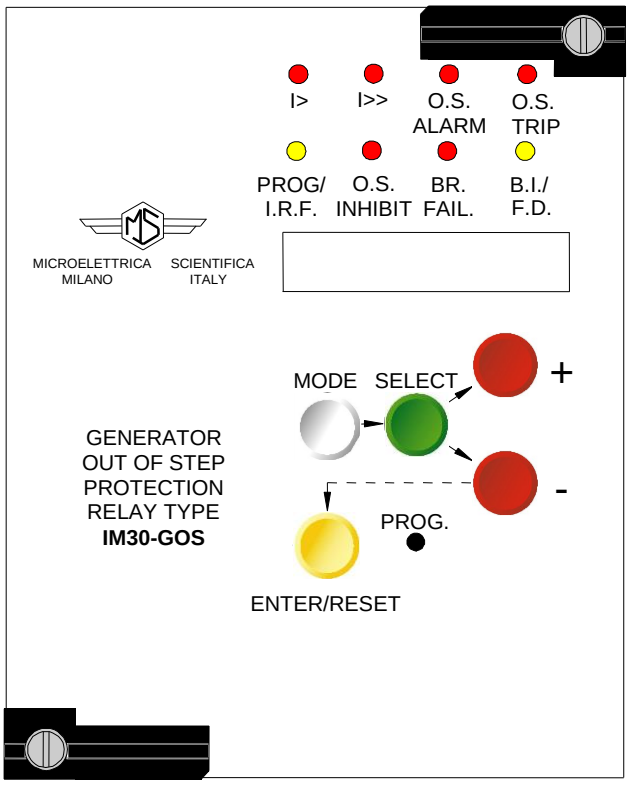
MULTIFUNCTION MICROPROCESSOR RELAY for GENERATOR OUT-of-STEP PROTECTION

TYPE
IM30-GOS

OPERATION MANUAL



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1. GENERAL UTILIZATION AND COMMISSIONING DIRECTIONS

Always make reference to the specific description of the product and to the Manufacturer's instruction. Carefully observe the following warnings.

1.1 - STORAGE AND TRANSPORTATION,

must comply with the environmental conditions stated on the product's instruction or by the applicable IEC standards.

1.2 - INSTALLATION,

must be properly made and in compliance with the operational ambient conditions stated by the Manufacturer.

1.3 - ELECTRICAL CONNECTION,

must be made strictly according to the wiring diagram supplied with the Product, to its electrical characteristics and in compliance with the applicable standards particularly with reference to human safety.

1.4 - MEASURING INPUTS AND POWER SUPPLY,

carefully check that the value of input quantities and power supply voltage are proper and within the permissible variation limits.

1.5 - OUTPUTS LOADING,

must be compatible with their declared performance.

1.6 - PROTECTION EARTHING

When earthing is required, carefully check its efficiency.

1.7 - SETTING AND CALIBRATION

Carefully check the proper setting of the different functions according to the configuration of the protected system, the safety regulations and the co-ordination with other equipment.

1.8 - SAFETY PROTECTION

Carefully check that all safety means are correctly mounted, apply proper seals where required and periodically check their integrity.

1.9 - HANDLING

Notwithstanding the highest practicable protection means used in designing M.S. electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules. The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits produced by M.S. are completely safe from electrostatic discharge (15 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

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 AND OPERATION

Input currents are supplied to internal current transformers measuring phases currents.
Current input can be 1 or 5A
Input phase to phase voltage is supplied to one voltage transformer with rated input programmable 100-125V.
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 - AUXILIARY 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 energizing the unit check that supply voltage is within the allowed limits.

2.2 - Measuring input

The relay computes the RMS value of current and voltage and the relevant phase displacement.

2.2.1 - Current inputs

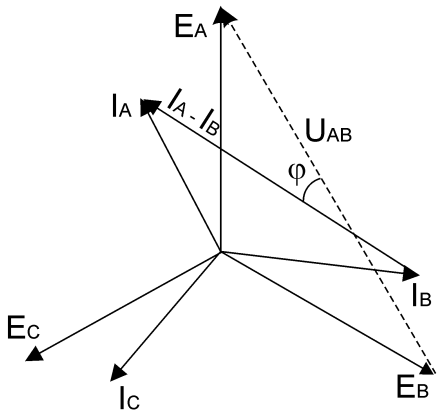
Phase currents are supplied to four current transformers with 5A rated primary. By movable jumpers on the relay card, the secondary can be switched-on to two different taps to obtain a relay rated input current In = 5 or 1 Amp (different values can be provided on request).

2.2.2 - Voltage input

Phase-to-phase voltage " U_{AB} " is supplied to one Potential transformers rated 220V. Relay's rated phase-to-phase input voltage (Uns) can be adjusted from 100 through 125V.

2.2.3 - Phase displacement

The relay detects the displacement between the input voltage phasor "$\overline{U}_{AB}$ " and the phasor $\overline{I}_A - \overline{I}_B$
The displacement angle is therefore :



$$\varphi = \left(\overline{I}_A - \overline{I}_B\right) \wedge U_{AB}$$

Angles are measured anticlockwise from 0° to 359° with accuracy ±2°.
Displacement is not measured if current or voltage are null.

2.3 - Algorithms of the different functions

2.3.1 - Setting range of the reference input quantities :

- System frequency : **Fn** = (50 - 60)Hz
- Rated primary current of phase C.Ts. : **In** = (1 - 9999)A, step 1A
- Rated secondary phase-to-phase voltage of P.Ts. : **Uns** = (100 - 125)V, step 1V
- Relay basic current (Generator's rated current) : **Ib** = (0.5 - 1.1)In, step 0.1In

2.3.2 - F50/51 - Dual level 3-phase overcurrent

F1 50/51 : Low set overcurrent

- Pick-up (operation) level : **I>** = (1-2.5)**Ib**, step 0.01**Ib**
  Setting **I>** = Dis blocks function's operation

- Drop-out ratio ≥ 0.95

- Minimum operation time of instantaneous element : ≤ 30ms

- Trip time delay in the definite time operation mode **F(I>) = D**
  t = **tI>** = (0.05-30)s, step 0.01s

- Trip time delay in the inverse time operation mode **F(I>) = SI**

$$t = \frac{0.033 \bullet tI>}{(I/I>)^{0.02} - 1}$$ (**tI>** = trip time delay at I/I> = 5) (see curves TU0311)

F2 50/51 : High set overcurrent

- Pick-up (operation) level : **I>>** = (1-12)**Ib**, step 0.1**Ib**
  Setting **I>>** = Dis blocks function's operation

- Drop-out ratio ≥ 0.95

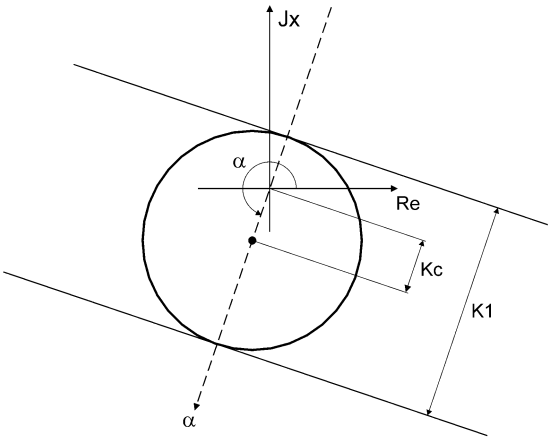
- Minimum operation time of the instantaneous element : ≤ 30ms

- Independent trip time delay t = **tI>>** = (0.05-3)s, step 0.01s

2.3.3 – F78 – Out-of-Step Protection

2.3.3.1 – MHO Supervision element

The relay computes the impedance as seen at the point of installation of the relay (Generator terminals or step-up Transformer terminals):



$$Z = \frac{|U_{AB}|}{|I_{AB}|} \bullet \frac{100}{Zb}$$

where

$$Zb = \frac{[Uns]}{\sqrt{3}[Ib]}$$

and allows the operation of the Out-of-Step element only if " Z " is inside the MHO Circle.

- The direction of the line where the center of the MHO circle is located is indicated as the " characteristics angle " α " of the impedance" [α] = [0° - 359°] step 1°.
  Conventionally angles are counted counterclockwise from 0° (Real axis) through 359°.
  the relation between the displacement angle " φ " of the current and that of the Impedance is :

$$\alpha = 360° - \varphi$$

- The center of the MHO circle is located on the line " α " at a distance "Kc" from the origin:

[Kc] = [0 – 200]%Zb, step 1%

- The diameter of the MHO circle is:

[K1] = [50 – 300]%Zb, step 1%

- The measurements of the Impedance " Z " is inhibited if:

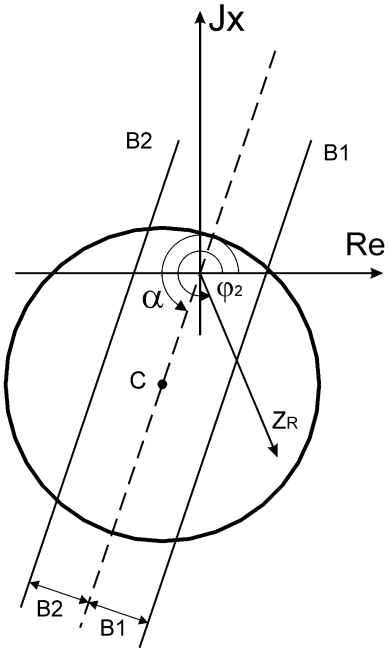
U_{AB} < 0.3Uns and/or I_{AB} < 0.2Ib

2.3.3.2 - Blinders

In the " Re-Jx " plane the blinders are line parallel to the line on which the center of the MHO circle is located at distance " B " from the same.

- Blinder B1
  [B1] = [0 – 0.5]K1, step 0.01

- Blinder B2
  [B2] = [-0.5 - 0]K1, step 0.01



Operation of the Out-of-Step protection takes place when the impedance " Zr " measured at Relay point, being inside the MHO circle, swings <u>from right to left</u> crossing first the Blinder " B1 " , then the Blinder " B2 " always in the same direction.

According to what above, the pick-up conditions for the different elements are:

1) <u>" Z_R " Inside the MHO Circle</u>

$$\left|\bar{Z}r - \overline{OC}\right| < \left[\frac{K1}{2}\right] \qquad Zr = \frac{|U_{AB}|}{|I_{AB}|}$$

$$\sqrt{\left(\frac{Zr}{Zb}\right)^2 + Kc^2 - 2Kc \cdot \frac{Zr}{Zb}\cos(\varphi + \alpha)} < \left[\frac{K1}{2}\right]$$

2) <u>Blinder " B1 " pick-up</u>

$$Zr\ \ \text{sen}(\varphi_2 - \alpha) < [B1] \ \Rightarrow\ Zr\ \ \text{sen}(\varphi + \alpha) > [B1]$$

$$[\text{sen}(\varphi_2 - \alpha) = -\ \text{sen}(\varphi + \alpha)]$$

$$\frac{Zr}{Zb}\ \text{sen}(\varphi + \alpha) < [B1]$$

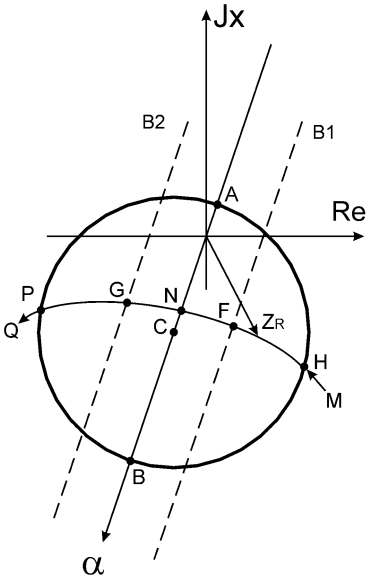
3) <u>Binder " B2 " pick-up</u>

$$Zr\ \ \text{sen}(\varphi_2 - \alpha) > [B2] \ \Rightarrow\ Zr\ \ \text{sen}(\varphi + \alpha) < [B2]$$

$$\frac{Zr}{Zb}\ \text{sen}(\varphi + \alpha) > [B2]$$

2.3.3.3 – Out-of-step operation logic

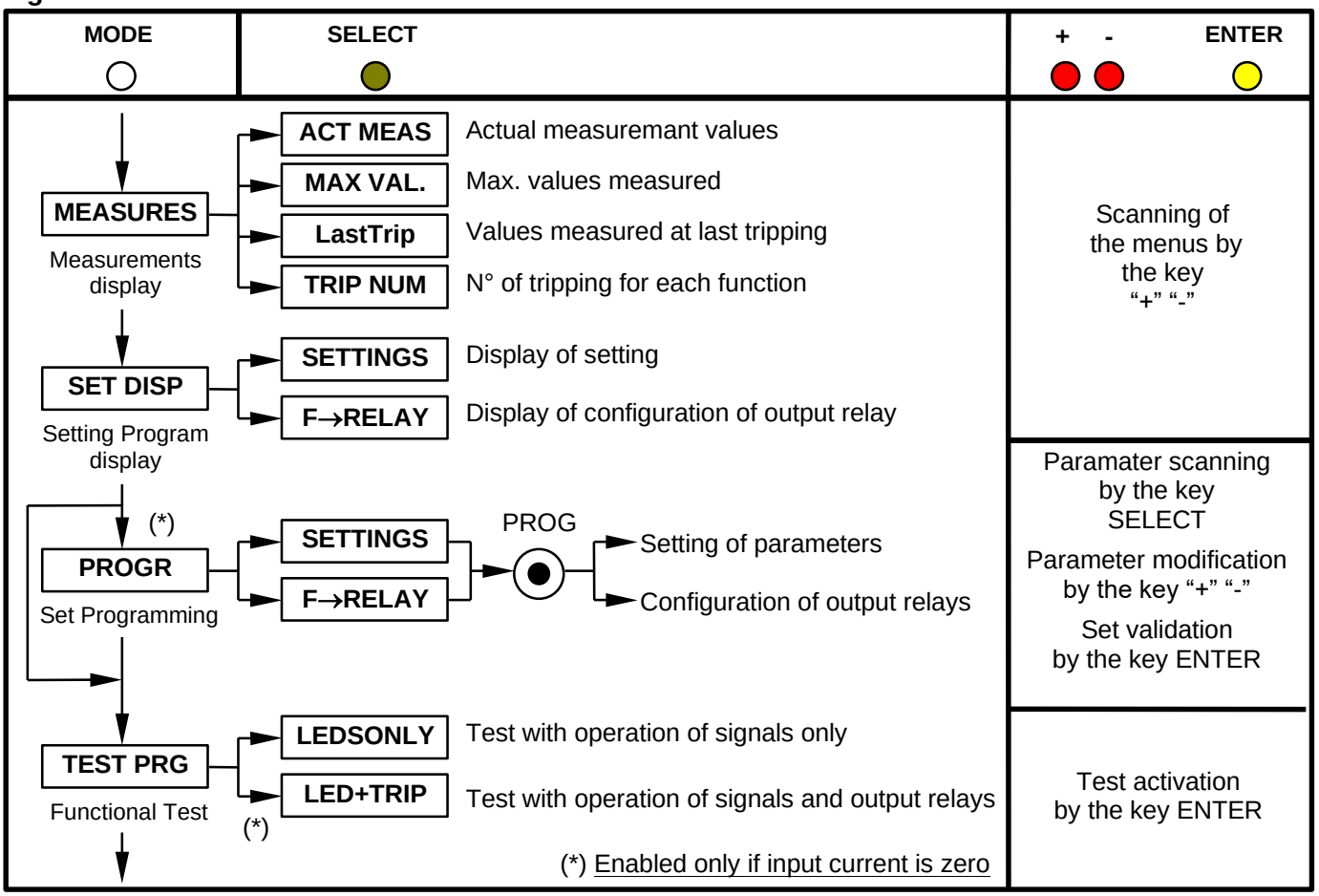
With reference to the figure, suppose an Impedance swing from " M " to " Q ".
As soon as " Zr "reaches the point " H ", the MHO element picks-up and the Blinder " B2 " also picks-up (or was already operated).
When the swing reaches the point " F " also the blinder " B1 " picks-up and a first alarm is issued.
Proceeding, at point " G " " B2 " will reset and a OUT-of-STEP conditions is counted.
When the number of OUT-of-STEP conditions counted attains the set number " N " programmable from 1 to 5 tripping takes place (normally N = 1).
When the swing eventually reaches the point " P " a timer ([tR]=[0.1-30]s, step 0.1s) is started to delays the reset of the MHO Supervision and allows counting the next swing " H → F → G " if it takes places within " tR ".

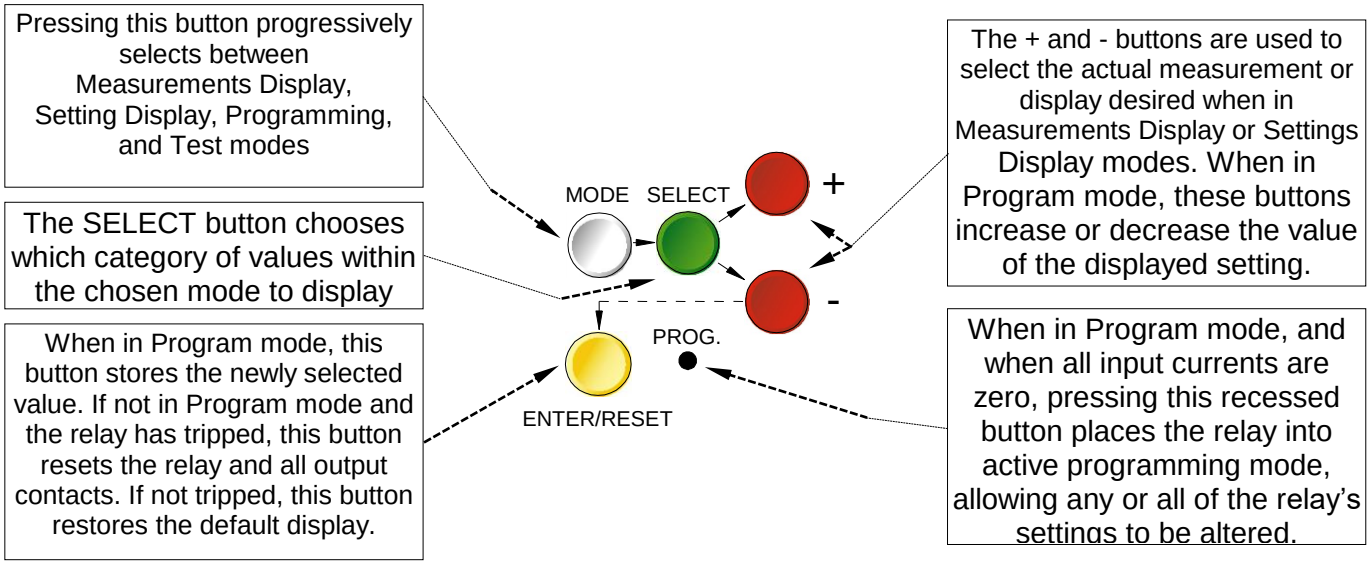


3. CONTROLS AND MEASUREMENTS

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)

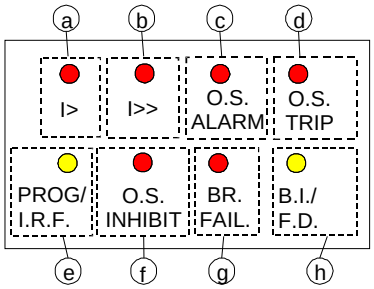
Fig. 1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**I>**	❑ Flashing when measured current overcomes the set trip level [I>]. ❑ Illuminated on trip after expiry of the set trip time delay [tI>].
b)	Red LED	**I>>**	❑ same as above related to [I>>], [tI>>].
c)	Red LED	**O.S. ALARM**	❑ Flashing for Out-of-Step Alarm
d)	Red LED	**O.S. TRIP**	❑ Illuminated on Out-of-Step Trip (n>[N]).
e)	Yellow LED	**PROG/ I.R.F.**	❑ Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**O.S. INHIBIT**	❑ Flashing when voltage U_{AB} and/or current I_{AB} are below the trip permissive level (U<,I<)
g)	Red LED	**BR. FAIL.**	❑ Lit-on when the BREAKER FAILURE function is activated.
h)	Yellow LED	**B.I./ F.D.**	❑ Lit-on when the operation of one or more of the relay functions has been disactivated in the programming. ❑ Flashing when a blocking signal is present at the relevant input terminals.

The reset of the leds takes place as follows:

- ❑ 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.

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 one of the IM30-GOS's functions.
One relay eventually associated to the instantaneous element of one of the overcurrent 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 relevant 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). Moreover any of the relays R2,R3,R4, can be programmed to be energised at the end of the delay tBF after pick-up of the relay R1 (Breaker Failure function).
Reset of the output relays associated to overcurrent time delayed function and/or Out-of-Step Alarm and trip 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 output relay to both instantaneous and delayed overcurrent elements. Therefore any relay already associated to the time delayed overcurrent element cannot be associated to the instantaneous overcurrent 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 or (with proper adapters) a fiber optic bus for interfacing with a Personal Computer (type IBM or compatible).
All the operations which can be performed locally (for example reading of measured data and changing of relay’s settings) are also possible via the serial communication interface.
Furthermore the serial port allows the user to read the demand recording 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, thus 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

Two inputs are provided: they are active when the relevant terminals are shorted

❑ **2**	(terminals 1 - 2)	: ❑	it blocks the operation of the time delayed elements relevant to phase overcurrent protection; programming allows to block the operation of the functions I>(Il) or I>>(Ih).
❑ **3**	(terminals 1 - 3)	: ❑	it blocks the operation of the Out-of-Step tripping alarm and trip element.

When a function is blocked the pick-up of its output is inhibited. For input -2- programming allows to have the inhibition either permanent as long as the blocking input is active (t_2=OFF) or automatically removed after the expiry of the set trip time delay of the function involved plus additional time 2tBF (t_2=2tBF).

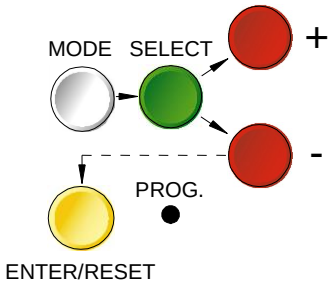
8. TEST

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 ≤ 4ms). 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
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.
Uabxxxx**%**	R.M.S. voltage Uab (Ua-Ub) as % of rated VTs secondary.
Zrxxx**%Zb**	Impedance measured at relay installation point.
φxxxxx°	Phase displacement of IAB from Uab.
IABxxxxxx	True R.M.S. value of the current IAB (IA-IB) displayed as primary Amps. (0 - 99999)

N.B: If no key is operated within 60 sec. the display is automatically switched to the default indication (IAxxxxxA)

10.2 - MAX VAL

Maximum demand values recorded starting from 100ms after closing of main Circuit Breaker plus highest inrush values recorded within the first 100ms from Breaker closing, (updated any time the breaker closes).

Display	Description
IAxxxx**In**	Max. value of phase A current after the first 100ms, displayed as p.u. of C.Ts rated current
IBxxxx**In**	As above, phase B
ICxxxx**In**	As above, phase C.
Uabxxxx**%**	Max value of voltage Uab (Ua-Ub) as % of rated VTs secondary.
SAxxxx**In**	Max. current of phase A during the first 100ms.
SBxxxx**In**	As above, phase B.
SCxxxx**In**	As above, phase C.

10.3 - LASTTRIP

Display of the function which caused the tripping of the relay plus values of the parameters at the moment of tripping.

Display	Description
F:xxxxxx	Function which produced the last event being displayed and faulty phase in case of phase current element's trip **I>, I>>, Al, O.S..**
IAxxxx**In**	Current of phase A. (value recorded at the moment of tipping)
IBxxxx**In**	Current of phase B. (as above)
ICxxxx**In**	Current of phase C. (as above)
Uabxxxx**%**	R.M.S. voltage Uab (Ua-Ub) as % of rated VTs secondary.
Zrxxx%**Zb**	Impedance measured at relay installation point. (as above)
φxxxxx°	Displacement of IAB from Uab. (as above)

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	Trip number of Low set overcurrent time delayed element [tI>].
I>>xxxx	Trip number of High set overcurrent time delayed element[tI>>].
OSxxxx	Trip number of Out-of-Step [OS].
Al xxxx	Trip number of Out-of-Step Alarm element [Al].

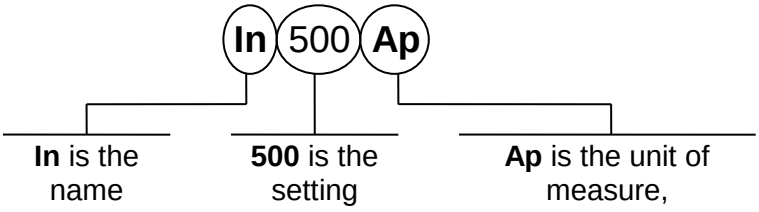
11. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

Enter the mode "SET DISP", select the menu "SETTINGS" or "F→RELAY", scroll information available in the menu by keys "+" or "-".
SETTING= values of relay's operation parameters as programmed; the setting program actually active is displayed with steady light whereas the stand-by program is displayed with flashing light.
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 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



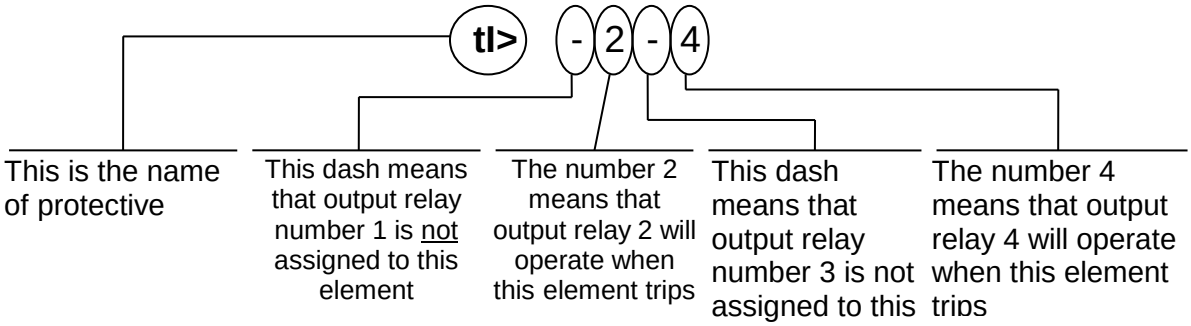
Mode PROG menu SETTINGS. (Production standard settings here under shown).

Display	Description	Setting Range	Step	Unit
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	-
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	Ap
Uns 100**V**	Rated secondary voltage of Vts (phase to phase)	100 –125	1	V
Ib 0.5**In**	Generator's rated current as p.u. of Cts rated current	0.5 - 1.1	0.1	In
F(I>) D	Operation characteristic of the low-set overcurrent element D = Independent definite time. SI = Dependent normal inverse time.	D SI	D SI	-

Display	Description	Setting Range	Step	Unit
I> 1.0**Ib**	Trip level of low-set overcurrent element (p.u. of Ib)	1- 2.5 - Dis	0.01	Ib
tI> 0.05**s**	Trip time delay of the low-set overcurrent element In the inverse time operation [tI>] is the trip time delay at I = 5x[I>].	0.05 - 30	0.01	s
I>> 1**Ib**	Trip level of high-set overcurrent element (p.u. of Ib)	1 – 12 - Dis	0.1	Ib
tI>> 0.05**s**	Trip time delay of the high-set overcurrent element	0.05 - 3	0.01	s
αz270 **C**	Impedance characteristic angle	0 - 359	1	°
$K_1$300**%Zb**	Diameter of the circle	50 – 300 - Dis	1	%Zb
K_c 50**%Zb**	MHO circle centre offset	0 – 200	1	%Zb
B1 +0.25**K_1**	Blinder 1 position	0 – 0.5	0.01	K1
B2 –0.25**K_1**	Blinder 2 position	- (0 – 0.5)	0.01	K1
N 1	N° of Out-of-Step conditions to detected before tripping.	1 - 5	1	-
tR 10 **s**	Reset time delay of MHO supervision element	0.1 – 30	0.1	s
tBF 0.05**s**	Max. reset time delay of the instantaneous elements after tripping of the time delayed elements and time delay for activation of the output relay associated to the Breaker Failure function	0.05 - 0.5	0.01	s

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	
I> --3-	Instantaneous element of low-set overcurrent (only one or more, whatever combination)	operates relays R1,R2,R3,R4
tI> 1---	As above, time delayed element	operates relays R1,R2,R3,R4
I>> --3-	Instantaneous element of high-set overcurrent	operates relays R1,R2,R3,R4
tI>> 1---	As above, time delayed element	operates relays R1,R2,R3,R4
AI -2--	Out-of-Step alarm	operates relays R1,R2,R3,R4
OS 1---	Out-of-Step trip	operates relays R1,R2,R3,R4
tBF ---4	Breaker Failure function.	operates relays 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.	
2: Ih--	The input (2) for blocking the time delayed elements relevant to phase and ground faults operate on I>(Il) or I>>(Ih) as programmed.	
t_2 OFF	The operation of the blocking input (2) can be programmed so that it lasts as long the blocking input signal is present (t_2=OFF) or so that, even with the blocking input still present, it only lasts for the set trip time delay of the function plus an additional time 2xtBF (t_2=2xtBF).	

13. MANUAL AND AUTOMATIC 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 (IAxxxxxA).
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)

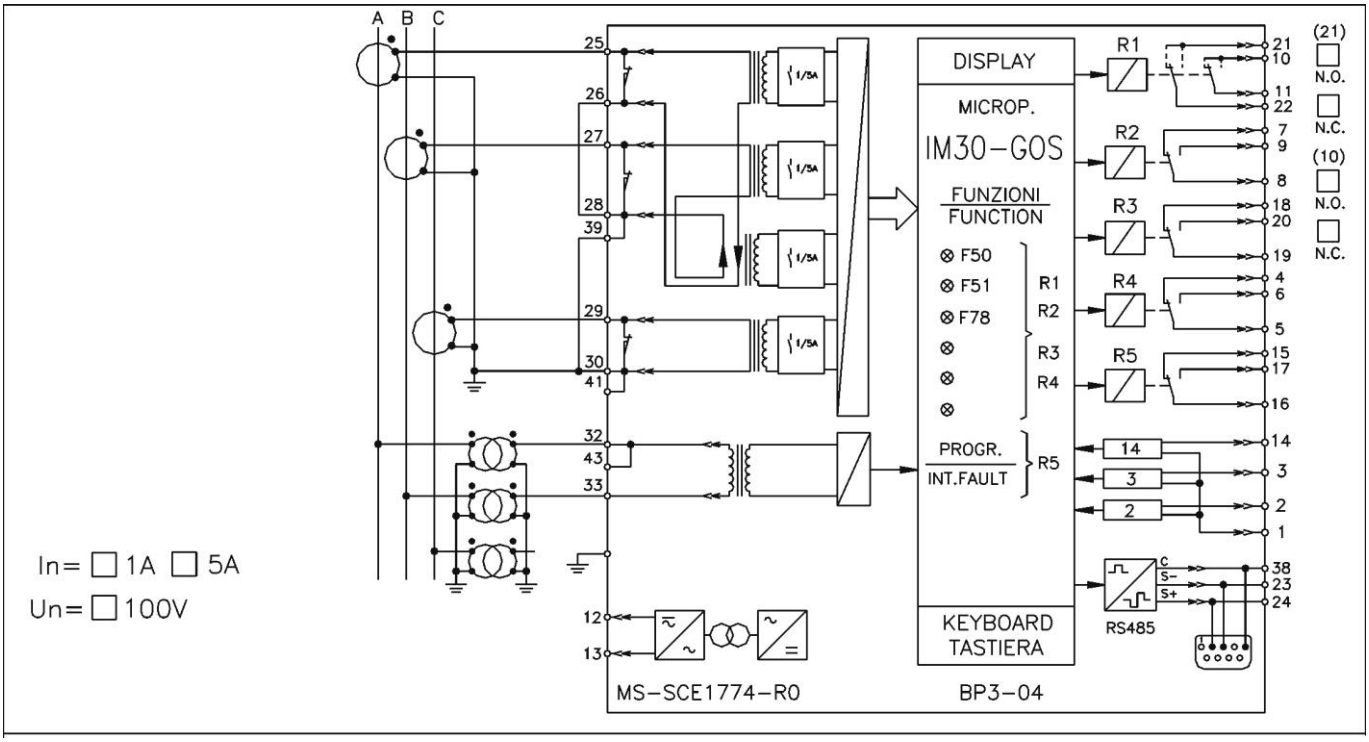
❑ Electromagnetic emission	EN55022 industrial environment			
❑ Radiated electromagnetic field immunity test	IEC61000-4-3 ENV50204	level 3	80-1000MHz 900MHz/200Hz	10V/m 10V/m
❑ Conducted disturbances immunity test	IEC61000-4-6	level 3	0.15-80MHz	10V
❑ Electrostatic discharge test	IEC61000-4-2	level 4	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

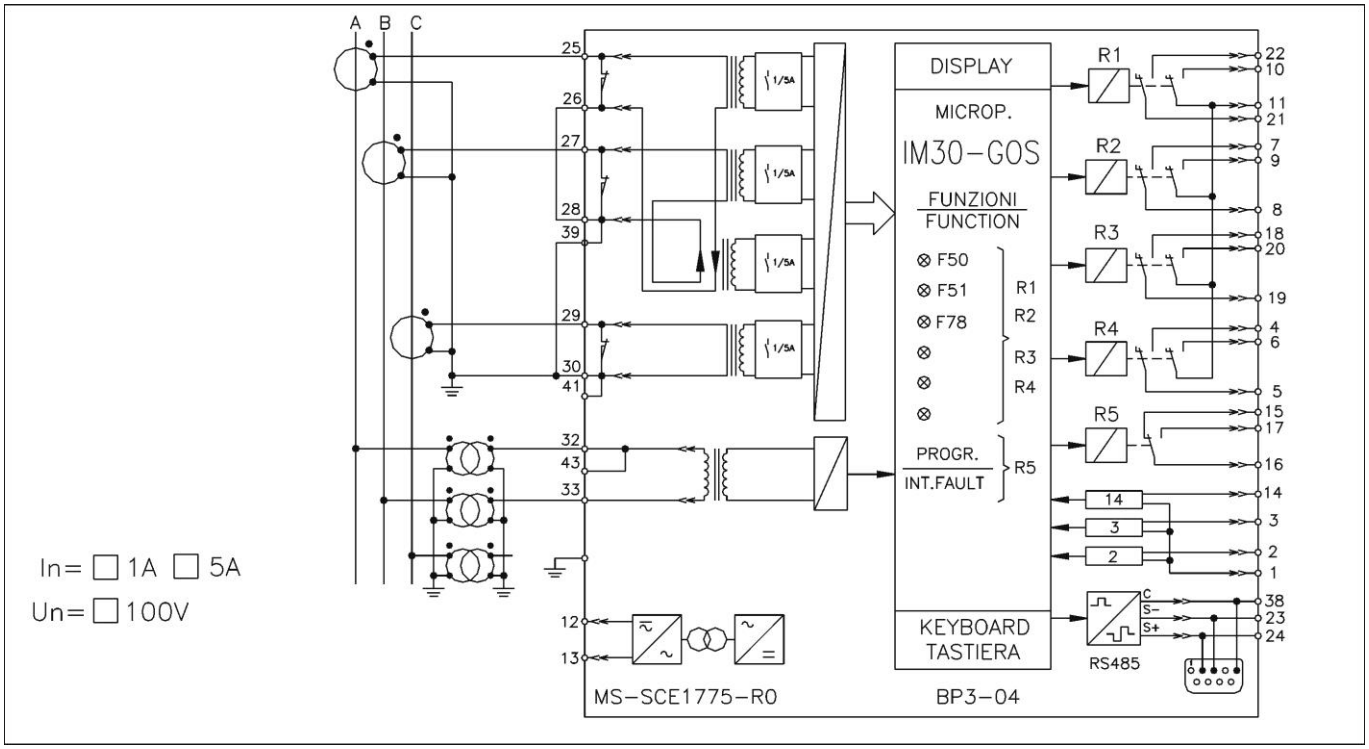
❑ Accuracy at reference value of influencing factors	2% In for measure 2% +/- 10ms for times
❑ Rated Current	In = 1 or 5A
❑ Current overload	200 A for 1 sec; 10A continuos
❑ Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A
❑ Rated Voltage	Un = 100V (different on request)
❑ Voltage overload	2 Un continuous
❑ Burden on voltage input	0,04 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.)

Microelettrica Scientifica S.p.A. - 20089 Rozzano (MI) - Italy - Via Alberelle, 56/68
Tel. (##39) 02 575731 - Fax (##39) 02 57510940
http://www.microelettrica.com **e-mail :** ute@microelettrica.com

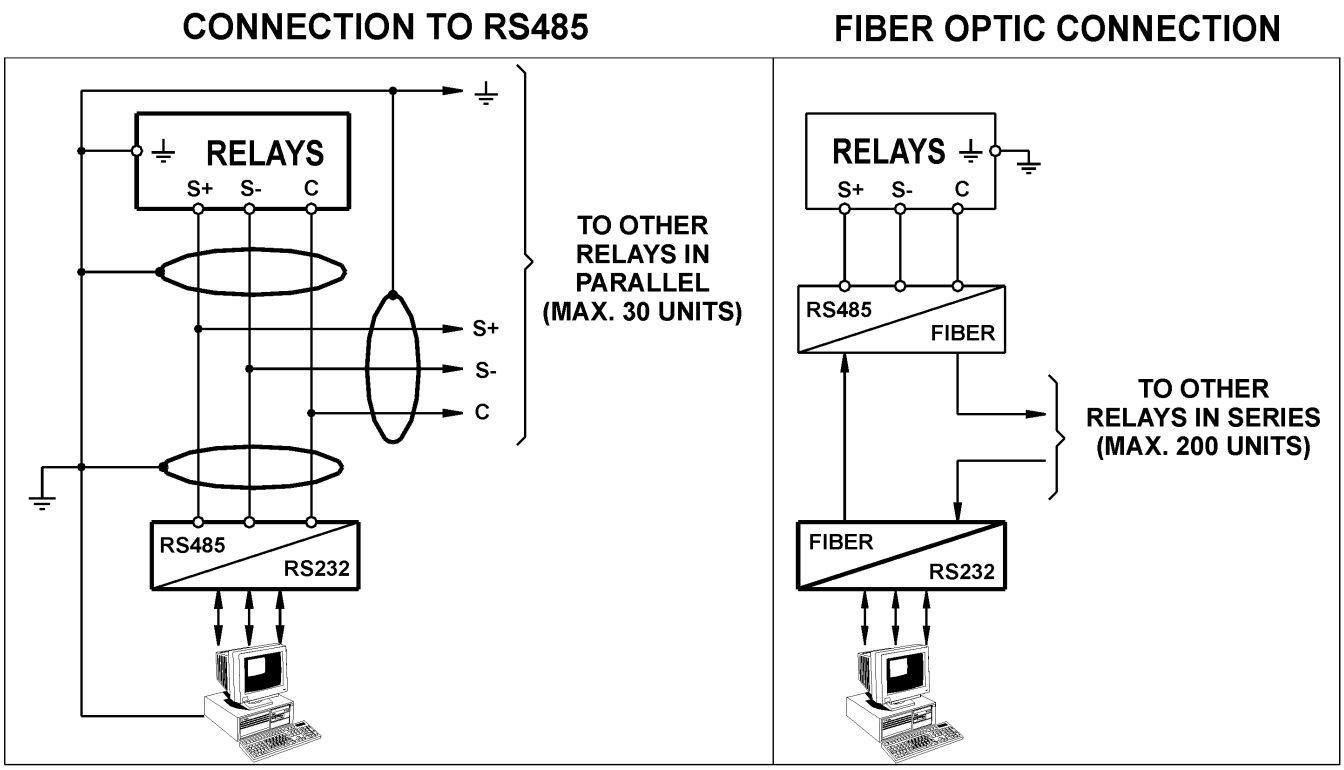
17. CONNECTION DIAGRAM (SCE1774 Rev.0 STANDARD OUTPUT)



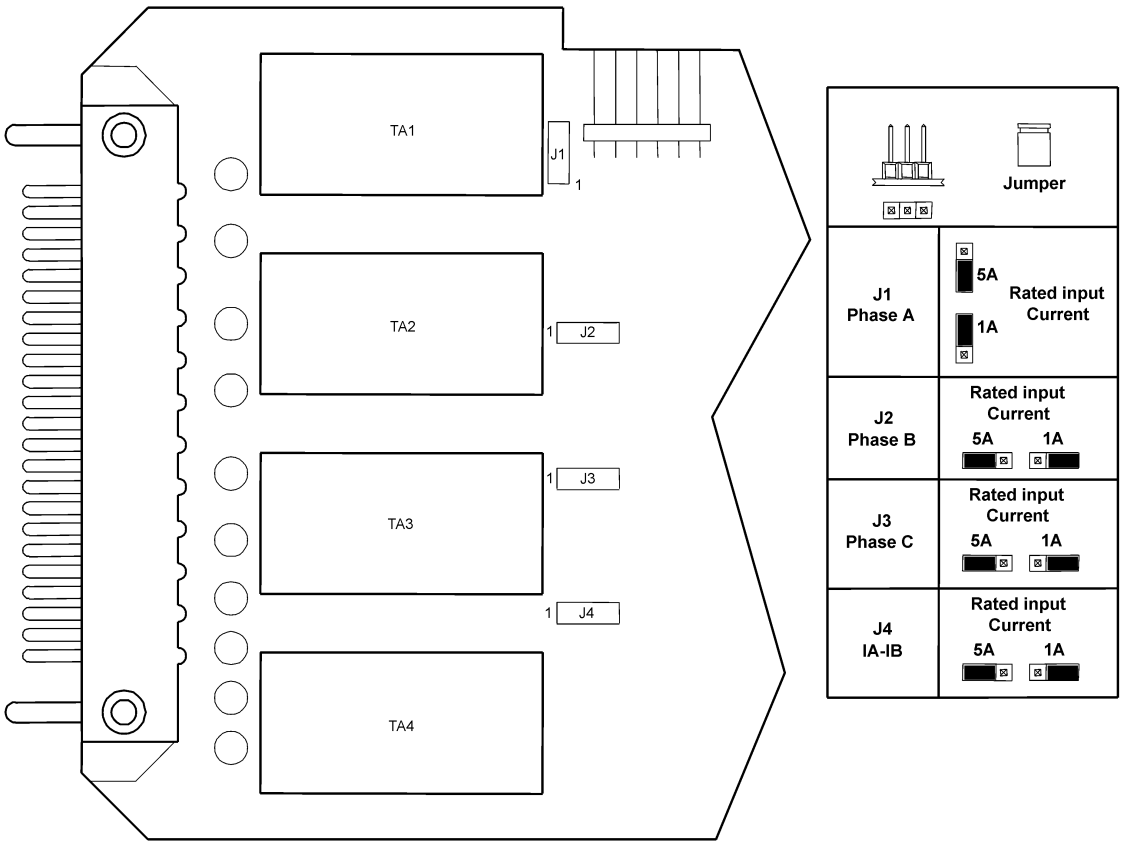
17.1 - CONNECTION DIAGRAM (SCE1775 Rev.0 DOUBLE OUTPUT)



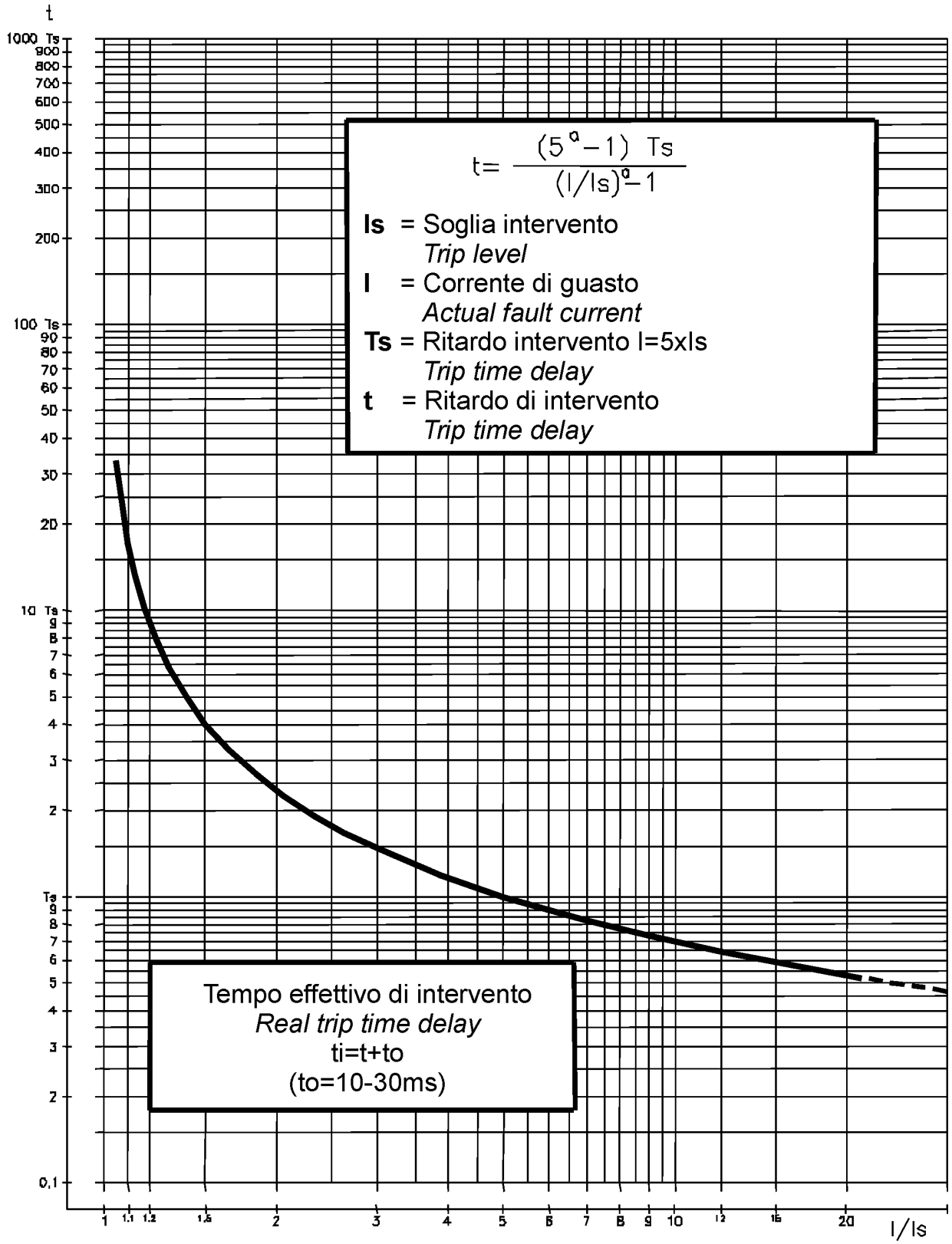
18. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)



19. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A



20. TIME CURRENT CURVES F51 (TU0311 Rev.0)



Tempo normalmente inverso
Normal inverse time

a=0.02

F51

Is = I> = (1 - 2.5)Ib
Ts = tI> = (0.05 - 30)s

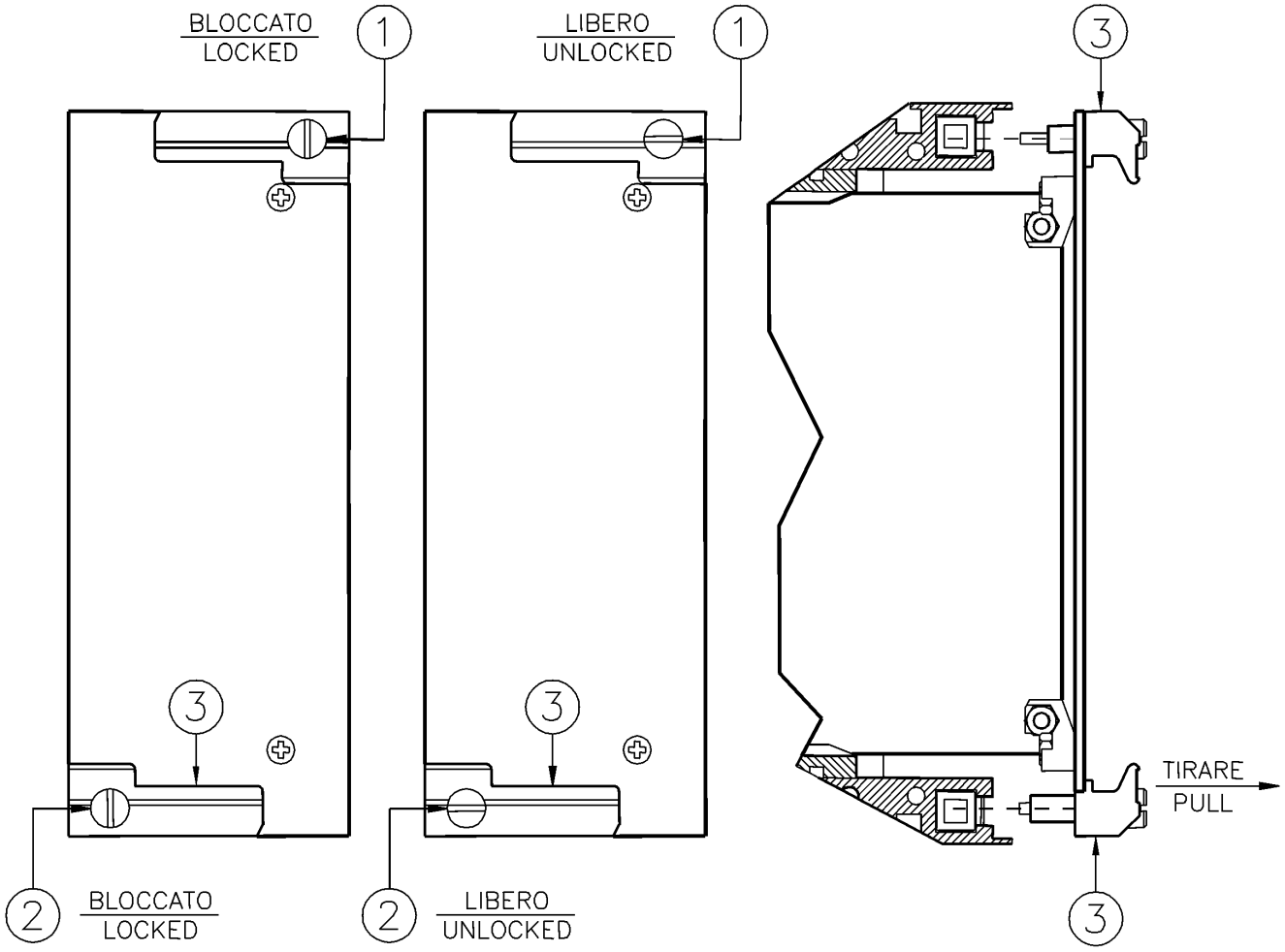
21. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

21.1 Draw-out

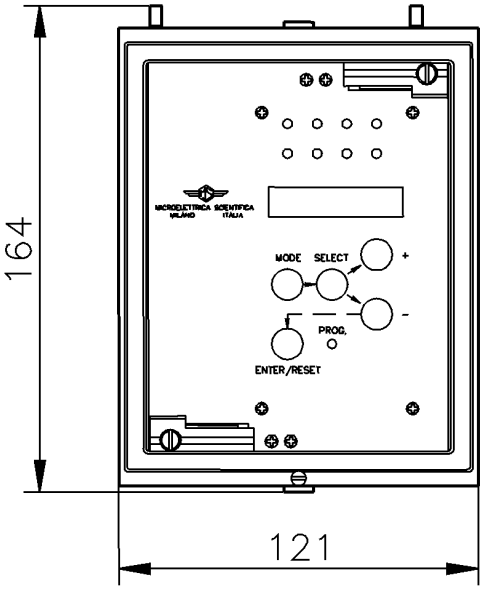
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

21.2 Plug-in

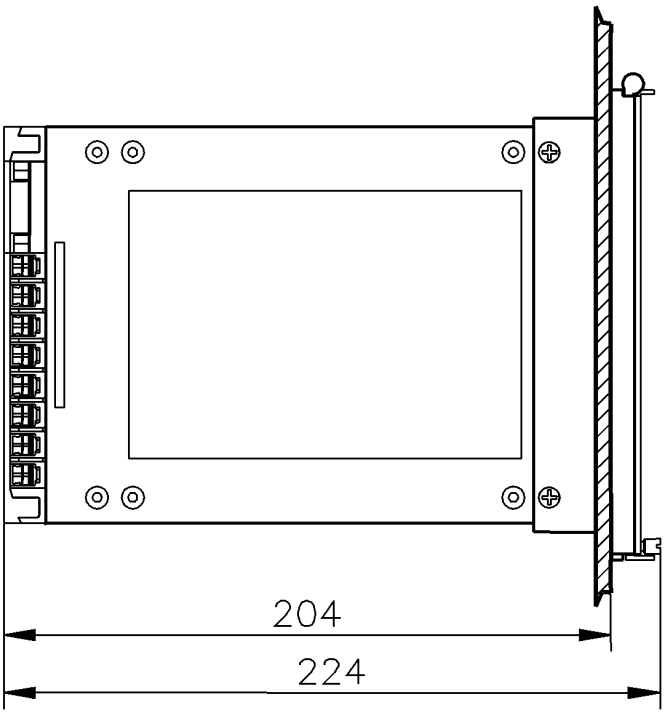
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
otate anticlockwise the screws ① and ② with the mark in the vertical position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

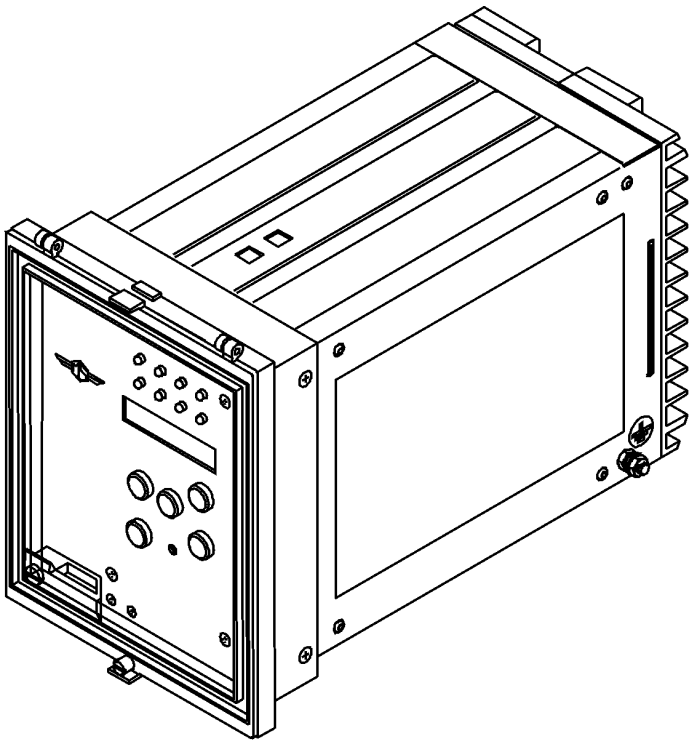


25. MOUNTING

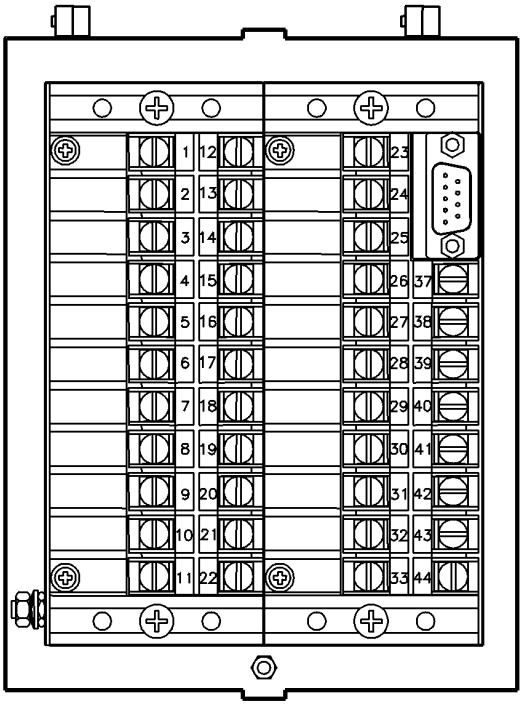


PANEL CŪT OUT 113x142 (LxH)

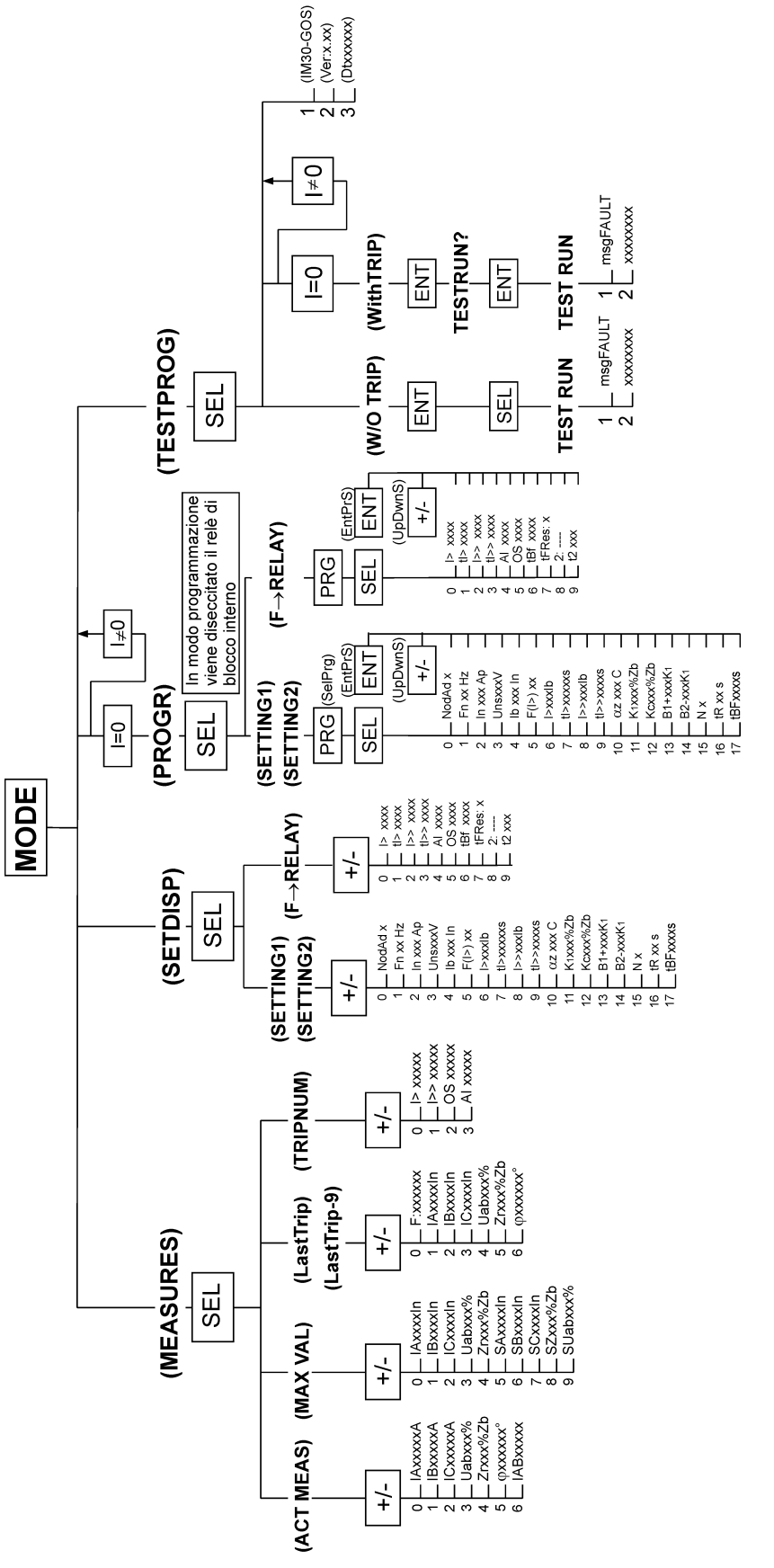




View of Rear Terminal Connection



23. KEYBOARD OPERATIONAL DIAGRAM



24. SETTING'S FORM

Relay Type	**IM30-GOS**	**Station :**		**Circuit :**	
Date :	**/ /**			**Relay Serial Number :**	
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c. 24V(-20%) / 125V(+20%) d.c.			**Rated Current :**	
	☐ 80V(-20%) / 220V(+15%) a.c. 90V(-20%) / 250V(+20%) d.c.			**Rated Voltage :**	

RELAY PROGRAMMING

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
NodAd	Identification number for serial communication bus	1 - 250	**-**	1			
Fn	Mains frequency: setting range	50 - 60	**Hz**	50			
In	Rated primary current of the phase C.Ts.	1 - 9999	**Ap**	500			
Uns	Rated secondary voltage of Vts (phase to phase)	100 –1 25	**V**	100			
Ib	Generator's rated current as p.u. of Cts rated current	0.5 - 1.1	**In**	0.5			
F(I>)	Operation characteristic of the low-set overcurrent element.	D, SI	-	D			
I>	Trip level of low-set overcurrent element (p.u. of Ib)	1- 2.5 - Dis	**Ib**	1.0			
tI>	Trip time delay of the low-set overcurrent element	0.05 - 30	**s**	0.05			
I>>	Trip level of high-set overcurrent element (p.u. of Ib)	1 – 12 - Dis	**Ib**	1			
tI>>	Trip time delay of the high-set overcurrent element	0.05 - 3	**s**	0.05			
αz	Impedance characteristic angle	0 - 359	**C**	270			
K_1	Diameter of the circle	50–300-Dis	**%Zb**	300			
K_c	MHO circle centre offset	0 – 200	**%Zb**	50			
B1	Blinder 1 position	0 – 0.5	**K_1**	+0.25			
B2	Blinder 2 position	- (0 – 0.5)	**K_1**	–0.25			
N	N° of Out-of-Step conditions to detected before tripping	1 – 5	**-**	1			
tR	Reset time delay of MHO supervision element	0.1 – 30	**s**	10			
tBF	Max. reset time delay of the instantaneous elements after tripping of the time delayed elements and time delay for activation of the output relay associated to the Breaker Failure function	0.05 - 0.5	**s**	0.05			

CONFIGURATION OF OUTPUT RELAYS

Default Setting						Actual Setting					
Prot Elem.	**Output Relays**				**Description**	**Prot. Elem.**	**Output Relays**				
I>	-	-	3	-	Instantaneous element of low-set overcurrent	**I>**					
tI>	1	-	-	-	As above, time delayed element	**tI>**					
I>>	-	-	3	-	Instantaneous element of high-set overcurrent	**I>>**					
tI>>	1	-	-	-	As above, time delayed element	**tI>>**					
AI	-	2	-	-	Out-of-Step alarm	**AI**					
OS	1	-	-	-	Out-of-Step trip	**OS**					
tBF	-	-	-	4	Breaker Failure function.	**tBF**					
tFRes:	A				The reset after tripping of the relays associated to the time delayed elements can take place: **(A)** automatically , **(M)** manually	**tFRes:**					
2:	--Ih--				The input (2) for blocking the time delayed elements relevant to phase and ground faults operate on I>(Il) or I>>(Ih) as programmed.	**2:**					
t_2	OFF				The operation of the blocking input (2) can be programmed so that it lasts as long the blocking input signal is present (t_2=OFF) or so that, even with the blocking input still present, it only lasts for the set trip time delay of the function plus an additional time 2xtBF (t_2=2xtBF).	**t_2**					

Commissioning Engineer : _____ **Date :** _____

Customer Witness : _____ **Date :** _____