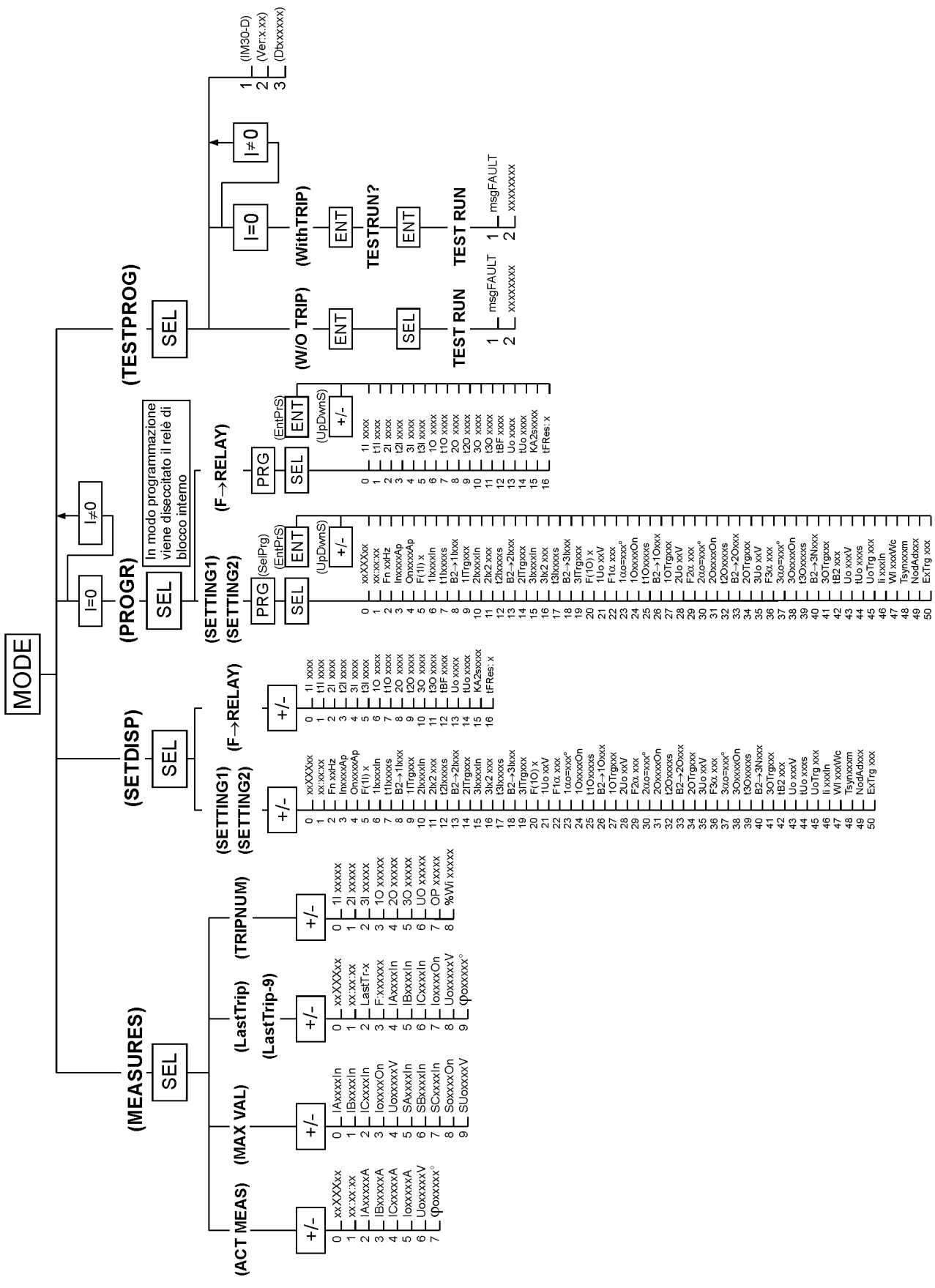




View of Rear Terminal Connection



24. KEYBOARD OPERATIONAL DIAGRAM



25. SETTINGS' FORM – Commissioning Test Record

Relay type	**IM30-D**	**station :**		**Circuit :**	
Date :	**/ /**	**FW Version:**		**Relay serial number :**	
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c. 24V(-20%) / 125V(+20%) d.c.		**Rated current In:**	☐ **1A**	☐ **5A**
	☐ 80V(-20%) / 220V(+15%) a.c. 90V(-20%) / 250V(+20%) d.c.		**Rated current Ion:**	☐ **1°**	☐ **5°**
			Rated voltage :		

RELAY PROGRAMMING

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
xxXXXxx	Current date	GGMMMAA	**-**	random			
xx:xx:xx	Current time	HH:MM:SS	**-**	random			
Fn	Mains frequency: setting range	50 - 60	**Hz**	50			
In	Rated primary current of the phase C.Ts.	0 - 9999	**Ap**	500			
On	Rated primary current of the C.Ts	0- 9999	**Ap**	500			
F(1I)	Operation characteristic of the first element 50/51	D-A-B-C-MI SI-VI-I-EI	**-**	D			
1I	Trip level of first element 50/51 (p.u. of the rated current of the phase C.Ts.)	0,1 - 4- Dis	**In**	0.5			
t1I	Trip time delay of the first element 50/51.	0,02 - 42	**-**	0.05			
B2→1I	B2 blocks function 1I	ON / OFF	**s**	OFF			
1I Trg	Trip of t1I triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
2I	Trip level of second element 50/51	0,1 - 40- Dis	**In**	0.5			
2Ix2	Automatic doubling of level 2I	ON / OFF	**-**	ON			
t2I	Trip time delay of the second element 50/51	0,02 - 60	**s**	0.05			
B2→2I	B2 blocks function 2I	ON / OFF	**-**	OFF			
2I Trg	Trip of t2I triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
3I	Trip level of third element 50/51	0,1 - 40- Dis	**In**	0.5			
3Ix2	Automatic doubling of level 3I	ON / OFF	**-**	ON			
t3I	Trip time delay of the third element 50/51	0,02 - 60	**s**	0.05			
B2→3I	B2 blocks function 3I	ON / OFF	**-**	OFF			
3I Trg	Trip of t3I triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
F(1O)	Operation characteristic of the first element 67N	D-A-B-C-MI SI-VI-I-EI	**-**	D			
1Uo	Minimum level of residual voltage for directional operation of the element 1O	1 - 50	**V**	10			
F1α	Operation mode of 1O	Dir–Sup-Dis	**-**	Dir			
1αo=	Characteristic angle of directional element 1O	0 – 359	°	90			
1O	Trip level of first element 67N	0,02–0,4-Dis	**On**	0.02			
t1O	Trip time delay of first element 67N	0,02 - 42	**s**	0.05			
B2→1O	B2 blocks function 1O	ON / OFF	**-**	OFF			
1O Trg	Trip of t1O triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
2Uo	Minimum level of residual voltage for directional operation of the element 2O	1 - 50	**V**	12			
F2α	Operation mode of element 2O	Dir–Sup-Dis	**-**	Sup			
2αo=	Characteristic angle of directional element 2O	0 – 359	°	90			
2O	Trip level of second element 67N (p.u. of the rated current of the C.Ts. for zero sequence detection)	0,02–2-Dis	**On**	0.02			
t2O	Trip time delay of second element 67N	0,02 - 60	**s**	0.05			
B2→2O	B2 blocks function 1O	ON / OFF	**-**	OFF			
2O Trg	Trip of t2O triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
3Uo	Minimum level of residual voltage for directional operation of the element 3O	1 - 50	**V**	15			
F3α	Operation mode of element 3O	Dir–Sup-Dis	**-**	Dis			
3αo=	Characteristic angle of directional element 3O	0 – 359	°	90			
3O	Trip level of third element 67N	0,02–2-Dis	**On**	0.02			
t3O	Trip time delay of third element 67N	0,02 - 60	**s**	0.05			
B2→3O	B2 blocks function 3O	ON / OFF	**-**	OFF			
3O Trg	Trip of t3O triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
tB2	Duration of blocking of the input B2 (See § 7)	Dis – 2tBF	**-**	Dis			
Uo	Trip level of maximum residual voltage element	1–50-Dis	**V**	20			
tUo	Trip time delay of function Uo	0,02 - 65	**s**	1.0			
Uo Trg	Trip of tUo triggers oscillographic recording	ON / OFF	**-**	OFF	OPTIONAL		
tBF	Time delay for Breaker Failure alarm	0.05 – 0.75	**s**	0.05			
Ii	C/B rated current	0.1 – 9.99	**In**	1.0			
WI	Max. amount of accumulated interruption energy	1 – 9999	**Wc**	100			
Tsyn	Synchronisation Time Expected time interval between sync. pulses.	5 - 60 - Dis	**m**	Dis			
NodAd	Identification number for serial communication	1 - 250	-	1			
Ex Trg	External trigger of oscillographic recording (input B3)	ON / OFF	-	ON	OPTIONAL		

CONFIGURATION OF OUTPUT RELAYS

Default Setting							Actual Setting					
Protect. Element	Output Relays				Description		Protect. Element	Output Relays				
1I	-	-	3	-	Instantaneous element of first element	50/51	**1I**					
t1I	1	-	-	-	As above, time delayed element	50/51	**t1I**					
2I	-	-	3	-	Instantaneous element of second element	50/51	**2I**					
t2I	1	-	-	-	As above, time delayed element	50/51	**t2I**					
3I	-	-	-	-	Instantaneous element of third element	50/51	**3I**					
t3I	-	-	-	-	As above, time delayed element	50/51	**t3I**					
1O	-	-	-	4	Instantaneous element of first element	67N	**1O**					
t1O	-	2	-	-	As above, time delayed element	67N	**t1O**					
2O	-	-	-	4	Instantaneous element of second element	67N	**2O**					
t2O	-	2	-	-	As above, time delayed element	67N	**t2O**					
3O	-		-	4	Instantaneous element of third element	67N	**3O**					
t3O	-	2	-	-	As above, time delayed element	67N	**t3O**					
tBF	-	-	-	-	Breaker Failure alarm		**tBF**					
Uo	-	-	-	-	Instantaneous element of function	59Uo	**Uo**					
tUo	-	-	-	-	As above, time delayed element of function	59Uo	**tUo**					
KA2s	-	-	-	-	C/B Breaking Energy maintenance level alarm		**KA2s**					
tFRes:	A				The reset after tripping of the relays associated to the time delayed elements can take place: **(A)** automatically **(M)** manually		**tFRes**:					

Commissioning Engineer: _____ **Date :** _____

Customer Witness: _____ **Date :** _____