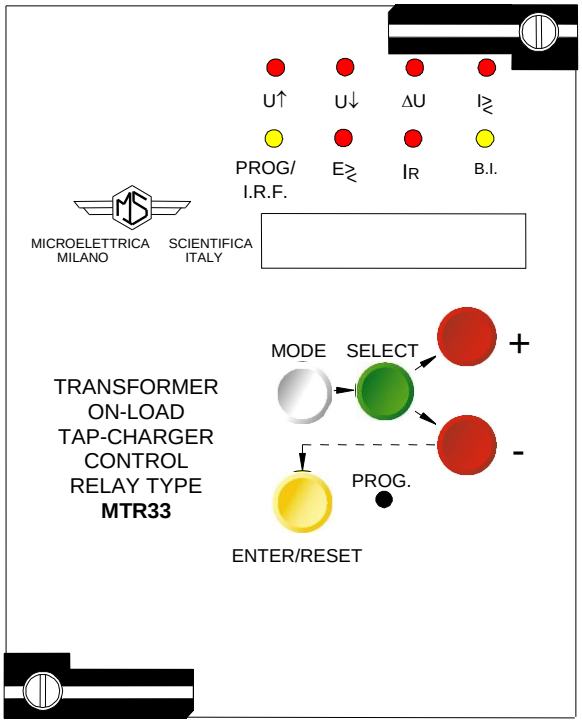
MICROPROCESSOR CONT ROL RELAY FOR TRANSFORMER ON-LOAD TAP-CHANGER

TYPE

MTR33

OPERATION MANUAL



CE

- **Voltage control**
- **Voltage and current Lock-out**
- **Continuos self supervision with built-in autodiagnostic**
- **Serial communication interface**
- **Local display of measurements, settings, event recording and operation counters**
- **Local and remote programming of settings and operation modes**

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 produced by M.S. are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

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

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

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

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

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

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

1.10 - MAINTENANCE

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

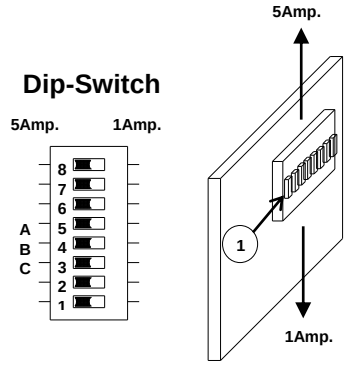
1.11 - FAULT DETECTION AND REPAIR

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

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

2. GENERAL CHARACTERISTICS AND OPERATION

Input quantities 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.
Make electric connection in conformity with the diagram reported on relay's enclosure. Check that input currents are same as reported on the diagram and on the test certificate. The auxiliary power is supplied by a built-in interchangeable module fully isolated and self protected.
Input rated current can be set to 1 or 5A by 3 dip-switches provided on relay's card (A-B-C).



2.1 - AUXILIARY POWER SUPPLY

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

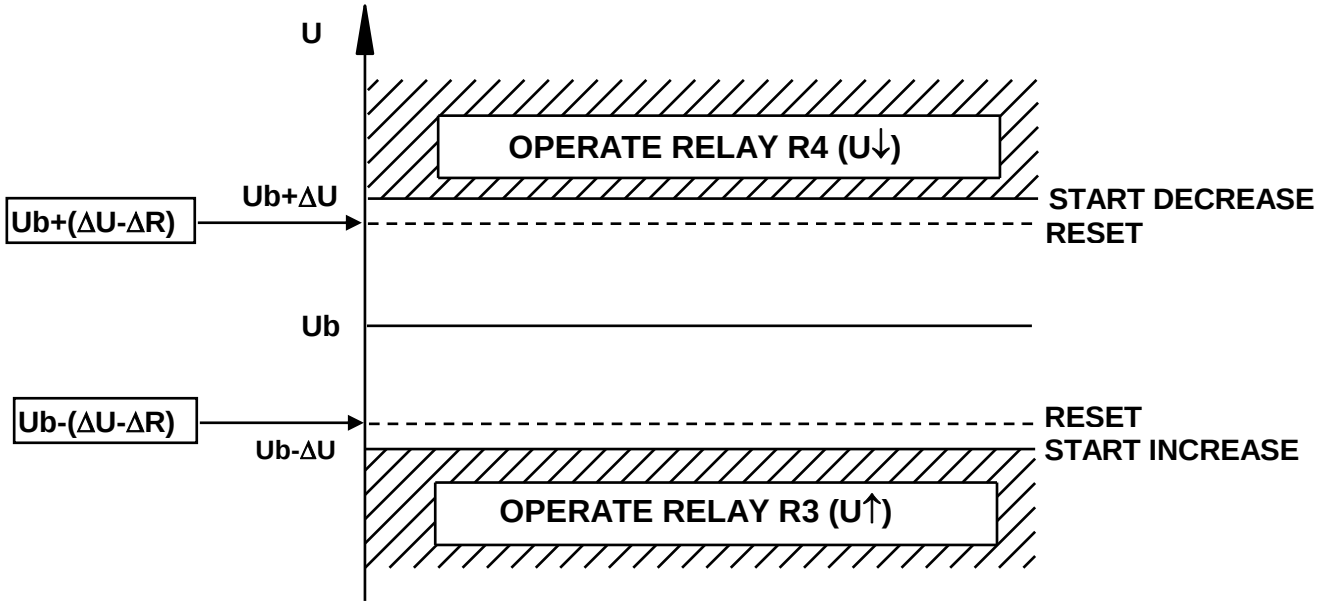
a) - 24V(-20%) / 110V(+15%) a.c
24V(-20%) / 125V(+20%) d.c.

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

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

2.2 - OPERATION OF VOLTAGE CONTROL

Voltage regulator control starts operating when the difference between the input voltage U and the set reference voltage [Ub] exceeds the set level [ΔU] : U< [Ub] - [ΔU]; U> [Ub] + [ΔU].
Voltage regulator control stops operating when the voltage difference becomes smaller than [ΔU] - [ΔR]: U> [Ub-(ΔU-ΔR)]; U< [Ub+(ΔU-ΔR)]



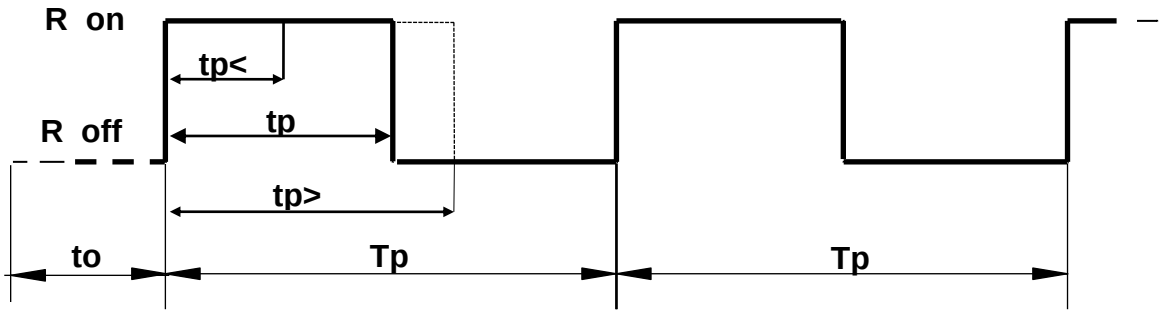
N.B. Voltage regulation is inhibited :

- When the voltage is out of the set limits : [E<] > E > [E>]
- When the current is out of the set limits : [I<] > I > [I>]
- When Lock-out input **3** is active. (Terminals 1-3 shorted; see also § 7)
- When the current exceeds the set value “Ib”.
  The variable “Ib” represents the rated current of the controlled Transformer as per unit of the CT rated current: Ib = (0.3-1.2)In.

- The voltage “ INCREASE “ control operates the output relay R3
- The voltage “ DECREASE “ control operates the output relay R4.

When the operation condition is detected (zone U↑ or U↓) the wait time [to] is started; at the end of [to] the pulse cycle Tp of the appropriate relay starts.

- The cycle is repeated every period [Tp]
- The output relay is energized at the beginning of Tp
- The relay remains energized (pulse duration) not less than the time [tp<] and not longer than the time [tp>]
- The actual pulse duration **tp** is proportional to the measured voltage difference according to the set value of the gain [Gs/V]



tp=[tp<]+[Gs/V] x ΔU ≤ [tp>]

if **[Gs/V] = 0 → tp = tp<**

if **([Gs/V] x ΔU) >(tp> - tp<) → tp = tp>**

Gs/V = [s/v]

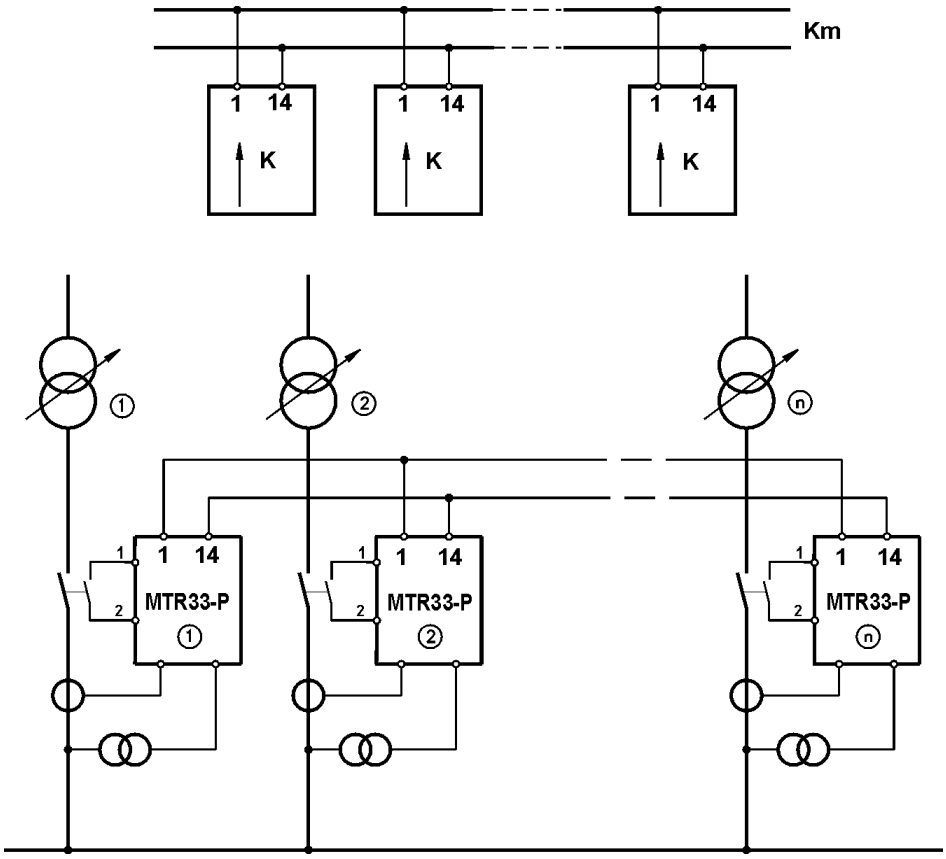
ΔU = [V]

2.3 - OPTIONAL CURRENT CIRCULATION CONTROL (OPTION P)

When Transformers with On-Load Tap Changer are operated in parallel on a common bus-bar, the Regulating Relay MTR33 must be fitted with the option “P” to control the Tap-Changer mechanism so that all the Transformers supply Reactive Power “Q” and active Power “W” proportionally to their rating thus preventing, or limiting, the circulation of Reactive Current among the Transformers.
When fitted with the option “P” (MTR33-P), each relay compares the share “Kx” of the current supplied by the Transformer it controls, with the average “Km” of the current supplied by all the Transformers operating in parallel:

Kx > Km drives the Tap-Changer to “Decrease Voltage”.
Kx < Km drives the Tap-Changer to “Increase Voltage”.

All the MTR33-P relays are connected in parallel to a common control bus (terminals 1-14) where the average current is measured.



The action of the Circulation Current Control is complementary to that of the Voltage Control:

- If both the Voltage Control and the Reactive Current Control are active, the first operates normally if the action of the second is in the same direction (U<Ub and Kx<Km or U>Ub and Kx>Km). If the action of the Reactive Current Control is in the opposite direction the (U<Ub and Kx>Km or U>Ub and Kx<Km), the Voltage Control is blocked.

- If the Voltage Control is <u>not</u> active, the Reactive Current Control operates independently.

2.3.1 – Operation of the Circulation Current Control

Circulation Current Control starts operation when the difference between “Kx“ and “Km” exceeds the set level:

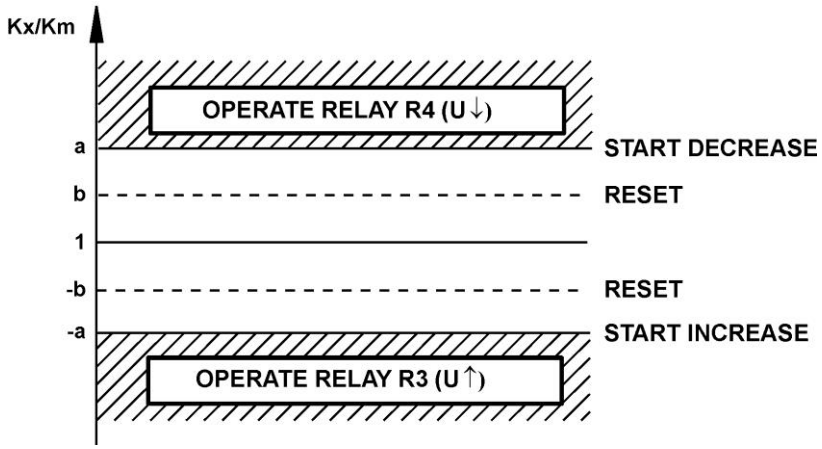
Kx > (1+[a])Km ⇒ Decrease voltage
Kx < (1-[a])Km ⇒ Increase voltage

Reset takes places when the difference comes back to the admissible level:

Kx < (1+[b])Km
Kx > (1-[b])Km

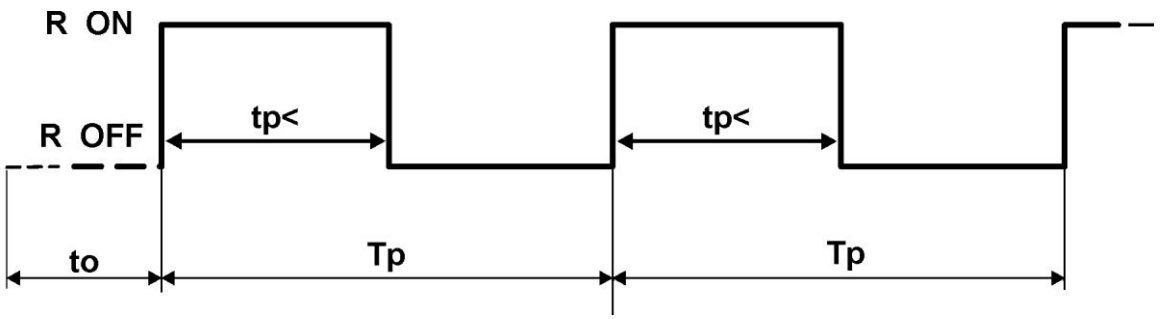
N.B. Circulation Current control is inhibited:

- When the voltage is out of the set limits: [E<] > E > [E>]
- When current is less than 5% of “Ib” (see § 2.2).
- When the current exceeds the set level of “Ib” (see § 2.2).
- When the current is out of the set limits: [I<] > I > [I>].
- When Lock-out input 3 is active (Terminals 1-3 shorted; see also §7).
- When the digital input 2 is not active (Terminals 1-2 open; see also §7).



The Circulation Current Control operates independently only if no voltage control operation is active (see §2.2).
When the Circulation Current Control is in the working zone (Kx > (1+[a])Km; Kx < (1-[a])Km), it operates the outputs relays “R3” or “R4” to respectively Increase or Decrease Voltage. (see § 2.2)
At the end of the wait time [To], the pulse cycle “Tp” of the appropriate relay starts:

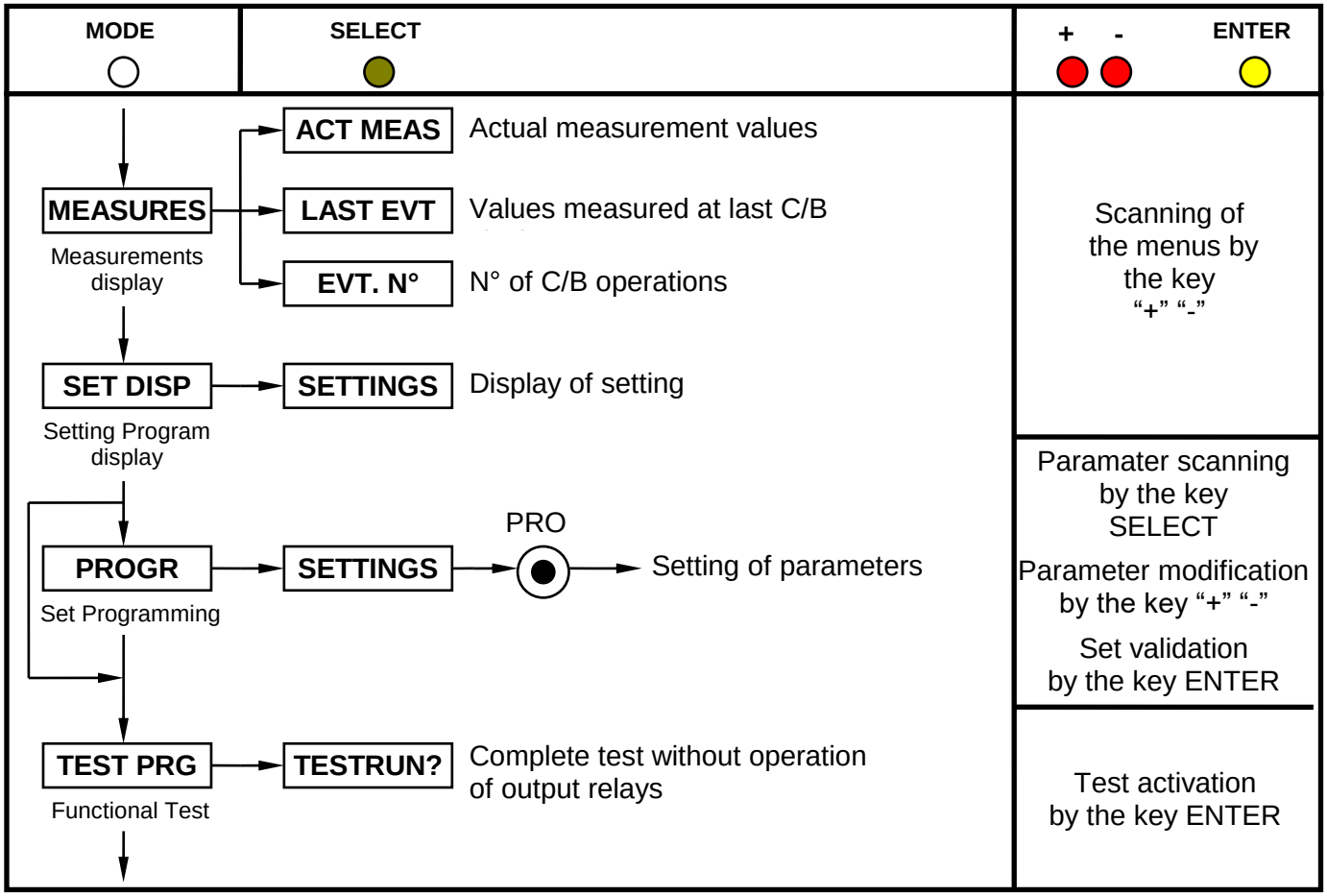
- The cycle is repeated every period “Tp”
- The output relay remains energized for the time [tp<]

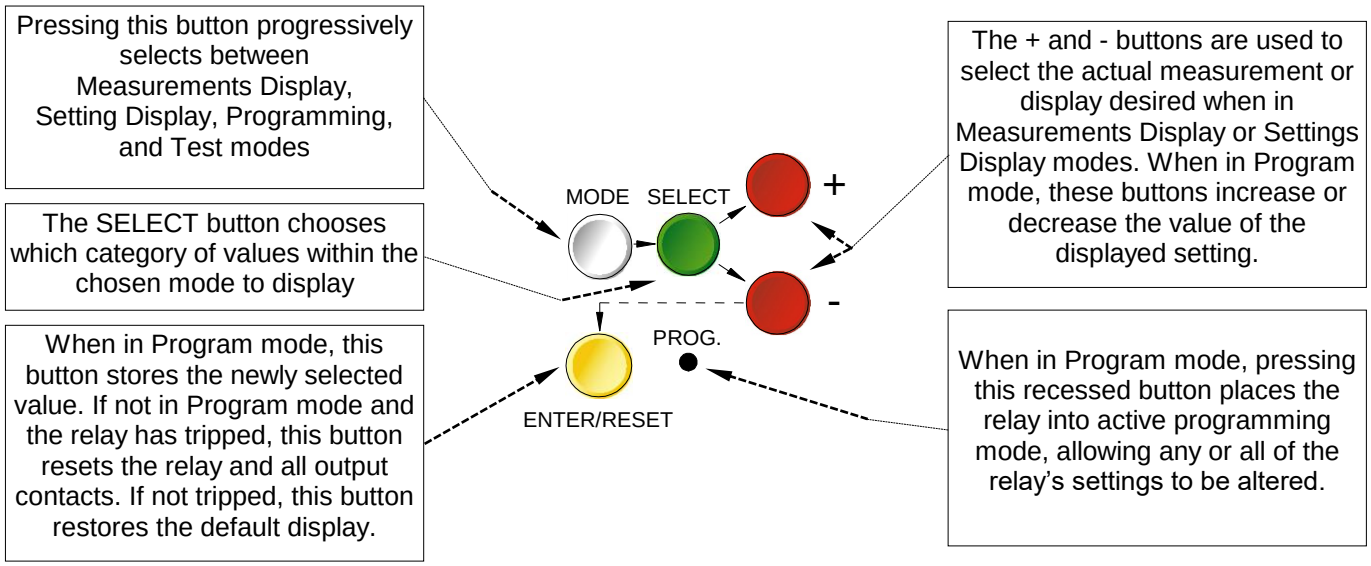


3. CONTROLS AND MEASUREMENTS

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)

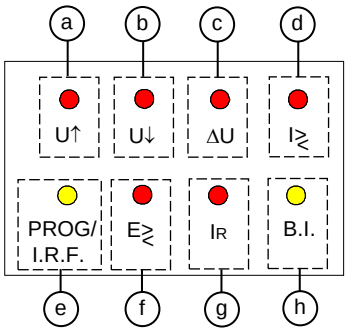
FIG.1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



a)	Red LED	**U↑**	❑ Lit-on when increase voltage control relay R3 is energized (pulse time tp). ❑ Flashing during the pause time (Tp - tp).
b)	Red LED	**U↓**	❑ Same as above with reference to decrease voltage control relay R4.
c)	Red LED	**ΔU**	❑ Flashing if ΔU ≥ [ΔU]. ❑ OFF when ΔU < [ΔU].
d)	Red LED	**I ≷**	❑ Flashing when any of the phase currents IA, IB, IC exceeds the set limits: [I<] > IA, IB, IC > [I>]. ❑ Lit-on when a current control element trips at the end of the set time delay [tI>], [tI<].
e)	Yellow LED	**PROG/ I.R.F.**	❑ Flashing when in programming mode. ❑ Lit-on when in Program mode and whenever a relay internal fault is detected.
f)	Red LED	**E ≷**	❑ Flashing any of the phase-to-neutral voltage EA, EB, EC exceeds the set limits : [E<] > EA, EB, EC > [E>]. ❑ Lit-on when a voltage control element trips at the end of the set time delay [tE>], [tE<].
g)	Red LED	**IR**	❑ Flashing when Current Circulation is detected.
h)	Yellow LED	**B.I.**	❑ Flashing when Regulator Lock-out input **3** is active (terminals 1-3 shorted).

5. OUTPUT RELAYS

Five normally deenergized relays are available:

- **R1** : Normally deenergized (energized on trip), can be associated to the time delayed elements tI>, tI<, tE>, tE<.
- **R2** : Normally deenergized (energized on trip), can be associated to tI>, tI<, tE>, tE<.
- **R3** : Energized to increase voltage.
- **R4** : Energized to decrease voltage.
- **R5** : Diagnostic. Normally energized, is not programmable and it is deenergized on:
  - Internal fault.
  - Power supply failure.
  - During the programming.

6. SERIAL COMMUNICATION (Optional: see relevant instruction manual)

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

7. DIGITAL INPUTS

Two digital inputs, active when the relevant terminals are shorted by cold contacts, are available:

- **2** (terminals 1 - 2) : When terminals 1-2 are open, the digital input blocks the Circulation Current Control element (option P) and isolates the relay from the Control bus connected to terminals 1-14.
- **3** (terminals 1 - 3) : When terminals 1-3 are shorted, the digital input blocks the operation of the regulator's control relays (R3, R4)

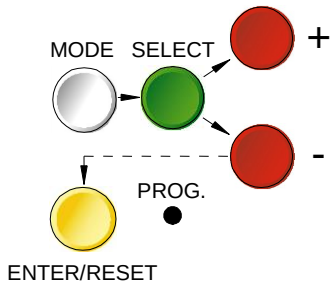
8. TEST

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$4). 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. (Anyway the output relay associated to reclosing in not energized during test)

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" -"LAST EVT"-"EVT. N°", 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
F xx.xx **Hz**	Input Frequency : 40.00 – 70.00 Hz.
EAxxx**%En**	Voltage measured at input EA (% of Un:√3).
EBxxx**%En**	Voltage measured at input EB (% of Un:√3).
ECxxx**%En**	Voltage measured at input EA (% of Un:√3).
ΔUxxx**%Ub**	Voltage difference **ΔU=** $\left\lvert Ub - \frac{Ea+EB+EC}{3} \bullet \sqrt{3} \right\rvert \bullet \frac{100}{Ub}$ (% of Ub)
IAxxxxx**A**	Current measured at input IA (RMS primary Amps).
IBxxxxx**A**	Current measured at input IB (RMS primary Amps).
ICxxxxx**A**	Current measured at input IC (RMS primary Amps).
φxxxxxx**°**	Phase displacement (I_A^E_A).
Kxxxx**%**	Transformer Current (%Ib).
Kmxxxx**%**	Bus-Bar average current (%Σ K).

10.2 – EVT. N°

Counter of the number of operation pulses to the regulator
The N° is increased at each next operation.
The memory is not-volatile and can be cancelled only with a secret procedure

Display	Description
U↑xxxxxx	Increasing voltage R3
U↓xxxxxx	Decreasing voltage R4

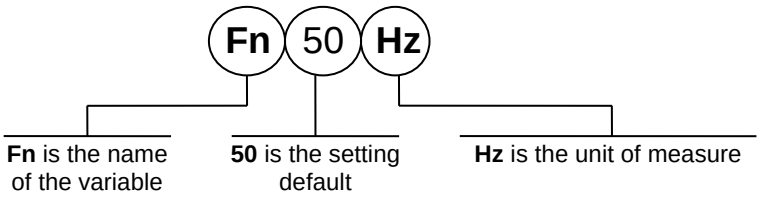
11. READING OF PROGRAMMED SETTINGS

Enter the mode "SET DISP", select the menu "SETTINGS", scroll information available in the menu by keys "+" or "-".
SETTINGS= values of relay's operation parameters 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/BI flashes
Operation of the output relays is blocked during programming.
Enter MODE "PROG" and SELECT either "SETTINGS" for programming of parameters ;
enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT while "+" or "-" are pressed.
Press key "ENTER/RESET" to validate the set values.

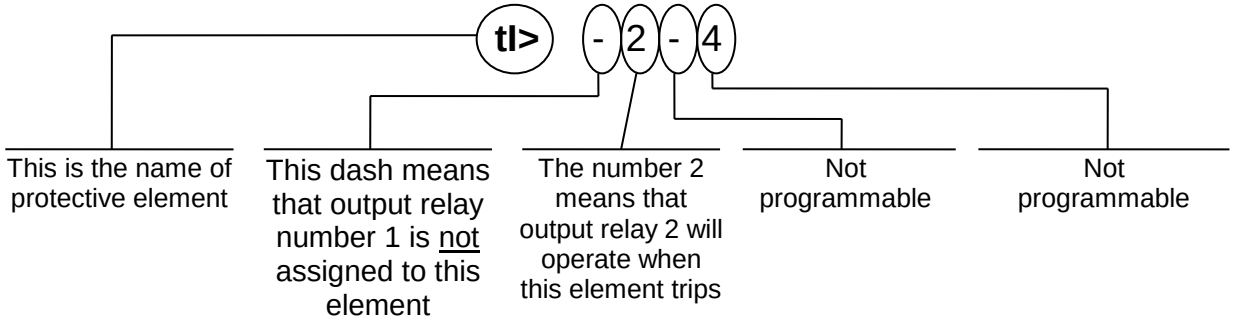
12.1 - PROGRAMMING OF FUNCTIONS SETTINGS



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

Display	Description	Setting Range	Step	Unit
Fn 50 **Hz**	Mains frequency: setting range	50 or 60	10	Hz
Un 100**V**	Rated input voltage	100-125	1	V
In 500**A**	Rated primary current of CT's	0-9999	1	A
Ib 1.00 **In**	Transformer rated current (control lock-out level)	0.30-1.2	0.01	In
E< 80**%En**	Undervoltage level for regulation Lock-out (En=Un:√3)	Dis - 15-120	1	%En
tE< 3 **s**	Undervoltage alarm time delay	0.1-30	0.1	s
E>120**%En**	Overvoltage level for regulation Lock-out (En=Un:√3)	15-120-Dis	1	%En
tE> 3 **s**	Overvoltage alarm time delay	0.1-30	0.1	s
Ub100**%Un**	Reference voltage	70-150	1	%Un
ΔU 10**%Ub**	Regulator insensitivity (minimum operation voltage difference) U%>(100+ΔU-ΔR); U%<(100-ΔU)	1-20	1	%Ub
ΔR1.0**%Ub**	Drop out level (reset voltage differential) U%<(100+ΔU-ΔR); U%>(100-ΔU+ΔR)	0.1-9.9	0.1	%Ub
a	Operation level of the Reactive Current Control	0.10-0.50-Dis	0.01	-
b	Reset level of the Reactive Current Control	0.05-0.45	0.01	-
to 10 **s**	Minimum operation wait time	1-600	1	s
Tp 10.0 **s**	Period of pulse to voltage regulator	0.1-60	0.1	s
tp< 0.5 **s**	Minimum pulse duration	0.1-60	0.1	s
tp> 6.0 **s**	Maximum pulse duration	0.1-60	0.1	s
G 0.2 **s/V**	Gain for proportional pulse duration	0-9.9	0.1	s/V
I> 1.5 **In**	Overcurrent level for regulation Lock-out	0.1-5-Dis	0.1	In
tI> 2.0 **s**	Overcurrent alarm time delay	0.1-30	0.1	s
I< 0.2 **In**	Undercurrent level for regulation Lock-out	Dis-0.1-5	0.1	In
tI< 10.0 **s**	Undercurrent alarm time delay	0.1-30	0.1	s
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	-

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 programmable relays in the sequence 1,2 (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
tI> 1---	Delayed element of overcurrent operates relays R1 and/or R2
tI< -2--	Delayed element of undercurrent operates relays R1 and/or R2
tE> 1---	Delayed element of overvoltage operates relays R1 and/or R2
tE< -2--	Delayed element of undervoltage operates relays R1 and/or R2
tFRes: A	The reset after tripping of the relays associated to the time delayed elements can take place: **(A)** automatically when current drops below the trip level. **(M)** manually by the operation of the "ENTER/RESET" key.

13. MANUAL AND AUTOMATIC TEST OPERATION

13.1 - Mode "TESTPROG" subprogram "TEST RUN?"

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 (Fnxx.xxHz)
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.

Further operation of key SELECT instead of the TEST programs gives the indication of the version and production date of the firmware

14. MAINTENANCE

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

WARNING

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

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

15. POWER FREQUENCY INSULATION TEST

Every relay individually undergoes a factory insulation test according to IEC255-5 standard at 2 kV, 50 Hz 1min. Insulation test should not be repeated as it unusefully stresses the dielectrics.
When doing the insulation test, the terminals relevant to serial output must always be short circuited to ground. When relays are mounted in switchboards or relay boards that have to undergo the insulation tests, the relay modules must be drawn-out of their enclosures and the test must only include the fixed part of the relay with its terminals and the relevant connections.
This is extremely important as discharges eventually tacking place in other parts or components of the board can severely damage the relays or cause damages, not immediately evident to the electronic components.

16. ELECTRICAL CHARACTERISTICS

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

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

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

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

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

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

CHARACTERISTICS

❑	Accuracy at reference value of influencing factors	2% 2% +/- 10ms	for measure for times
❑	Rated Current	In = 1 or 5A	
❑	Current overload	200 A for 1 sec; 10A continuous	
❑	Burden on current inputs	Phase : 0.01VA at In = 1A; 0.2VA at In = 5A	
❑	Rated Voltage	Un = 100V (different on request)	
❑	Voltage overload	2 Un continuous	
❑	Burden on voltage input	0,08 VA at Un	
❑	Average power supply consumption	8.5 VA	
❑	Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)	

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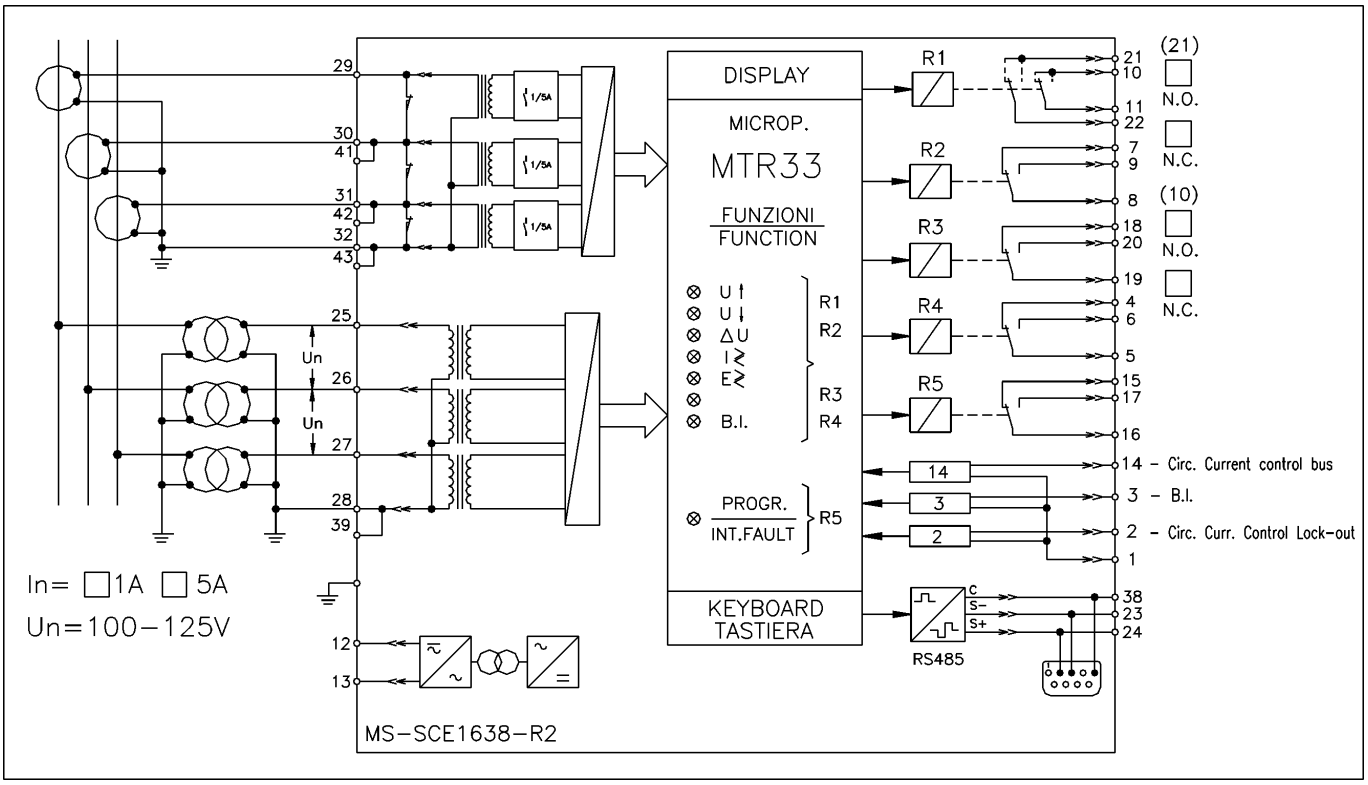
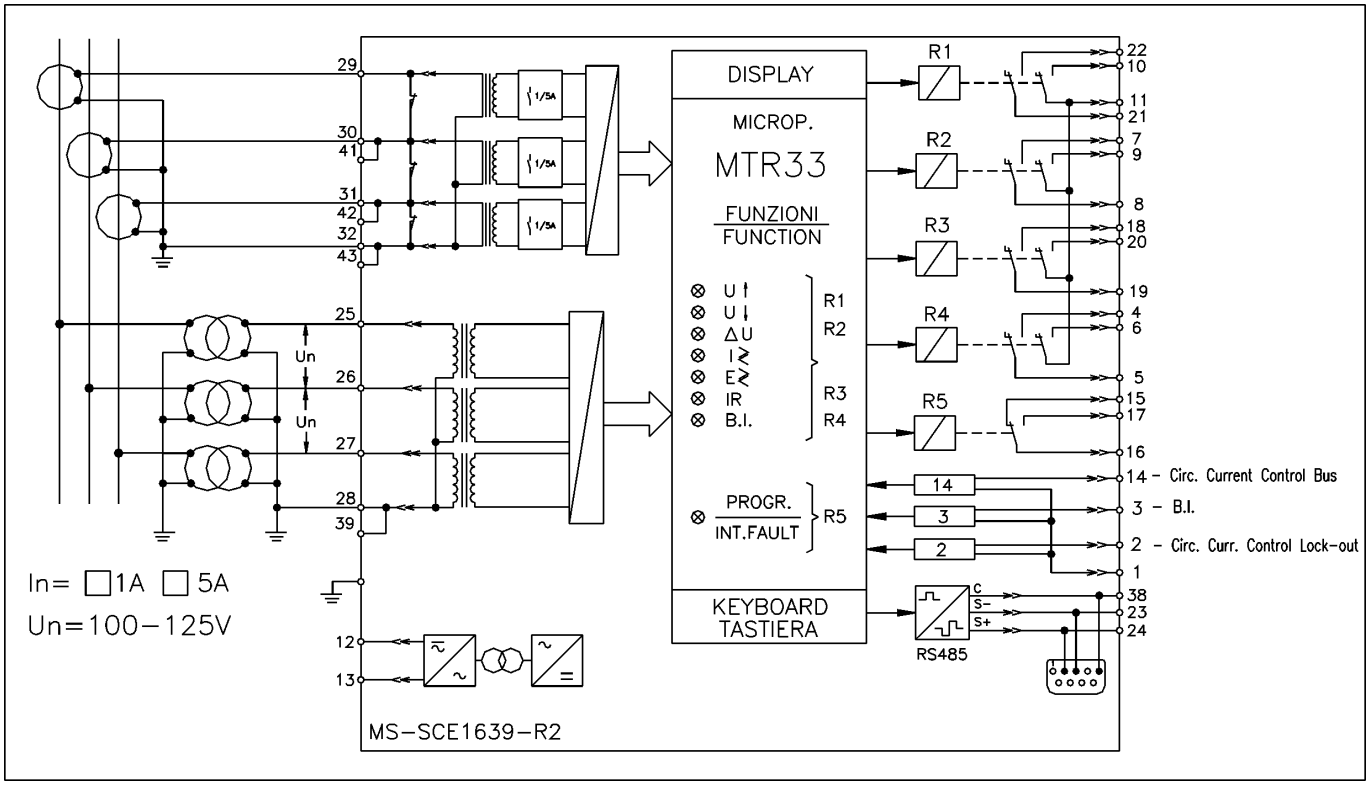
17. CONNECTION DIAGRAM (SCE1638 Rev.2 Standard Output)

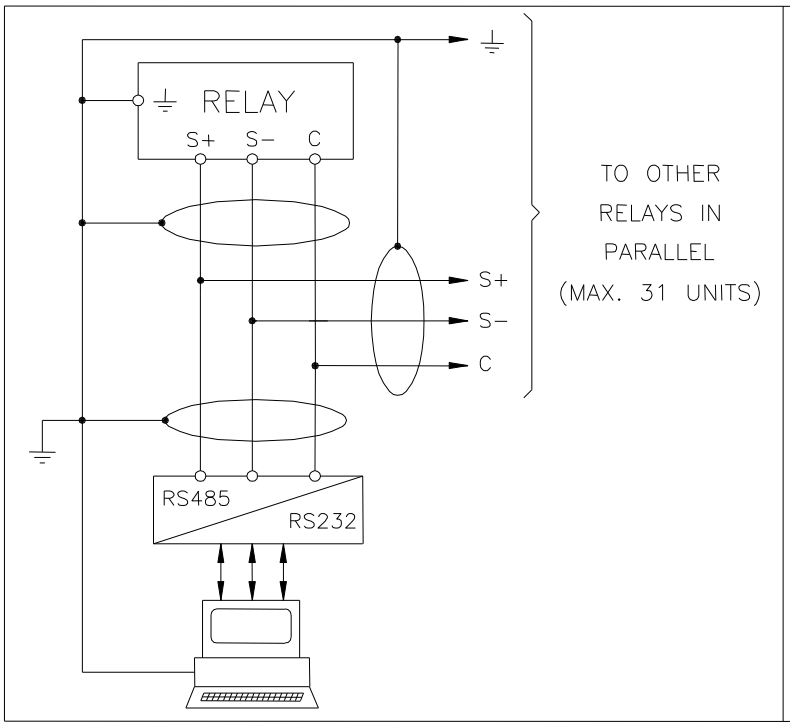


17.1 - CONNECTION DIAGRAM (SCE1639 Rev.2 Double Output)

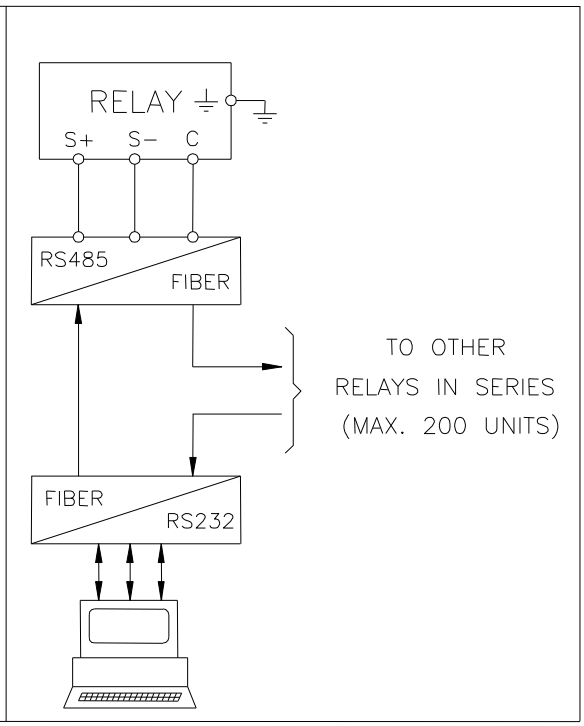


18. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

CONNECTION TO RS485



FIBER OPTIC CONNECTION



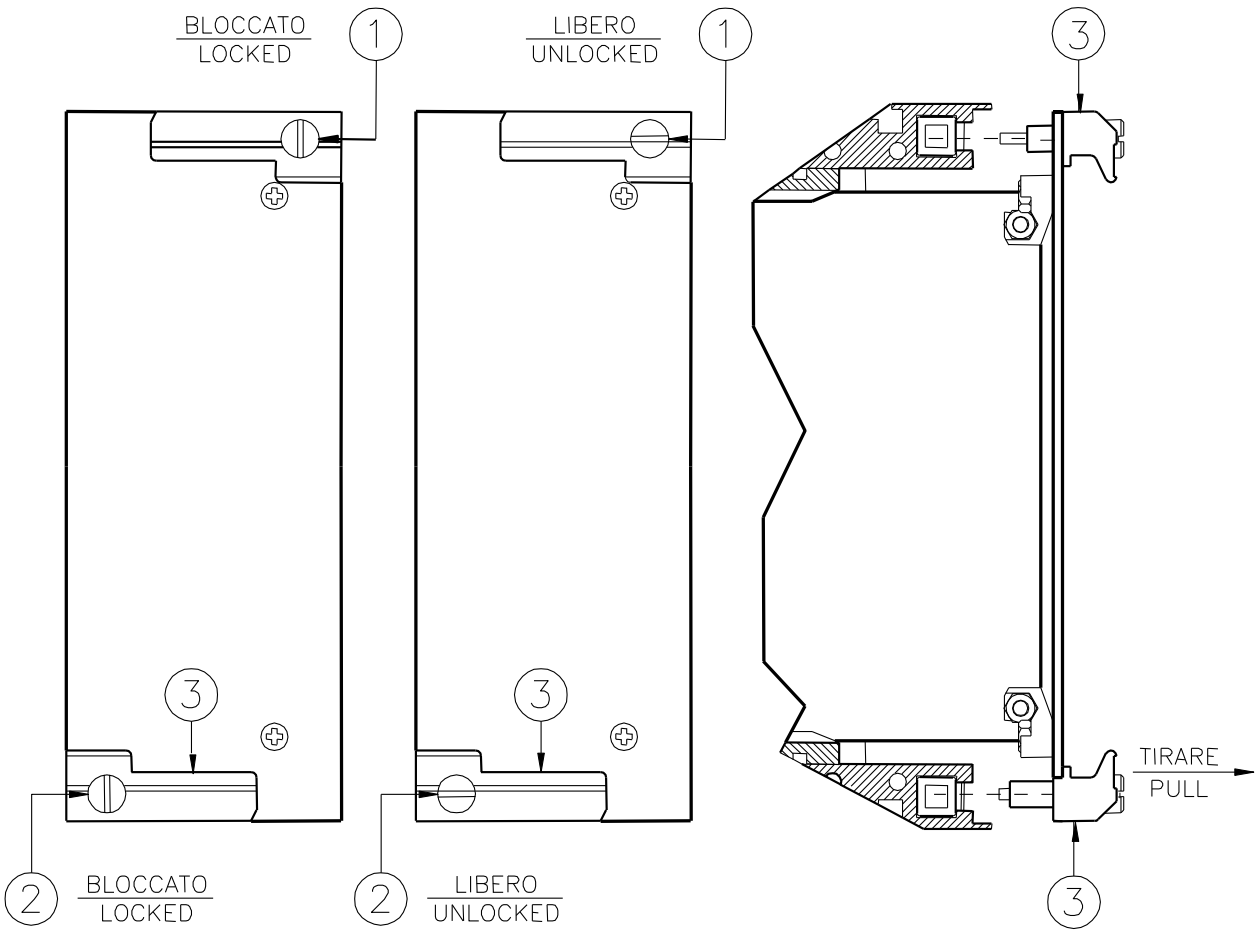
19. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

19.1 Draw-out

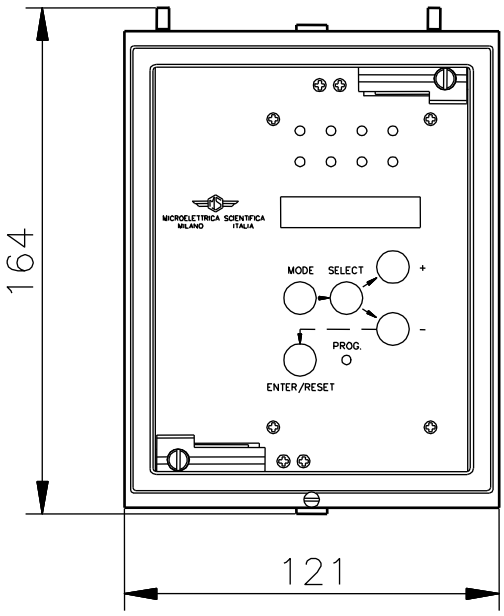
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

19.2 Plug-in

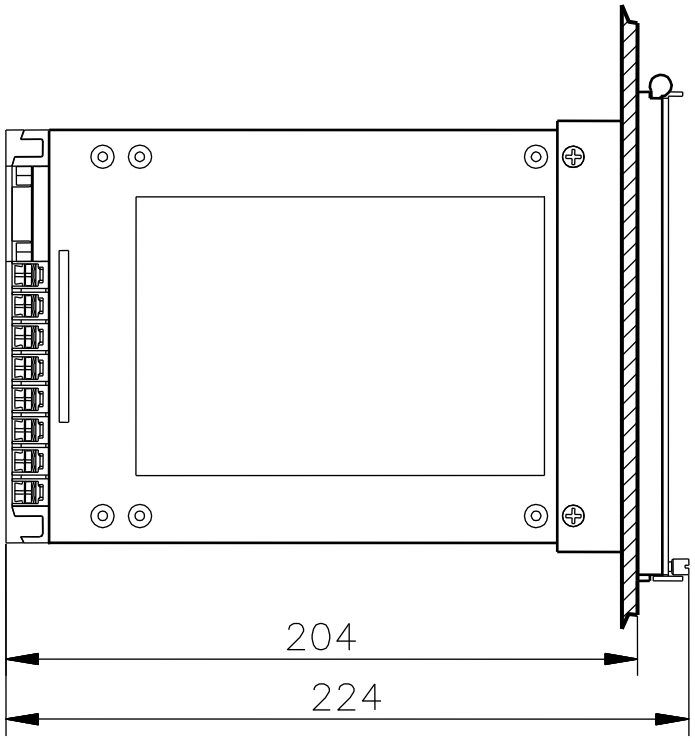
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position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

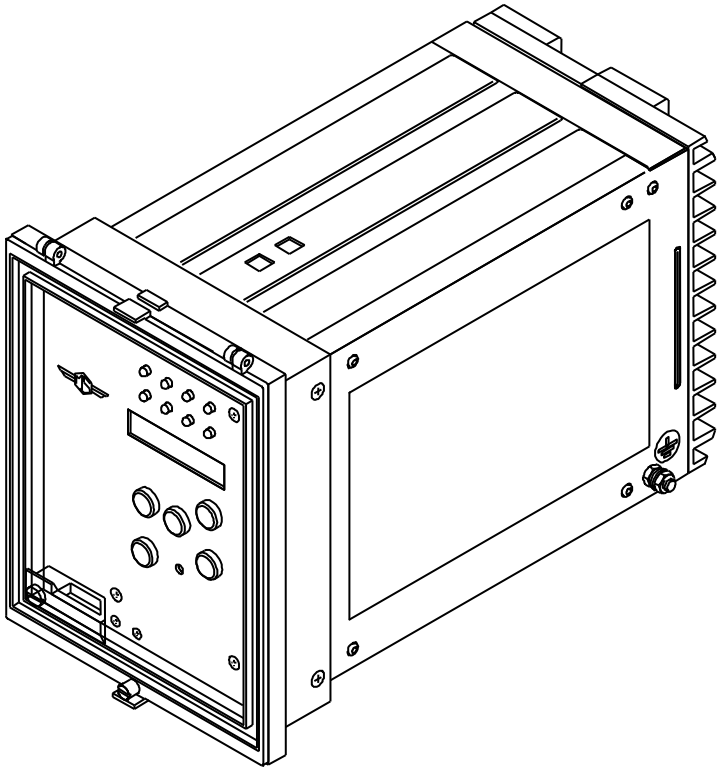


20. MOUNTING

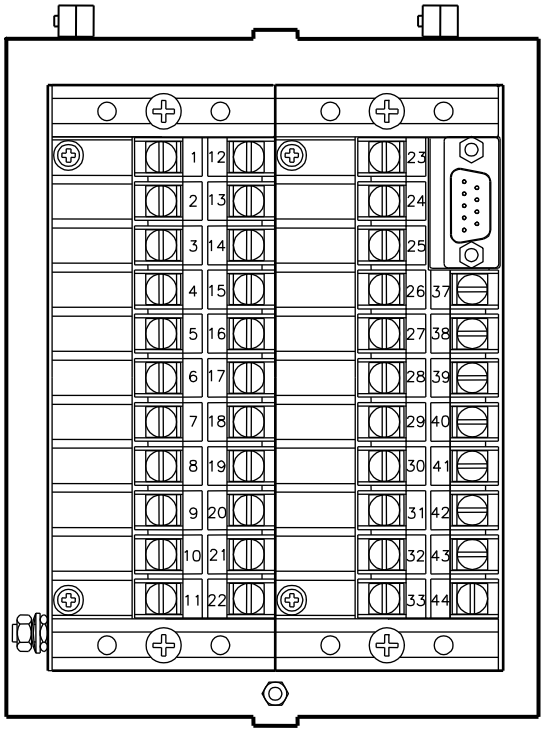


PANEL CUT-OUT 113x142 (LxH)

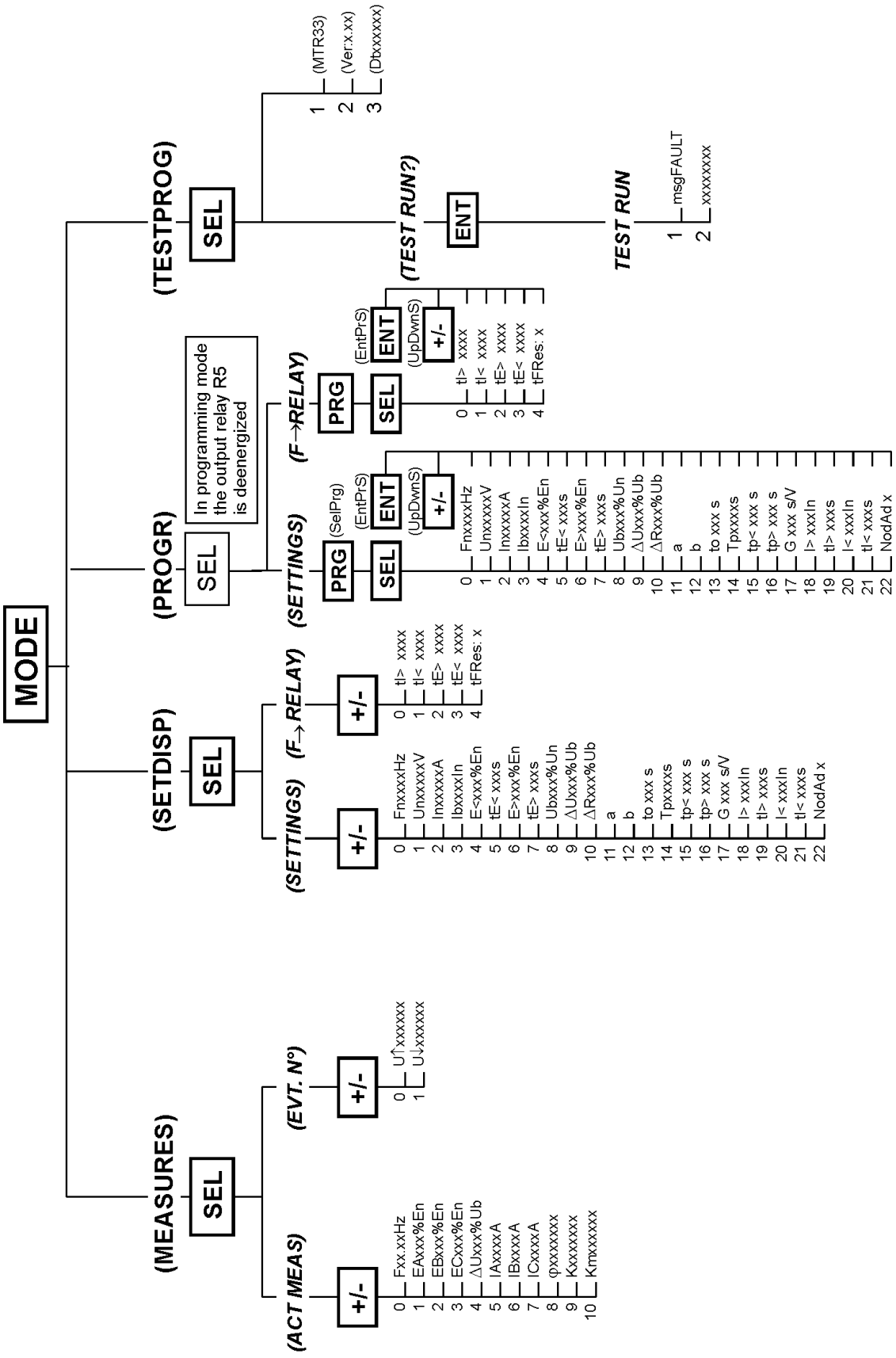




View of Rear Terminal Connection



21. KEYBOARD OPERATIONAL DIAGRAM



22. SETTING'S FORM

Relay Type	**MTR33**	**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
Fn	System Frequency	50 or 60	**Hz**	50			
Un	Rated input voltage	100-125	**V**	100			
In	Rated primary current of CT's	0-9999	**A**	500			
Ib	Transformer rated current (control lock-out level)	0.30-1.2	**In**	1.00			
E<	Undervoltage level for regulation Lock-out (En=Un:√3)	Dis - 15-120	**%En**	80			
tE<	Undervoltage alarm time delay	0.1-30	**s**	3			
E>	Overvoltage level for regulation Lock-out (En=Un:√3)	15-120-Dis	**%En**	120			
tE>	Overvoltage alarm time delay	0.1-30	**s**	3			
Ub	Reference voltage	70-150	**%Un**	100			
ΔU	Regulator insensitivity	1-20	**%Ub**	10			
ΔR	Drop out level	0.1-9.9	**%Ub**	1.0			
a	Operation level of the Reactive Current Control	0.10-0.50-Dis	-	-			
b	Reset level of the Reactive Current Control	0.05-0.45	-	-			
to	Minimum operation wait time	1-600	**s**	10			
Tp	Period of pulse to voltage regulator	0.1-60	**s**	10.0			
tp<	Minimum pulse duration	0.1-60	**s**	0.5			
tp>	Maximum pulse duration	0.1-60	**s**	6.0			
G	Gain for proportional pulse duration	0-9.9	**s/V**	0.2			
I>	Overcurrent level for regulation Lock-out	0.1-5-Dis	**In**	1.5			
tI>	Overcurrent alarm time delay	0.1-30	**s**	2.0			
I<	Undercurrent level for regulation Lock-out	Dis-0.1-5	**In**	0.2			
tI>	Undercurrent alarm time delay	0.1-30	**s**	10.0			
NodAd	Identification number	1 - 250	**-**	1			

CONFIGURATION OF OUTPUT RELAYS

Default Setting			Description	Actual Setting		
Protective Element	**Output Relays**			**Protective Element**	**Output Relays**	
tI>	-	-	Low-set phase overcurrent pick-up	**tI<**		
tI<	1	-	Time delayed low-set phase overcurrent	**tI<**		
tE>	-	-	High-set phase overcurrent pick-up	**tE>**		
tE<	-	2	Time delayed high-set phase overcurrent	**tE<**		
tFRes:	A		Relay reset mode A=Automatic, M=Manual (*)	**tFRes:**		

Commissioning Engineer : _____ **Date :** _____

Customer Witness : _____ **Date :** _____