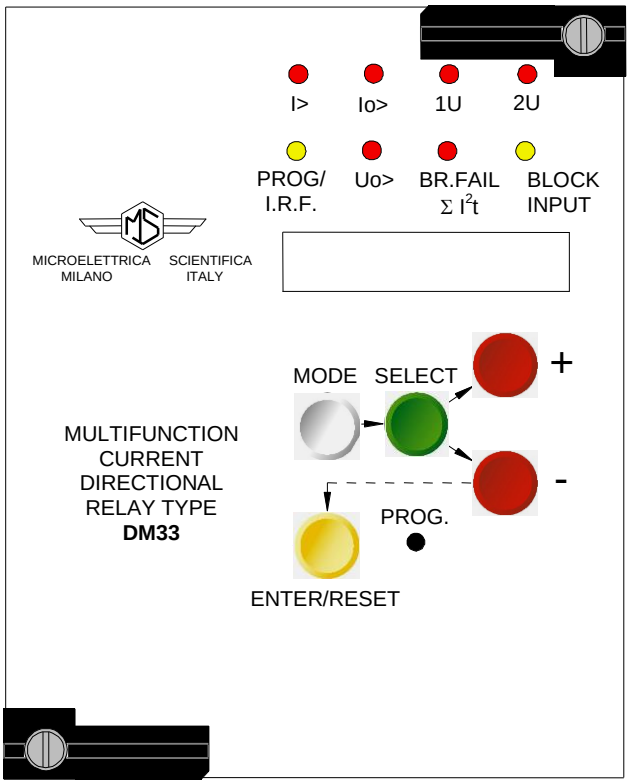
MULTIFUNCTION MICROPROCESSOR PROTECTION RELAY DIRECTIONAL 3 PHASE OVERCURRENT + DIRECTIONAL EARTH FAULT

TYPE

DM33

OPERATION MANUAL



CE

INDEX

1. General utilization and commissioning directions

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

1.1 STORAGE AND TRANSPORTATION,

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

1.2 INSTALLATION,

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

1.3 ELECTRICAL CONNECTION,

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

1.4 MEASURING INPUTS AND POWER SUPPLY,

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

1.5 OUTPUTS LOADING,

must be compatible with their declared performance.

1.6 PROTECTION EARTHING

When earthing is required, carefully check its efficiency.

1.7 SETTING AND CALIBRATION

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

1.8 SAFETY PROTECTION

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

1.9 HANDLING

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

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

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

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

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

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

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

1.10 - MAINTENANCE

Make reference to the instruction manual of the Manufacturer ;
maintenance must be carried-out by specially trained people and in strict conformity with the safety regulations.

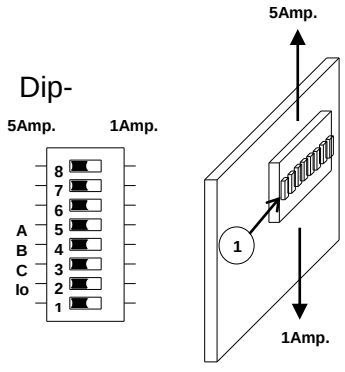
1.11 - FAULT DETECTION AND REPAIR

Internal calibrations and components should not be alterated or replaced.
For repair please ask the Manufacturer or its authorised Dealers.

Misapplication of the above warnings and instruction relieves the Manufacturer of any liability.

2. GENERAL CHARACTERISTICS

Input quantities are supplied to 3 Voltage Transformers and to 4 Current Transformers (- three measuring phase current - one measuring the earth fault current). The rated input voltage is programmable from 50 to 125V phase-to-phase. The rated input current can be set to 1A or 5A by selecting the position of 7 dip-switches provided on relay card (see figure). The zero sequence polarizing voltage is internally reconstructed. 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.



2.1 - POWER SUPPLY

The auxiliary power is supplied by a built-in interchangeable module fully isolated an self protected.
Two options are available :

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

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

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

2.2 - Operation

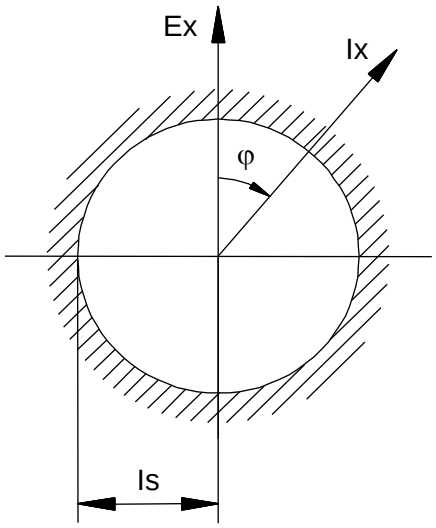
The relay performs three phase and earth fault protection. Each of the Phase Fault elements and Each of the Earth Fault elements can operate in three different ways according to the programming respectively of the variables Fα and Fα$_o$.

2.2.1 – Operation of the Phase Overcurrent element

It is assumed :

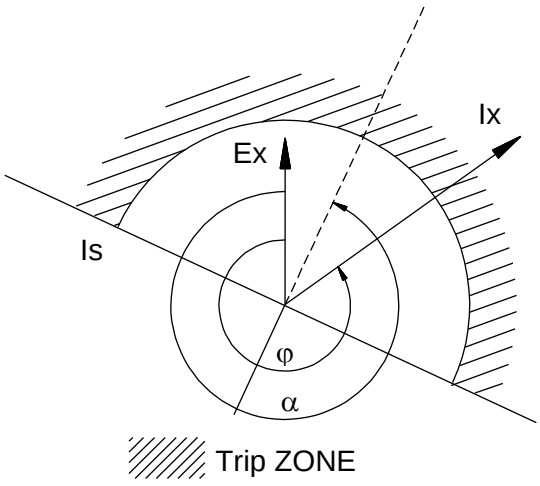
- Is = Set minimum pick-up level of the phase overcurrent element
- α = Set characteristic angle (max. torque angle)
- Ix = Actual relay input current (highest among the three phase currents IA, IB, IC.)
- φ = Actual displacement of current Ix from the phase voltage Ex
- Idx = Component of Ix in the direction α

A) Programming Fα = Dis.



The element just operates as a non directional overcurrent element when Ix ≥ [Is] independently from the displacement φ

B) Programming Fα = Sup.

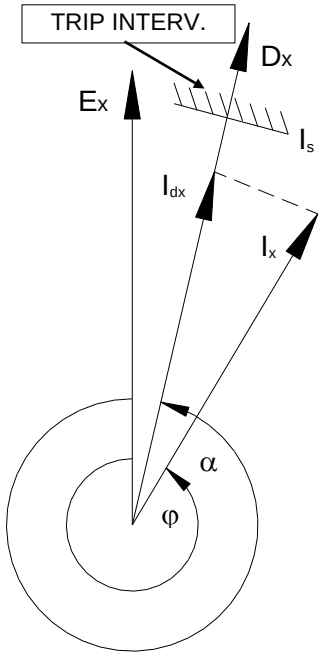


The element simply operates with supervision of the current flow direction.

The pick-up conditions are:

- The input phase-to-neutral Voltage Exceeds 1-2% of the rated input voltage Vn/√3.
- The input current exceeds the set level Is: Ix ≥ [Is]
- The displacement φ of Ix from Ex is within ±90° from the set direction α

C) Programming Fα = Dir.



The element operates a full directional control (wattmetric operation) measuring for each phase the current:

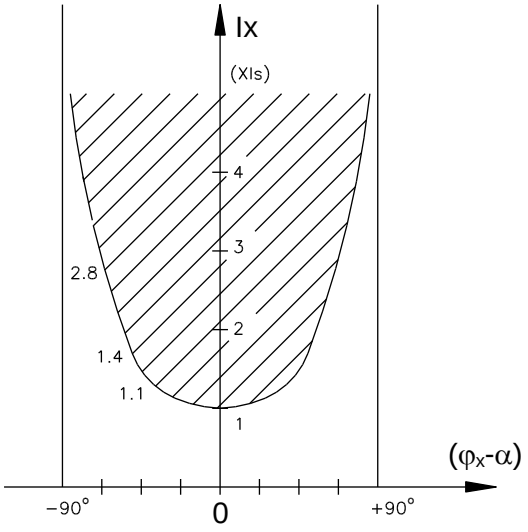
$I_{dA}=I_A \cos(\varphi_A-\alpha)$ $I_{dB}=I_B \cos(\varphi_B-\alpha)$ $I_{dC}=I_C \cos(\varphi_C-\alpha)$

Any of the relay's phase elements initiates the operation of the overcurrent functions when the component I_{dx} of its phase current I_x in the direction Dx (vector displaced α degees from the relevant phase voltage Ex) exceeds the set pick-up level Is.
$I_{dx} = I_x \cos(\varphi_x-\alpha) \geq$ Is

Consequently :

- When $\varphi_x = \alpha$: $I_{dx}= I_x \rightarrow$ operation when I_x>Is
- When $(\varphi_x-\alpha) = 90°$: $I_{dx}= 0 \rightarrow$ no operation
- When $(\varphi_x-\alpha) > 90°$: I_{dx} opposite to Dx $\rightarrow$ no operation

Operation of the phase elements is virtually independent from the magnitude of the voltage as down as 1-2% of rated voltage.



Recommended angles for different applications :

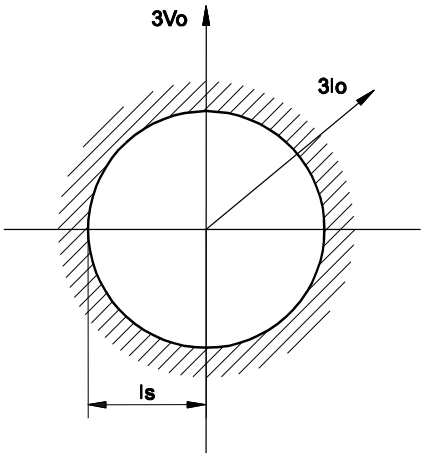
- Measurement of active current (power) :
  Forward : α = 0° - Reverse : α = 180°
- Phase fault directional overcurrent :
  Forward : α = 300°(60° lag) - Reverse : α = 120°
- Measurement of inductive reactive current :
  Forward : α = 270°(90° lag) - Reverse : α = 90°
- Measurement of capacitive reactive current:
  Forward : α = 90°(90° lead) - Reverse : α = 270°

2.3 - OPERATION OF THE DIRECTIONAL EARTH FAULT ELEMENT

It is assumed :

- **Is** = Set minimum pick-up residual current (3Io)
- **Uo** = Set minimum residual voltage (level to enable Is pick-up)
- **α_o** = Set characteristic angle (max. torque angle)
- **3Io** = Relay earth fault input current
- **3Vo** = Relay earth fault input voltage
- **φ_o** = Actual Io/Vo phase displacement
- **Ios** = Component of 3Io in the direction α

The directional earth fault element can operate in three different ways according to the programming of the variable Fα_o.



Fα_o = Dis.

The element just operates as a normal overcurrent element without either residual voltage control (U_o) and zero sequence current displacement control (α_o)

- The element operates if : $3I_o \geq [I_s]$

Fα_o = Sup.

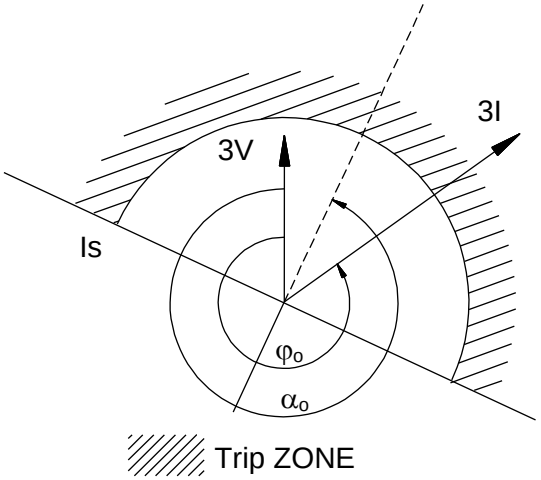
The element operates if the following 3 conditions are present :

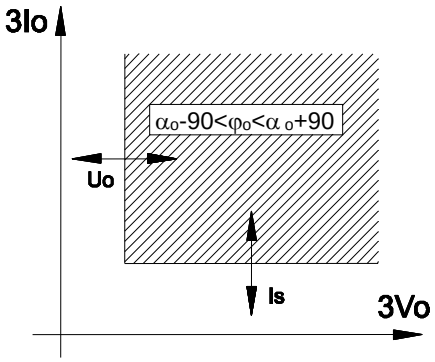
- The input residual voltage $3V_o$ exceeds the set level U_o $3Vo \geq [U_o]$

- The input residual current $3I_o$ exceeds the set level I_s $3I_o \geq [I_s]$

- The displacement φ_o of I_o from V_o is within ± 90° from the set direction α_o.

$$\alpha_o - 90 \leq \varphi_o \leq \alpha_o + 90$$



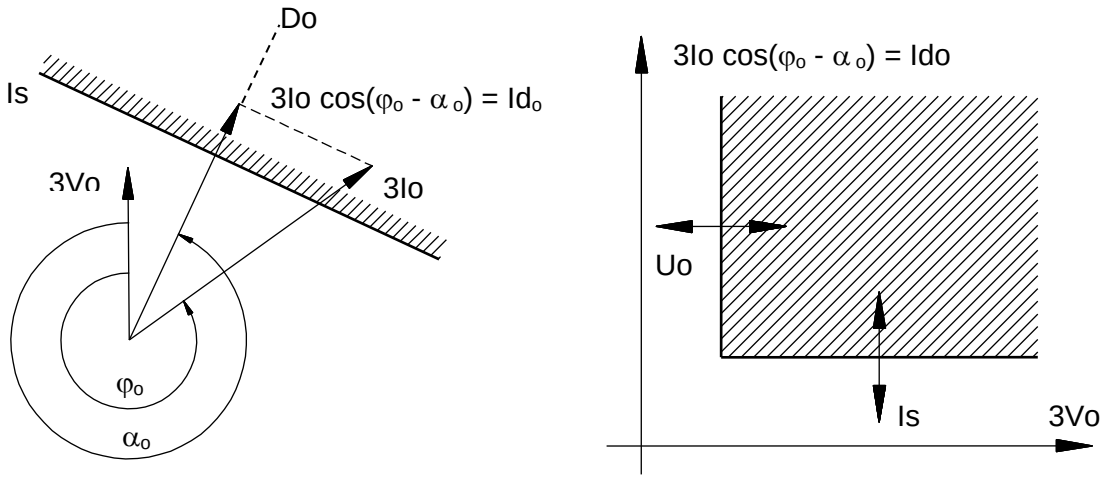


Fα_o = Dir

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

- The input residual voltage $3V_o$ exceeds the set U_o : $3V_o \geq [U_o]$

- The component of the input residual current $3I_o$ in the direction α exceeds the set level I_s: $3I_o \cos(\varphi_o - \alpha_o) \geq [I_s]$



N.B. Angles are measured anti-clockwise from 0° to 360° (four quadrants)

Consequently :

- when $\varphi_o = \alpha_o$: $I_{do} = 3I_o$ → operation when $3Io \geq Is$
- when $(\varphi_o - \alpha_o)=90°$: $I_{do} = 0$ → no operation
- when $(\varphi_o - \alpha_o)>90°$: I_{do} opposite to Do → no operation

Recommended angles for different application :

- Isolated neutral : $\alpha_o = 270°$ (reverse 90° lead)
- Resistance or reactance earthed neutral : $\alpha_o = 0°$
- Solidly earthed neutral : $\alpha_o = 300°$ (60° lag)

2.4 - ALGORITHM OF THE TIME CURRENT CURVES

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

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

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

Is = Set minimum pick-up level

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

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

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

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

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

2.5 Breaking Energy accumulation

The relay computes the Arc Energy developed during each interruption of the Circuit Breaker and accumulates these values.
When the amount of the accumulated energy exceed a settable level the relay gives out an alarm to signal that maintenance inspection of the Circuit Breaker is needed.
The operation of this function is based on the following parameters:

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

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

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

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

Any time the Circuit Breaker opens (digital input shorted by C/B Normally Closed contact 52b) the relay accumulates the energy corresponding to a number of conventional interruption units.

$$nW_C = \frac{I^2 \cdot t_X}{Ii^2 \cdot t_X}$$

When the amount of accumulated energy exceeds the set value [Wi] the relay energized a user programmable output relay.
This relays can not be reset unless a “clear” procedure is entered.

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

- Press white button “MODE” to show the “PROG” mode displayed.
- Press green button “SELECT” to show the “SETTING” mode displayed.
- Operate the indirect access button “PROG” and while keeping this button pressed also press at the same time the button red “+” and red “-“ and green “SELECT”.
  As all the four button are pressed at the same time, the display shows “CLEAR?” release the four button “ENTER” to clear all relay recorded values (last trip – trip counters, energy accumulated).

2.6 - CLOCK AND CALENDAR

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

2.6.1 - Clock synchronization.

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

2.6.2 - Date and time setting.

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

2.6.3 - Time resolution.

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

2.6.4 - Operation during power off.

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

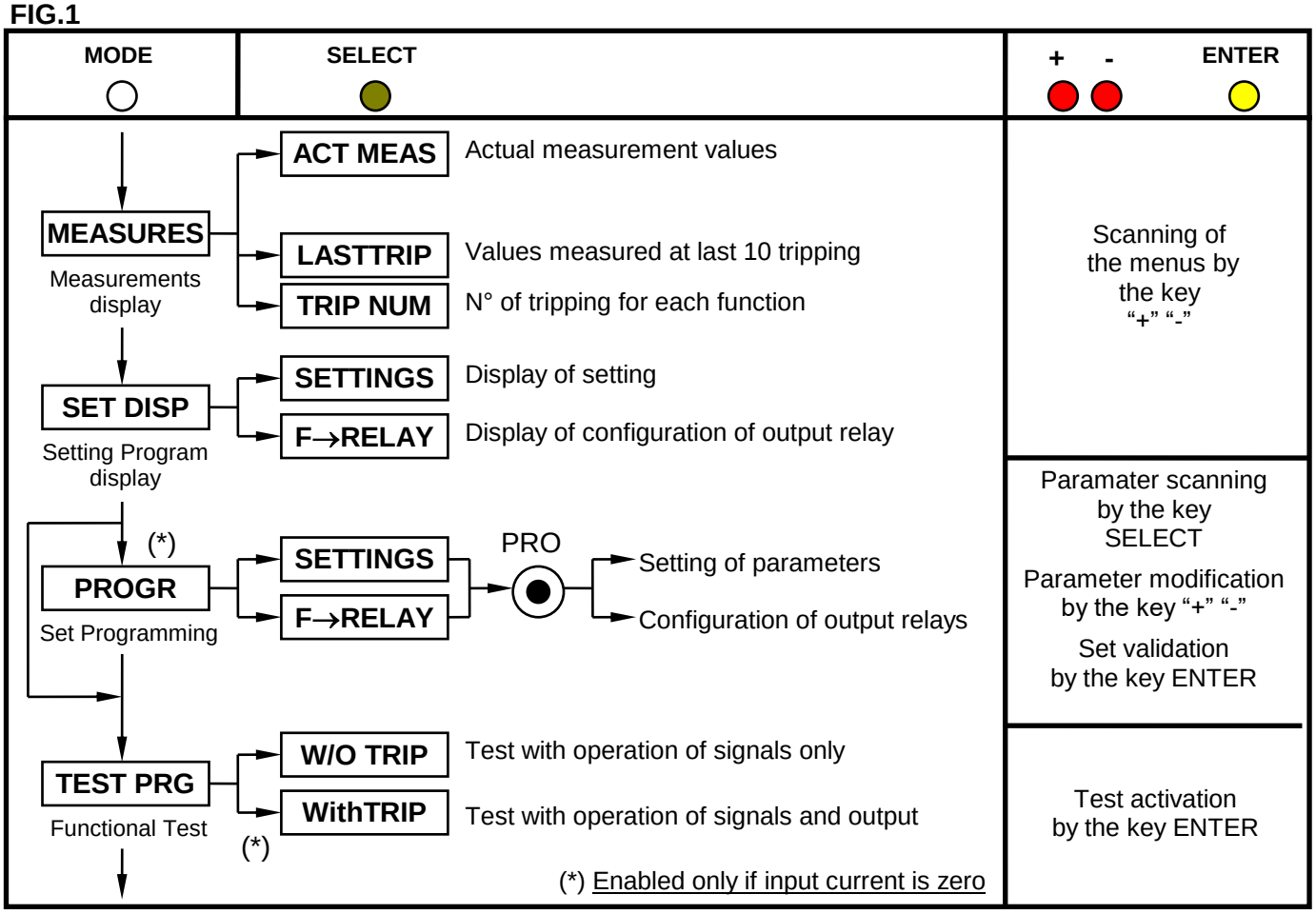
2.6.5 - Time tolerance.

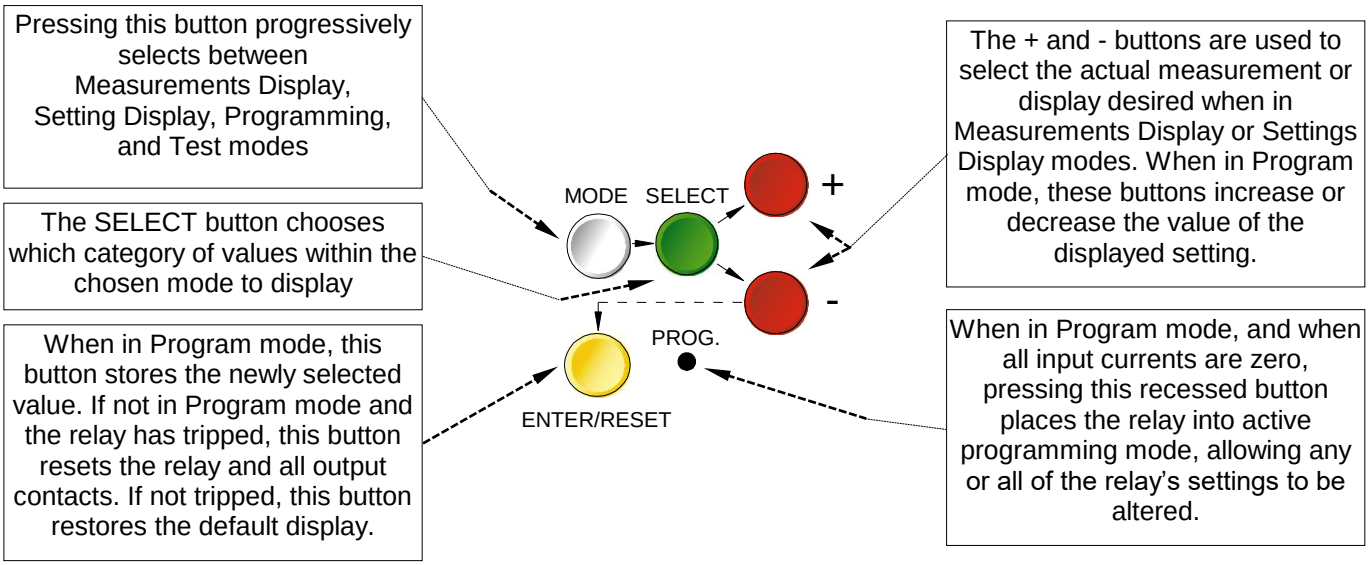
During power on, time tolerance depends on the on board crystal (+/-50ppm typ, +/-100ppm max. over full temperature range).
During power off, time tolerance depends on the RTC's oscillator (+65 /–270 ppm max over full temperature range).

3. CONTROLS AND MEASUREMENTS

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

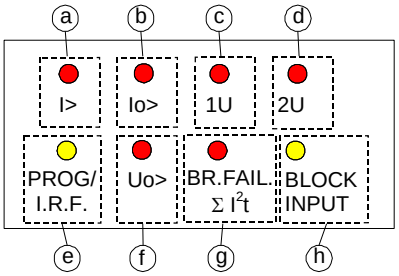
FIG.1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**I>**	❑	Flashing when measured current exceeds the overcurrent set level. ❑ Illuminated on trip after expiry of the set overcurrent trip time delay.
b)	Red LED	**Io>**	❑	same as above related to Earth Fault element
c)	Red LED	**1U**	❑	same as above related to 1U and t1U (First Voltage element).
d)	Red LED	**2U**	❑	same as above related to 2U and t2U (Second Voltage element).
e)	Yellow LED	**PROG/ I.R.F.**	❑	Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**Uo>**	❑	Flashing when measured zero sequence voltage exceeds the set level Uo ❑ Illuminated on trip after expiry of the set trip time delay tUo
g)	Red LED	**BR.FAIL. Σ I²t**	❑	Illuminated when the BREAKER FAILURE function is activated. ❑ Flashing when the maintenance Breaking Energy Level is exceeded
h)	Yellow LED	**BLOCK INPUT**	❑	Flashing when a blocking signals present at the relevant input terminals 1 – 2 or 1 – 3.

The reset of the leds takes place as follows:

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

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

5. OUTPUT RELAYS

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

a) - The relays **R1,R2,R3,R4** are normally deenergized (energised on trip); these output relays are user programmable and any of them can be associated to any (one or more) of the DM33'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 time delayed element of the some function, the drop-out of the instantaneous relay is anyhow forced after an adjustable waiting time [tBF].(Diasactivation of the blocking output eventually used to block a relay upstream in the distribution system). The timer tBF is also started at any time the relay R1 picks-up and any relays R2, R3, R4 can be programmed to be energized at the end of the delay tBF (Breaker Failure functions).
Reset of the output relays associated to any time delayed function can be programmed to take place "Automatically" (tFRes= A) as soon as the tripping cause has disappeared, or "Manually" (tFRes= M) only by operating the ENTER/RESET key on relay's front or via the serial bus.
It has to be remarked that the programming structure does not allow to associate the same relay at the same time to instantaneous and delayed elements. Therefore any relay already associated to any time delayed element cannot be associated to any instantaneous element and viceversa.

b) - The relay **R5**, normally energised, is not programmable and it is deenergized on:

- internal fault
- power supply failure
- during the programming

6. SERIAL COMMUNICATION

The relays fitted with the serial communication option can be connected via a cable bus a fiber optic bus for interfacing with a Personal Computer (type IBM or compatible).
All the functionalities that can be operated locally (for example reading of input measurement and changing of relay's settings) are also possible via the serial communication interface.
Furthermore the serial port allows the user to read event recording and stored data.
The unit has a RS232 / RS485 interface and can be connected either directly to a P.C. via a dedicated cable or to a RS485 serial bus, allowing having many relays to exchange data with a single master P.C. using the same physical serial line. A RS485/232 converter is available on request.
The communication protocol is MODBUS RTU (only functions 3, 4 and 16 are implemented).
Each relay is identified by its programmable address code (NodeAd) and can be called from the P.C.
A dedicated communication software (MSCOM) for Windows 95/98/NT4 SP3 (or later) is available.
Please refer to the MSCOM instruction manual for more information Microelettrica Scientifica.

7. DIGITAL INPUTS

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

- **B2** (terminals 1 - 2) : it blocks the operation of the of the time delayed elements relevant to phase fault detection
- **B3** (terminals 1 - 3) : it blocks the operation of the time delayed elements relevant to earth fault detection.

When a function is blocked the pick-up of its output is inhibited. Programming allows to have the inhibition either permanent as long as the blocking input is active or automatically removed with a programmable wait-time (see § 12.2 : tB2 , tB3) after the operation of the time delayed function. By proper interconnection of the blocking inputs output among different relays it is possible to configurate very efficient arrangements of logic fault discrimination as well as to feature a safe and quick breaker back-up protection.

- **B4** (terminals 1 - 14) : Connected to a N.C. (52b) it detected Circuit Breaker opening

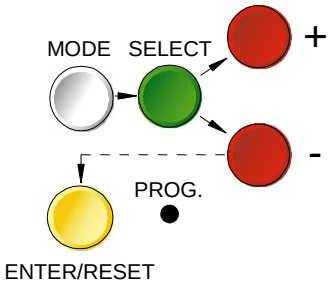
8. TEST

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 - the actuation of test programs - the forcing of the default display indication - the reset of signal Leds.
e) - Indirect key	●	:	Enables access to the programming.

10. READING OF MEASUREMENTS AND RECORDED PARAMETERS

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

10.1 - ACT.MEAS

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

Display	Description
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds
Fxx.xx**Hz**	Input frequency : 40,00 - 70,00 Hz
IAxxxxx**A**	True R.M.S. value of the current of phase A displayed as primary Amps.(0 - 99999)
IBxxxxx**A**	As above, phase B.
ICxxxxx**A**	As above, phase C.
EAx.xx**En**	R.M.S. value of system's phase A-to neutral voltage
EBx.xx**En**	As above phase B
ECx.xx**En**	As above phase C
Ioxxx.x**A**	zero sequence current (3Io)
Uoxxx.x**V**	zero sequence voltage (3Uo)
φoxxxxx**°**	Phase displacement of Io on Uo : (0-360° anticlockwise)
φaxxxxx**°**	Phase displacement of IA on EA : (0-360° anticlockwise)
φbxxxxx**°**	Phase displacement of IB on EB : (0-360° anticlockwise)
φcxxxxx**°**	Phase displacement of IC on EC : (0-360° anticlockwise)

10.2 - EVENT RECORDING (10 Most Recent Tripping)

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

Display	Description
LastTr-x	Indication of the recorded event (x= 0 to 9) Example: Last event (LastTr -0) Last but one event (LastTr-1) etc...
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds
Cau:xxx	Display of the function which caused the last tripping: **1IA; 1IB; 1IC; 2IA; 2IB; 2IC; 3IA; 3IB; 3IC; 1O; 2O; 3O; Uo; 1U; 2U; KA²s.**
Fxx.xx**Hz**	Input frequency
IAxx.xx**n**	Current of phase A.
IBxx.xx**n**	Current of phase B.
ICxx.xx**n**	Current of phase C.
EAx.xx**En**	R.M.S. value of system's phase A-to neutral voltage
EBx.xx**En**	As above phase B
ECx.xx**En**	As above phase C
Io.xxx**On**	Earth fault current.
Uoxxx.x**V**	Zero sequence voltage
φoxxxxx**°**	Zero sequence displacement degrees
φaxxxxx**°**	Phase A displacement degrees
φbxxxxx**°**	Phase B displacement degrees
φcxxxxx**°**	Phase C displacement degrees

10.4 - TRIP NUM

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

Display		Description
1I	xxxxx	First phase overcurrent time delayed element
2I	xxxxx	Second phase overcurrent time delayed element
3I	xxxxx	Third phase overcurrent time delayed element
1O	xxxxx	First Earth Fault time delayed element
2O	xxxxx	Second Earth Fault time delayed element
3O	xxxxx	Third Earth Fault time delayed element
Uo	xxxxx	Zero Sequence overvoltage time delayed element
1U	xxxxx	First Voltage time delayed element
2U	xxxxx	Second Voltage time delayed element
Op#	xxxx	C/B operation number
%Wi	xxxx	C/B Breaking Energy to reach maintenance level

11. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

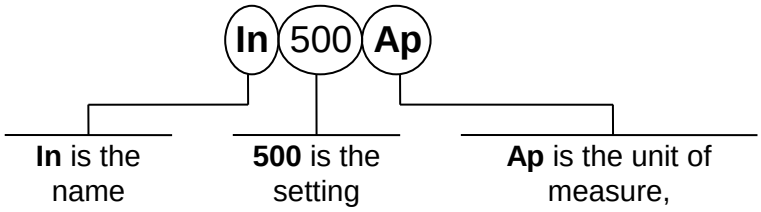
Enter the mode "SET DISP", select the menu "SETTINGS" or "F→RELAY", scroll information available in the menu by keys "+" or "-".

- 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 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 which can be disclosed on request only.
As soon as programming is enabled, the Led PRG/IRF flashes and the alarm relay R5 is deenergized..
Enter MODE "PROG" and SELECT either "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).

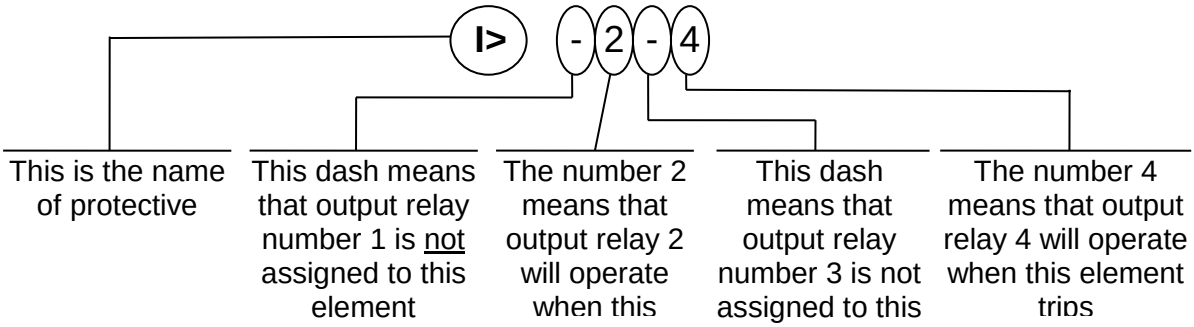
Display	Description	Setting Range	Step	Unit
xxxxxxx	Current date	DDMMMYY	-	-
xx:xx:xx	Current time	HH:MM:SS	-	-
TsynDis**m**	Synchronisation Time Expected time interval between sync. signal.	5 - 60 - Dis	5-10 15-30 60-Dis	m
Fn 50 **Hz**	Mains frequency	50 - 60	-	Hz
In 500**Ap**	Rated primary current of the phase C.Ts.	1 - 9999	1	Ap
On 500**Ap**	Rated primary current of the C.Ts. or of the tore C.T. supplying the zero sequence current	1 - 9999	1	Ap
UnS 100**V**	P.Ts. rated secondary phase-to-phase voltage	50 – 125	0.1	V
F1α Dir	Operation mode of the first phase O/C elements (see § 2.2.1)	Dis.–Sup.–Dir.	-	-
1α= 90**°**	Reference direction of first phase fault elements	0° - 359°	1	°
F(1I) D	Operation characteristic of the first 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	-	-

Display	Description	Setting Range	Step	Unit
1I 0.50**In**	Trip level of first overcurrent element (p.u. of the rated current of the phase C.Ts.):	0.1 - 4 - Dis	0.01	In
t1I 0.05**s**	Trip time delay of the first overcurrent element: In the dependent time operation it is the trip time delay at I = 10x[1I] (see Time Current Curves)	0.05 - 42	0.01	s
B2→1I OFF	Digital Input B2 Blocks timed element 1I	ON - OFF	-	-
F2α Dir	Operation mode of the 2nd phase O/C element (see § 2.2.1)	Dis.–Sup.–Dir.	-	-
2α= 90°	Reference direction of 2nd phase fault element	0° - 359°	1	°
2I 0.5**In**	Trip level of 2nd overcurrent element in p.u. of the rated current of the phase C.Ts.	0.1 – 40 - Dis	0.1	In
t2I 0.05**s**	Trip time delay of the 2nd overcurrent element	0.05 - 42	0.01	s
B2→2I OFF	Digital Input B2 Blocks timed element 2I	ON - OFF	-	-
2Ix2 ON	Automatic doubling of level 2I on inrush	ON - OFF	-	-
F3α Dir	Operation mode of the 3rd phase O/C element (see § 2.2.1)	Dis.–Sup.–Dir.	-	-
3α= 90°	Reference direction of 3rd phase fault element	0° - 359°	1	°
3I 0.5**In**	Trip level of 3rd overcurrent element in p.u. of the rated current of the phase C.Ts.:	0.1 – 40 - Dis	0.1	In
t3I 0.05**s**	Trip time delay of the 3rd overcurrent element	0.05 - 42	0.01	s
B2→3I OFF	Digital Input B2 Blocks timed element 3I	ON - OFF	-	-
3Ix2 ON	Automatic doubling of level 3I on inrush	ON - OFF	-	-
F1αo Dir	Operation mode of the first Earth Fault elements (see § 2.2.2)	Dis.–Sup.–Dir.	-	-
1αo= 90°	Reference direction of first earth fault elements	0°- 359°	1	°
1Uo 10**V**	Minimum level of the zero-sequence polarizing input voltage for enabling operation of the first earth fault element	1 - 50	1	V
F(1O) D	Operation characteristic of the first earth fault element (F67N): (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	-	-
1O 0.002**On**	Trip level of first earth fault element (F67N) in p.u. of the rated current of the earth fault detection C.T.	0.002-0.4-Dis	0.001	On
t1O 0.05**s**	Trip time delay of first earth fault element: In the inverse time operation it is the trip time delay at I_0 = 10x[1O] (see Time Current Curves)	0.05 - 42	0.01	s
B3→1OOFF	Digital Input B3 Blocks timed element 1O	ON - OFF	-	-
F2αo Sup	Operation mode of the 2nd Earth Fault elements (see § 2.2.2)	Dis.–Sup.–Dir.	-	-
2αo= 90°	Reference direction of 2nd earth fault elements	0°- 359°	1	°
2Uo 12**V**	Minimum level of the zero-sequence polarizing input voltage for enabling operation of the 2nd earth fault element	1 - 50	1	V
2O 0.002**On**	Trip level of 2nd earth fault element (F67N) in p.u. of the rated current of the earth fault detection C.T.	0.002-0.8-Dis	0.001	On
t2O 0.05**s**	Trip time delay of 2nd earth fault element: In the inverse time operation it is the trip time delay at I_0 = 10x[2O] (see Time Current Curves)	0.05 - 42	0.01	s
B3→2O OFF	Digital Input B3 Blocks timed element 2O	ON - OFF	-	-
F3αo Dis	Operation mode of the 3rd Earth Fault elements (see § 2.2.2)	Dis.–Sup.–Dir.	-	-
3αo= 90°	Reference direction of 3rd earth fault elements	0°- 359°	1	°
3Uo 15**V**	Minimum level of the zero-sequence polarizing input voltage for enabling operation of the 3rd earth fault element	1 - 50	1	V

Display	Description	Setting Range	Step	Unit
3O 0.002**On**	Trip level of third earth fault element (F67N) in p.u. of the rated current of the earth fault detection C.T.	0.002-0.8-Dis	0.001	On
t3O 0.05**s**	Trip time delay of third earth fault element: In the inverse time operation it is the trip time delay at I_0 = 10x[3O] (see Time Current Curves)	0.05 - 42	0.01	s
B3→3OOFF	Digital Input B3 Blocks timed element 3O	ON - OFF	-	-
Uo 20**V**	Trip level of the Sequence (3Uo) overvoltage element	1 – 50 - Dis	1	V
tUo 1.00**s**	Trip time delay of the Zero Sequence overvoltage element	0.05 - 65	0.01	s
Un - **1u**	Operation mode of the first voltage control element **-** = undervoltage **+** = overvoltage **-/+** = under/over voltage **Dis** = function is disactivated	- + -/+ Dis	-	-
1u 10**%Un**	Trip differential level of the 1st voltage control element	5 - 90	1	%Un
t1u 0.1 **s**	Trip time delay of 1st voltage control element	0.05 - 65	0.01	s
Un - **2u**	Operation mode of the second voltage control element **-** = undervoltage **+** = overvoltage **-/+** = under/over voltage **Dis** = function is disactivated	- + -/+ Dis	-	-
2u 20**%Un**	Trip differential level of the 2nd voltage control element	5 - 90	1	%Un
t2u 0.2 **s**	Trip time delay of 2nd voltage control element	0.05 - 65	0.01	s
Ii 1.00 **In**	Rated current of the C/B	0.1 – 9.99	0.01	In
WI 100**Wc**	Maximum level of accumulated breaking energy in multiples of the conventional interruption energy (see § 2.5)	1 - 9999	1	Wc
tBF 0.05**s**	Time delay for Breaker Failure alarm	0.05 - 0.75	0.01	s
NodAd 1	Identification number for the connection on serial communication bus	1 - 250	1	-

When Dis is programmed, the function is disactivated.

12.2 PROGRAMMING THE CONFIGURATION OF OUTPUT RELAYS



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

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

Display		Description	
1I	--3-	Instantaneous element of first overcurrent (F67)	operates relay R1,R2,R3,R4.
t1I	1---	As above, time delayed element.	operates relay R1,R2,R3,R4.
2I	--3-	Instantaneous element of second overcurrent (F67)	operates relay R1,R2,R3,R4.
t2I	1---	As above, time delayed element.	operates relay R1,R2,R3,R4.
3I	----	Instantaneous element of third overcurrent (F67)	operates relay R1,R2,R3,R4.
t3I	----	As above, time delayed element.	operates relay R1,R2,R3,R4.
1O	---4	Instantaneous element of first earth fault element (F67N)	operates relay R1,R2,R3,R4.
t1O	-2--	As above, time delayed element.	operates relay R1,R2,R3,R4.
2O	---4	Instantaneous element of second earth fault element (F67N)	operates relay R1,R2,R3,R4.
t2O	-2--	As above, time delayed element	operates relay R1,R2,R3,R4.
3O	----	Instantaneous element of third earth fault element (F67N)	operates relay R1,R2,R3,R4.
t3O	----	As above, time delayed element.	operates relay R1,R2,R3,R4.
Uo	----	Instantaneous element of the Zero Sequence overvoltage element	operates relay R1,R2,R3,R4.
tUo	----	As above, time delayed element.	operates relay R1,R2,R3,R4.
1U	----	Instantaneous element of the first voltage element	operates relay R1,R2,R3,R4.
t1U	----	As above, time delayed element.	operates relay R1,R2,R3,R4.
2U	----	Instantaneous element of the second voltage element	operates relay R1,R2,R3,R4.
t2U	----	As above, time delayed element.	operates relay R1,R2,R3,R4.
KA2s	----	C/B Breaking Energy maintenance level	operates relay R1,R2,R3,R4.
tBF	----	Breaker Failure signalization	operates relay R2,R3,R4.
tFRESAut		The reset after tripping of the relays associated to the time delayed elements can take place: **(Aut)** automatically when current drops below the trip level. **(Man)** manually by the operation of the "ENTER/RESET" key.	
tB2 2tBF		The blocking of the phase fault elements can be programmed so that it lasts as long the blocking input signal is present (tB2 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 2xtBF (tB2 = 2tBF)	
tB3 2tBF		The blocking of the phase fault elements can be programmed so that it lasts as long the blocking input signal is present (tB3 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 2xtBF (tB3 = 2tBF)	

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

13.2 Mode "TESTPROG" subprogram "WithTRIP"

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

 **WARNING**

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

14. MAINTENANCE

No maintenance is required. Periodically a functional check-out can be made with the test procedures described under MANUAL TEST chapter. In case of malfunctioning please contact Microelettrica Scientifica Service or the local Authorised Dealer mentioning the relay's Serial No reported in the label on relays enclosure.

 **WARNING**

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

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

15. ELECTRICAL CHARACTERISTICS

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

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

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

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

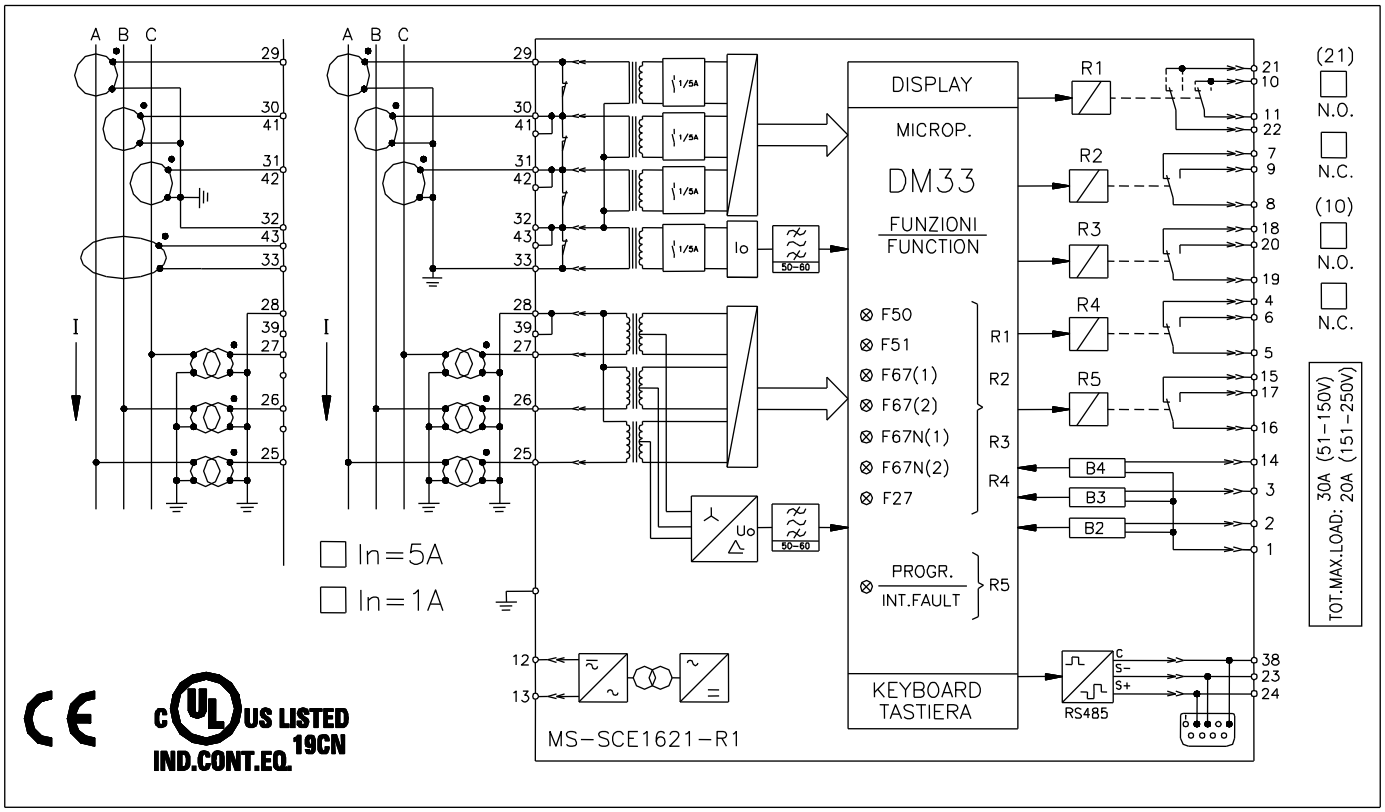
CHARACTERISTICS

❑	Accuracy at reference value of influencing factors	2% In for measure 0,2% On 2% +/- 10ms for times
❑	Rated Current	In = 1 or 5A - On = 1 or 5A
❑	Current overload	200 A for 1 sec; 10A continuos
❑	Burden on current inputs	Phase : 0.01VA at In = 1A ; 0.2VA at In = 5A 0.02VA at On = 1A ; 0.4VA at On = 5A
❑	Rated Voltage	Un = 100V (different on request)
❑	Voltage overload	2 Un continuous
❑	Burden on voltage input	0,2 VA at Un
❑	Average power supply consumption	8.5 VA
❑	Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)
❑	Operation ambient temperature	-10°C / +55°C
❑	Storage temperature	-25°C / +70°C
❑	Humidity	IEC68-2-3 RH 93% Without Condensing at 40°C

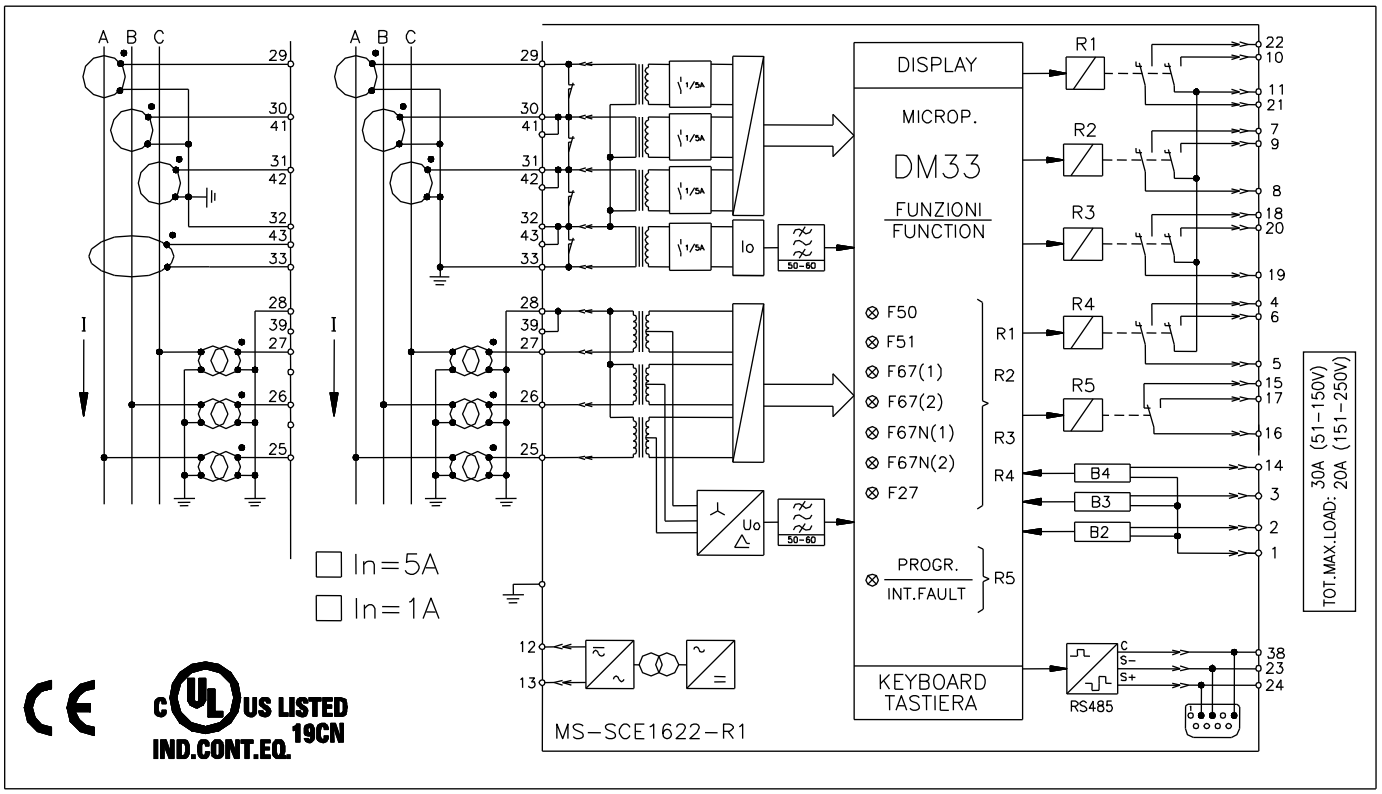
Microelettrica Scientifica S.p.A. - 20089 Rozzano (MI) - Italy - Via Alberelle, 56/68
Tel. (##39) 02 575731 - Fax (##39) 02 57510940
http://www.microelettrica.com **e-mail :** ute@microelettrica.com

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

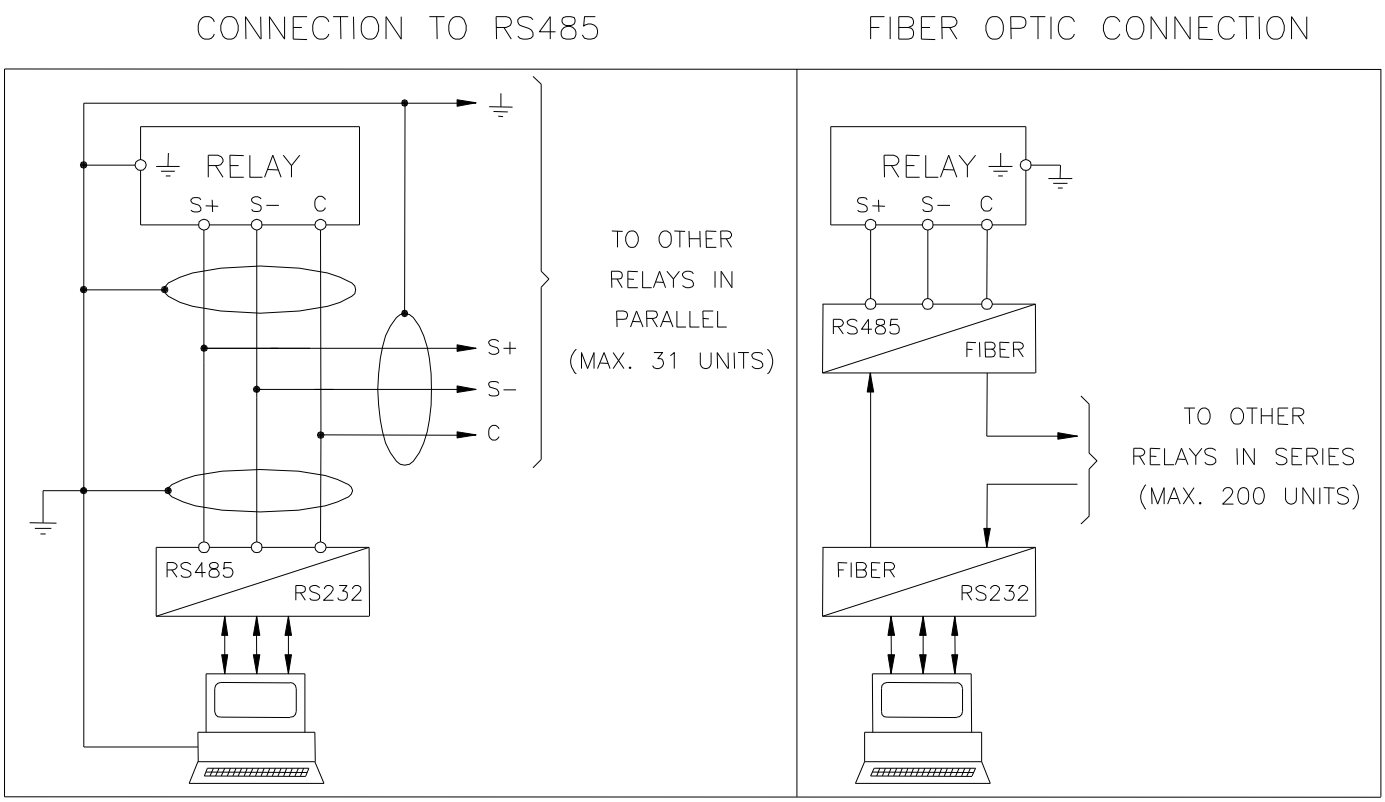
16. CONNECTION DIAGRAM (SCE1621 Rev.1 Standard Output)



16.1 - CONNECTION DIAGRAM (SCE1622 Rev.1 Double Output)

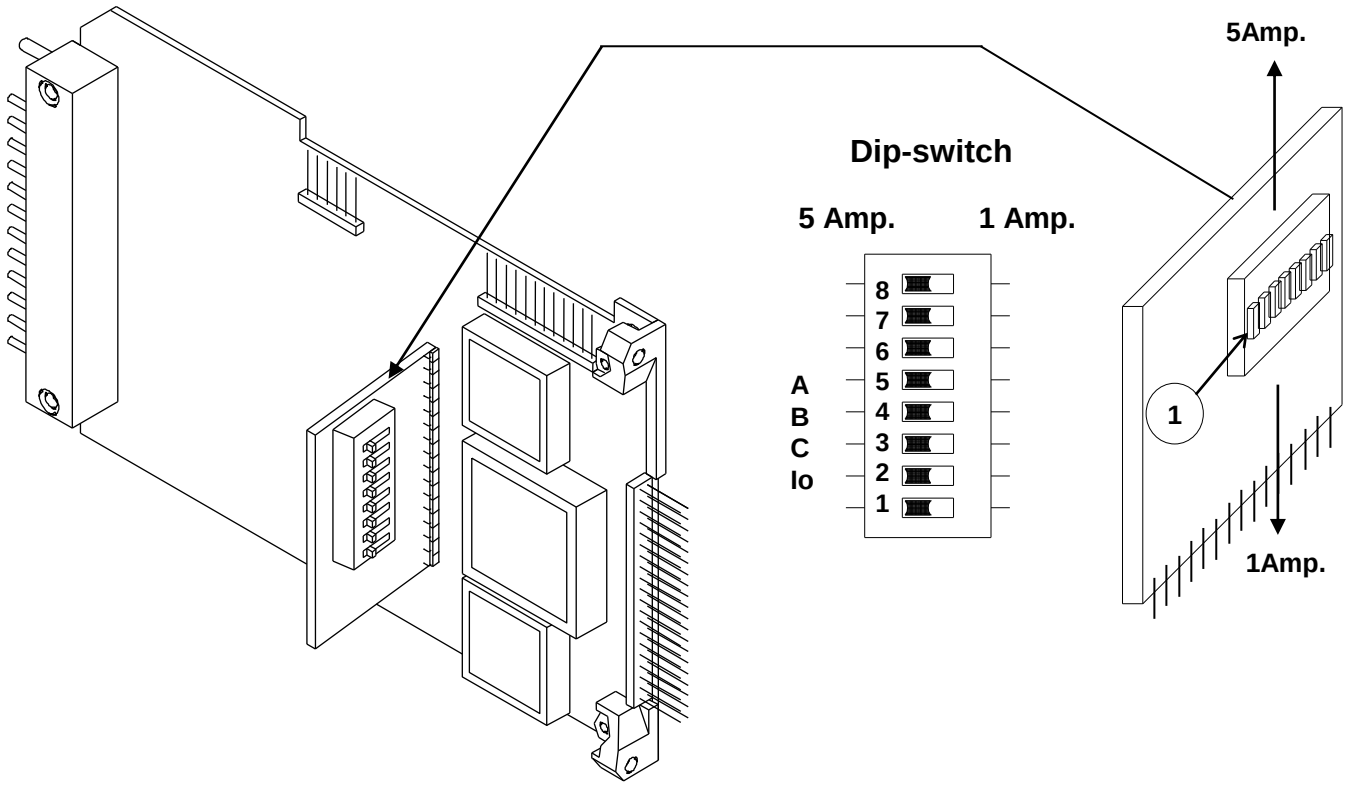


17. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

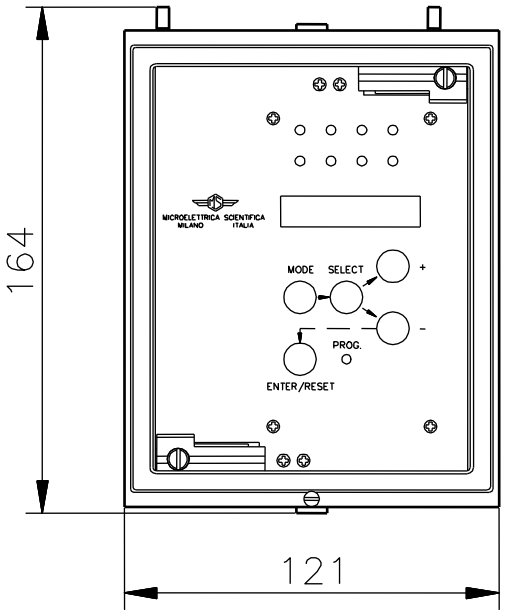


18. CHANGE PHASE CURRENT RATED INPUT 1 or 5A

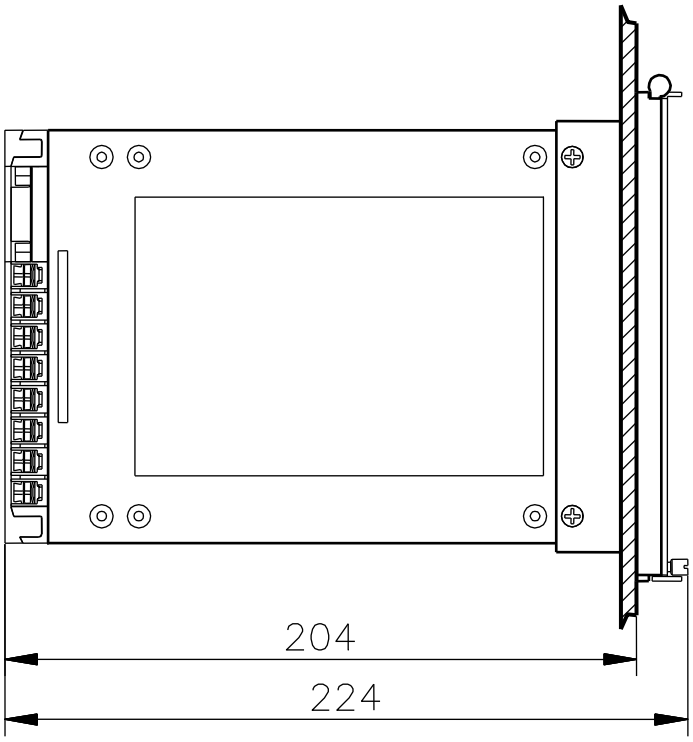
Phase current input can be 1 or 5A (movable jumpers on relay's card).

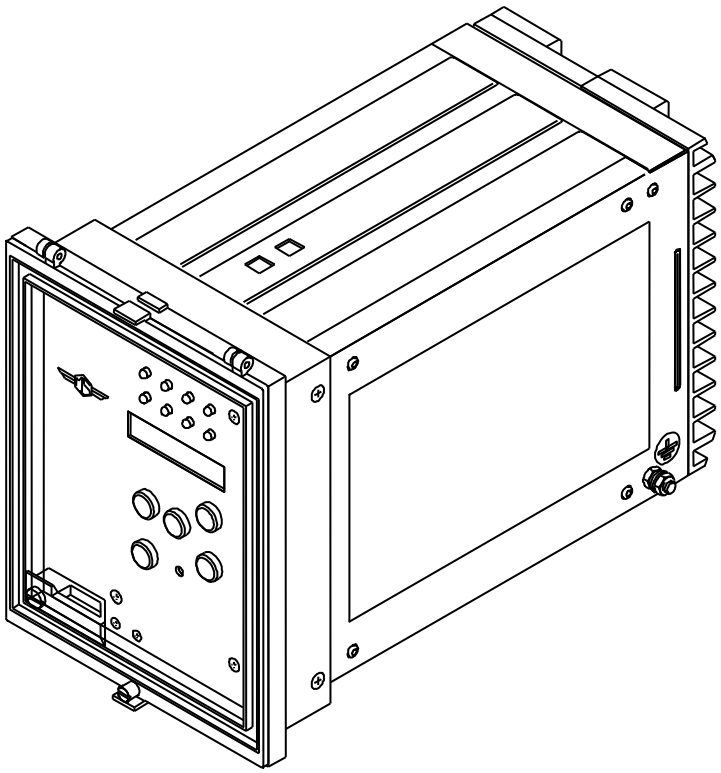


19. OVERALL DIMENSIONS / MOUNTING

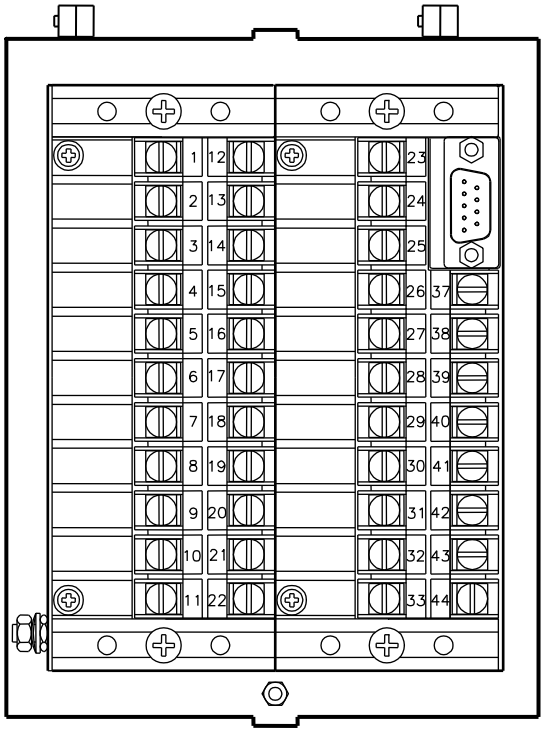


PANEL CUT-OUT 113x142 (LxH)

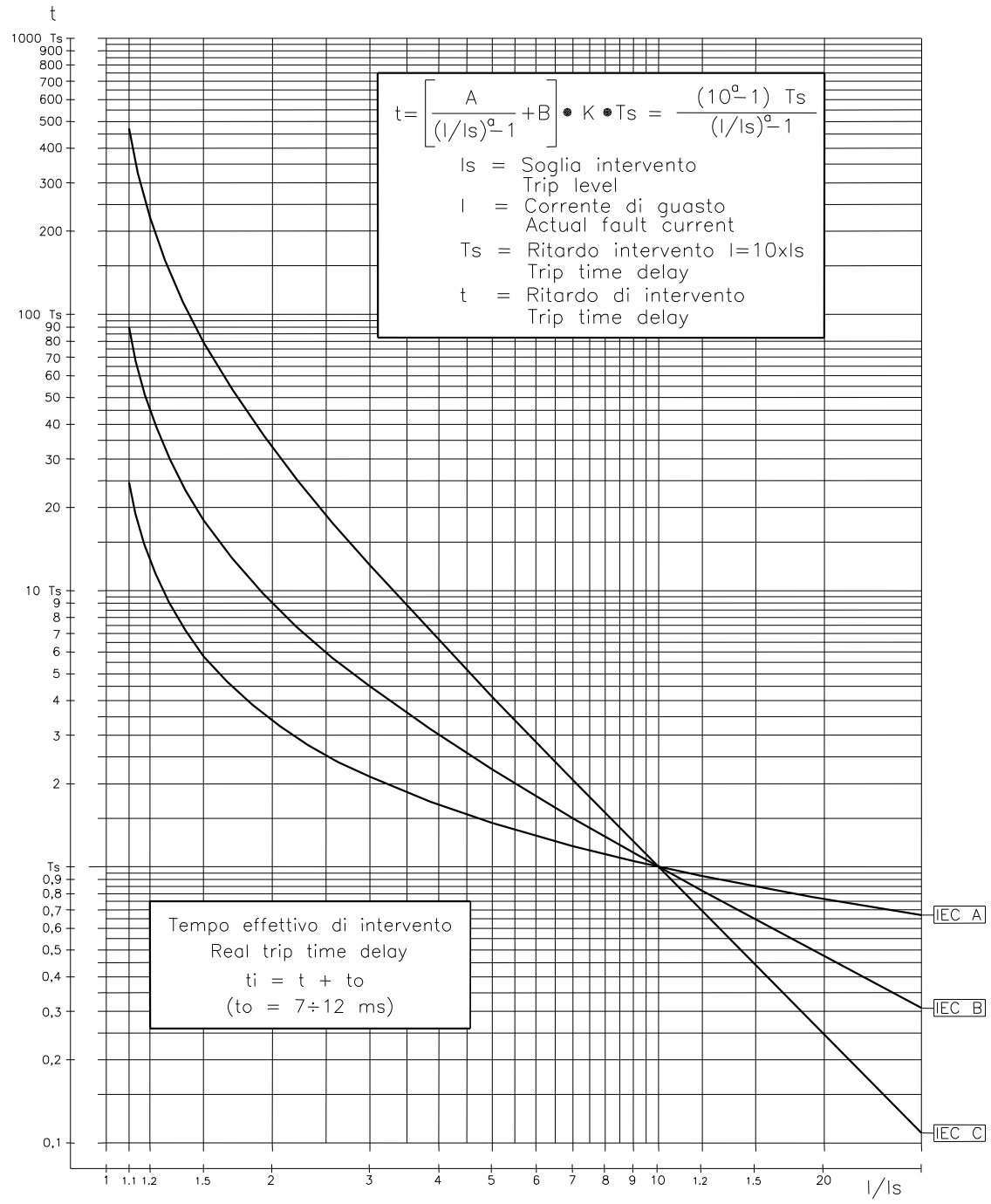




View of Rear
Terminal Connection



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



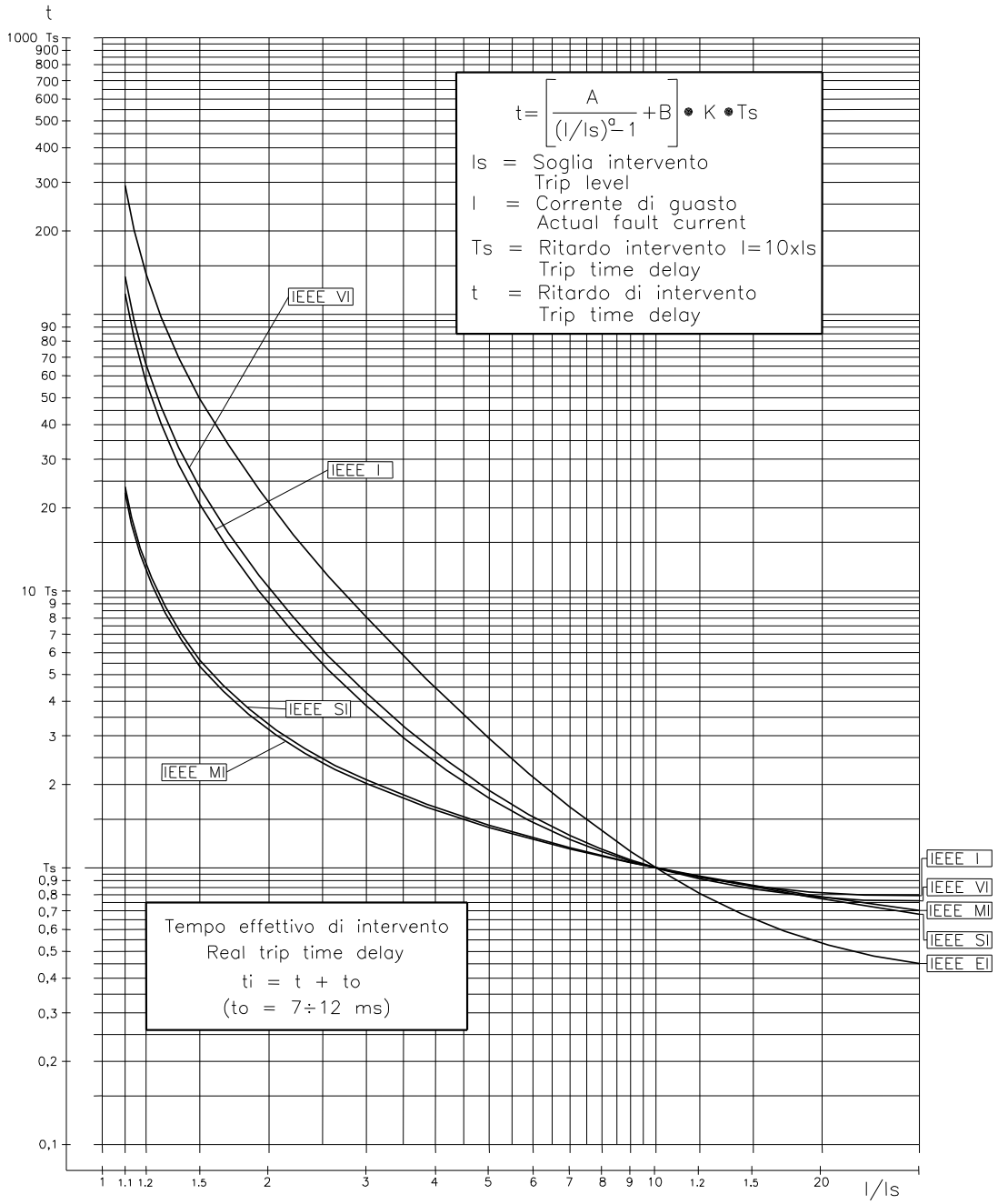
Curve Type	A	B	K	a
IEC A	0.14	0	0.336632	0.02
IEC B	13.5	0	0.666667	1
IEC C	80	0	1.2375	2

F51 { Is = I> = (0.5−4)In ; Ts = tI> = (0.05−30)s

F51N { Is = O> = (0.02−0.4)On ; Ts = tO> = (0.05−30)s

For F51 saturation at I> 50 In
For F51N saturation at Io> 4 On

21. TIME CURRENT CURVES (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 { Is = I> = (0.5−4)In
Ts = tI> = (0.05−30)s

F51N { Is = O> = (0.02−0.4)On
Ts = tO> = (0.05−30)s

For F51 saturation at I> 50 In
For F51N saturation at Io> 4 On

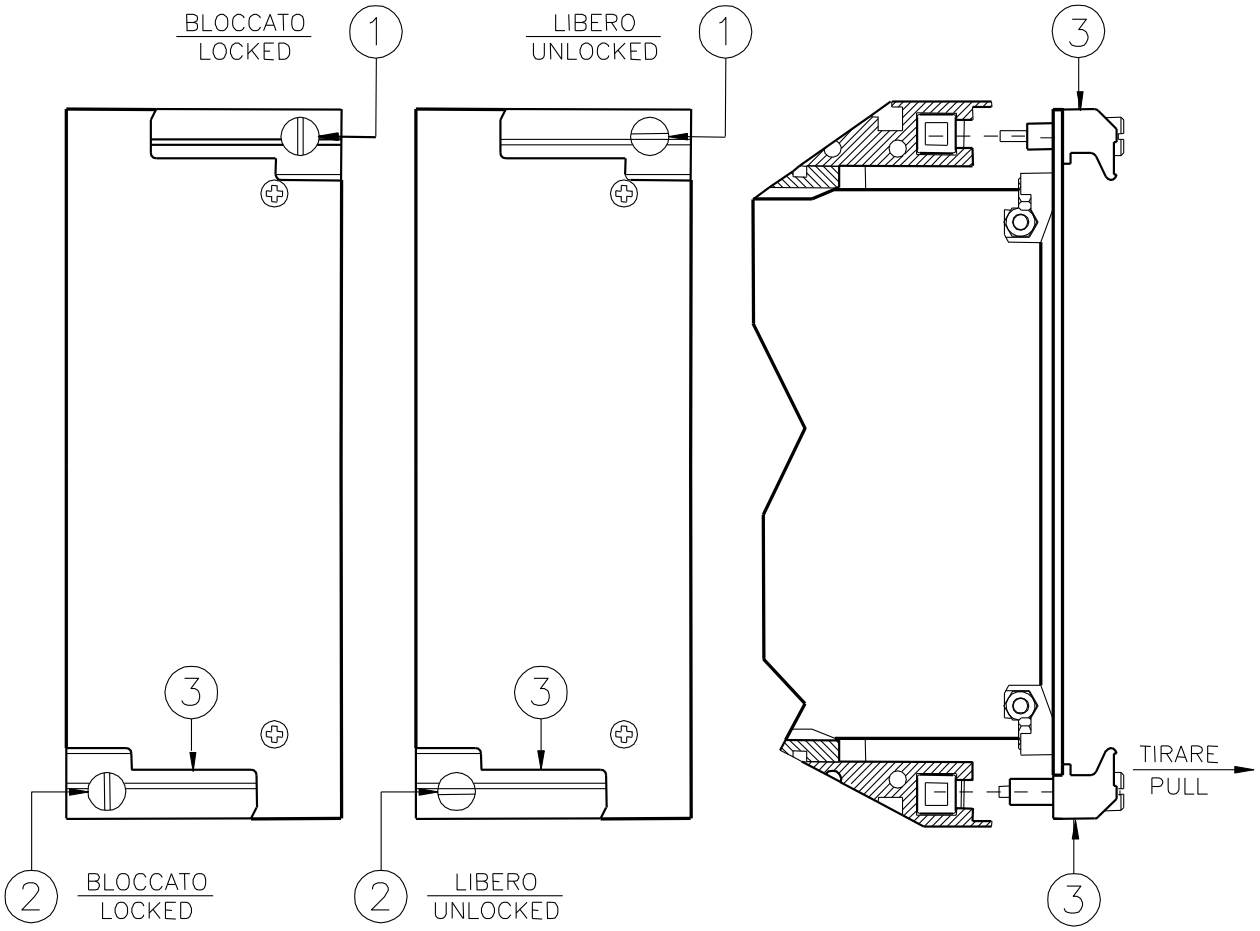
22. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

22.1 - Draw-out

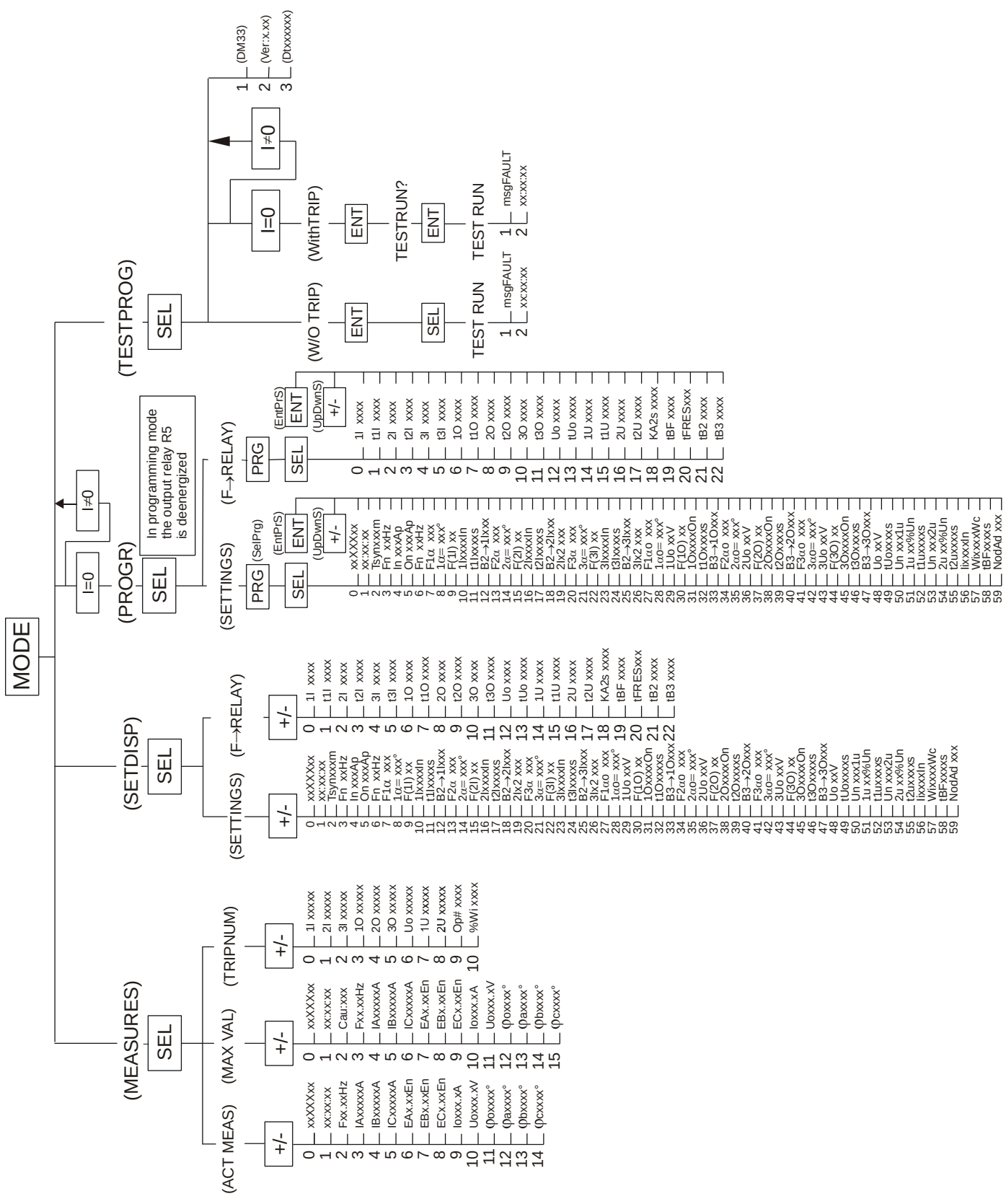
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

22.2 - Plug-in

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



23. KEYBOARD OPERATIONAL DIAGRAM



24. Setting Form – Commissioning Test Record

Relay Type	**DM33**	**Station :**		**Circuit :**	
Date :	**/ /**	**FW Version:**		**Relay Serial Number :**	
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c.	24V(-20%) / 125V(+20%) d.c.	**Rated Current :**	☐ **1A**	☐ **5A**
	☐ 80V(-20%) / 220V(+15%) a.c.	90V(-20%) / 250V(+20%) d.c.			

RELAY PROGRAMMING

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
xxxxxxx	Current date	DDMMMYY	-	random			
xx:xx:xx	Current time	HH:MM:SS	-	random			
Tsyn	Synchronisation Time	5 - 60 - Dis	**m**	Dis			
Fn	Mains frequency	50 - 60	**Hz**	50			
In	Rated primary current of the phase C.Ts.	1 - 9999	**Ap**	500			
On	Rated primary current of the C.Ts.	1 - 9999	**Ap**	500			
UnS	P.Ts. rated secondary phase-to-phase voltage	50 – 125	**V**	100			
F1α	Operation mode of the first phase O/C elements	Dis.-Sup.-Dir.	-	Dir			
1α=	Reference direction of first phase fault elements	0° - 359°	**°**	90			
F(1I)	Operation characteristic of the first overcurrent element	D-A-B-C-MI SI-VI-I-EI	-	D			
1I	Trip level of first overcurrent element	0.1 - 4 - Dis	**In**	0.50			
t1I	Trip time delay of the first overcurrent element	0.05 - 42	**s**	0.05			
B2→1I	Digital Input B2 Blocks timed element 1I	ON - OFF	-	OFF			
F2α	Operation mode of the 2nd phase O/C element	Dis.–Sup.-Dir.	-	Dir			
2α=	Reference direction of 2nd phase fault element	0° - 359°	-	90°			
2I	Trip level of 2nd overcurrent element	0.1 – 40 -Dis	**In**	0.5			
t2I	Trip time delay of the 2nd overcurrent element	0.05 - 42	**s**	0.05			
B2→2I	Digital Input B2 Blocks timed element 2I	ON - OFF	-	OFF			
2Ix2	Automatic doubling of level 2I on inrush	ON - OFF	-	ON			
F3α	Operation mode of the 3rd phase O/C element	Dis.-Sup.-Dir.	-	Dir			
3α=	Reference direction of 3rd phase fault element	0° - 359°	-	90°			
3I	Trip level of 3rd overcurrent element	0.1 – 40 -Dis	**In**	0.5			
t3I	Trip time delay of the 3rd overcurrent element	0.05 - 42	**s**	0.05			
B2→3I	Digital Input B2 Blocks timed element 3I	ON - OFF	-	OFF			
3Ix2	Automatic doubling of level 3I on inrush	ON - OFF	-	ON			
F1αo	Operation mode of the first Earth Fault elements	Dis.–Sup.-Dir.	-	Dir			
1αo=	Reference direction of first earth fault elements	0°- 359°	-	90°			
1Uo	Minimum level of the zero-sequence polarizing input voltage	1 - 50	**V**	10			
F(1O)	Operation characteristic of the first earth fault element (F67N)	D-A-B-C-MI SI-VI-I-EI	-	D			
1O	Trip level of first earth fault element (F67N)	0.002-0.4-Dis	**On**	0.002			
t1O	Trip time delay of first earth fault element	0.05 - 42	**s**	0.05			
B3→1O	Digital Input B3 Blocks timed element 1O	ON - OFF	-	OFF			
F2αo	Operation mode of the 2nd Earth Fault elements	Dis.–Sup.–Dir.	-	Sup			
2αo=	Reference direction of 2nd earth fault elements	0°- 359°	-	90°			
2Uo	Minimum level of the 2nd zero-sequence polarizing input voltage	1 - 50	**V**	12			
2O	Trip level of 2nd earth fault element (F67N)	0.002-0.8-Dis	**On**	0.002			
t2O	Trip time delay of 2nd earth fault element	0.05 - 42	**s**	0.05			
B3→2O	Digital Input B3 Blocks timed element 2O	ON - OFF	-	OFF			
F3αo	Operation mode of the 3rd Earth Fault elements	Dis.–Sup.–Dir.	-	Dis			
3αo=	Reference direction of 3rd earth fault elements	0°- 359°	-	90°			
3Uo	Minimum level of the 3rd zero-sequence polarizing input voltage	1 - 50	**V**	15			
3O	Trip level of third earth fault element (F67N)	0.002-0.8-Dis	**On**	0.002			
t3O	Trip time delay of third earth fault element	0.05 - 42	**s**	0.05			
B3→3O	Digital Input B3 Blocks timed element 3O	ON - OFF	-	OFF			
Uo	Trip level of the Sequence (3Uo) overvoltage element	1 – 50 - Dis	**V**	20			

tUo	Trip time delay of the Zero Sequence overvoltage element	0.05 - 65	**s**	1.00			
Un	Operation mode of the first voltage control element	- + -/+ Dis	**1u**	-			
1u	Trip differential level of the 1st voltage control element	5 - 90	**%U n**	10			
t1u	Trip time delay of 1st voltage control element	0.05 - 65	**s**	0.1			
Un	Operation mode of the second voltage control element	- + -/+ Dis	**2u**	-			
2u	Trip differential level of the 2nd voltage control element	5 - 90	**%U n**	20			
t2u	Trip time delay of 2nd voltage control element	0.05 - 65	**s**	0.2			
Ii	Rated current of the C/B	0.1 – 9.99	**In**	1.00			
WI	Maximum level of accumulated Breaking Energy	1 - 9999	**Wc**	100			
tBF	Time delay for Breaker Failure alarm	0.05 - 0.75	**s**	0.05			
NodAd	Identification number for communication bus	1 - 250	-	1			

CONFIGURATION OF OUTPUT RELAYS

Default Setting						Actual Setting				
Protect. Element	**Output Relays**				**Description**	**Protect. Element**	**Output Relays**			
1I	-	-	3	-	Instantaneous element of first overcurrent (F67)	**1I**				
t1I	1	-	-	-	As above, time delayed element.	**t1I**				
2I	-	-	3	-	Instantaneous element of second overcurrent (F67)	**2I**				
t2I	1	-	-	-	As above, time delayed element.	**t2I**				
3I	-	-	-	-	Instantaneous element of third overcurrent (F67)	**3I**				
t3I	-	-	-	-	As above, time delayed element.	**t3I**				
1O	-	-	-	4	Instantaneous element of first earth fault element (F67N)	**1O**				
t1O	-	2	-	-	As above, time delayed element.	**t1O**				
2O	-	-	-	4	Instantaneous element of second earth fault element (F67N)	**2O**				
t2O	-	2	-	-	As above, time delayed element	**t2O**				
3O	-	-	-	-	Instantaneous element of third earth fault element (F67N)	**3O**				
t3O	-	-	-	-	As above, time delayed element.	**t3O**				
Uo	-	-	-	-	Instantaneous element of the Zero Sequence overvoltage element	**Uo**				
tUo	-	-	-	-	As above, time delayed element.	**tUo**				
1U	-	-	-	-	Instantaneous element of the first voltage element	**1U**				
t1U	-	-	-	-	As above, time delayed element.	**t1U**				
2U	-	-	-	-	Instantaneous element of the second voltage element	**2U**				
t2U	-	-	-	-	As above, time delayed element.	**t2U**				
KA2s	-	-	-	-	C/B Breaking Energy maintenance level	**KA2s**				
tBF		-	-	-	Breaker Failure signalization	**tBF**				
tFRES	Aut				Relay reset mode Aut = Automatic , Man = Manual	**tFRES**				
tB2	2tBF				The blocking time for phase faults	**tB2**				
tB3	2tBF				The blocking time for earth faults	**tB3**				

Commissioning Engineer : _____ **Date :** _____

Customer Witness : _____ **Date :** _____