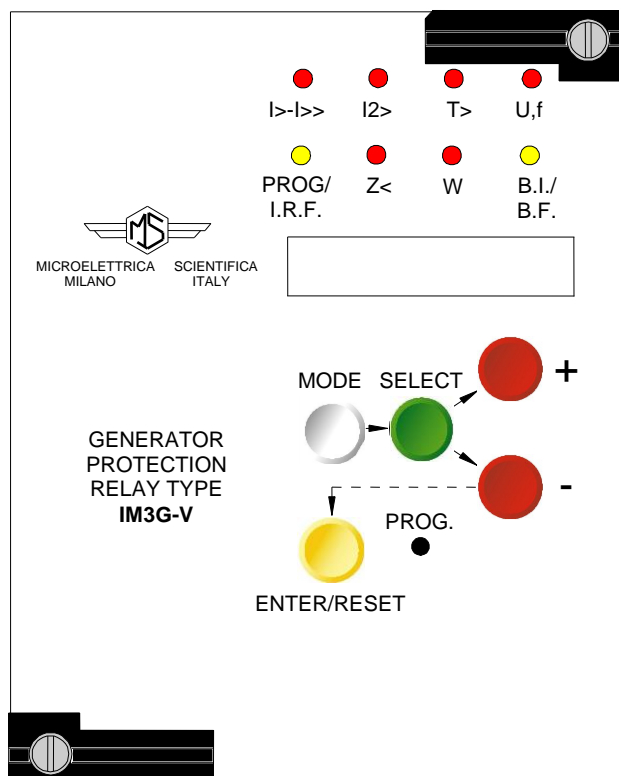


MULTIFUNCTION MICROPROCESSOR PROTECTION RELAY

TYPE

IM3G-VX

OPERATION MANUAL



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1. General utilization and commissioning directions

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

1.1 - STORAGE AND TRANSPORTATION,

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

1.2 - INSTALLATION

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

1.3 - ELECTRICAL CONNECTION

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

1.4 - MEASURING INPUTS AND POWER SUPPLY

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

1.5 - OUTPUTS LOADING,

must be compatible with their declared performance.

1.6 - PROTECTION EARTHING

When earthing is required, carefully check its effectiveness.

1.7 - SETTING AND CALIBRATION

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

1.8 - SAFETY PROTECTION

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

1.9 - HANDLING

Notwithstanding the highest practicable protection means used in designing M.S. electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules. The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits reduced by M.S. are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

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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 3 current transformers and 3 potential transformers respectively measuring phase currents and phase-to-neutral voltages. Phase current input can be 1 or 5A (movable jumpers on relay's card). Rated voltage input can be programmed from 100 to 125V (phase-to-phase) 50 or 60Hz.

Time-current curves, operation algorithms and performances are reported in relay catalogue and in this manual together with diagrams and dimension drawings.

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

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

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

2.1 - POWER SUPPLY

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

- | | | | |
|--------|-------------------------------|--------|-------------------------------|
| a) - { | { 24V(-20%) / 110V(+15%) a.c. | b) - { | { 80V(-20%) / 220V(+15%) a.c. |
| | 24V(-20%) / 125V(+20%) d.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** Phase currents are supplied to three 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 $I_n = 5$ or 1 Amp (different values can be provided on request).
The measuring dynamics of the C.Ts. runs from 0.001 through 50 times I_n .
For the phase current the measuring range of the A/D Converters runs from 0 to $13I_n$ automatically switched to two channels one measuring from 0 to $1.3I_n$ and the second from 0 to $13I_n$. The theoretical accuracy of the measurement is $0.12\%I_n$ from 0 to $1.3I_n$ and $1.2\%I_n$ from 1.3 through $13I_n$.
The actual absolute error on each measurement M can be:

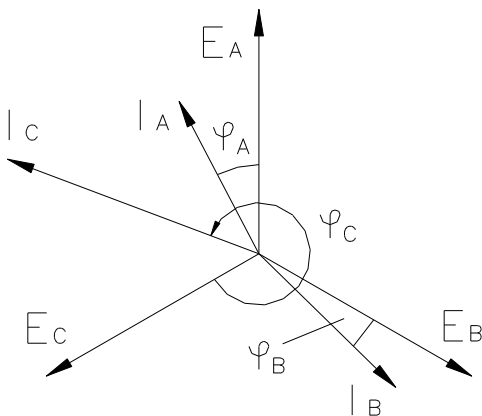
- $\varepsilon_1 = \pm 0.02 M \pm 0.002 I_n$ from 0 to $1.3 I_n$
- $\varepsilon_2 = \pm 0.02 M \pm 0.02 I_n$ from 1.3 to $13 I_n$

- 2.2.2** Phase-to-neutral voltages are supplied to three Potential transformers rated 220V. Relay's rated phase-to-phase input voltage (U_{ns}) can be adjusted from 100 through 125V.
The ADC converter measuring range runs up to $2 \times U_{ns}$.
The theoretical accuracy is $0.2\%U_{ns}$.
The actual absolute error can be :

- $\varepsilon_v = \pm 0.02 M \pm 0.003 U_{ns}$

2.2.3 - Phase displacement

The relay detects the displacement between the input voltage of phase C and each phase current I_A , I_B , I_C . The displacement angle are therefore :



$$\varphi_A = \varphi_{A-C} - 120^\circ ; \varphi_B = \varphi_{B-C} + 120^\circ ; \varphi_C = \varphi_{C-C}$$

This means that the voltage system is considered to be balanced as it is normally, where as the currents can be however unbalanced. (see figure)
Angles are measured anticlockwise from 0° to 360° with accuracy $\pm 2^\circ$.
Displacement is not measured if current or voltage are null.

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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** = (0-9999)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 - F49 - Thermal overload

The relay computes a thermal image of the machine based on the ratio $I/[Ib]$ of the RMS of the current flowing in each phase to the rated full load current of the generator :

- Warming-up time constant : **Tc** = (2 - 400)m, step 1m
- Maximum continuous overload : **Ic** = 1.05Ib ($\equiv 110\%Tn$)
- Rated full load ($I=Ib$) temperature rise : **Tn**
- Overtemperature prealarm level : **Ta** = (50-110)% Tn, step 1%
- Current corresponding to machine's temperature before the overload : **Ip** ($\equiv \sqrt{Tp}$)
- Time to warm-up from Tp to trip temperature (110%Tn) in function of the current overload

$$t = [Tc] \ln \frac{(Tx/Tn) - (Tp/Tn)}{(Tx/Tn) - (Tb/Tn)} = [Tc] \ln \frac{(I/[Ib])^2 - (Ip/[Ib])^2}{(I/[Ib])^2 - (Ib/[Ib])^2}$$

(see curves TU0325 §20)

Cooling is computed with the same time constant (Tc) as heating.

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2.3.3 - F50/51 - Dual level 3-phase overcurrent with or without voltage control

F1 50/51 : Low set overcurrent

- Voltage control activated / non activated : I>/U = ON-OFF
- Pick-up (operation) level : I> = (1-2.5)I_b, step 0.01I_b
Setting I> = Dis blocks function's operation
- Drop-out ratio ≥0.95
- Minimum operation time of instantaneous output 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** :

$$t = \frac{0.033 \cdot tI>}{(I/I>)^{0.02} - 1} ; \quad (tI> = \text{trip time delay at } I/I> = 5)$$

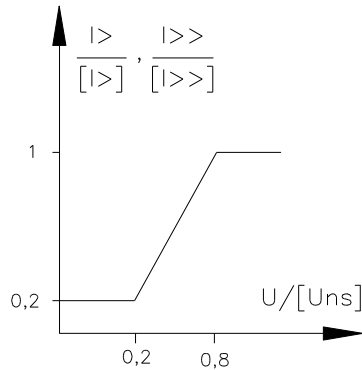
(see curves TU0311 §18)

F2 50/51 : High set overcurrent

- Voltage control activated / non activated : I>>/U = ON-OFF
- Pick-up (operation) level : I>> = (1-12)I_b, step 0.1I_b
Setting I>> = Dis blocks function's operation
- Drop-out ratio ≥0.95
- Minimum operation time 30ms
- Independent trip time delay : t = tI>> = (0.05-3)s, step 0.01s

**2.3.4 - Voltage controlled overcurrent**

If the parameters $I>/U$ and/or $I>>/U$ are set to "ON" the voltage controls is active respectively for the level $I>$ and/or $I>>$. The actual pick-up levels ($I>$, $I>>$) variate in respect to the programmed levels ($[I>]$, $[I>>]$) proportionally to variation of the voltage according to the curve herbelow



$$\frac{I>}{[I>]}, \frac{I>>}{[I>>]} = \frac{\text{Actual pick - up level}}{[\text{Set pick - up level}]}$$

$$\frac{U}{[Uns]} = \frac{\text{Actual voltage}}{[\text{Rated input voltage}]}$$

The voltage ratio is measured on each phase $\left(\frac{E_x \cdot \sqrt{3}}{[Uns]} \right)$ and the smallest among the values is

used in the algorithm. Practically in the zone between 0.2 and 0.8 Uns, the relay operates as underimpedance protection when $Z_x = \frac{E_x}{I_x} < \frac{[Uns]}{\sqrt{3}[I>}], \frac{[Uns]}{\sqrt{3}[I>>]}$.

2.3.5 - F46 - Current unbalance : Measurement of RMS Negative Sequence Current I_2

F1 46 : $I_2^2 t = K$ (adiabatic heating)

- Generator's continuous I_2 rating : **1Is** = (0.05-0.5)Ib, step 0.01Ib

Setting **1Is** = Dis blocks function's operation

- Time multiplier : **Ks** = (5-80)s, step 1s ; **Ks** = Trip time when $I_2 = I_b$

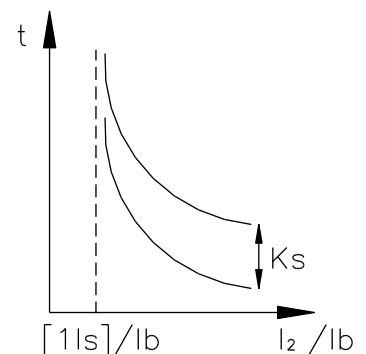
- Trip time delay $t_h = \frac{Ks}{(I_2 / I_b)^2}$; Heat accumulation only operates if $I_2 \geq [1Is]$

- Cooling time from trip level to the status corresponding to the operation at $I_2 = [1Is]$:
tcs = (10-1800)s, step 1s

$$\text{Cooling time } t_1 = \frac{[tcs]}{Ks} \left(\frac{I_2}{I_b} \right)^2 \cdot t ; \quad t_1 = [tcs] \text{ when } \left(\frac{I_2}{I_b} \right)^2 \cdot t = Ks$$

Cooling only takes places if $\frac{I_2}{I_b} < 1Is$

(see curves TU0312 §19)



F2 46 : Unbalance Alarm

- Alarm level : **2Is** = (0.03-1)Ib, step 0.01Ib
- Setting **2Is** = Dis blocks function's operation
- Independent trip time delay : **t2Is** = (1-100)s, step 1s

2.3.6 - F32 - Reverse active power

- Active current ($I \cos \varphi$) setting range : **Ir** = (0.02-0.2)Ib, step 0.01Ib
- Setting **Ir** = Dis blocks function's operation
- Operation level : $I_c \cos (\varphi_c - 180^\circ) \geq [Ir]$
- Independent trip time delay : **tIr** = (0.1-60)s, step 0.1s
- Operation zone : $90^\circ < \varphi_c < 270^\circ$

2.3.7 - F37 - Underpower W<

The element measures the 3-phase active power and trips when the power generated (forward) drops below the set level [W<]

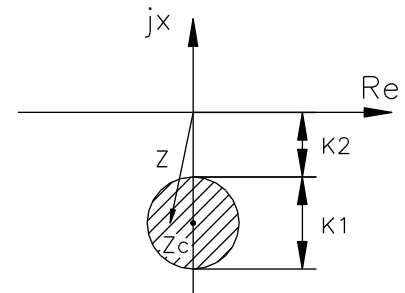
- Pick-up (operation) level : **W<** = (0.05-1.00)Wb, step 0.05Wb
- Setting **W<** = Dis blocks function's operation
- Independent trip time delay : **tW<** = (0.1-60)s, step 0.1s

2.3.8 - F40 - Loss of excitation : capacitive underimpedance Zc<

- For each phase the relay computes the impedance

$$Z_{c_x} = \frac{E_x}{I_x \cos(\varphi_x - 90^\circ)}$$

- Characteristics angle of the impedance $\alpha_z = 270^\circ$



N.B. By definition the relation between current displacement φ and impedance displacement α is :

$$\alpha = 360^\circ - \varphi$$

Angles are counted anticlockwise from 0° (real axis = direction of phase-to-neutral voltage E) through 360° .

For example : the displacement of a totally capacitive current is $\varphi = 90^\circ$; the angle of a totally capacitive impedance is $\alpha = 270^\circ$.

- Operation zone is that included in the circle having (see figure) :

Center on the axle displaced by α_z at distance $K2 + \frac{K1}{2}$ from the axes' origin and
Diameter = K1

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- Circle offset : **K2** = (5-50)%Zb, step 1%
- Circle diameter : **K1** = (50-300)%Zb, step 1%
Setting **K1** = Dis blocks the function's operation
- rated generator's impedance : $Z_b = \frac{[Uns]}{\sqrt{3} [lb]}$
- Independent trip time delay : **tz** = (0.2-60)s, step 0.1s
- Integration time : **ti** = (0-10)s, step 0.1s
In case of impedance oscillation, reset of the timer tz only takes place if Z remains outside the trip area for at least [ti].
- Undervoltage inhibition level : $E_x < 0.3 \frac{[Uns]}{\sqrt{3}}$
- Undercurrent inhibition level : $I_x < 0.2 [lb]$
- Operation taxes place only if all the 3 impedances of phase A, B, C are within the trip zone

2.3.11 - F27-59 : Dual level 3-phase over-under voltage

F1 27-59 : First voltage element 1U

- Pick-up (operation) level of voltage difference : **1u** = (5-50)%Un, step 1%
 - Independent trip time delay : **t1u** = (0.1-60)s, step 0.1s
 - Operation mode : (Un +/- 1u)
The function can be programmed to operate as :
 - Overvoltage (Un + 1u) : operates when any phase voltage E_x rises above the rated value $\frac{[Uns]}{\sqrt{3}}$
by more than [1u]%.
$$\frac{\sqrt{3} \cdot E_x}{[Uns]} \cdot 100 \geq (100 + [1u])\%$$
 - Undervoltage (Un - 1u) : operates when any phase voltage E_x drops below the rated value $\frac{[Uns]}{\sqrt{3}}$
by more than [1u]%.
$$\frac{\sqrt{3} \cdot E_x}{[Uns]} \cdot 100 \leq (100 - [1u])\%$$
 - Voltage balance (Un +/- 1u) : operates when any phase voltage differs from the rated value more then [1u]%
- $$\frac{\sqrt{3} \cdot E_x}{[Uns]} \cdot 100 \geq (100 + [1u])\% \quad \text{or} \quad \frac{\sqrt{3} \cdot E_x}{[Uns]} \cdot 100 \leq (100 - [1u])\%$$
- Operation blocked : (Un = Dis)

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F2 27-59 : Second voltage element 2U

It operates same as the first element the programmable parameter are :

- Pick-up level : **2u** = (5-50)%Un, step 1%
- Independent trip time delay : **t2u** = (0.1-60)s, step 0.1s
- Operation mode : (Un +/- 2u)

2.3.12 - F81 : Dual level over/under frequency

F1 81 : First frequency element 1f

- Pick-up (operation) level of frequency difference : **1f** = (0.05-9.99)Hz, step 0.01Hz
- Independent trip time delay : **t1f** = (0.1-60)s, step 0.1s
- Operation mode : (Fn +/- 1f)
The function can be programmed to operate as :
 - Overfrequency (Fn + 1f) : operates when the frequency rises above the rated value [Fn] by more than 1f Hz. $f \geq (Fn + [1f])\text{Hz}$
 - Underfrequency (Fn - 1f) : operates when the frequency drops below the rated value [Fn] by more than [1f]Hz. $f \leq (Fn - [1f])\text{Hz}$
 - Frequency balance (Fn +/- 1f) : operates when frequency differs from rated value by more than [1f]Hz. $f \geq (Fn + [1f])\text{Hz}$ or $f \leq (Fn - [1f])\text{Hz}$
- Operation blocked : (Fn = Dis)

F2 F81 : Second frequency element 2f

It operates same as the first element ; the programmable parameters are :

- Pick-up level : **2f** = (0.05-9.99)Hz, step 0.01Hz
- Independent trip time delay : **t2f** = (0.1-60)s, step 0.1s
- Operation mode : (Fn +/- 2f)

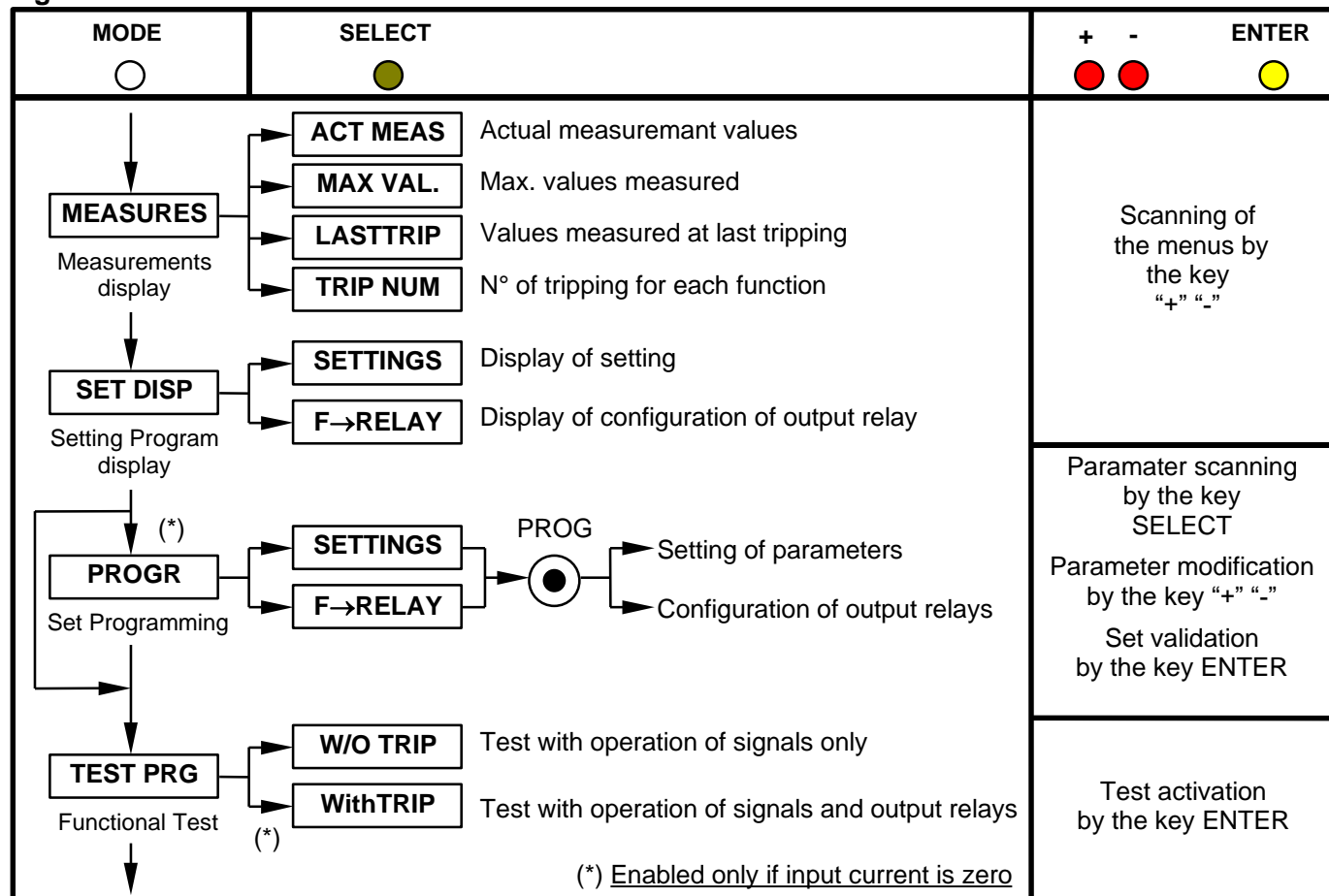
3. CONTROLS AND MEASUREMENTS

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)

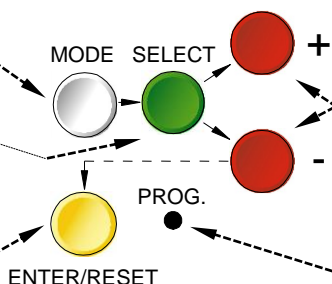
Fig.1



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.

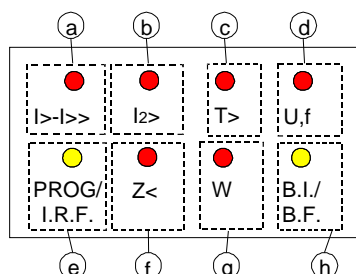


The + and - buttons are used to select the actual measurement or display desired when in Measurements Display or Settings Display modes. When in Program mode, these buttons increase or decrease the value of the displayed setting.

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>-I>>	<input type="checkbox"/> Flashing when measured current exceeds the set trip level [I>],[I>>] <input type="checkbox"/> Illuminated on trip after expiry of the set trip time delay [tl>],[tl>>].
b) Red LED	I2>	<input type="checkbox"/> Same as above related to [1Is], [2Is].
c) Red LED	T>	<input type="checkbox"/> Flashing when the thermal image's temperature exceeds the prealarm temperature [Ta]. <input type="checkbox"/> Illuminated when temperature exceeds the trip level.
d) Red LED	U,f	<input type="checkbox"/> Flashing during the trip time delay of any over/under voltage elements 1U,2U or over/under frequency elements 1f,2f. <input type="checkbox"/> Illuminated on trip at the end of time delay.
e) Red LED	PROG/ I.R.F.	<input type="checkbox"/> Flashing during the trip time delay of the function Zc<. <input type="checkbox"/> Illuminated on trip at the end of time delay
f) Yellow LED	Z<	<input type="checkbox"/> Flashing during the programming of the parameters. <input type="checkbox"/> Illuminated in case of Internal Relay Fault.
g) Red LED	W	<input type="checkbox"/> Flashing during the trip time delay of the functions W< or Ir>. <input type="checkbox"/> Illuminated at the end of the time delay of either W< or Ir>.
h) Yellow LED	B.I./ B.F.	<input type="checkbox"/> Illuminated when the Breaker Failure functions operated <input type="checkbox"/> 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 via serial bus command 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

The unit IM3G-VX includes four (R1, R2, R3, R4) user programmable plus one diagnostic (R5) output relays.

The number of output relays can be increased by the addition of one or two optional Relay Expansion modules REX-8.

The modules REX-8 are for protruding mounting and are controlled by the master module IM3G-VX via a screened twisted pairs of cables connecting dedicated RS485 serial ports (see diagram herebelow).

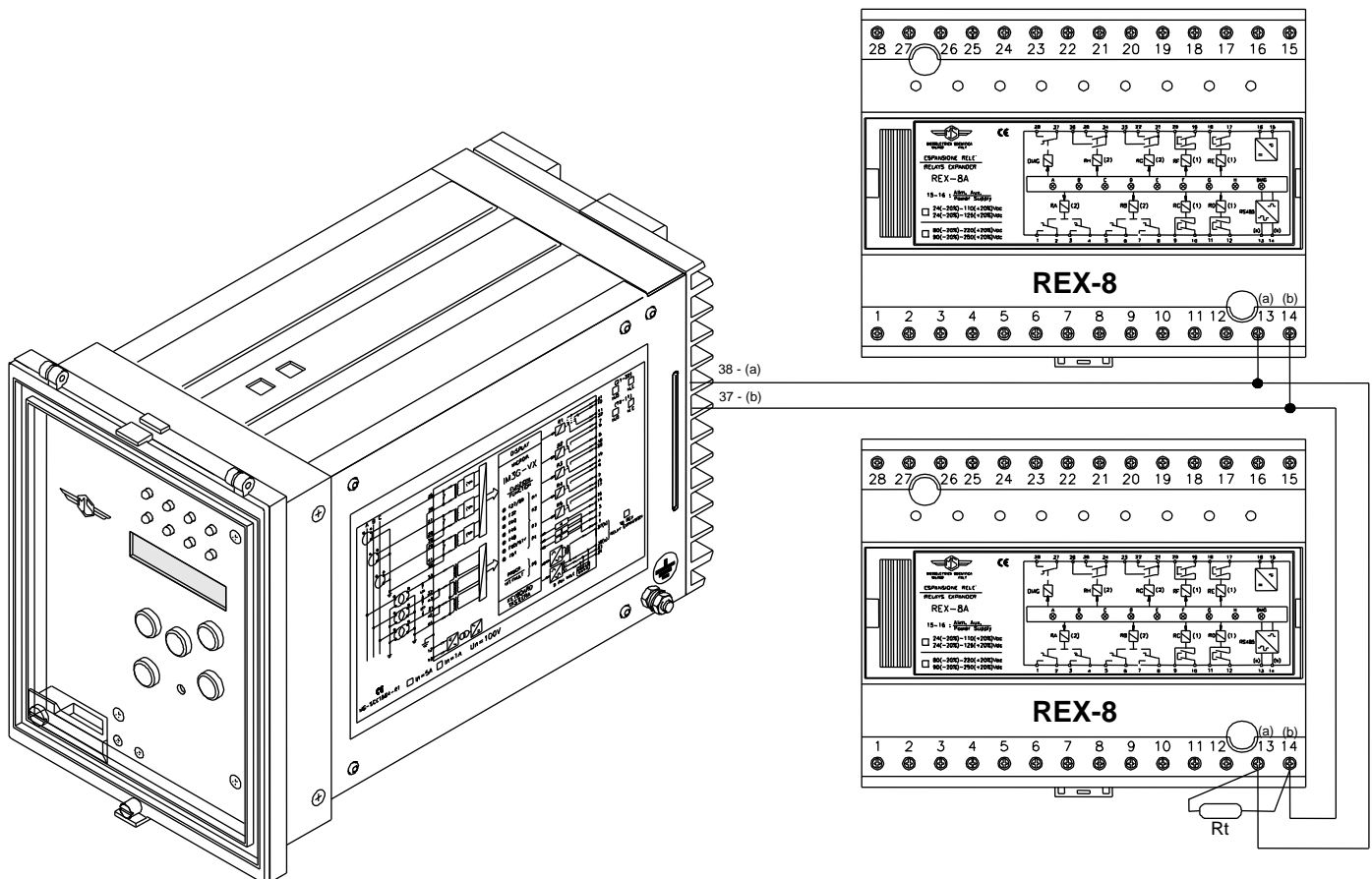
The module REX-8 includes eight (RA, RB, RC, RD, RE, RF, RG, RH) user programmable plus one (R-Diag) diagnostic output relays

The master module IM3G-VX can control all together up to sixteen output relays

- 4 internal R1 – R2 – R3 – R4
- 8 from the first optional REX-8 module RA – RB – RC – RD – RE – RF – RG – RH
- 4 from a second optional REX-8 module RI(RA+RB) – RJ(RC+RD) – RK(RE+RF) – RL(RG+RH)

This second unit REX-8 is configured (by internal Dip-Switch) to operate the eight relays two by two in parallel (only four user programmable outputs with double number of available contacts)

Any of the function featured by the IM3G-VX can be programmed to control up to four out of the sixteen user programmable output relays



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- a) - The user programmable relays (All but R5 – RDIAG) are normally deenergized (energised on trip). 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.
If the cause remains longer than the time delay programmed for the delayed element of the same function, the drop-out of the instantaneous relay is anyhow forced after an adjustable waiting time [tBF]. (Disactivation of the blocking output eventually used to block a relay upstream in the distribution system).
Moreover any of the programmable relays 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) by operating the ENTER/RESET key on relay’s front or via the serial bus.
- b) - The relays R5, R DIAG, are not user programmable; they are normally energized and get deenergized on :

R5 { - internal fault of IM3G-VX - IM3G-VX power supply failure - during the programming	R DIAG	{ - Internal fault of REX-8 - REX-8 power supply failure - Interruption/fault on the serial control communication
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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.

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7. DIGITAL INPUTS

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

- **2** (terminals 1 - 2) : it blocks the operation of the relays associated to the time delayed elements of the overcurrent functions ($I>$) or ($I>>$) or ($I>+I>>$).
- **3** (terminals 1 - 3) : it blocks the operation of the relays associated to time delayed elements relevant of the functions Under Impedance of Reverse Power : ($Z<$) or (I_r) or ($Z<+I_r$)
- **4** (terminals 1-14) : It blocks the operation of the relays associated to one or more of the functions 1U, 2U, 1f, 2f in any possible combination

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 $2t_{BF}$ ($t_2=2t_{BF}$). By proper interconnection of the blocking inputs and blocking 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

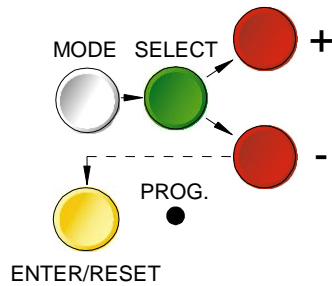
Besides the normal "WATCHDOG" and "POWERFAIL" functions, a comprehensive program of self-test and self-diagnostic provides:

- ❑ 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 $\leq 4ms$). 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 <ul style="list-style-type: none"> - 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
Txxxx%Tn	Actual thermal status as % of the steady full load status Tn : (0-999)%
IAxxxxxA	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
EAxxx%En	R.M.S. of phase voltage A as % of the rated voltage : (0-999)%
EBxxx%En	As above, phase B
ECxxx%En	As above, phase C
φaxxxx°	Phase displacement of IA on EA : (0-360° anticlockwise)
φbxxxx°	Phase displacement of IB on EB : (0-360° anticlockwise)
φcxxxx°	Phase displacement of IC on EC : (0-360° anticlockwise)
Wxxxx%Wb	Three phase active power as % of generator's rated power: (0-999)% ($Wb=\sqrt{3} \cdot Un \cdot Ib$)
fxxxxHz	System frequency : (40,00-70,00)Hz
I2xxxx%Ib	R.M.S. Negative sequence current as % of generator's rated current Ib

10.2 - MAX VAL

Maximum demand values recorded starting from 100ms after closing of main Circuit Breaker (updated any time the C/B closes)

Display	Description
Txxxx%Tn	Thermal image status as % of full load temperature
IAxx.xIn	Phase A current displayed as p.u. of C.Ts rated current
IBxx.xIn	As above, phase B
ICxx.xIn	As above, phase C
I2xxxx%Ib	Negative sequence current as % of generator's rated current
Irxxxx%Ib	As above reverse current . ($I_r = [(I \cdot \cos \phi) / I_b] \cdot 100$)
Wxxxx%Wb	Active power as % of generator's rated power

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 I>,I>>,1Is,2Is,Ir>,Z<,1U,2U,1f,2f,W<,T>.
Txxxx%Tn	Temperature of thermal image.
IAxx.xIn	Current phase A.
IBxx.xIn	Current phase B.
ICxx.xIn	Current phase C.
EAxx%En	Voltage phase A.
EBxx%En	Voltage phase B.
ECxx%En	Voltage phase C.
φaxxxx°	Phase displacement of current phase A
φbxxxx°	Phase displacement of current phase B
φcxxxx°	Phase displacement of current phase C
Wxxx%Wb	Three phase active power.
fxxxxHz	Frequency.
I2xxx%Ib	Negative sequence 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
T>xxxxxx	Thermal overload
I>xxxxxx	Time delayed element of 1st O/C level [tl>].
I>>xxxxx	As above, 2nd O/C level [tl>>].
1Isxxxxx	As above, 1st negative sequence O/C element
2Isxxxxx	As above, 2nd negative sequence O/C element
Ir>xxxxx	As above, reverse current
1Uxxxxx	As above, element 1U
2Uxxxxx	As above, element 2U
1fxxxxx	As above, element 1f
2fxxxxx	As above, element 2f
Z<xxxxx	As above, loss of field element
W<xxxxx	As above, under power element

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;

F→RELAY= output relay associated to the different functions as programmed.



12. PROGRAMMING

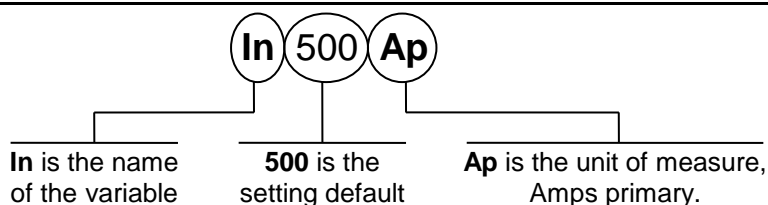
The relay is supplied with the standard default programming used for factory test. [Values here below reported in the "Display" column].

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	50 - 60	10	Hz
In 500Ap	Rated primary current of the phase C.Ts.	0 - 9999	1	A
UnS 100V	Rated secondary voltage of Vts (phase to phase)	100 - 125	1	V
Ib 0.5In	Generator's rated current as p.u. of C.Ts 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	-
U/I> ON	Voltage control on level I>	ON - OFF	ON-OFF	-
I> 1.0Ib	Trip level of low-set overcurrent element (p.u. of Ib)	1 - 2.5 - Dis	0.01	Ib
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 = 5x[I>]	0.05 - 30	0.01	s
U/I>> ON	Voltage control on level I>>	ON - OFF	ON-OFF	-
I>> 3Ib	Trip level of high-set overcurrent element (p.u. of Ib)	1 - 9.9 - Dis	0.1	Ib
tl>> 0.05s	Trip time delay of the high-set overcurrent element	0.05 - 3	0.01	s
1Is 0.05Ib	Generator's max. continuous negative sequence current rating (p.u. of Ib)	0.05 - 0.5 - Dis	0.01	Ib
Ks 5s	Time multiplier of the I ² t time-current curve	5 - 80	1	s
tcs 10s	Cooling time from trip level to the state corresponding to I ₂ =1Is	10 - 1800	1	s



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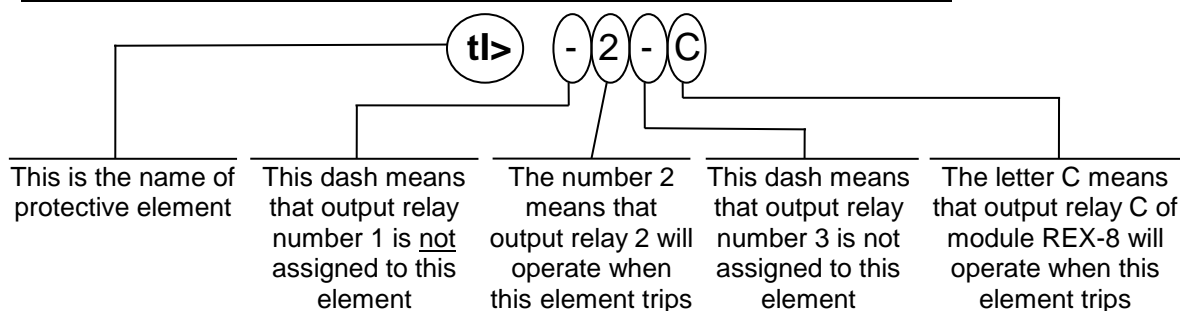
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Display	Description	Setting Range	Step	Unit
2Is 0.03lb	Negative sequence current alarm level	0.03 - 0.5 - Dis	0.01	lb
t2Is 1s	Independent trip time delay of alarm element	1 - 100	1	s
Ir>.02lb	Trip level of the reverse power element (Active component of current as p.u. of In)	0.02 - 0.2 - Dis	0.01	lb
tIr> 0.1s	Independent trip time delay of reverse power element	0.1 - 60	0.01	s
K1300%Zb	Diameter of the circle including the underimpedance tripping zone	50 - 300 - Dis	1	%
K2 50%Zb	Offset of the circle (% of $Z_b = V_n / (\sqrt{3} I_b)$) Underimpedance trip is inhibited on undervoltage $U < 0,3U_n$ and undercurrent $I < 0,2I_b$	5 - 50	1	%
tz 0.2s	Trip time delay of the underimpedance element	0.2 - 60	0.1	s
ti 0s	Integration time of underimpedance element. To avoid non operation in case of impedance swinging the reset of the trip time delay (tZ) only takes place if the measured impedance remains outside the tripping zone for at least ti N.B. (ti) must be always shorter than (tz)	0 - 10	0.1	s
Un +/- 1u	Operation mode of first voltage element + = overvoltage - = undervoltage +/- = over/under voltage Dis = disactivated	+ - +/- Dis	+ - +/- Dis	-
1u 15%Un	Pick-up level of the first voltage element	1 - 50	1	%
t1u 1.00s	Trip time delay of the first voltage element	0.10 - 60	0.1	s
Un + 2u	Operation mode of second voltage element + = overvoltage - = undervoltage +/- = over/under voltage Dis = disactivated	+ - +/- Dis	+ - +/- Dis	-
2u 10%Un	Pick-up level of the second voltage element	1 - 50	1	%
t2u 3s	Trip time delay of the second voltage element	0.10 - 60	0.1	s
Fn +/- 1f	Operation mode of first frequency element + = overfrequency - = underfrequency +/- = over/under frequency Dis = disactivated	+ - +/- Dis	+ - +/- Dis	-
1f 0.5Hz	Pick-up level of the first frequency element	0.05 - 9.99	0.01	Hz
t1f 3s	Trip time delay of the first frequency element	0.1 - 60	0.1	s
Fn + 2f	Operation mode of second frequency element + = overfrequency - = underfrequency +/- = over/under frequency Dis = disactivated	+ - +/- Dis	+ - +/- Dis	-
2f 1Hz	Pick-up level of the second frequency element	0.05 - 9.99	0.01	Hz
t2f 0.5s	Trip time delay of the second frequency element	0.1 - 60	0.1	s
Tc 60m	Thermal time constant of the alternator	1 - 400	1	m
Ta/n100%	Prealarm level of the thermal image	50 - 110	1	% Tn
W<0.05Wb	Pick-up level of the active underpower element	0.05 - 1.00	0.05	Wb
tW<0.1s	Trip time delay	0.1 - 60	0.1	s
tBF 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 - 0.5	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 (Settings out of production are here under shown).

The key "+" operates as cursor; it moves through the digits corresponding to the four relays programmable for any functions in the sequence 4-3-2-1-L-K-J-I-H-G-F-E-D-C-B-A (4=Relay R4 etc.) and makes start flashing the information actually present in the digit. The information present in the digit can be either the number/letter of the relay (if this was already associated to the function actually on programming) or a dot (-) if this place was not yet addressed.

The key "-" changes the existing status from the dot to the relay number/letter or viceversa.

Display	Description	
I> ----	Instantaneous element of low-set overcurrent	operates relays R1,R2,R3,R4
tl> 1---	As above, time delayed element	operates relays R1,R2,R3,R4
I>> ----	Instantaneous element of high-set overcurrent	operates relays R1,R2,R3,R4
tl>> 1---	As above, time delayed element	operates relays R1,R2,R3,R4
1Is -2--	First unbalance element (time delayed)	operates relays R1,R2,R3,R4
2Is ---4	As above, second unbalance element	operates relays R1,R2,R3,R4
tlr> -23-	Reverse power time delayed element	operates relays R1,R2,R3,R4
Z< -2--	Underimpedance time delayed element	operates relays R1,R2,R3,R4
tW< ---4	Underpower time delayed element	operates relays R1,R2,R3,R4
1U ---4	Time delayed element 1U	operates relays R1,R2,R3,R4
2U -23-	Time delayed element 2U	operates relays R1,R2,R3,R4
1f ---4	Time delayed element 1f	operates relays R1,R2,R3,R4
2f ---4	Time delayed element 1f	operates relays R1,R2,R3,R4
T> -2--	Overtemperature element	operates relays R1,R2,R3,R4
Ta/n ---4	Thermal prealarm	operates relays R1,R2,R3,R4
tBF ----	Breaker Failure	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= I>>	The input (2) for blocking the time delayed elements relevant to phase and ground faults operate on (I>) or (I>>) or (I>+I>>)	
t2= OFF	The operation of the blocking input (2) can be programmed so that it lasts as long the blocking input signal is present (t2=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 (t2=2xtBF).	
3= --lr	The blocking input (3) operate on function (Z<) or (lr>) or (Z<+lr>)	
4=1--2--	The blocking input (4) (terminals 1-14) blocks the operation of one or more of the function 1U, 2U, 1f, 2f in any possible combination.	

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 (Txxxx%Tn).

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. ELECTRICAL CHARACTERISTICS

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"/> Climatic tests | IEC 68-2-1 68-2-2 68-2-33 | |

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

- | | | | |
|---|-------------------------------|----------|--|
| <input type="checkbox"/> Electromagnetic emission | EN55022 | IND.ENV. | |
| <input type="checkbox"/> Radiated electromagnetic field immunity test | IEC61000-4-3
ENV50204 | level 3 | 80-1000MHz 10V/m
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 4 | 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 | | |

CHARACTERISTICS

- | | |
|---|--|
| <input type="checkbox"/> Accuracy at reference value of influencing factors | 2% In for measure
0,2% On
2% +/- 10ms 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 continuous |
| <input type="checkbox"/> Burden on current inputs | Phase : 0.01VA at In = 1A; 0.2VA at In = 5A
Neutral : 0.03VA at In = 1A ; 0.2VA at In = 5A |
| <input type="checkbox"/> Rated Voltage | Un = 100V (different on request) |
| <input type="checkbox"/> Voltage overload | 2 Un continuous |
| <input type="checkbox"/> Burden on voltage inputs | 0.2VA at Un |
| <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.) |
| <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 a 40°C |

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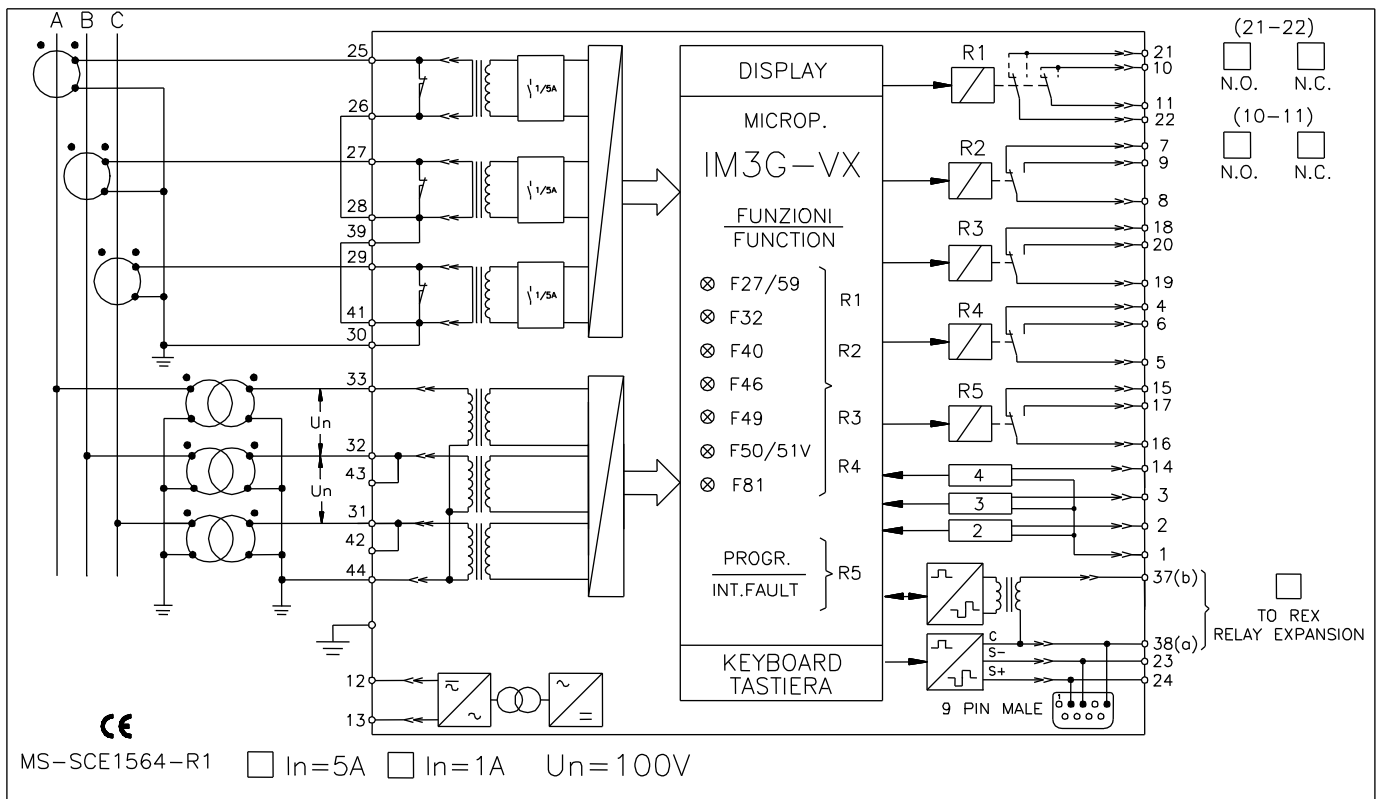
<http://www.microelettrica.com> e-mail : ute@microelettrica.com

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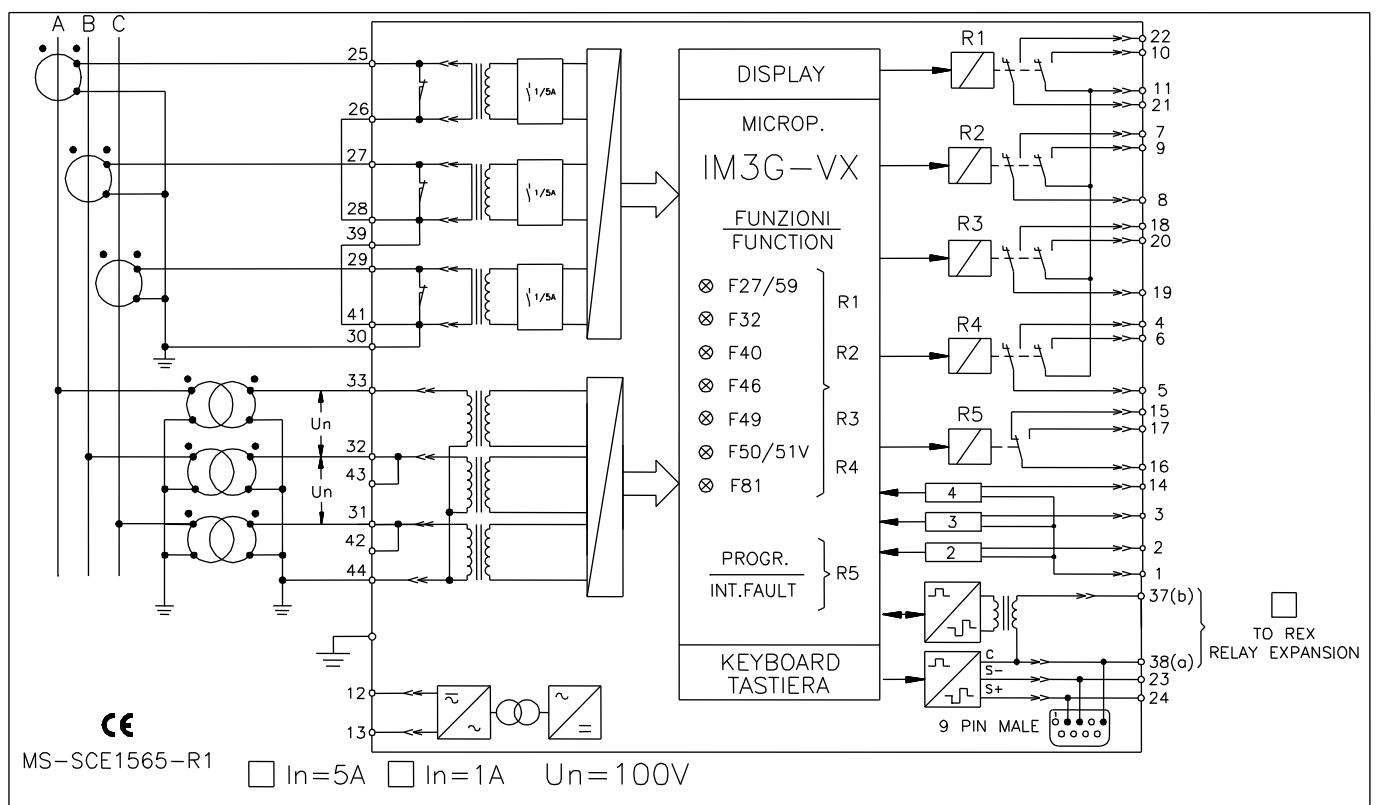
The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice



16. CONNECTION DIAGRAM (SCE1564 Rev.1 Standard Output)



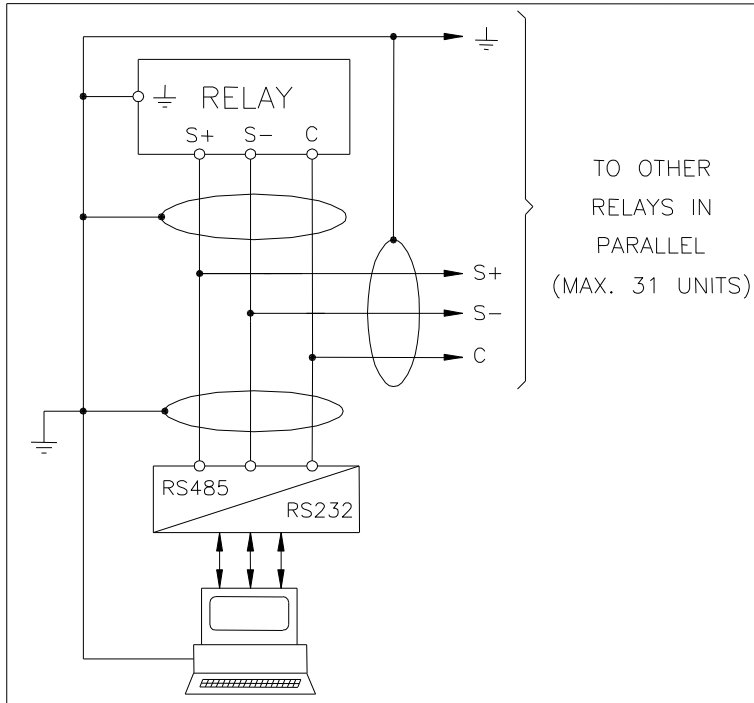
16.1 - CONNECTION DIAGRAM (SCE1565 Rev.1 Double Output)



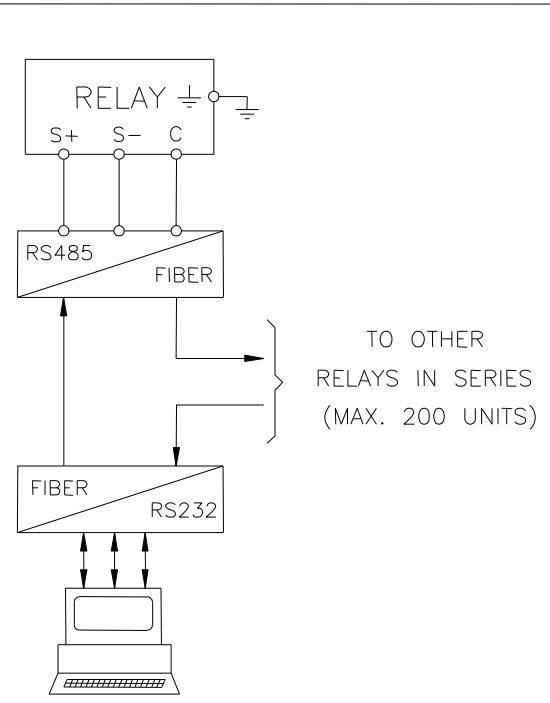


17. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

CONNECTION TO RS485



FIBER OPTIC CONNECTION





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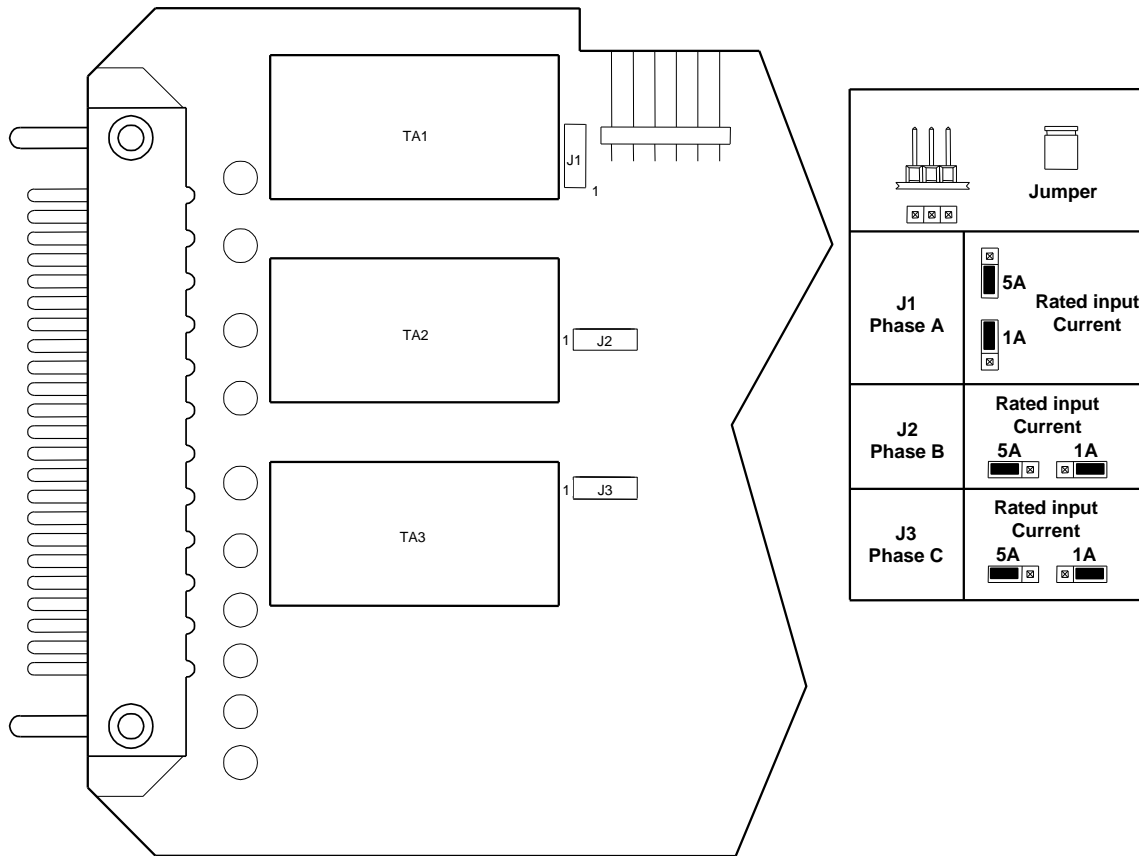
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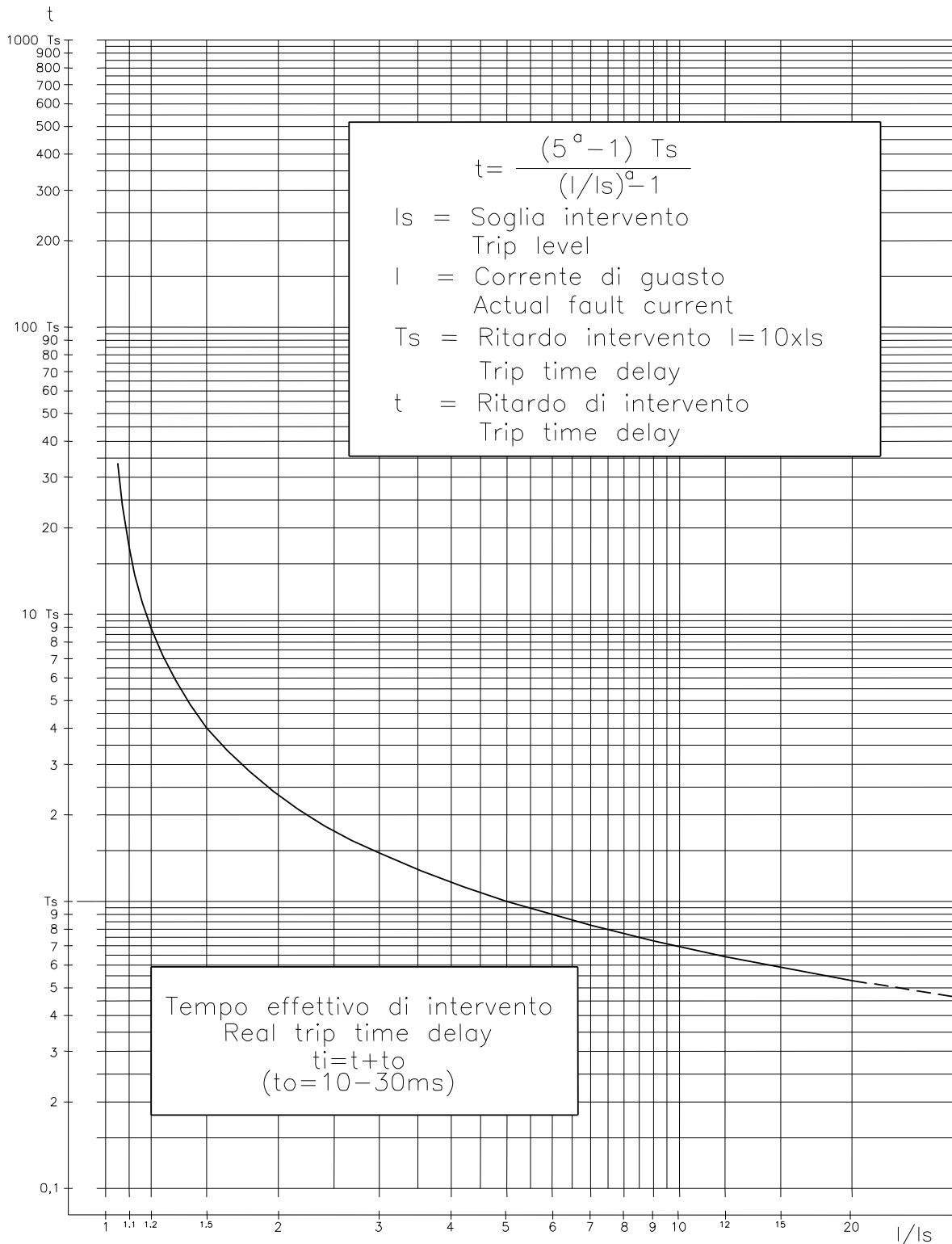
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18. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A





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

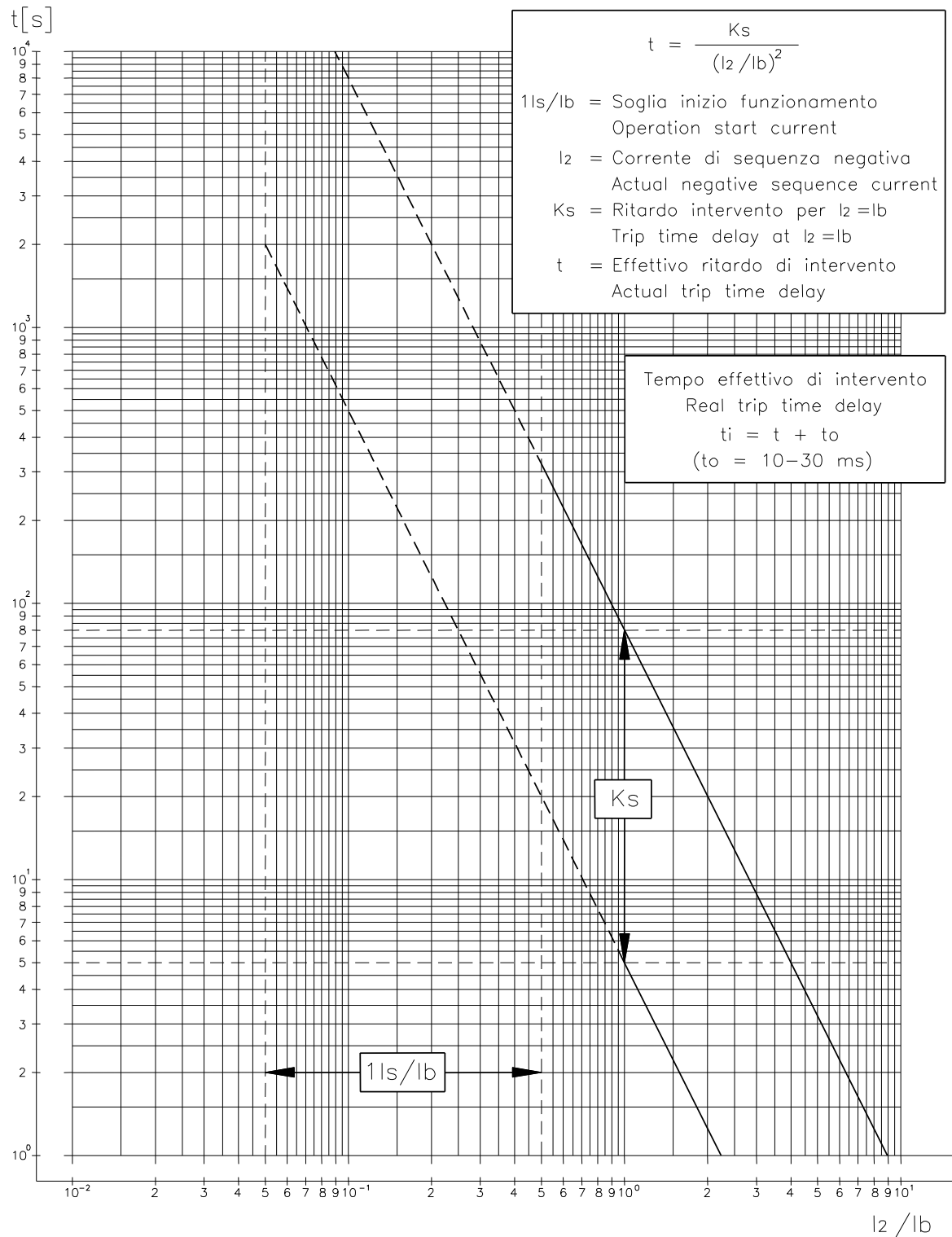


Tempo normalmente inverso
Normal inverse time

$a=0.02$

F51

$$\begin{cases} I_s = I_{>} = (1 - 2,5)I_b \\ T_s = t_{>} = (0.05-30)s \end{cases}$$

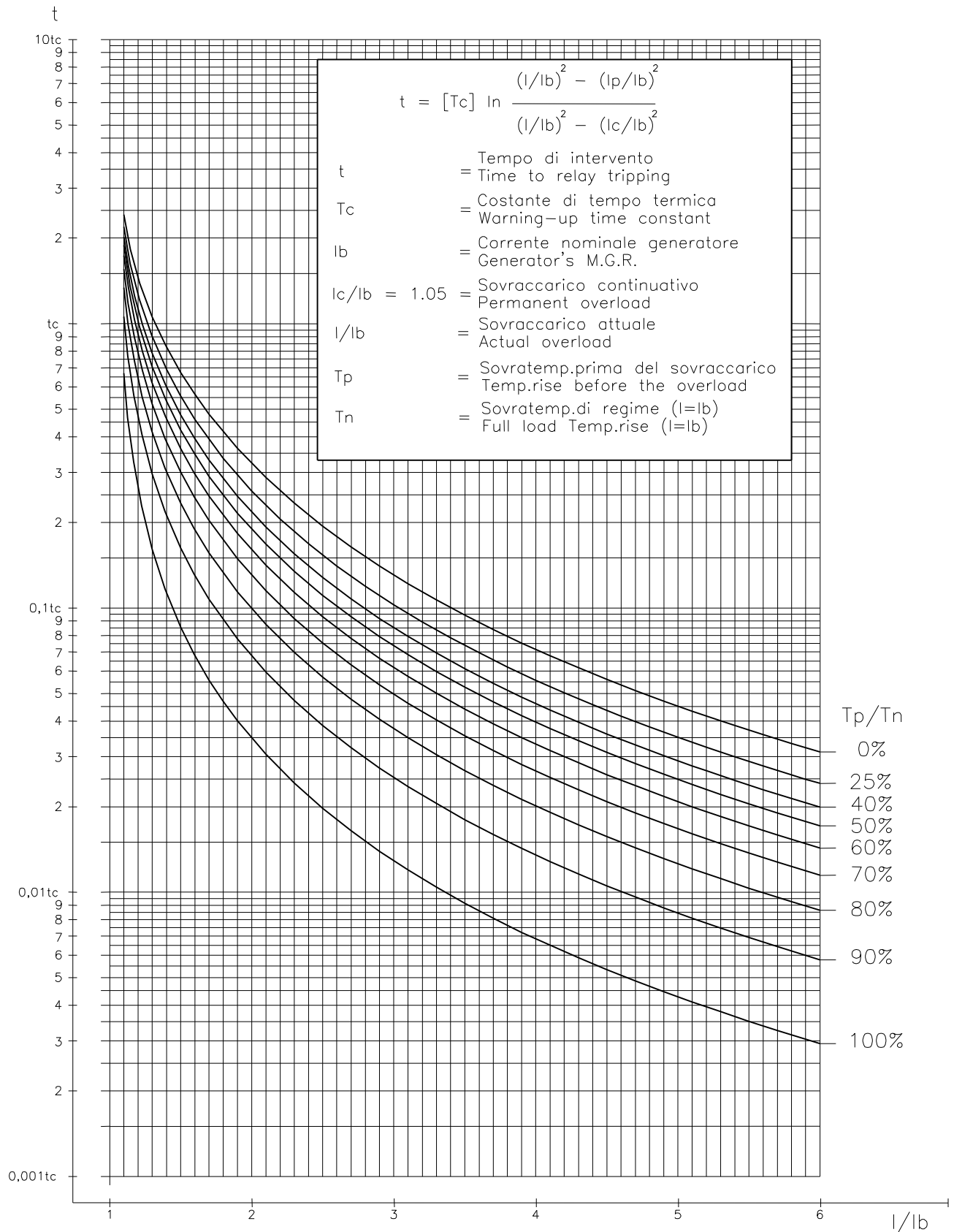
**20. I^2t = CONSTANT ELEMENT F46 (TU0312 Rev.0)**

$$I_2 = (0.05 - 0.5)I_b \text{ step } 0.01I_b$$

$$K_s = (5 - 80)\text{sec.} @ I_2 = I_b \text{ step } 1\text{sec.}$$



21. THERMAL IMAGE CURVES (TU0325 Rev.0)





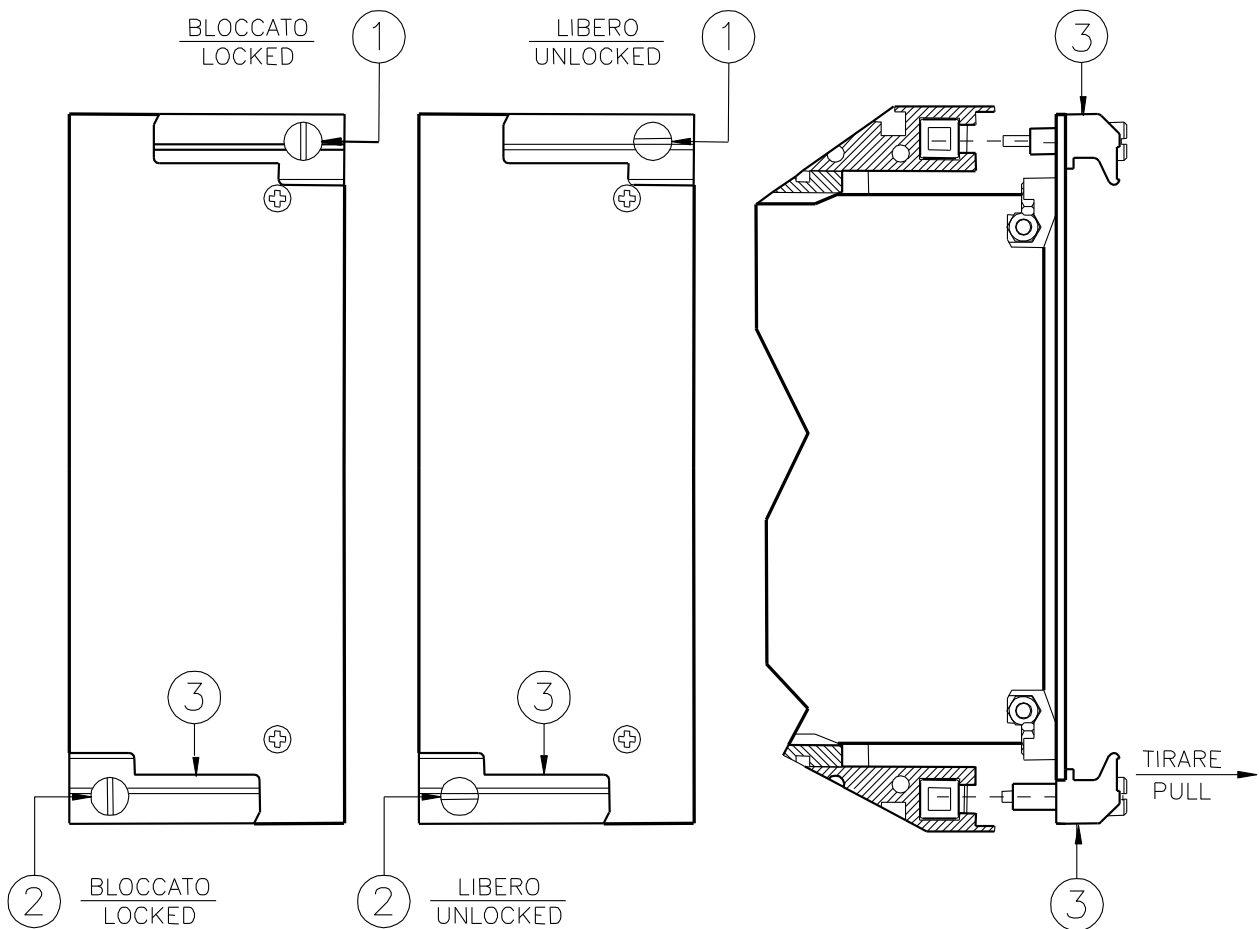
22. DIRECTION FOR PCB's DRAW-OUT AND PLUG-IN

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 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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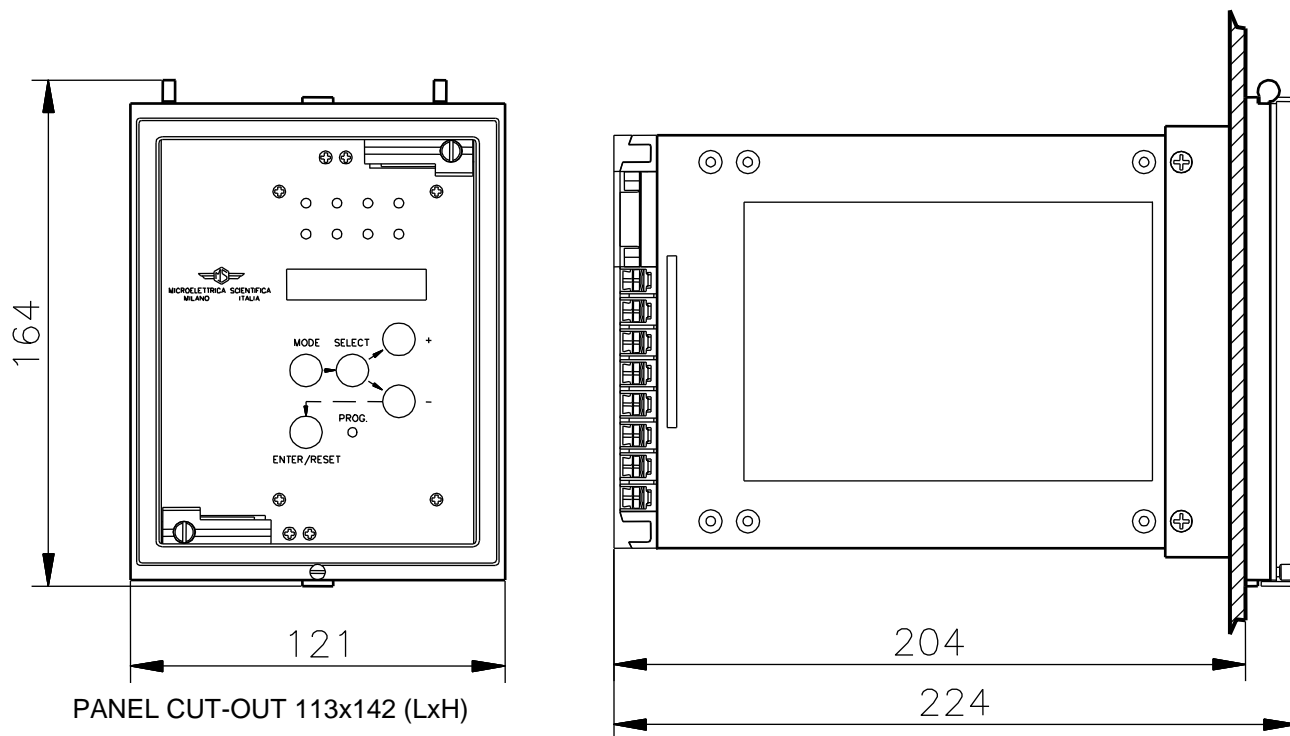
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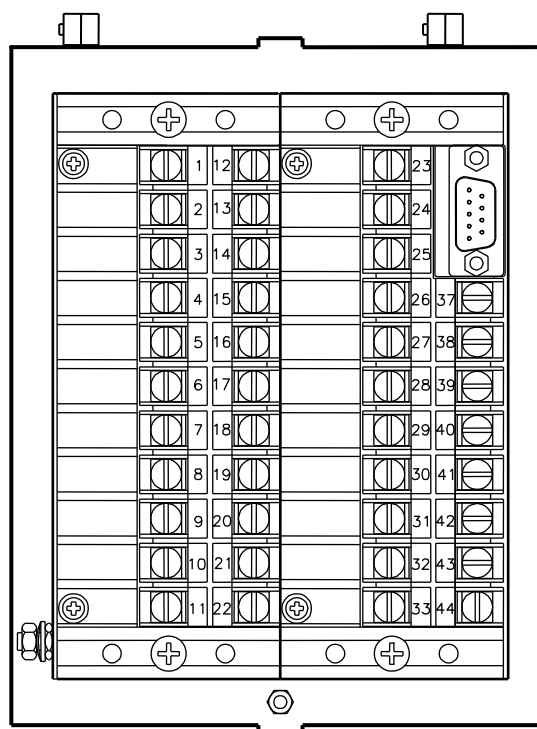
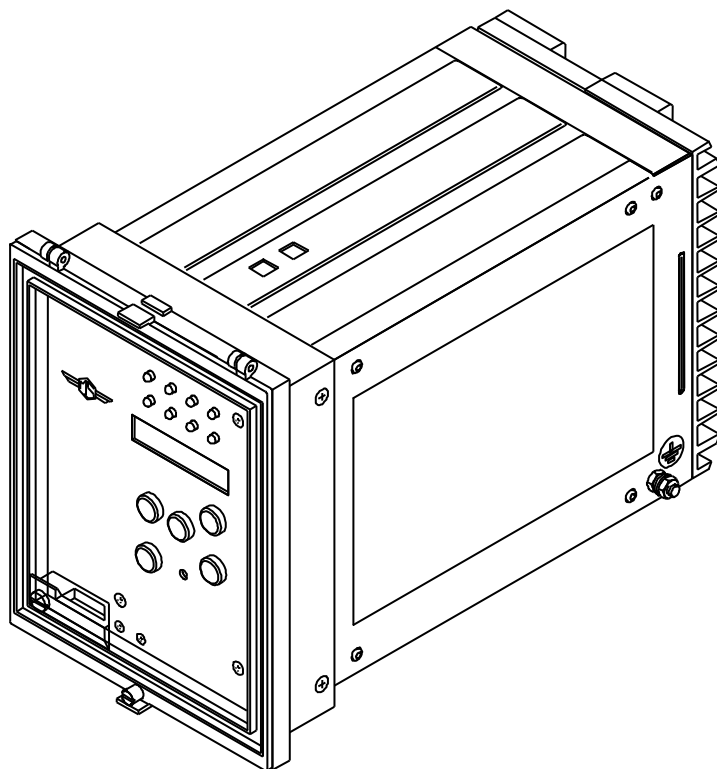
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23. OVERALL DIMENSIONS



View of Rear
Terminal Connection





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25. PROGRAMMING'S FORM

Date :			Number Relay:			
RELAY PROGRAMMING						
Default Setting				Actual Setting		
Variable	Value	Units	Description	Variable	Value	Units
NodAd	1	-	Identification number for connection on serial communication bus	NodAd		-
Fn	50	Hz	Mains frequency	Fn		Hz
In	500	Ap	Rated primary current of the phase C.Ts.	In		Ap
UnS	100	V	Rated secondary voltage of Vts (phase to phase)	UnS		V
Ib	0.5	In	Generator's rated current as p.u. of C.Ts rated current	Ib		In
F(I>)	D	-	Operation characteristic of the low-set overcurrent element	F(I>)		-
U/I>	ON	-	Voltage control on level I>	U/I>		-
I>	1.0	Ib	Trip level of low-set overcurrent element (p.u. of Ib)	I>		Ib
tl>	0.05	s	Trip time delay of the low-set overcurrent element	tl>		s
U/I>>	ON	-	Voltage control on level I>>	U/I>>		-
I>>	3	Ib	Trip level of high-set overcurrent element (p.u. of Ib)	I>>		Ib
tl>>	0.05	s	Trip time delay of the high-set overcurrent element	tl>>		s
1Is	0.05	Ib	Generator's max. continuous negative sequence current rating	1Is		Ib
Ks	5	s	Time multiplier of the I ² t time-current curve	Ks		s
tcs	10	s	Cooling time from trip level to the state corresponding to I ₂ =1Is	tcs		s
2Is	0.03	Ib	Negative sequence current alarm level	2Is		Ib
t2Is	1	s	Independent trip time delay of alarm element	t2Is		s
Ir>	0.02	Ib	Trip level of the reverse power element	Ir>		Ib
tlr>	0.1	s	Independent trip time delay of reverse power element	tlr>		s
K1	300	%Zb	Diameter of the circle including the underimpedance tripping zone	K1		%Zb
K2	50	%Zb	Offset of the circle	K2		%Zb
tz	0.2	s	Trip time delay of the underimpedance element	tz		s
ti	0	s	Integration time of underimpedance element.	ti		s
Un	+/-	1u	Operation mode of first voltage element	Un		1u
1u	15	%Un	Pick-up level of the first voltage element	1u		%Un
t1u	1.00	s	Trip time delay of the first voltage element	t1u		s
Un	+	2u	Operation mode of second voltage element	Un		2u
2u	10	%Un	Pick-up level of the second voltage element	2u		%Un
t2u	3	s	Trip time delay of the second voltage element	t2u		s
Fn	+/-	1f	Operation mode of first frequency element	Fn		1f
1f	005	Hz	Pick-up level of the first frequency element	1f		Hz
t1f	3	s	Trip time delay of the first frequency element	t1f		s
Fn	+	2f	Operation mode of second frequency element	Fn		2f
2f	1	Hz	Pick-up level of the second frequency element	2f		Hz
t2f	0.5	s	Trip time delay of the second frequency element	t2f		s
Tc	60	m	Thermal time constant of the alternator	Tc		m
Ta/n	100	%	Prealarm level of the thermal image	Ta/n		%
W<	0.05	Wb	Pick-up level of the active underpower element	W<		Wb
tW<	0.1	s	Trip time delay	tW<		s
tBF	0.05	s	Breaker Failure function	tBF		s



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CONFIGURATION OF OUTPUT RELAYS

Default Setting				Actual Setting	
Protect. Element	Output Relays	Description		Protect. Element	Output Relays
I>	- - - -	Instantaneous element of low-set overcurrent		I>	
tl>	1 - - -	As above, time delayed element		tl>	
I>>	- - - -	Instantaneous element of high-set overcurrent		I>>	
tl>>	1 - - -	As above, time delayed element		tl>>	
1Is	- - - -	First unbalance element (time delayed)		1Is	
2Is	- - - -	As above, second unbalance element		2Is	
tlr>	- 2 3 -	Reverse power time delayed element		tlr>	
Z<	- 2 - -	Underimpedance time delayed element		Z<	
tW<	- - - 4	Underpower time delayed element		tW<	
1U	- - - 4	Time delayed element 1U		1U	
2U	- 2 3 -	Time delayed element 2U		2U	
1f	- - - 4	Time delayed element 1f		1f	
2f	- - - 4	Time delayed element 1f		2f	
T>	- 2 - -	Overtemperature element		T>	
Ta/n	- - - 4	Thermal prealarm		Ta/n	
tBF	- - - -	Breaker Failure		tBF	
tFRes:	A	Relay reset mode A= Automatic , M = Manual		tFRes:	
2=	I>>	The blocking input (2)		2=	
t2=	OFF	The operation of the blocking input (2)		t2=	
3=	--lr	The blocking input (3)		3=	
4=	1--2--	The blocking input (4)		4=	