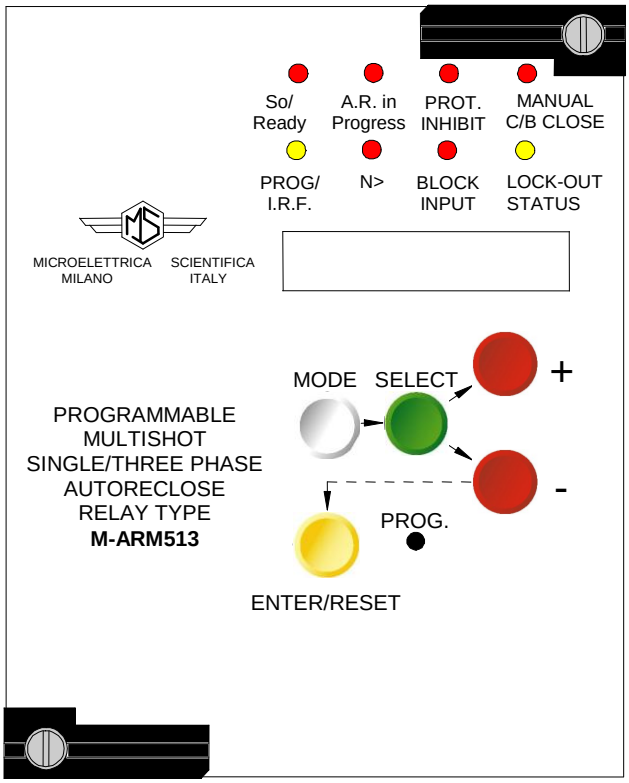
MULTIFUNCTION AUTORECLOSING CONTROL RELAY

TYPE

M-ARM513

OPERATION MANUAL



Selectable Single and/or Three phase autoreclosing
Up to 4 programmable reclosure shots
Sequence coordination
Serial communication
Event recording

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 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.

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

Make electrical connection in conformity with the diagram reported on relay's enclosure.
The auxiliary power is supplied by a build-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. / 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 - Digital Inputs

The relay is controlled via 11 digital inputs directly energized by the relay internal auxiliary voltage and controlled by external cold contacts.
The minimum pick-up current is 2.5mA and the resistance of the control contact must be less than 4 kOhm.
The maximum voltage at the open terminals of the digital inputs is less than 30V.
With reference to the wiring diagram SCE1546 the digital inputs operate as follows:

❑	**Input 1 – 2**	= Block A.R.	:	When activated (1 - 2 shorted) the operation of relay is blocked and the Led “Block Input“ is “ON”. When activation is removed the relay goes to the initial state “S0”.
❑	**Input 1 – 3**	= Synchrocheck	:	It detects the permissive signal from an external Synchrocheck relay (see § 3.7).
❑	**Input 1- 14**	= Reset	:	It resets instantaneously the relay from the Lock-out state “Sb1” to the initial state “S0”.
❑	**Input 1 – 26**	= C/B Aux. Switch	:	It is connected to the normally Open auxiliary contact of the Circuit Breakers giving the signalization of Closed State of all the poles.
❑	**Input 1 - 27**	= C/B Healthy/Ready	:	It is connected to the normally Open auxiliary contact of the C/B giving the signalization of Breakers ready to be operated. Warning: in the multi Shot reclosing mode, the reclosing dead time of the Shots following the first, must be set longer than the time required by the C/B to have the closing mechanism ready to operate.
❑	**Input 1 – 28**	= A.R. start Ph A	:	It is connected to the trip signal contact of the protection relay relevant to the phase “A” pole of the Circuit Breaker. When activated it initiates the AutoReclose sequence according to the programming.
❑	**Input 1 – 29**	= A.R. start Ph B	:	As above, for phase B
❑	**Input 1 – 30**	= A.R. start Ph C	:	As above, for phase C
❑	**Input 1 – 31**	= A.R. start 3 Ph	:	It is connected to the trip contact of a protection that operates the three poles of the C/B simultaneously. When activated it initiate the A.R. sequence according to the program.
❑	**Input 1 – 32**	= Manual C/B close	:	It is activated by the Manual C/B close control; it starts the counting of the reclaim time “tN” and operates the relevant signal Led.
❑	**Input 1 – 33**	= User Available	:	When active it directly energizes the output relay 4 (see § 10.2). Furthermore, if so programmed, when this input is activated during a multishot A.R. cycle, the relay skips the first next shot and directly operates the second next shot.

2.3 - Output Relays

Five output relays are available; four (R1, R2, R3, R4) are normally deenergized and pick-up when operated. The fifth is normally energized.

- **R1** : Two N/O contacts for C/B close control
- **R2** : One C/O contact for forcing the three-phase trip of then C/B
- **R3** : One C/O contact for signalization of Auto Reclosure in progress.
- **R4** : One C/O contact for protection inhibit after any programmed Reclosure Shot.
- **R5** : Normally deenergized with one C/O contact; it gets deenergized:
  - During relay's programming
  - For internal relay fault or power supply failureù
  - When the unit is in the Lock-out state

2.4 - 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.

2.4.1 - 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.

2.4.2 - 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.

2.4.3 - 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.

2.4.4 - Operation during power off.

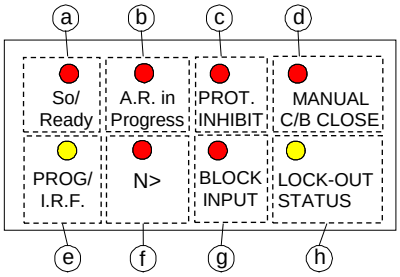
The unit has an on board Real Time Clock which maintains time information for at least 1 hour in case of power supply failure.

2.4.5 - 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).

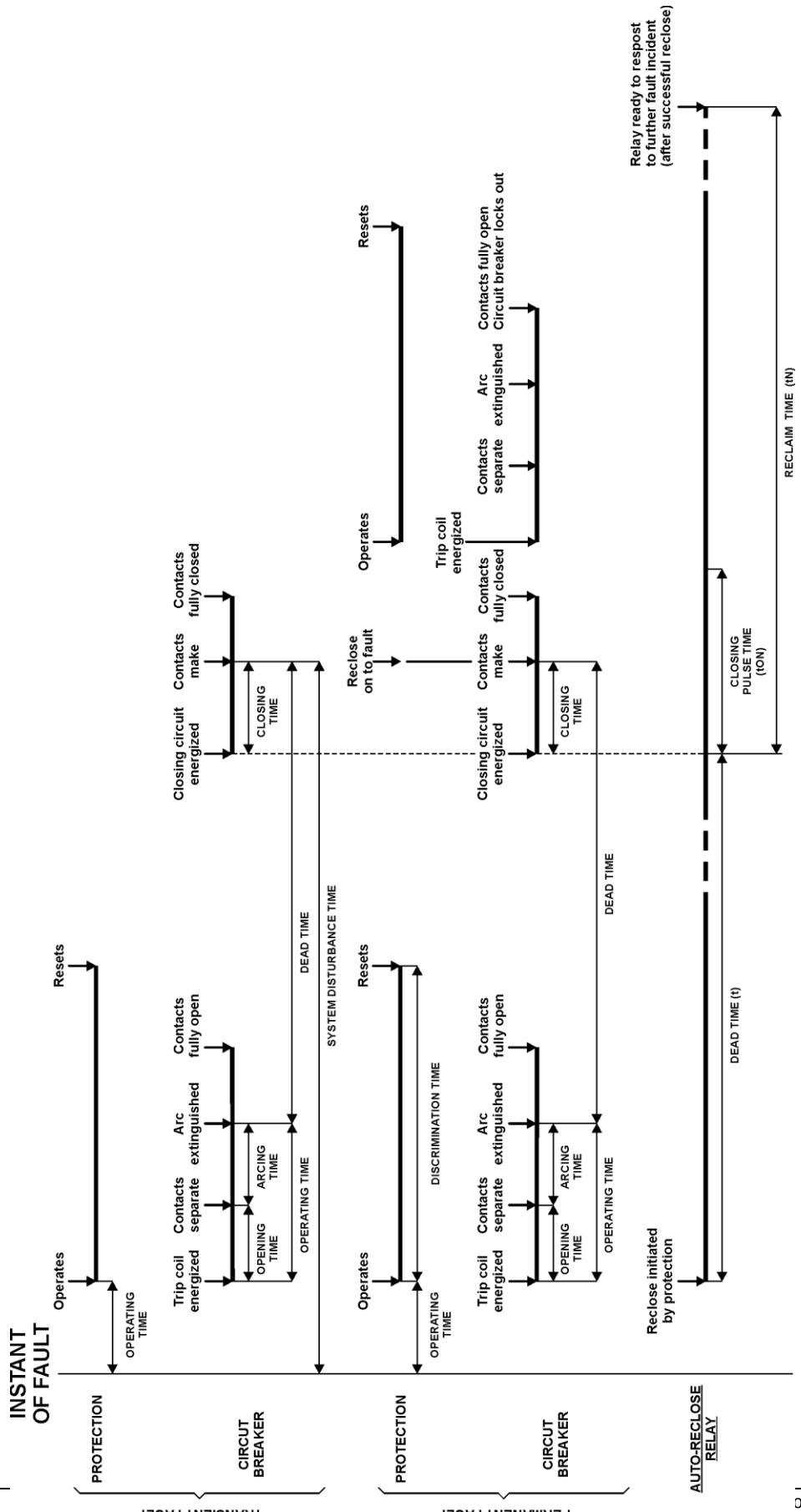
2.5 – Signalling Leds

Besides the information available from the alphanumerical display on relay's front face, eight Leds give the following signalizations :



a)	Red LED	**So / Ready**	❑	Illuminated when the relay is into the initial state ready to operate
b)	Red LED	**A.R. in Progress**	❑	Flashing during the dead time (1t, 2t, 3t, 4t) of a Reclosure Shot
c)	Red LED	**PROT. INHIBIT**	❑	Illuminated when the PROTECTION INHIBIT output contact is energized.
d)	Red LED	**Manual C/B Closing**	❑ ❑	Flashing when the C/B was closed by a manual operation. Illuminated when the C/B was closed by an autoreclose operation.
e)	Yellow LED	**PROG./ I.R.F.**	❑ ❑	Flashing during relay programming. Illuminated on relay Internal Fault.
f)	Red LED	**N>**	❑	Illuminated when the set permissible maximum number of closing operations is attained.
g)	Red LED	**BLOCK INPUT**	❑	Illuminated when the A.R. block input is active
h)	Yellow LED	**LOCK-OUT STATUS**	❑ ❑	Illuminated when the relay is in the Lock-out state. Flashing during the Lock-out reset time tBL.

3. OPERATION



The Autoreclose relay M-ARM513 allows to operate single and / or Three phase Reclosing in single or multishot mode (up to 4 shots to lock-out).
All the variables can be set in the Programming Mode either by the relay keyboard or via the serial communication port.

As listed in the §10.1, the programmable variables involved in the reclosure logic, are:

❑	**Sh→LO**	:	N° of Reclosure Shots-to-Lockout in a Reclosing cycle
❑	**P.I.Sh**	:	The user can program this variable so that after any shot of the cycle the output relay “R4” is energized to give a inhibition signal to the protection relay.
❑	**tON**	:	When the reclose signal is issued the output relay “R1” is energized for the time “tON” to give the closing pulse to the C/B.
❑	**tBL**	:	Automatic reset from the Lockout state “Sb1” takes place after the set time “tBL” from the moment when the blocking cause disappeared or the C/B was manually closed.
❑	**ts**	:	In the Three-phase mode, the permissive signal from the Synchrocheck relay must be present at the input terminals “1-3” at least “ts” seconds before the expiry of the Reclosing Dead Time (1t, 2t, 3t, 4t). “ts” must always be set shorter than the Reclose Dead Time programmed for any shot operating in the Three-phase Mode. If the Synchrocheck relay is not provided, the terminals “1-3” must be permanently shorted.
❑	**tD**	:	Is the time from the Reclosure initiation (Protection Relay Trip Signal) within which a Fault Evolution is detected (see following §3.1 – sd).
❑	**Skip**	:	If this function is enabled (ON), during a reclosure cycle activation of the input “1-33” makes the relay skip the first next programmed shot and directly operates the second next. Example: Sh-LO=4 After shot n°2, before shot n°3, the input “1-33” is closed: the shot n°4 is executed and shot n°3 is not.
❑	**N**	:	When the set n° of reclosing operations is attained the relay goes into the Lock-out state “Sb1”.
❑	**tN**	:	Reclaim time started after any automatic or manual reclose command (operation of output relay R1). Any initiation signal (protection trip) detected during “tN” after a Reclose Shot in a multishot cycle, starts the next Reclose Shot. Any initiation signal detected during “tN” after a manual close of the C/B, produces the Lock-out state ”Sb1”. Any initiation signal detected during “tN” after the last shot of a Reclose Cyle, produced the Lock-out state “Sb1”.

❑	**1R, 2R, 3R, 4R**	:	Selection of the Reclose Mode respectively for the 1st, 2nd, 3rd, 4th Shot of the Reclose Cycle.
❑	**1t, 2t, 3t, 4t**	:	Reclose dead time respectively for the 1st, 2nd, 3rd, 4th Shot of the Reclose Cycle. (Also see §2.2 input 1-27).
❑	**tA**	:	All the trip signals detected within the set time “tA” from the first trip signal, are considered as simultaneous. The relay retains the situation detected at the end of “tA” as the definite one which discriminates the kind of the initiating Fault (Single,

two or three phase)

3.1 Operation State

The autoreclosing Process develops through some main operational states:

- **Initial State So** : In this state the relay is ready to start a Reclosure Cycle; all permissive signals from the field must be on (Input 26 C/B Closed, input 27 C/B Ready) and all the others must be off.
  Furthermore the reclaim time "tN" started after a reclosure shot or after a manual closure of the C/B must be expired.

- **State Sd** : It is the state immediately following So when, after initiation by tripping of a protection relay, the unit discriminates the type of fault in a set time tD.

  In the "Single-phase" operation mode, during the time "tD" from the first initiation trip signal, the relay waits to see whether any further trip signal (indicating an Evolving Fault) is detected and modifies the Reclosure logic accordingly:

  - Single phase Reclose Mode (1P): if Evolving Fault is detected, the relays forces a three-phase trip (Relay R2 energized) and goes into Lock-out state "S1".

  In the "Three pole" (3P) as well as in the "Single and three pole (1P+3P) mode, evolving fault is ignored.

- **State Sr** : This is the relay state during the reclose dead time when a Reclose Shot has been started after fault discrimination (the dead time is indicated as "tR" in the operation flow charts, whereas it is indicated as 1t, 2t, 3t, 4t in the set programming).

- **State Sc** : This state takes place in a multishot Autoreclose Cycle during the reclaim time tN between one shot and the next.

- **Lock-out State Sb1, Sb2** : The state "Sb1" is produced by any abnormal situation which requires to inhibit the Autoreclosing:

  - New C/B trip after the last shot of a reclosure cycle.
  - Fault not programmed for initiating a Reclosure.
  - Evolution of the initial fault.
  - Maximum allowed n° of operations attained.
  - When the PROGRAMMING mode is entered.
  - Any situation foreseen in the operation logic which produces a Failed Reclosure

  The state "Sb2" is produced by the activation of the Blocking Input (1-2) by an external signal.

  The reset from the Lock-out State takes place:

  - Instantaneously by activation of the local (on relays front panel) or remote reset (input 1-14)
  - After the set time delay tBL when the Lock-out cause is removed or when the C/B is manually closed.

3.2 - Initiation

A reclosure cycle is initiated by the trip signal contact of a protection relay if the following conditions are present at the relay's detection inputs:

- All the three poles of the Circuit Breaker are closed (input 1-26 closed).
- The C/B is ready to operate (input 1-27 closed)
- No blocking input (input 1-2 open) or Lock-out State detected.

3.3 - Single Phase Reclosure

The relay can be programmed to operate a single-phase reclosing (1P) only or a three-phase (3P) only or both single and three-phase (1P + 3P).
A single-phase reclosure is initiated by a single-phase to Earth Fault (opening of one pole only of the C/B); the relay will energize the C/B close relay R1 which anyhow gives the close command to all the three poles closing circuits.
Any 2-phase fault is converted by the Recloser into a three-phase trip signal by energizing the output relay R2.

3.4 - Three-phase Reclosure

A three-phase Reclosure can be initiated by any kind of fault, single or poli phase, according to programming; anyhow when three-phase reclosure is programmed any single-phase or two-phase trip is converted into three-phase trip by the relay R2.
When the trip signal comes from a three-phase relay energizing the three-phase digital input (terminals 1-31), the recloser immediately detects a three-phase fault and operates accordingly.

3.5 - Evolving Faults

The evolution of a fault is detected when, with an autoreclosure in progress, a new fault appears on a phase different from that which first started the reclosing cycle during the discrimination time tD. Only, in the single-phase reclosing program (1P) the relay immediately converts the trip into a three-phase trip (Relay R2) and goes into the Lock-out state without producing the reclosure command.

In the reclosing programs for single and three phase reclosing (1P + 3P) if the fault evolution is detected within the discrimination time (tD), the Recloser produces a three-phase trip and then a three-phase Reclosure Shot.
If the Fault Evolution is detected after "tD" is expired, the relay goes into Lock-out state.

3.6 - Reset of a Reclosure Cycle

A reclosing cycle (single or multiple shot) is ready to restart from the beginning when no new tripping takes place within the Reclaim Time tN.
In a single shot reclosing, or after the last shot in a multishot cycle, a new tripping during tN produces the Lock-out status.
In a multishot reclosing a new tripping during tN initiates the next shot.

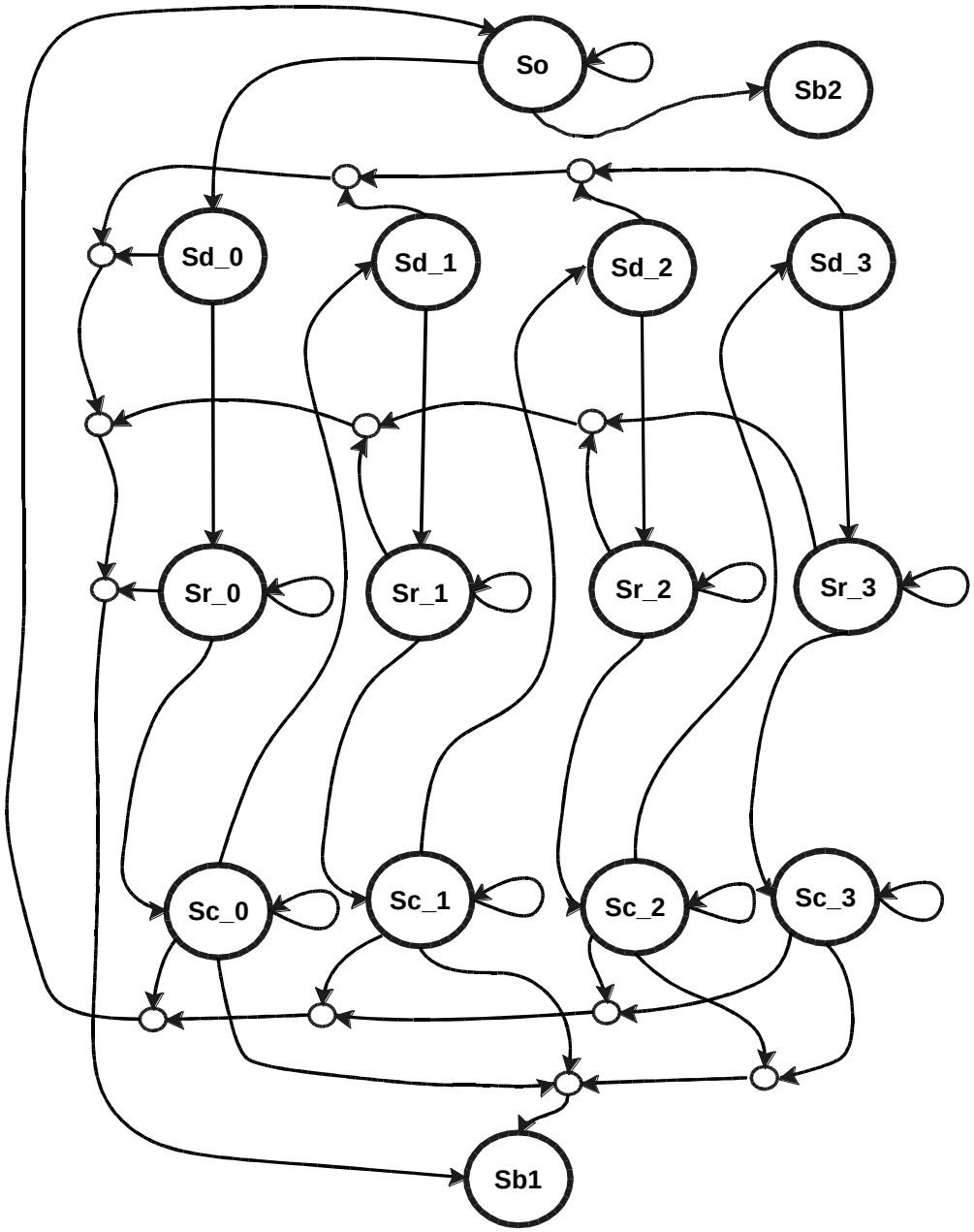
3.7 Reclosure Lock-out

The Reclosure Lock-out status is produced:

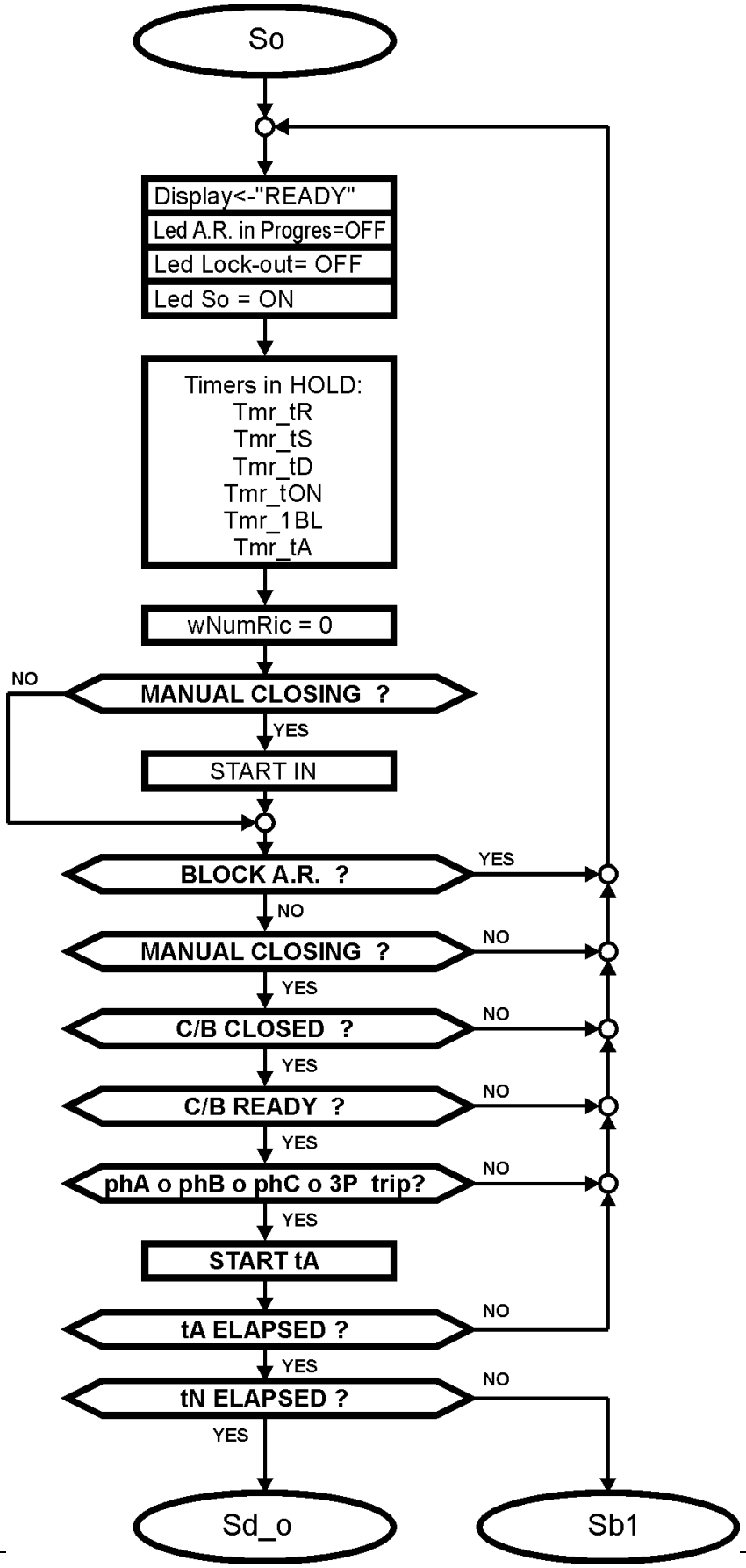
- When, after a reclosure shot, at the end of the reclaim time “tN”, the C/B was not closed.
- When, a new protection tripping is detected during the reclaim time “tN” after the last reclosure shot of a reclosing cycle.
- When, in case of three-phase reclosure, the permissive signal from the Synchrocheck relay is not detected at least “tS” seconds before the expiry of dead time “tR”.
- When, at the end of the reclose pulse time “tON”, the C/B is not closed.
- When the set n° of allowed operations has been attained.

3.8 Operation Flow Charts

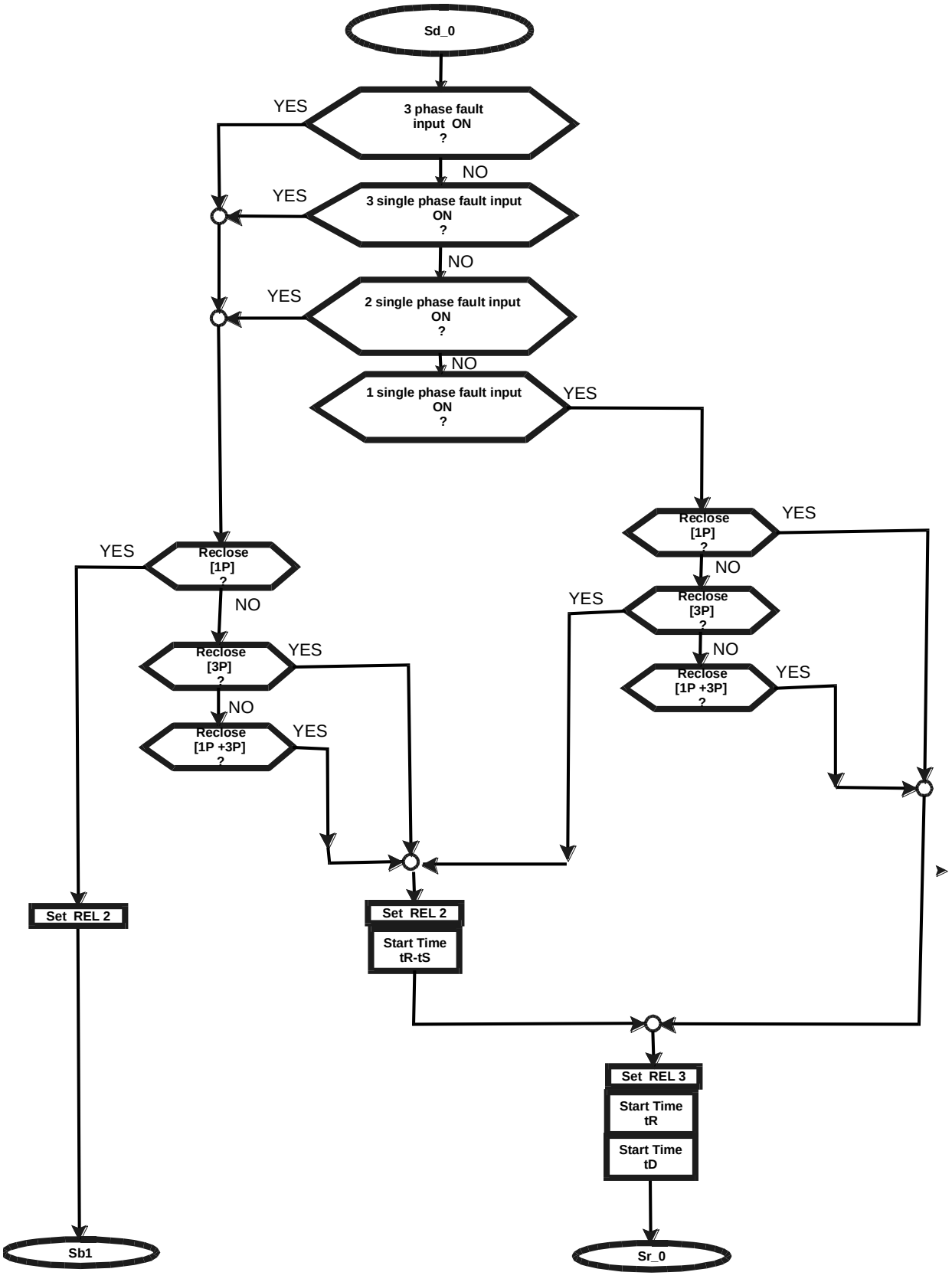
3.8.1 General State Diagram



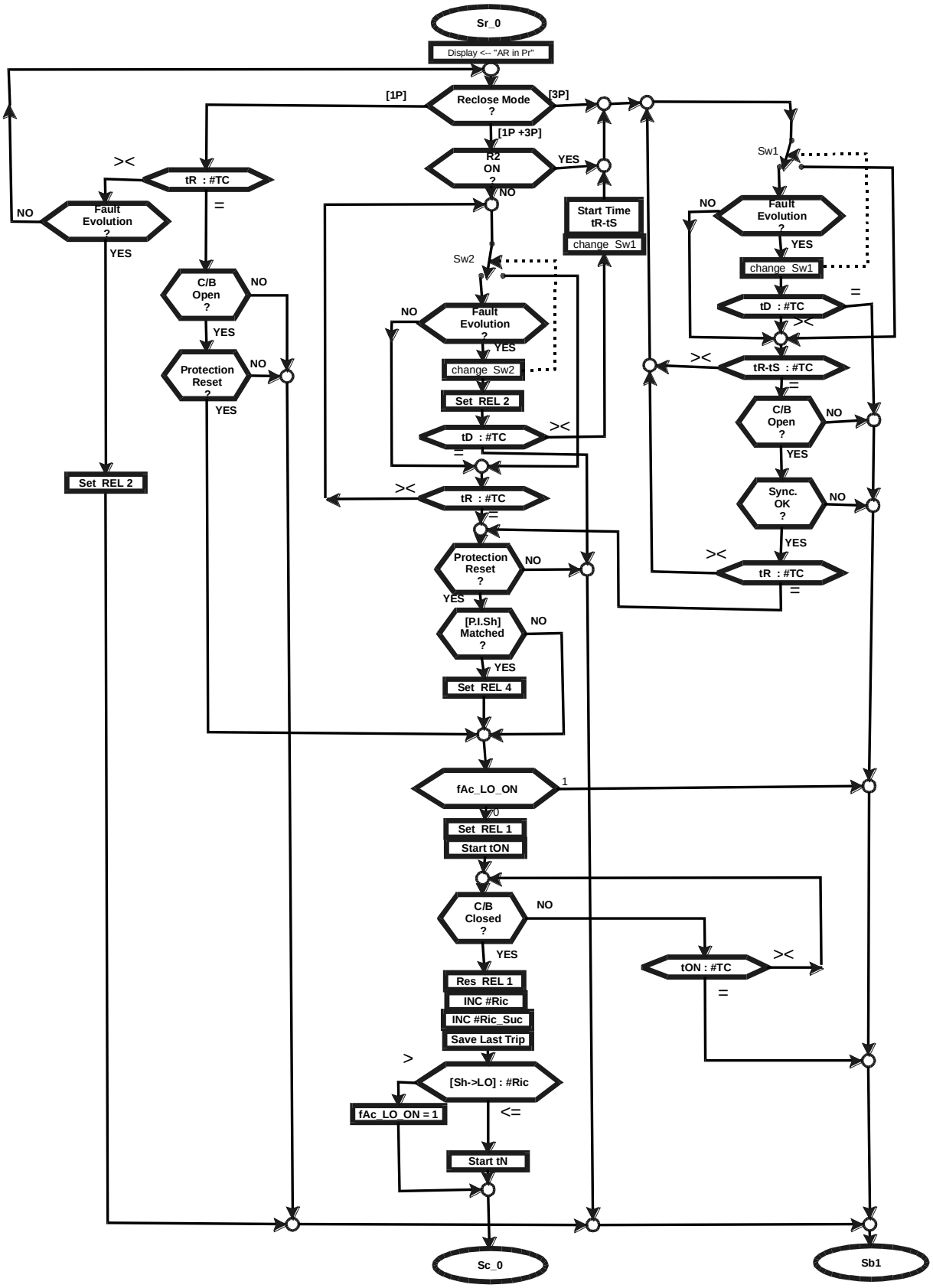
3.8.2 So to Sd_0/Sb1 State Process



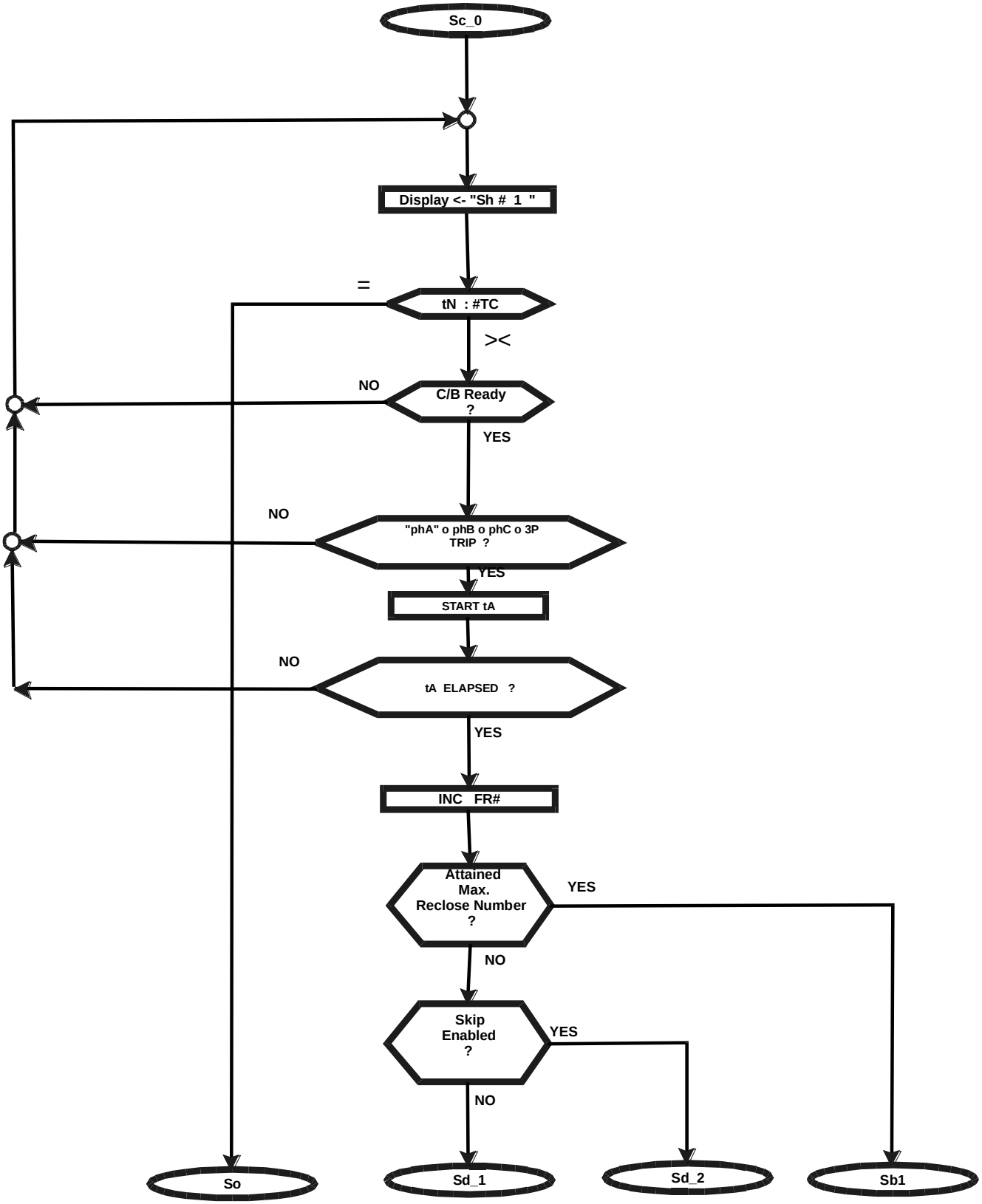
3.8.3 – Sd_0 to Sr_0 and/or Sb1 State Process



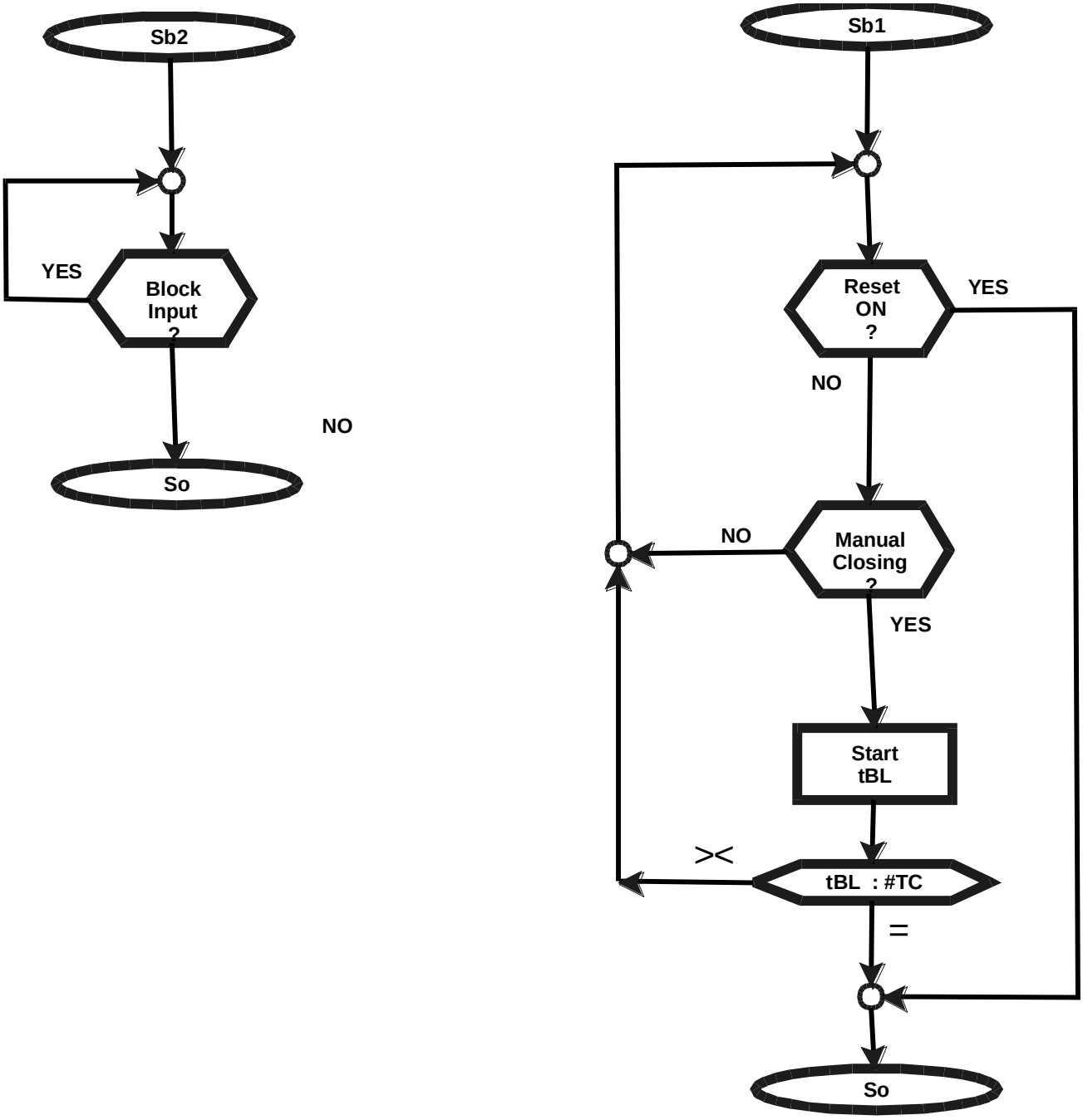
3.8.4 – Sr_0 to Sc_0 and/or Sb1 State Process



3.8.5 – Sc_0 to So/Sd_1/Sd_2/Sb1 State Process



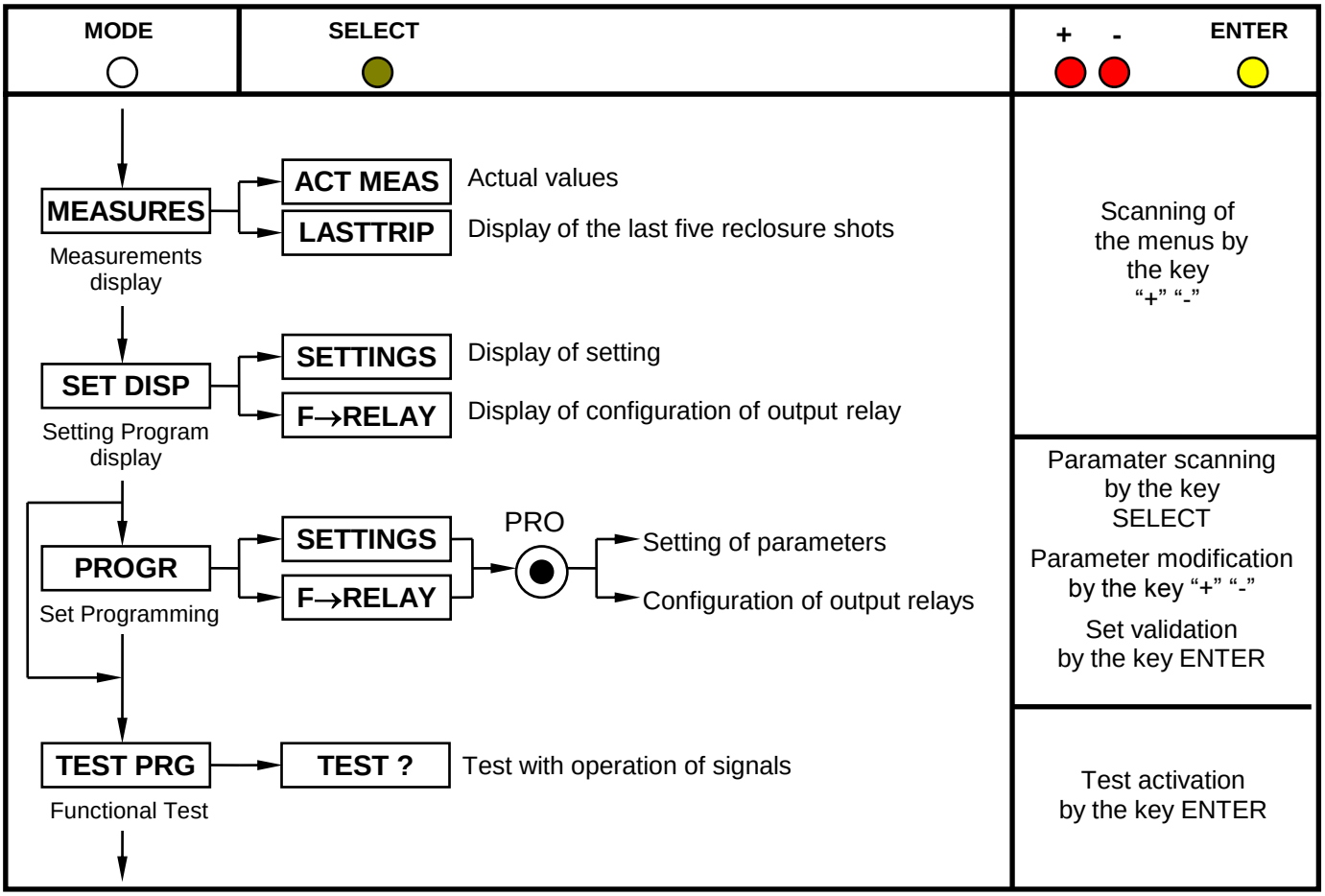
3.8.6 – Sb1/Sb2 to So State Process

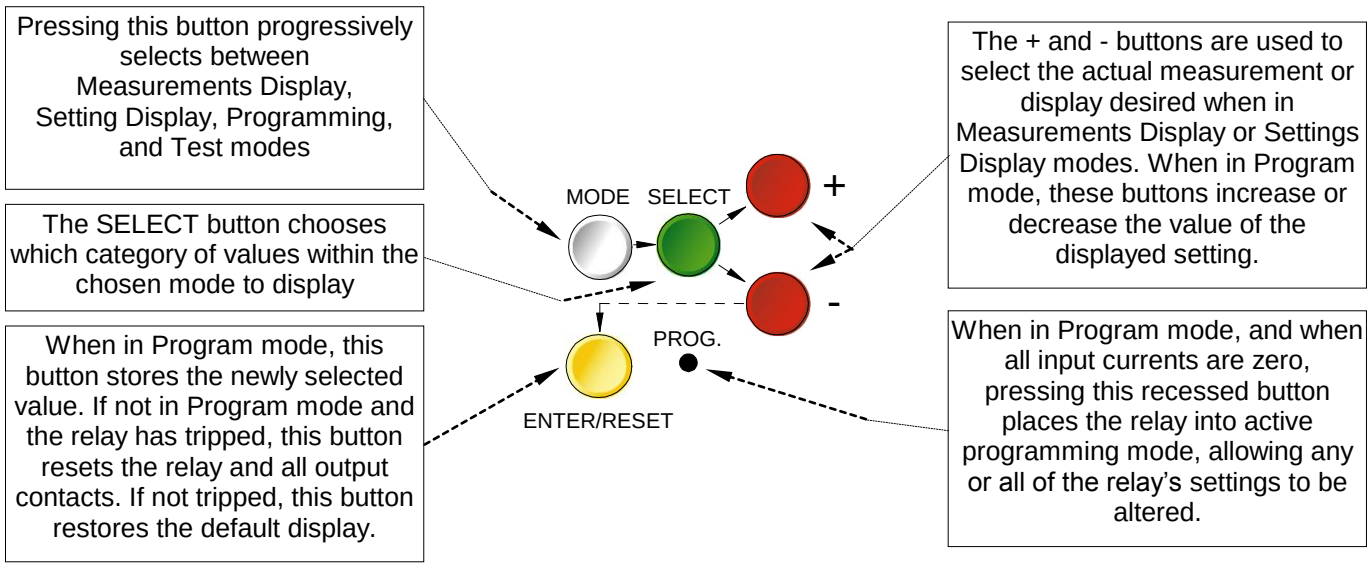


4. CONTROLS AND MEASUREMENTS

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





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

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.

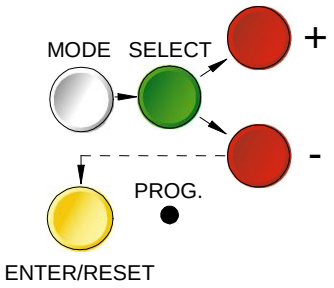
6. TEST

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

- Diagnostic and functional test, with checking of program routines and memory's content, run every time the aux. power is switched-on: the display shows the type of relay and its version number.
- Dynamic functional test run during normal operation every 15 min. (relay's operation is suspended for less than ≤4 ms). If any internal fault is detected, the display shows a fault message, the Led "PROG/IRF" illuminates and the relay R5 is deenergized.
- Complete test activated by the keyboard or via the communication bus either with or without tripping of the output relays.

7. 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.

8. 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 "-" .

8.1 - ACT.MEAS

The values displayed are continuously refreshed.

Display	Description
READY / AR in PR	Ready to start a reclosure / Autoreclosure in Progress
R#xxxxxx	Counter of successful Reclosure Shots
FR#xxxxx	Counter of failed Reclosure Shots
TC#xxxxx	Counter of total n° of C/B's
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds

8.2 - LASTTRIP

Display of the last five reclosure shots as recorded.
The memory buffer is refreshed at each new relay operation with a decreasing numbering (FIFO logic).

Display	Description
LastTr-x	Indication of the recorded event (x= 0 to 4) Example: Last event (LastTr -0) Last but one event (LastTr-1) etc...
xxXXXxx	Date : Day, Month, Year
xx:xx:xx	Hour : Hours, Minutes, Seconds
RS Sh #x	n° of reclose shot of a multishot reclosing cycle
RMxxxxxx	Reclosure mode of the recorded shot
TRxxxxxx	Total Reclosing number
R4 xxxx	State of Protection Inhibit output relay

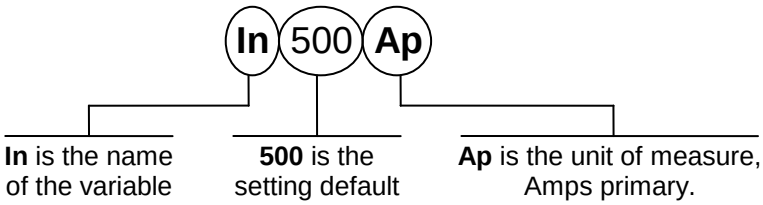
9. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

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.

10. 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
Programming can be made either from relay front face or via the serial communication port.
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 the Unit goes in to the Lock-out Status and the output 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.

10.1 - PROGRAMMING OF FUNCTIONS SETTINGS

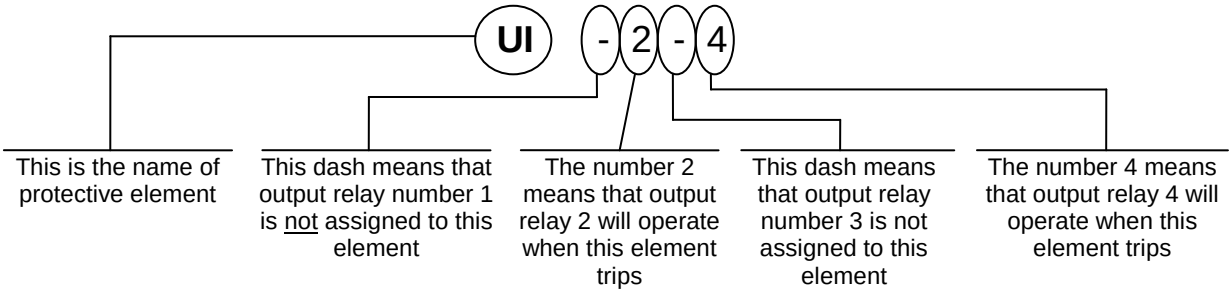


Mode PROG menu SETTINGS. (Production standard settings here under shown).

Display	Description	Setting Range	Step	Unit
xxxxxxx	Current date	DDMMMYY	-	-
xx:xx:xx	Current time	HH:MM:SS	-	-
Sh→LO x	N° of Reclosure Shots to Lock-out	1 – 4	1	-
P.I.Sh x	Activation of Protection Inhibit output (R4) after shot x	1 – 4	1	-
tON 0.20**s**	Duration of the close pulse to the C/B	0.01 – 9.99	0.01	s
tBL 10**s**	Reset time delay from the Lock-out Status	1 - 6000	1	s
tS 3.00**s**	Advance time of the Synchrocheck permissive signal before the reclose command	0.01 – 99.99	0.01	s
tD 0.30**s**	Fault discrimination time	0 – 9.00	0.01	s
Skip OFF	Skip of the next reclosure shot on activation of the input 1 - 33	ON - OFF	-	-
N> 1000	Maximum n° of reclosing operations	0 - 9999	1	-
tN 5.0**s**	Reclaim time started after any reclose command	1.0 - 600	0.1	s
1R 1P	Reclosure mode for the first shot of a reclosing cycle	1P – 3P – 1P3P	-	-
1t 0.3**s**	Reclosing dead time for the shot 1R	0.05 – 600	0.01	s
2R 1P	Reclosure mode for the second shot of a reclosing cycle	1P – 3P – 1P3P	-	-
2t 1.0**s**	Reclosing dead time for the shot 2R	0.05 – 600	0.01	s
3R 3P	Reclosure mode for the third shot of a reclosing cycle	1P – 3P – 1P3P	-	-
3t 3.0**s**	Reclosing dead time for the shot 3R	0.05 – 600	0.01	s
4R 3P	Reclosure mode for the fourth shot of a reclosing cycle	1P – 3P – 1P3P	-	-
4t 3.0**s**	Reclosing dead time for the shot 4R	0.05 – 600	0.01	s
tA 100**ms**	Acquisition time for the initial starting signal. All input signals received during tA are considered as simultaneous.	1 - 500	1	ms
Tsyn Dis**m**	Synchronisation Time for calendar Expected time interval between sync. pulse.	5 - 60 - Dis	5-10 15-30 60-Dis	m
NodAd 1	Identification number for connection on serial communication bus	1 - 250	1	-

The setting Dis indicates that the function is disactivated.

10.2 - 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
UI ---4	Input 1 – 33 can control the pick-up of the output relay(s) R1, R2, R3, R4 (N.B. this input can also control the " Skip next Shot function " by programming the variable " Skip ON")

11. MANUAL AND AUTOMATIC TEST OPERATION

11.1 - Mode "TEST ?"

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 (Ready).
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.

12. 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.

13. 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.

14. ELECTRICAL CHARACTERISTICS

APPROVAL: CE
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			

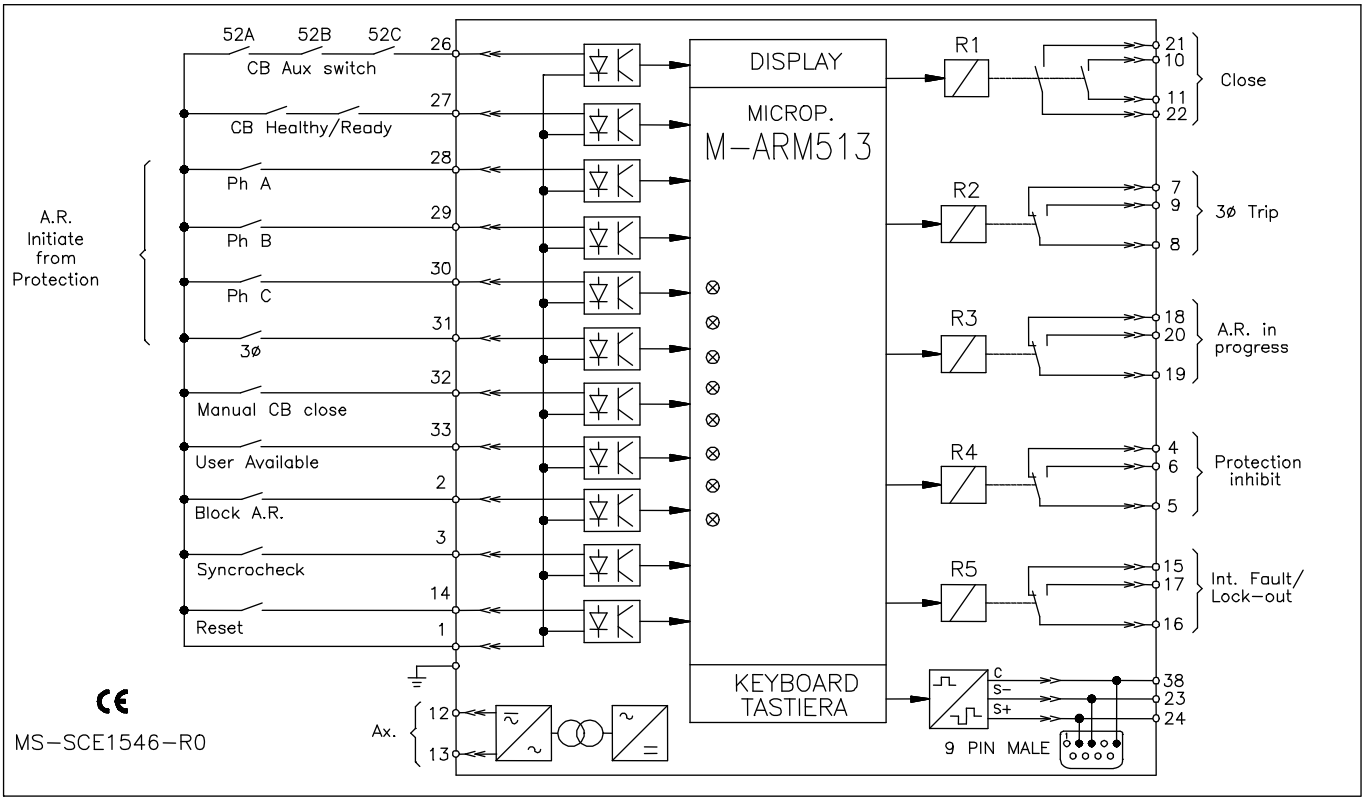
CHARACTERISTICS

❑	Average power supply consumption	8.5 VA
❑	Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)

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

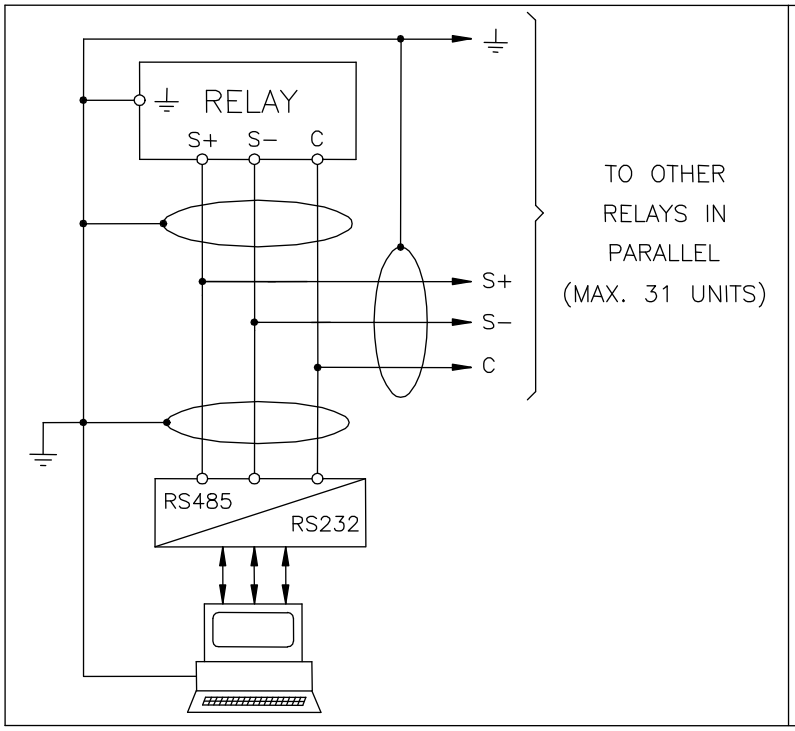
The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice

15. CONNECTION DIAGRAM (SCE1546 Rev.0 Standard Output)

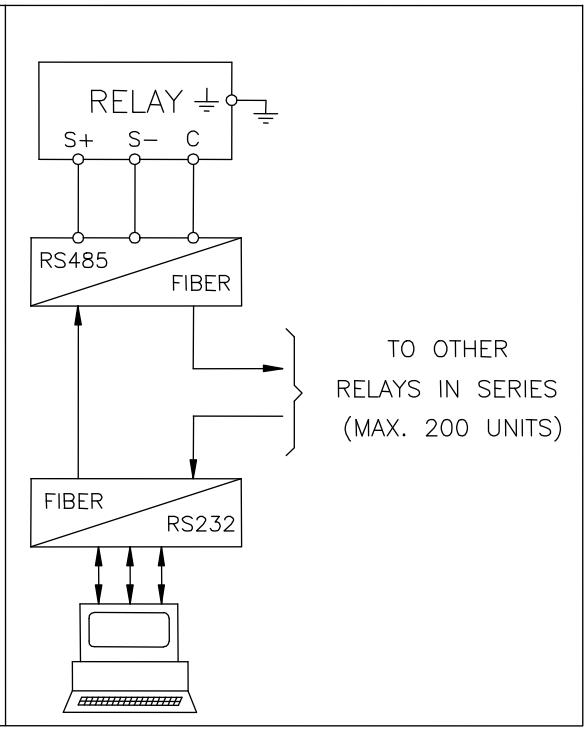


16. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

CONNECTION TO RS485



FIBER OPTIC CONNECTION



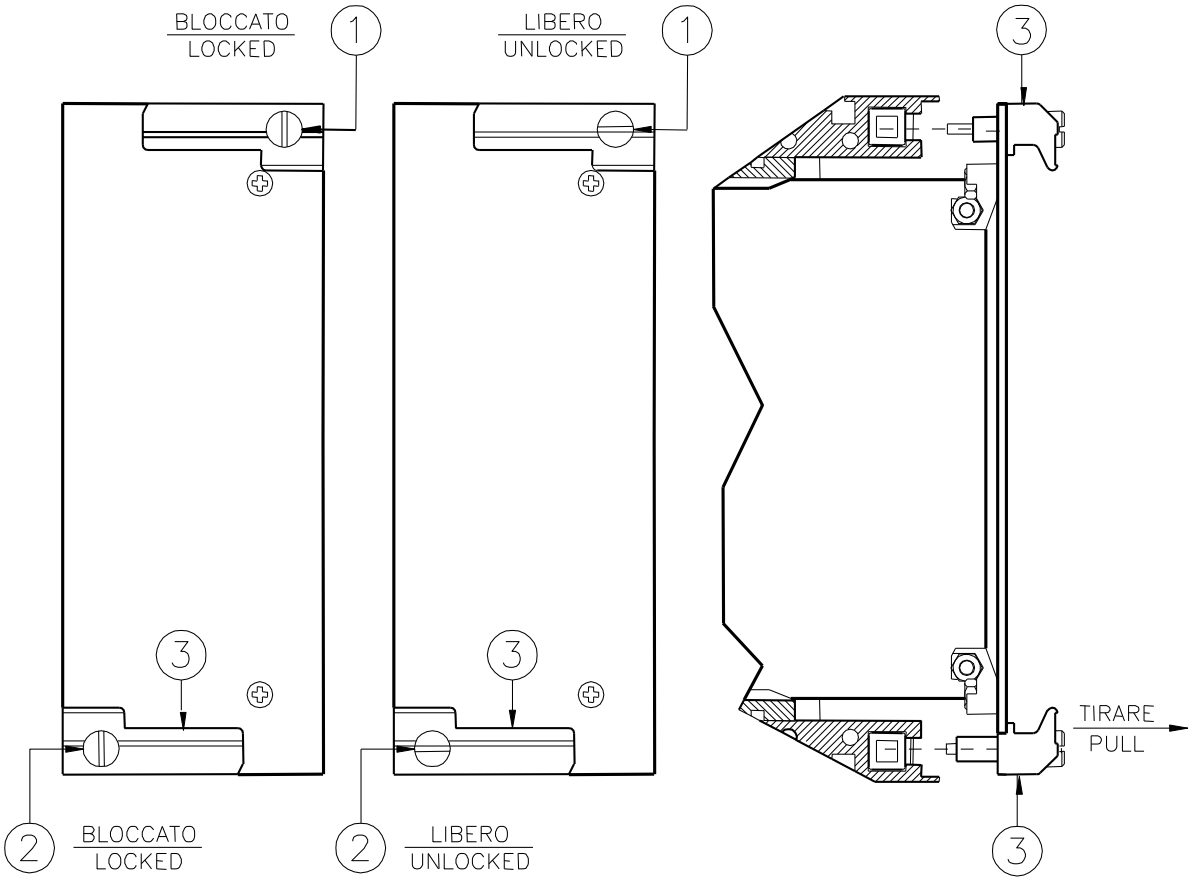
17. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

17.1 - Draw-out

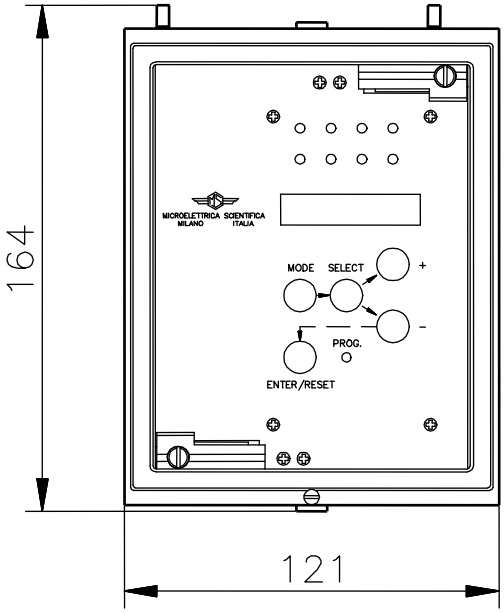
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

17.2 - Plug-in

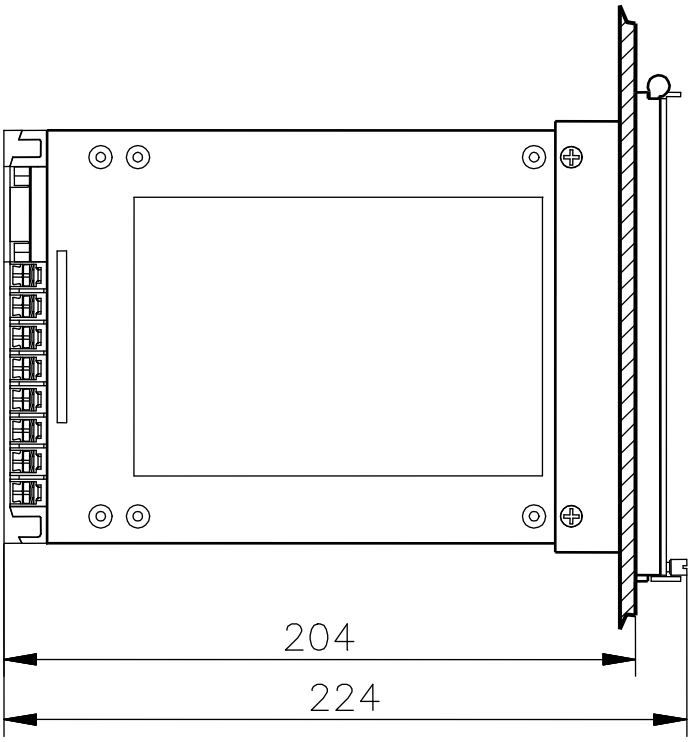
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position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

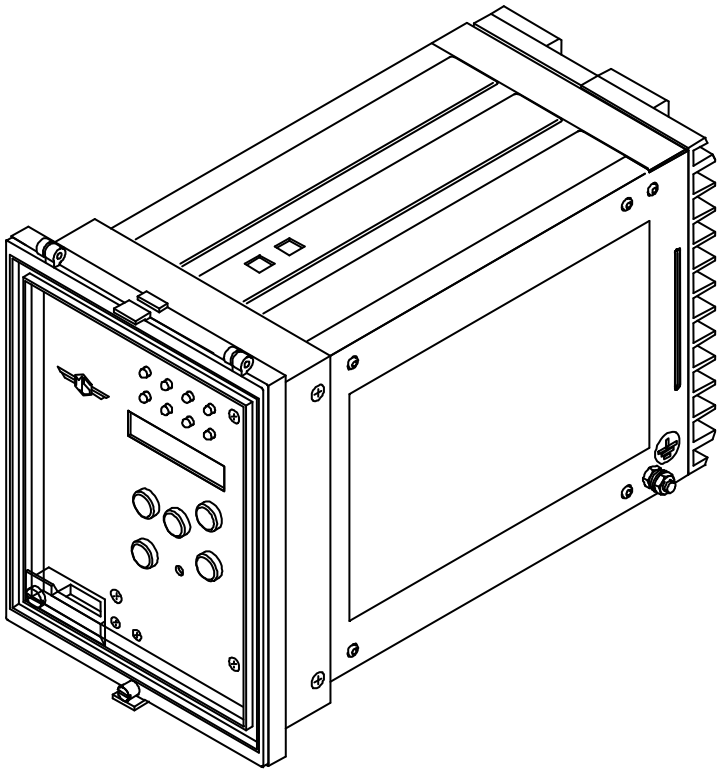


18. MOUNTING / OVERALL DIMENSIONS

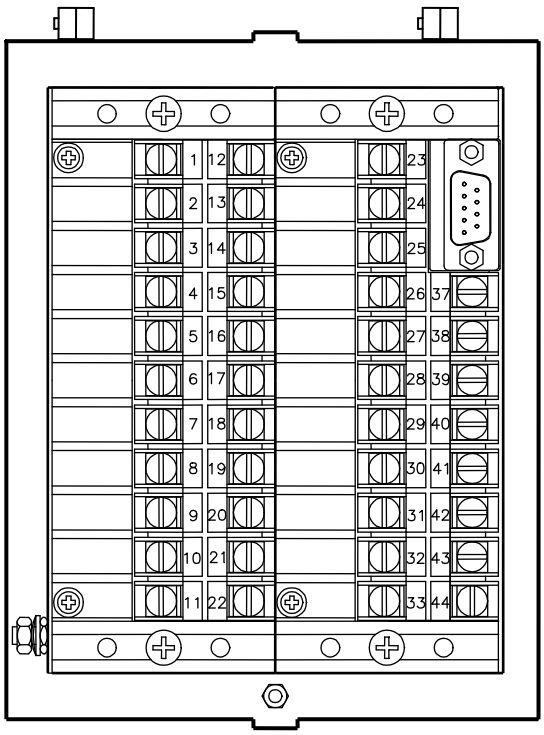


PANEL CUT-OUT 113x142 (LxH)

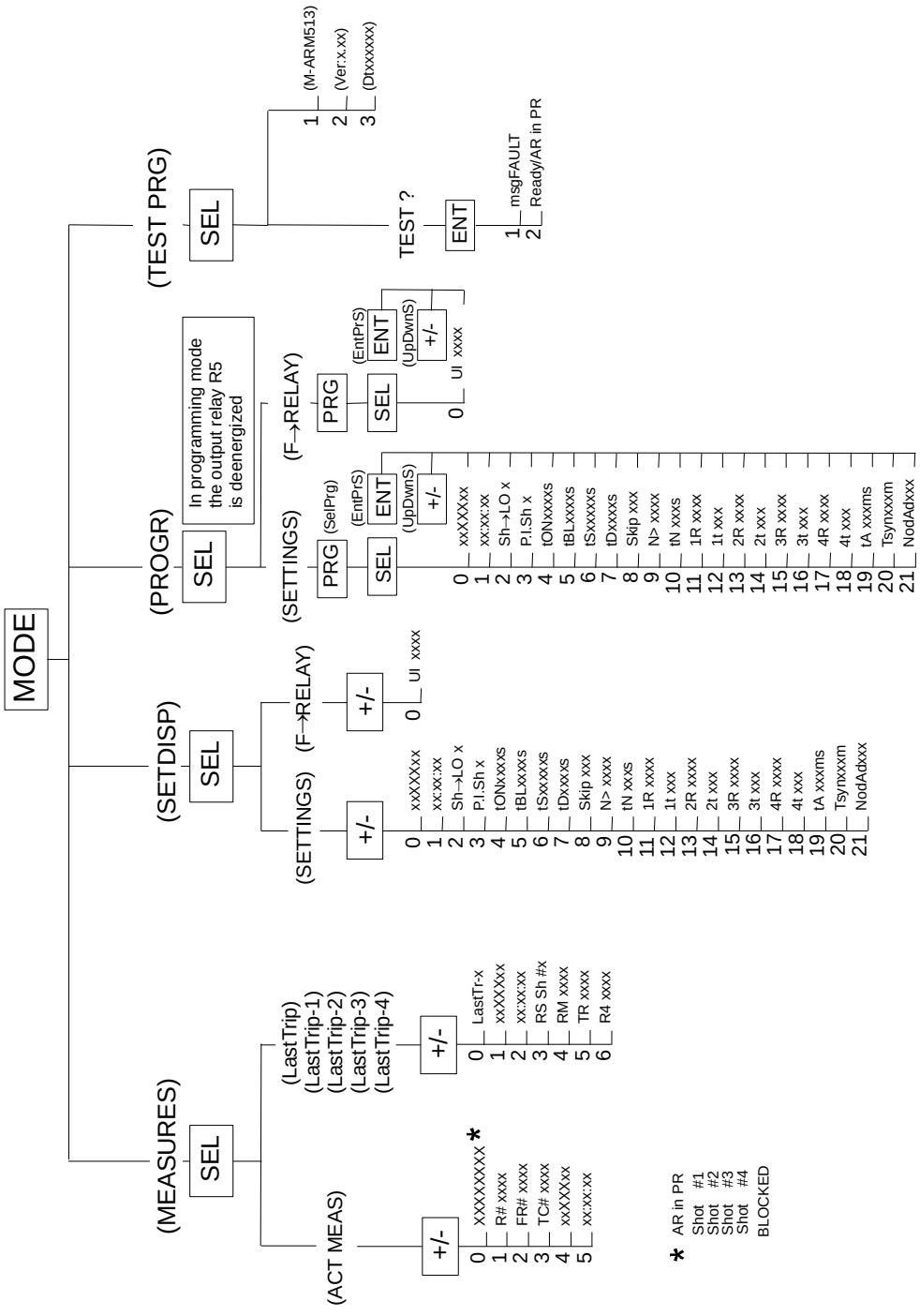




View of Rear Terminal Connection



19. KEYBOARD OPERATIONAL DIAGRAM



20. SETTING'S FORM

Relay Type	M-ARM513	Station :	Circuit :
Date :	/ /	FW Version:	Relay Serial Number :
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c.	24V(-20%) / 125V(+20%) d.c.	
	☐ 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	**-**	random			
xx:xx:xx	Current time	**-**	random			
Sh→LO	N° of Reclosure Shots to Lock-out	**-**	x			
P.I.Sh	Activation of Protect. Inhibit output (R4) after Shot x	**-**	x			
tON	Duration of the close pulse to the C/B	**s**	0.20			
tBL	Reset time delay from the Lock-out Status	**s**	10			
tS	Advance time of the Synchrocheck permissive signal before the reclose command	**s**	3.00			
tD	Fault discrimination time	**s**	0.30			
Skip	Skip of the next reclosure shot on activation of the input 1-33	**-**	OFF			
N>	Maximum n° of reclosing operation	**-**	1000			
tN	Reclaim time started after any reclose command	**s**	5.0			
1R	Reclosure mode for the first shot of a reclosing cycle	**-**	1P			
1t	Reclosing dead time for the shot 1R	**s**	0.3			
2R	Reclosure mode for the 2ND shot of a reclosing cycle	**-**	1P			
2t	Reclosing dead time for the shot 2R	**s**	1.0			
3R	Reclosure mode for the 3RD shot of a reclosing cycle	**-**	3P			
3t	Reclosing dead time for the shot 3R	**s**	3.0			
4R	Reclosure mode for the 4TH shot of a reclosing cycle	**-**	3P			
4t	Reclosing dead time for the shot 4R	**s**	3.0			
tA	Acquisition time for the initial starting signal.	**ms**	100			
Tsyn	Synchronisation Time for calendar	**m**	Dis			
NodAd	Identification number for serial connection.	**-**	1			

CONFIGURATION OF OUTPUT RELAYS

Default Setting						Actual Setting					
Protect. Element	Output Relays				Description	Protect. Element	Output Relays				
UI	-	-	-	4	Instantaneous element of low-set overcurrent	**UI**					