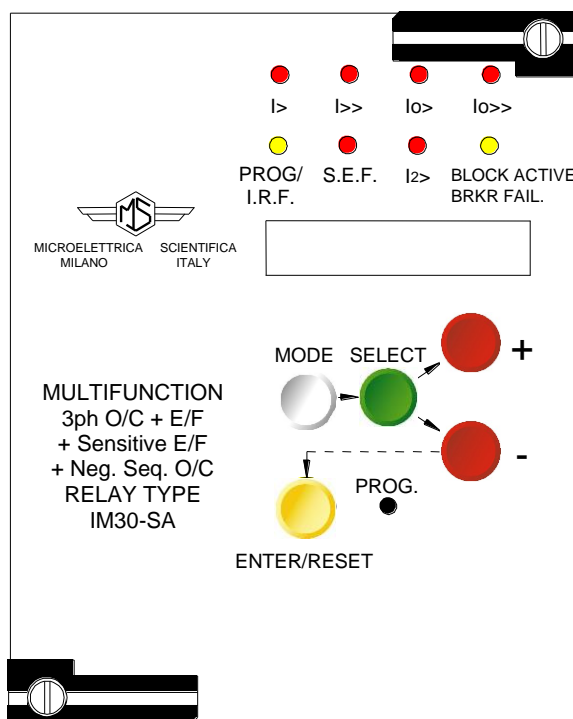


MICROPROCESSOR OVERCURRENT AND EARTH FAULT PROTECTION RELAY

TYPE IM30-SA

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 (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

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- 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

Input currents are supplied to 4 current transformers: - three measuring phase current - one measuring the earth fault zero-sequence current.

Phase current input can be 1 or 5A

For zero-sequence current, taps for 1A and 5A input are provided on relay's terminal board dimension drawings.

Make electric connection in conformity with the diagram reported on relay's enclosure.

Check that input currents are same as reported on the diagram and on the test certificate.

The auxiliary power is supplied by a built-in interchangeable module fully isolated and self protected

2.1 - POWER SUPPLY

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

- | | | |
|-----------------------------|-----------------------------|--------|
| a) - { | { | b) - { |
| 24V(-20%) / 110V(+15%) a.c. | 80V(-20%) / 220V(+15%) a.c. | |
| 24V(-20%) / 125V(+20%) d.c. | 90V(-20%) / 250V(+20%) d.c. | |

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

2.2 - ALGORITHM OF THE TIME CURRENT CURVES

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

$$t(I) = \left[\frac{A}{\left(\frac{I}{I_s} \right)^a - 1} + B \right] \bullet K \bullet T_s + t_r \quad \text{where :}$$

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

I_s = 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 $\frac{I}{I_s} = 10$

t_r = Operation time of the output relay on pick-up.

The constants **A**, **B**, **K** and **a** have different values for the different Time Current Curves.

Curve Name	Curve Identifier	A	B	a	K
IEC A Inverse	A	0.14	0	0.02	0.3366
IEC B Very Inverse	B	13.5	0	1	0.6667
IEC C Extr. Inverse	C	80	0	2	1.2375
IEEE Moderate Inverse	MI	0.0104	0.0226	0.02	4.1106
IEEE Short Inverse	SI	0.00342	0.00262	0.02	13.3001
IEEE Very Inverse	VI	3.88	0.0963	2	7.3805
IEEE Inverse	I	5.95	0.18	2	4.1649
IEEE Extremely Inverse	EI	5.67	0.0352	2	10.814
Independent Definite time	D	$t = T_s$			

Curves are user selectable for the following relay's functions

- ☐ **1F51** (FI>) = Low-set phase overcurrent
- ☐ **1F51N** (FO>) = Low-set Earth Fault current
- ☐ **F46** (FI₂>) = Negative Sequence overcurrent

For functions

- ☐ **2F51** (I>>, tI>>) = High-set phase overcurrent
- ☐ **2F51N** (O>>, tO>>) = High -set Earth Fault current

the operation is Independent Definite time only

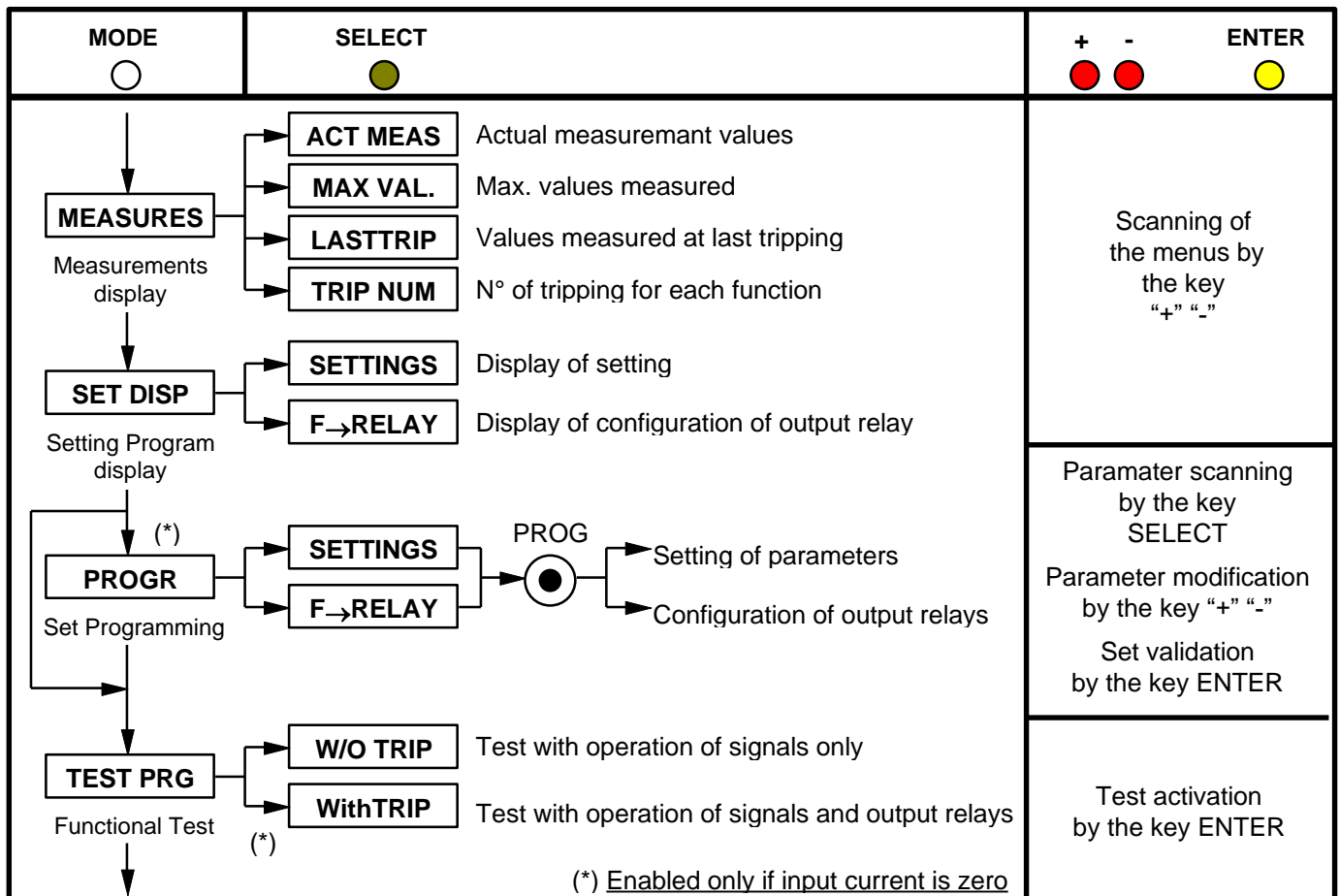
3. CONTROLS AND MEASUREMENTS

Five key buttons allow for local management of all relay's functions.

A 8-digit high brightness alphanumerical display shows the relevant readings (xxxxxxx)

(see synoptic table fig.1)

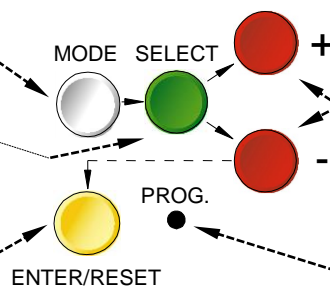
FIG.1



Pressing this button progressively selects between Measurements Display, Setting Display, Programming, and Test modes

The SELECT button chooses which category of values within the chosen mode to display

When in Program mode, this button stores the newly selected value. If not in Program mode and the relay has tripped, this button resets the relay and all output contacts. If not tripped, this button restores the default display.

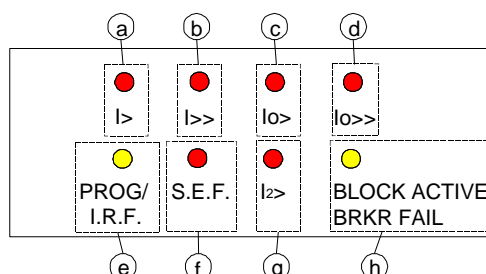


The + and - buttons are used to select the actual measurement or display desired when in Measurements Display or Settings Display modes. When in Program mode, these buttons increase or decrease the value of the displayed setting.

When in Program mode, and when all input currents are zero, pressing this recessed button places the relay into active programming mode, allowing any or all of the relay's settings to be altered.

4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	I>	<input type="checkbox"/> Flashing when measured current overcomes the set trip level [I>]. <input type="checkbox"/> Illuminated on trip after expiry of the set trip time delay [tl>].
b)	Red LED	I>>	<input type="checkbox"/> Same as above related to [I>>], [tl>>].
c)	Red LED	Io>	<input type="checkbox"/> Same as above related to [O>], [tO>].
d)	Red LED	Io>>	<input type="checkbox"/> Same, as above related to [O>>], [tO>>].
e)	Yellow LED	PROGRAM/ BLOCK FAIL	<input type="checkbox"/> Flashing during the programming of the parameters or in case <input type="checkbox"/> Illuminated on Internal Relay Fault.
f)	Red LED	S.E.F.	<input type="checkbox"/> Flashing when measured current overcomes the set trip level [I>]. <input type="checkbox"/> Illuminated on trip after expiry of the set trip time delay [tl>].
g)	Red LED	I2>	<input type="checkbox"/> Flashing when measured current overcomes the set trip level [I>]. <input type="checkbox"/> Illuminated on trip after expiry of the set trip time delay [tl>].
h)	Yellow LED	BLOCK ACTIVE BRKR FAIL	<input type="checkbox"/> Flashing when a blocking signal is present at the relevant input terminals. <input type="checkbox"/> Lit-on when the BREAKER FAILURE function is activated.

The reset of the leds takes place as follows:

<input type="checkbox"/>	Leds	a,b,c,d,g	<input type="checkbox"/> From flashing to off, automatically when the lit-on cause disappears. <input type="checkbox"/> From ON to OFF, by "ENTER/RESET" push button only if the tripping cause has disappeared.
<input type="checkbox"/>	Leds	e,f,h	<input type="checkbox"/> 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.

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5. OUTPUT RELAYS

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

- ❑ 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-SA's 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 relevant function, the drop-out of the instantaneous relay is anyhow forced after an adjustable waiting time [tBO]. (Deactivation of the blocking output eventually used to block a relay upstream in the distribution system).
Moreover any of the relays R1,R2,R3,R4, can be programmed to be energised at the end of the delay tBF (Breaker Failure function)
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.
- ❑ 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

Bf	terminals 1 – 2	:	<input type="checkbox"/> it blocks the operation of the time delayed elements relevant to phase fault detection.
Bo	terminals 1 – 3	:	<input type="checkbox"/> it blocks the operation of the time delayed elements relevant to earth fault and Sensitive E/F detection.
RR	terminals 1 – 14	:	<input type="checkbox"/> Remote Reset

When a function is blocked the pick-up of its time delayed output is inhibited. Programming allows to have the inhibition either permanent as long as the blocking input is active ($t_{Bf}=OFF$; $t_{Bo}=OFF$) or automatically removed after the expiry of the set trip time delay of the function involved plus an additional time $2t_{BF}$ ($t_{Bf}=2t_{BO}$; $t_{Bo}=2t_{BO}$). By proper interconnection of the blocking inputs and outputs of different relays it is possible to configurate very efficient arrangements of logic fault discrimination as well as to feature a safe and quick breaker back-up protection.

8. TEST

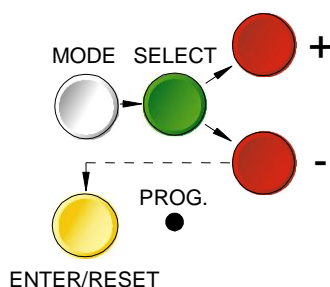
Besides the normal "WATCHDOG" and "POWERFAIL" functions, a comprehensive program of self-test and self-diagnostic provides:

- ☐ 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.

The display scrolls the different measurements every 2 seconds.

To stop on any of the measurements displayed just press the "Enter/Reset" push button.

Display	Description
I/Inxxx%	Highest among the 3 phase-currents displayed as % of the rated current of phase C.Ts (0-999%)
IAxxxxxA	True R.M.S. value of the current of phase A displayed as primary Amps.(0 - 99999)
IBxxxxxA	As above, phase B.
ICxxxxxA	As above, phase C.
IoxxxxxA	As above, earth fault current.
I2xxxxxIn	Negative Sequence component of the 3-phase current system displayed as p.u. of C.Ts rated current.

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
IAxxxxIn	Max. value of phase A current after the first 100ms, displayed as p.u. of C.Ts rated current.
IBxxxxIn	As above, phase B.
ICxxxxIn	As above, phase C.
IoxxxxOn	As above, earth fault current.
I2xxxxxIn	As above, negative sequence current component
SAxxxxIn	Max. current of phase A during the first 100ms.
SBxxxxIn	As above, phase B.
SCxxxxIn	As above, phase C.
SoxxxxOn	As above, earth fault current.

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10.3 - LASTTRIP

Display of the function which caused the tripping of the relay plus values of the parameters at the moment of tripping. The last five events are recorded

The memory buffer is refreshed at each new relay tripping with a decreasing numbering (FIFO logic).

Display	Description
LastTr-x	Indication of the recorded event (x= 0 to 4) Example: Last event (LastTr -0) - Last but one event (LastTr-1) - etc...
F:xxxxxx	Function which produced the event being displayed and faulty phase in case of phase current element's trip l> ph A,B,C; l>> ph A,B,C; O>; O>>.
IAxxxxIn	Current of phase A. (value recorded at the moment of tipping)
IBxxxxIn	Current of phase B. (as above)
ICxxxxIn	Current of phase C. (as above)
IoxxxxOn	Earth fault current. (as above)
I2xxxxxIn	Negative Sequence component of current.

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
l> xxxx	Trip number of Low set overcurrent time delayed element [tl>].
l>>xxxx	Trip number of High set overcurrent time delayed element [tl>>].
lo> xxxx	Trip number of Low set earth fault time delayed element [tO>].
lo>>xxxx	Trip number of High set earth fault time delayed element [tO>>].
So>xxxxx	Trip number of Sensitive earth fault time delayed element [tSo>].
I2 xxxxx	Trip number of Negative Sequence O/C time delayed element [tl2>].

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 relays 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 (----)].

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 which can be disclosed on request only.**

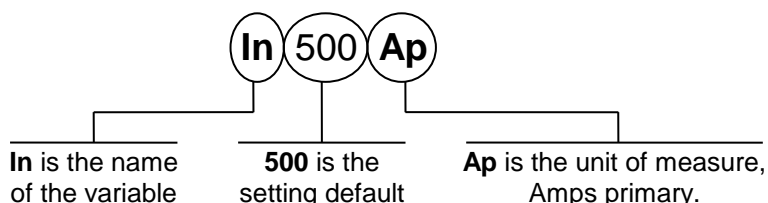
As soon as programming is enabled, the Led PRG/IRF flashes and the reclosing lock-out relay R5 is deenergized.

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).

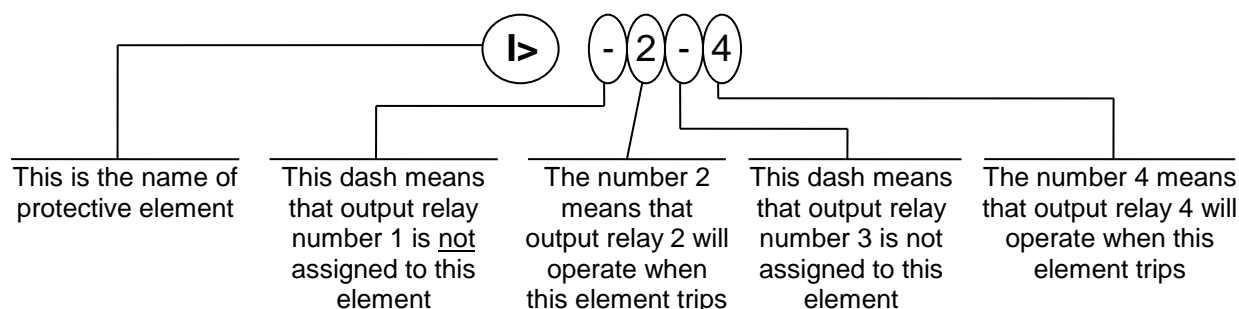
Display	Description	Setting Range	Step	Unit
Fn 50 Hz	Mains frequency	50 - 60	10	Hz
In 500Ap	Rated primary current of the phase C.Ts.	1 - 9999	1	A
On 500Ap	Rated primary current of the C.Ts. or of the tore C.T. supplying the zero sequence current	1 - 9999	1	A
F(I>) D	Operation characteristic of the low-set overcurrent element: (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	D A B C MI SI VI I EI	-

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Display	Description	Setting Range	Step	Unit
I> 0.5In	Trip level of low-set overcurrent element (p.u. of the rated current of the phase C.Ts.)	0.16 - 4 - Dis	0.01	In
tl> 0.05s	Trip time delay of the low-set overcurrent element In the inverse time operation [tl>] is the trip time delay at $I = 10x[I>]$.	0.01 - 30	0.01	s
2I>> ON	Automatic Cold Load pick-up	ON - OFF	ON-OFF	-
I>> 0.5In	Trip level of high-set overcurrent element (p.u. of the rated current of the phase C.Ts.):	0.1 - 40 - Dis	0.1	In
tl>> 0.05s	Trip time delay of the high-set overcurrent element	0.01 - 3	0.01	s
F(O>) D	Operation characteristic of the low-set earth fault element: (D) = Independent definite time (A) = IEC Inverse Time Curve type A (B) = IEC Very Inverse Time Curve type B (C) = IEC Extremely Inverse Time 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	D A B C MI SI VI I EI	-
O> 0.02On	Trip level of low-set earth fault element (p.u. of the rated current of the C.Ts. for zero sequence detection)	0.02 - 0.4 - Dis	0.01	On
tO> 0.05s	Trip time delay of low-set earth fault element. In the inverse time operation [tO>] is the trip time delay at $I = 10x[O>]$.	0.01 - 30	0.01	s
O>> 0.02On	Trip level of high-set earth fault element (p.u. of the rated current of the C.Ts. for zero sequence detection)	0.02 - 4 - Dis	0.01	On
tO>> 0.05s	Trip time delay of the high-set earth fault element	0.01 - 3	0.01	s
So 0.05On	Trip level of Sensitive E/F element (p.u. of the rated current of the C.Ts. for zero sequence detection)	0.01 - 0.05 - Dis	0.01	On
tSo 0.05s	Trip time delay Sensitive E/F element. In the inverse time operation [tO>] is the trip time delay at $I = 10x[O>]$.	0.01 - 30	0.01	s
F(I2) D	Operation characteristic of the Negative Sequence element: (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	D A B C MI SI VI I EI	-
I2 1.0In	Trip level of the negative sequence overcurrent element (p.u. of the rated current of phase C.Ts)	0.05 - 2.5 - Dis	0.01	In
tl2> 0.05s	Trip time delay of the negative sequence element. In the inverse time operation [tl2>] is the trip time delay at $I2=10x[I2>]$	0.05 - 30	0.01	s
tBO 0.05s	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 - 0.25	0.01	s
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	-

The setting Dis indicates that the function is deactivated.

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.
tl> 1---	As above, time delayed element.	operates relay R1,R2,R3,R4.
I>> --3-	Instantaneous element of high-set overcurrent	operates relay R1,R2,R3,R4.
tl>> 1---	As above, time delayed element.	operates relay R1,R2,R3,R4.
O> ---4	Instantaneous element of low-set earth fault element	operates relay R1,R2,R3,R4.
tO> -2--	As above, time delayed element.	operates relay R1,R2,R3,R4.
O>> ---4	Instantaneous element of high-set earth fault element	operates relay R1,R2,R3,R4.
tO>> -2--	As above, time delayed element.	operates relay R1,R2,R3,R4.
So> ---4	Instantaneous element of Sensitive earth fault element	operates relay R1,R2,R3,R4.
tSo> -2--	As above, time delayed element.	operates relay R1,R2,R3,R4.
I2> --3-	Instantaneous element of Negative Sequence O/C element	operates relay R1,R2,R3,R4.
tl2> 1---	As above, time delayed element.	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.	
Bf -li	The input (Bf) can block the operation of one or more of the time delayed O/C element, N = Negative Sequence O/C (I2>), i = low-set O/C (I>), I = High-set O/C (I>>)	
Bo -Oo	The input (Bo) can block the operation of one or more of the time delayed E/F element, S = Sensitive E/F (So), o = low-set E/F (O>), O = High-set E/F (O>>)	
tBf 2tBO	The blocking of the phase fault elements can be programmed so that it lasts as long as the blocking input signal is present (tBf Dis) or so that, even with the blocking input still present, it only lasts for the set trip time delay of the function plus an additional time 2xtBO (tBf 2xtBO).	
tBo 2tBO	As above, for the earth fault elements (tBo Dis) or (tBo 2tBO).	

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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 (I/Inxxx%). If an internal fault is detected, the display shows the fault identification code and the relay R5 is deenergized. This test can be carried-out even during the operation of the relay without affecting the relay tripping in case a fault takes place during the test itself.

13.2 - Mode "TESTPROG" subprogram "WithTRIP"

Access to this program is enabled only if the current detected is zero (breaker open). Pressing the yellow key the display shows "TEST RUN?". A second operation of the yellow key starts a complete test which also includes the activation of all the output relays. The display shows (TEST RUN) with the same procedure as for the test with W/O TRIP. Every 15 min during the normal operation the relay automatically initiates an auto test procedure (duration ≤ 10 ms). 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 taking place in other parts or components of the board can severely damage the relays or cause damages, not immediately evident to the electronic components.

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16. ELECTRICAL CHARACTERISTICS

APPROVAL: CE – RINA

REFERENCE STANDARDS IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

<input type="checkbox"/> Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.
<input type="checkbox"/> Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50µs
<input type="checkbox"/> Insulation resistance	> 100MΩ	

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

<input type="checkbox"/> Operation ambient temperature	-10°C / +55°C	
<input type="checkbox"/> Storage temperature	-25°C / +70°C	
<input type="checkbox"/> Humidity	IEC68-2-3 RH 93% Without Condensing AT 40°C	

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

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

CHARACTERISTICS

<input type="checkbox"/> Accuracy at reference value of influencing factors	2% Rated Input - 0,1% On 2% +/- 10ms	for measure for times
<input type="checkbox"/> Rated Current	In = 1 or 5A - On = 1 or 5A	
<input type="checkbox"/> Current overload	200 A for 1 sec; 10A continuos	
<input type="checkbox"/> Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A Neutral : 0.03VA at On =1A ; 0.2VA at On = 5A	
<input type="checkbox"/> Average power supply consumption	8.5 VA	
<input type="checkbox"/> 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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The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice



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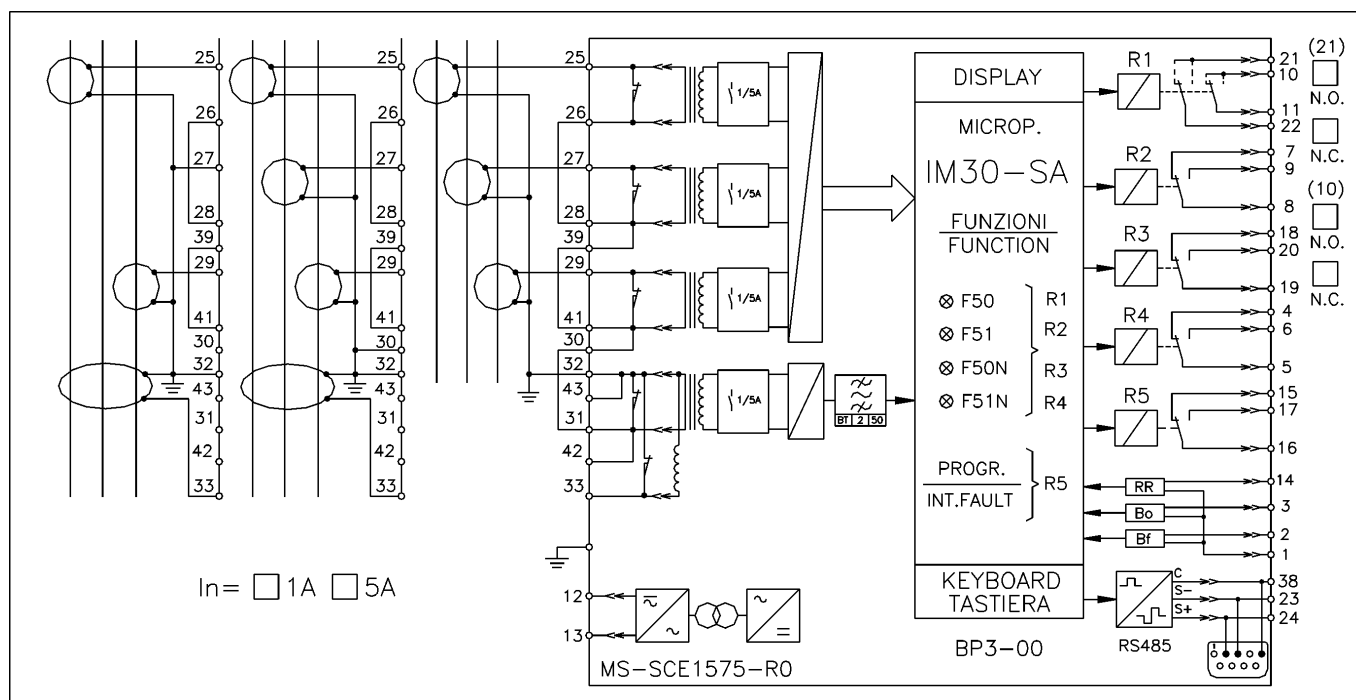
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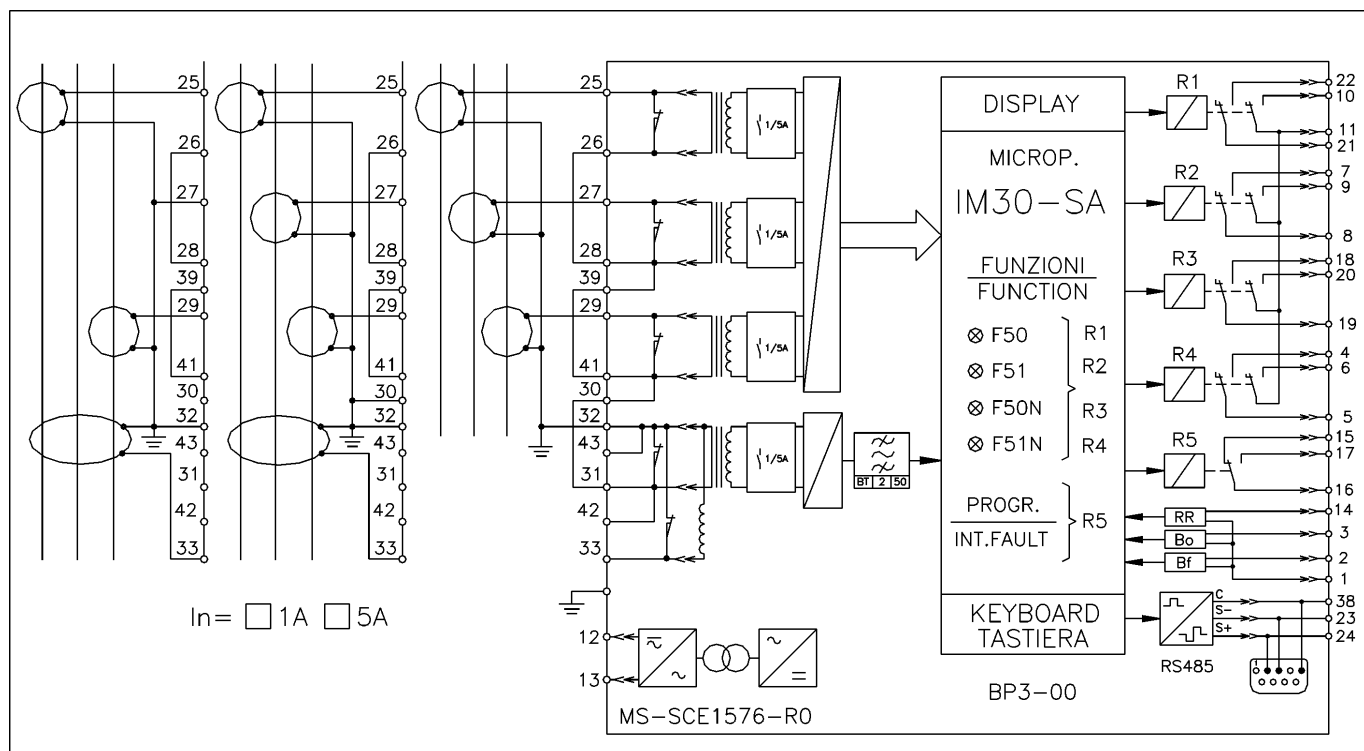
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17. CONNECTION DIAGRAM STANDARD OUTPUT (SCE1575 Rev.0)



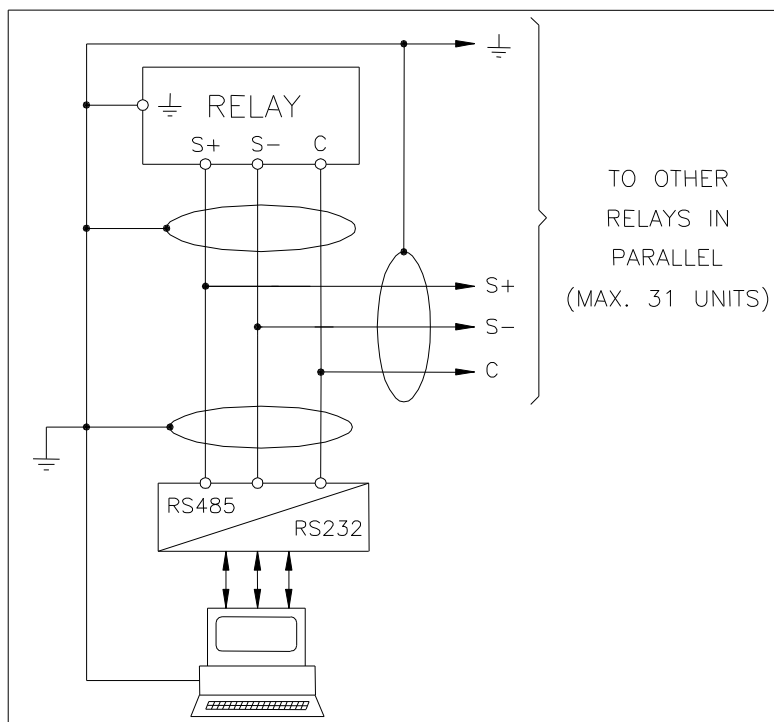
17.1 CONNECTION DIAGRAM DOUBLE OUTPUT (SCE1576 Rev.0)



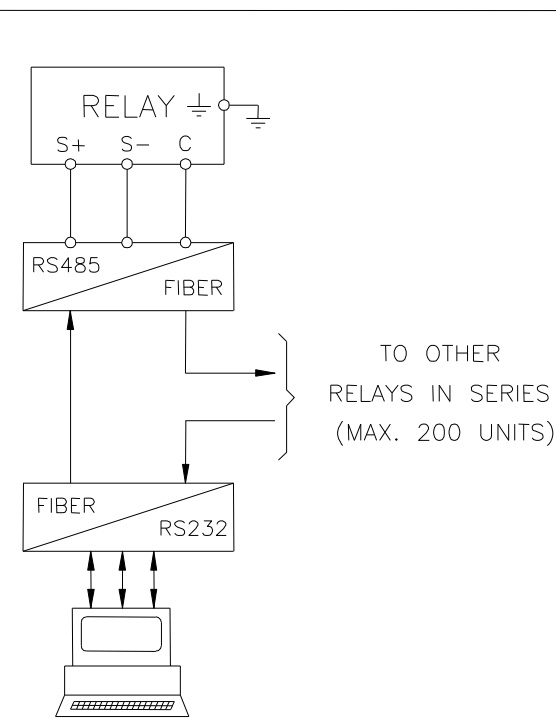


18. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

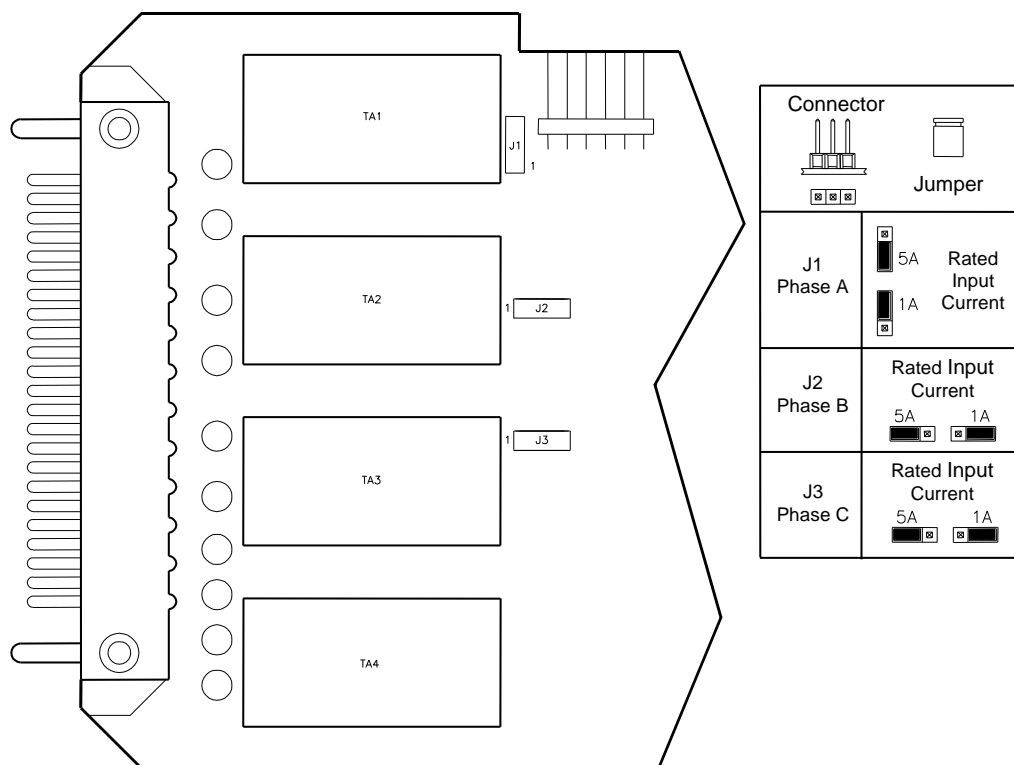
CONNECTION TO RS485



FIBER OPTIC CONNECTION

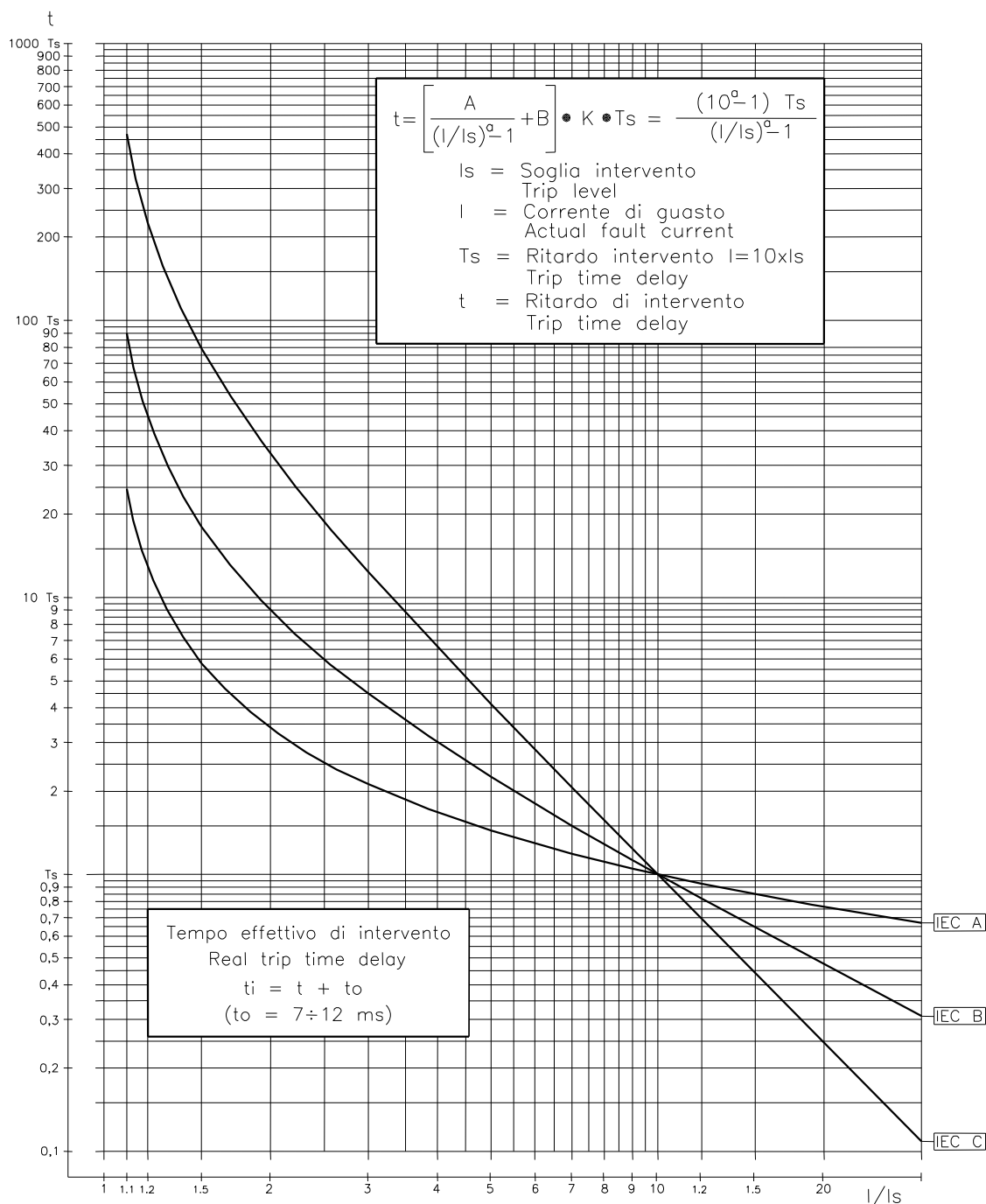


19. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A





20. TIME CURRENT CURVES IEC (TU0353 Rev.0 1/2)



Curve Type	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

$$F51 \begin{cases} I_s = I > = (0.5-4) I_n \\ T_s = t_i > = (0.05-30) s \end{cases}$$

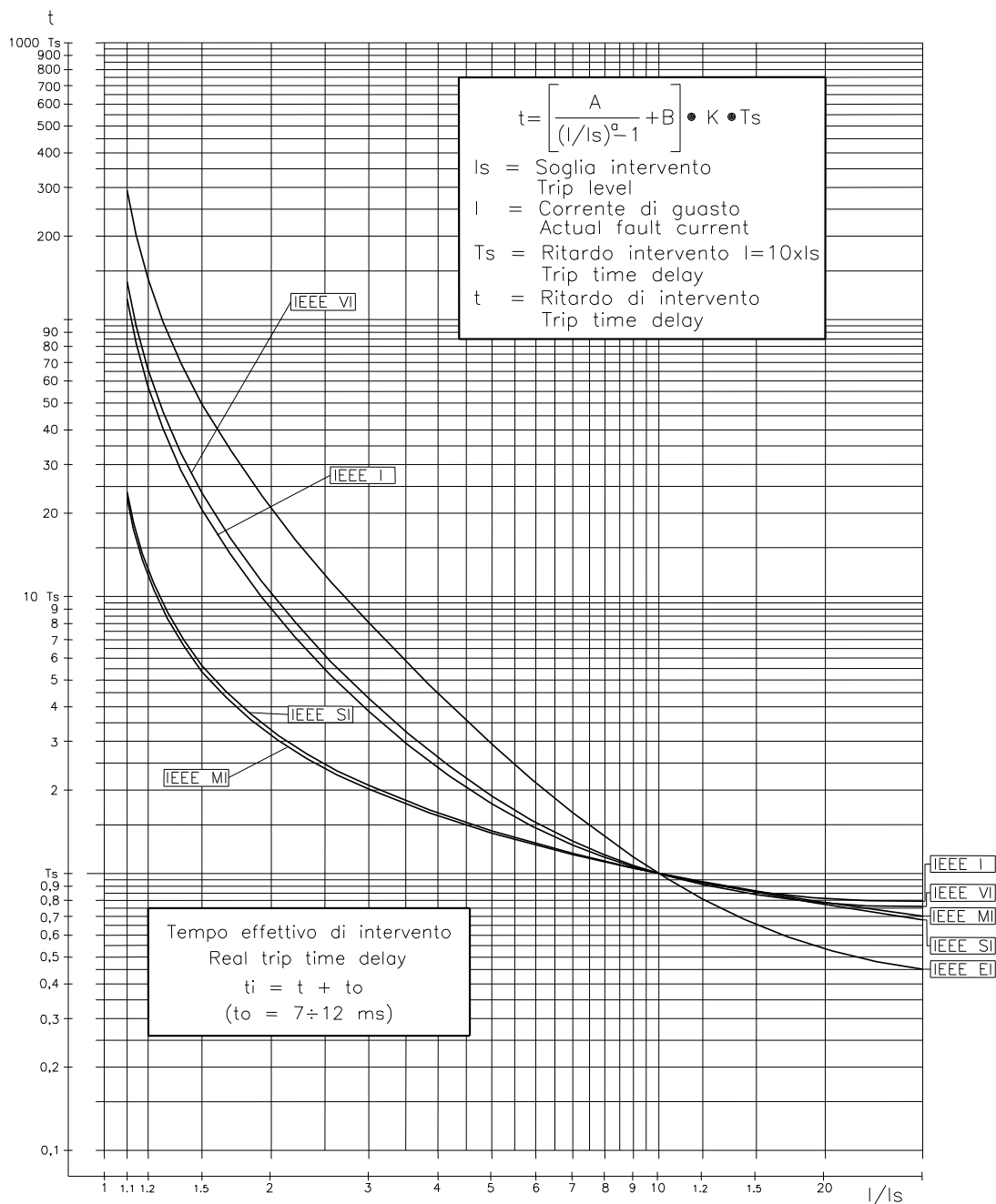
$$F51N \begin{cases} I_s = 0 > = (0.02-0.4) I_n \\ T_s = t_0 > = (0.05-30) s \end{cases}$$

For F51 saturation at $I > 50 I_n$

For F51N saturation at $I_0 > 4 I_n$



21. TIME CURRENT CURVES IEEE (TU0353 Rev.0 2/2)



Curve Type	A	B	K	a
MI=IEEE Moderate Inv.	0.0104	0.0226	4.110608	0.02
SI=IEEE Short Inv.	0.00342	0.00262	13.30009	0.02
VI=IEEE Very Inv.	3.88	0.0963	7.380514	2
I=IEEE Inverse	5.95	0.18	4.164914	2
EI=IEEE Extremely Inv.	5.67	0.0352	10.814	2

$F51 \begin{cases} I_s = I > = (0.5-4)I_n \\ T_s = tI > = (0.05-30)s \end{cases}$

$F51N \begin{cases} I_s = 0 > = (0.02-0.4)O_n \\ T_s = tO > = (0.05-30)s \end{cases}$

For F51 saturation at $I > 50 I_n$
For F51N saturation at $I_o > 4 O_n$

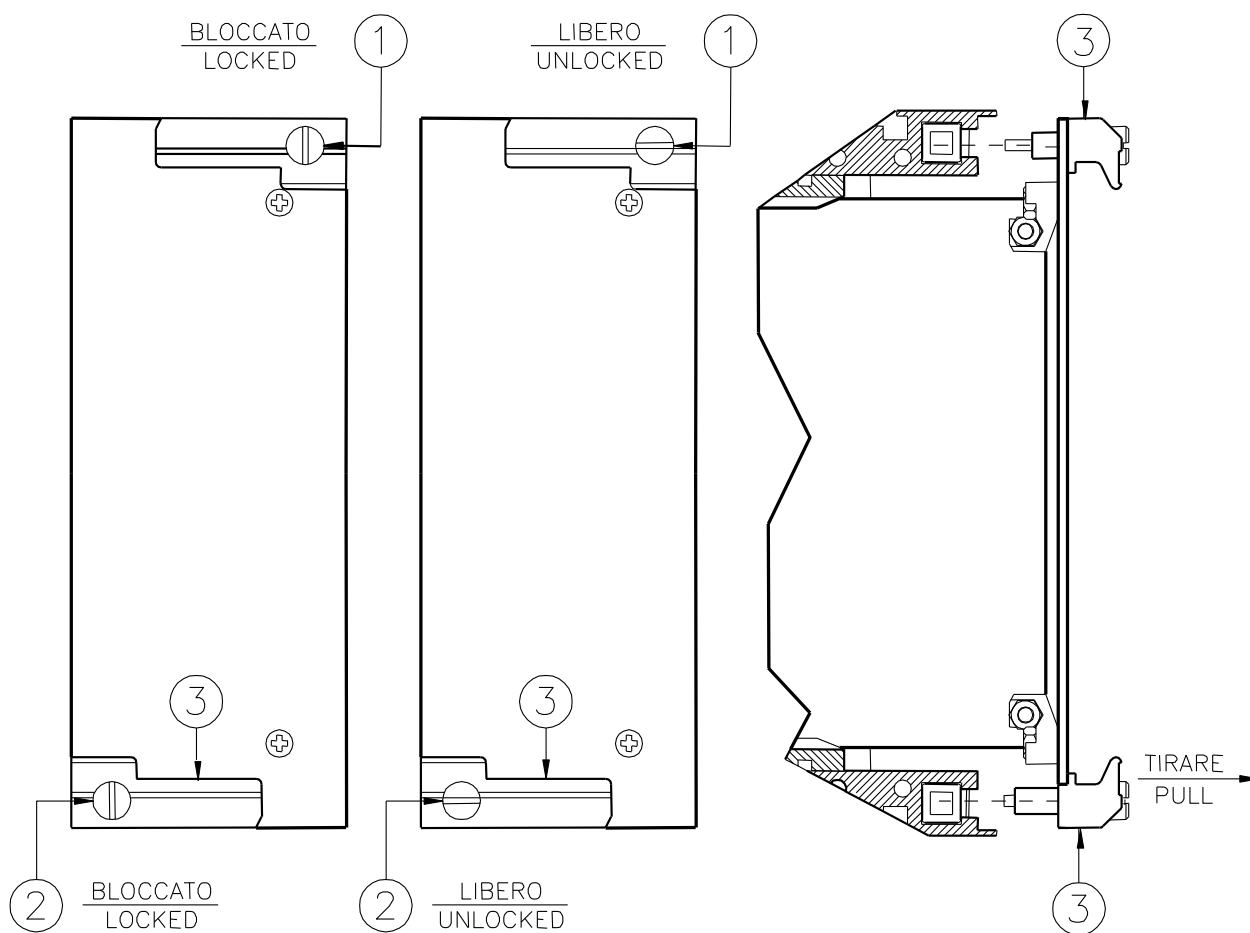
22. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

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 ② in 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).





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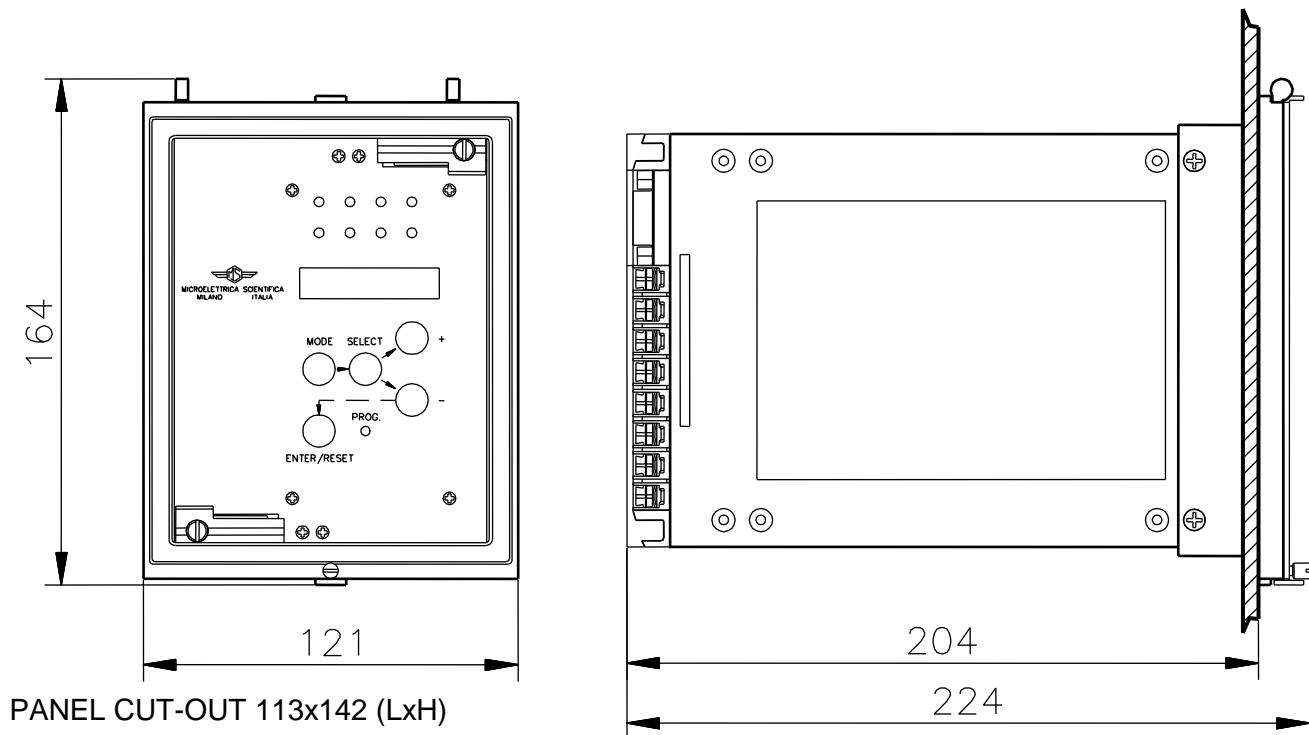
IM30-SA

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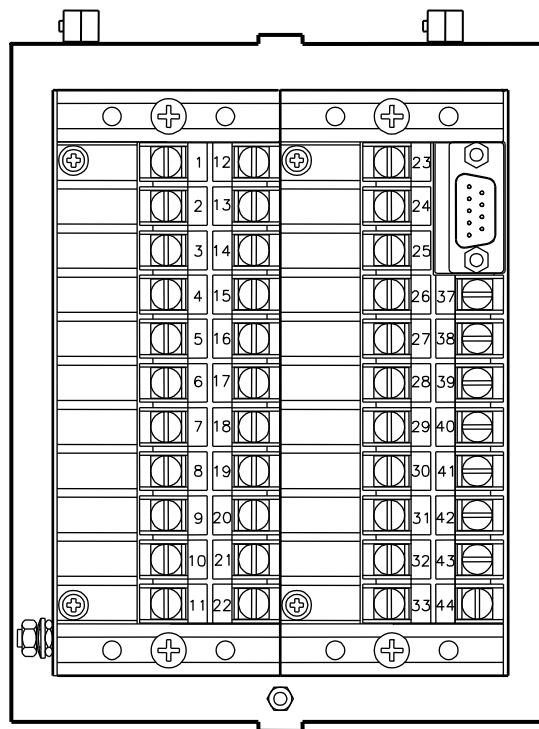
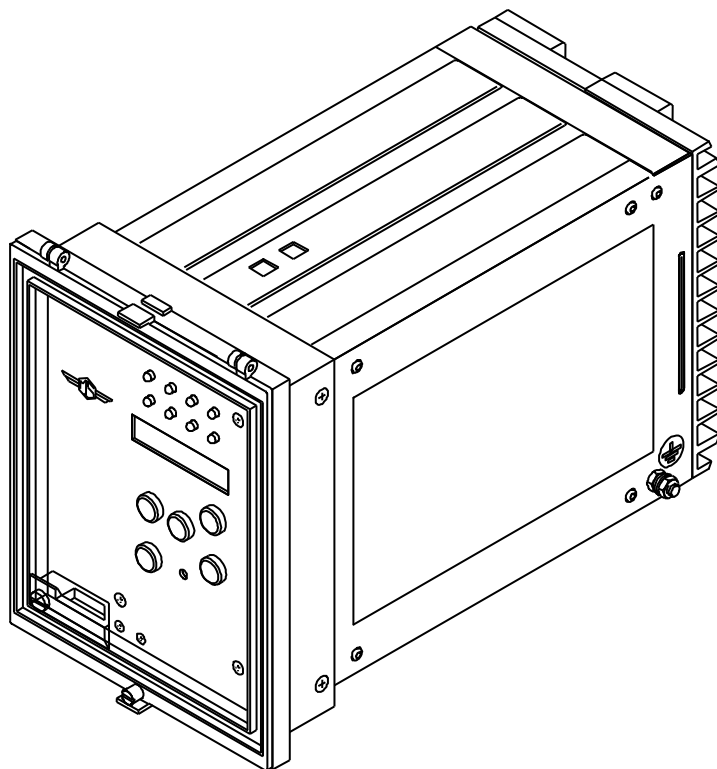
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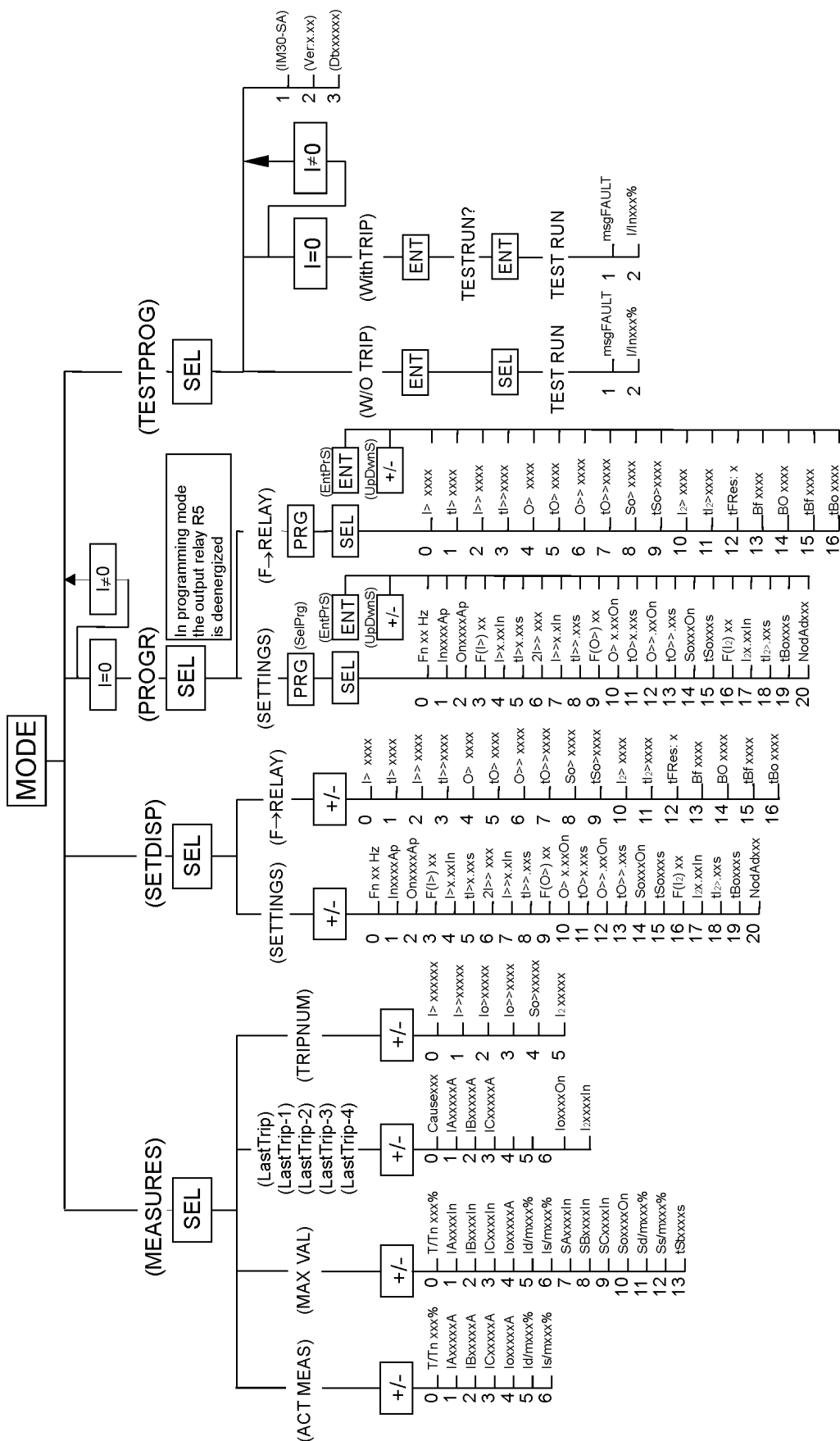
23. OVERALL DIMENSIONS



View of Rear
Terminal Connection



24. KEYBOARD OPERATIONAL DIAGRAM





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25. SETTING'S FORM

Relay Type	IM30-SA	Station :		Circuit :	
Date :	/ /	FW Version:		Relay Serial Number :	
Power Supply	<input type="checkbox"/> 24V(-20%) / 110V(+15%) a.c. 24V(-20%) / 125V(+20%) d.c. <input type="checkbox"/> 80V(-20%) / 220V(+15%) a.c. 90V(-20%) / 250V(+20%) d.c.		Rated Current :	<input type="checkbox"/> 1A	<input type="checkbox"/> 5A

RELAY PROGRAMMING

Variable	Description	Setting Range	Default Setting	Actual Setting	Test Result	
					Pick-up	Reset
Fn	System Frequency	50 - 60 Hz	50			
In	Phase CT rated primary current	1 - 9999 Ap	500			
On	Neutral CT rated primary current	1 - 9999 Ap	500			
F(I>)	Curve shape of low-set phase overcurrent	D,A,B,C,MI SI,VI,I,EI	-	D		
I>	Tap of phase low-set overcurrent elements	0.16 - 4 - Dis	In	0.5		
tl>	Time dial of phase low-set overcurrent elements	0.01 - 30 s	0.05			
2I>>	Automatic Cold Load pick-up	ON - OFF	-	ON		
I>>	Tap of phase high-set elements	0.1 - 40 - Dis	In	.5		
tl>>	Time dial of phase high-set elements	0.01 - 3 s	0.05			
F(O>)	Curve shape of low-set ground overcurrent	D,A,B,C,MI SI,VI,I,EI	-	D		
O>	Tap of low-set overcurrent ground element	0.02-0.4-Dis	On	0.02		
tO>	Time dial of ground low-set overcurrent element	0.01 - 30 s	0.05			
O>>	Tap of high-set overcurrent ground element	0.02 - 4 - Dis	On	0.02		
tO>>	Time delay of high-set ground overcurrent element	0.01 - 3 s	0.05			
So	Tap of Sensitive earth fault	0.01-0.05-Dis	On	0.05		
tSo	Time delay of sensitive earth fault	0.01 - 30 s	0.05			
F(I2)	Operation characteristic of the Negative Sequence element	D,A,B,C,MI SI,VI,I,EI	-	D		
I2	Tap of the negative sequence overcurrent element	0.05-2.5-Dis	In	1.0		
tl2>	Tap time delay of the negative sequence element	0.05 - 30 s	0.05			
tBO	Time delay of Breaker Failure	0.05 - 0.25 s	0.05			
NodAd	Communication address	1 - 250	-	1		

CONFIGURATION OF OUTPUT RELAYS

Default Setting					Actual Setting				
Protective Element	Output Relays				Description	Protective Element	Output Relays		
I>	-	-	3	-	Low-set phase overcurrent pick-up	I>			
	1	-	-	-	Time delayed low-set phase overcurrent	tl>			
I>>	-	-	3	-	High-set phase overcurrent pick-up	I>>			
tl>>	1	-	-	-	Time delayed high-set phase overcurrent	tl>>			
O>	-	-	-	4	Low-set ground overcurrent pick-up	O>			
tO>	-	2	-	-	Time delayed low-set ground overcurrent	tO>			
O>>	-	-	-	4	High-set ground overcurrent pick-up	O>>			
tO>>	-	2	-	-	Time delayed high-set ground overcurrent	tO>>			
So>	-	-	-	4	Instantaneous element of Sensitive earth fault	So>>			
tSo>	-	2	-	-	Time delayed element of Sensitive earth fault	tSo>			
I2>	-	-	3	-	Negative Sequence overcurrent pick-up	I2>			
tl2>	1	-	-	-	Time delayed Negative Sequence overcurrent	tl2>			
tFRes:	A				Relay reset mode A= Automatic, M= Manual	tFRes:			
Bf	-li				Elements blocked by digital input Bf	Bf			
Bo	-Oo				Elements blocked by digital input Bo	Bo			
tBf	2tB0				Reset of phase element blocking input	tBf			
tBo	2tB0				Reset of earth fault element blocking input	tBo			

Commissioning Engineer : _____

Date : _____

Customer Witness : _____

Date : _____