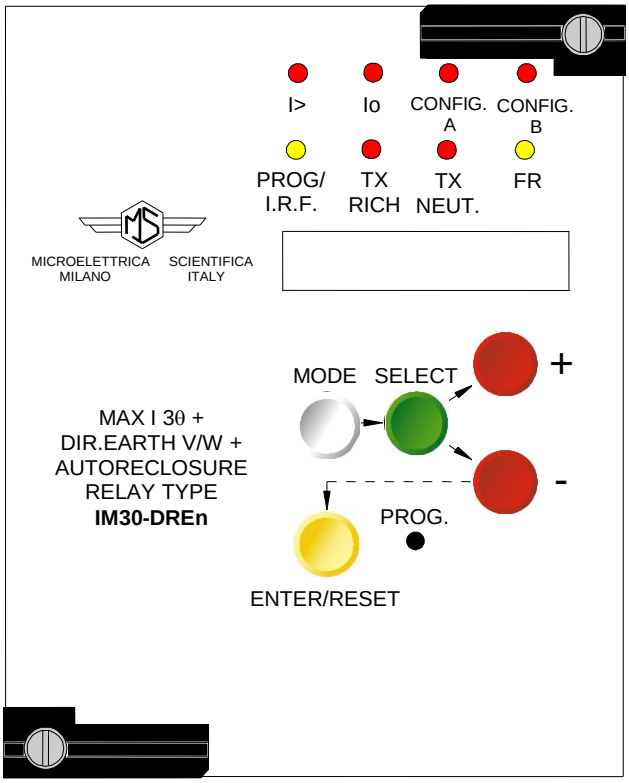
MICROPROCESSOR OVERCURRENT AND DIRECTIONAL EARTH FAULT PROTECTION RELAY + AUTORECLOSE

TYPE

IM30-DREn

OPERATION MANUAL



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1. GENERAL UTILIZATION AND COMMISSIONING DIRECTIONS

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

1.1 - Storage and Transportation

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

1.2 - Installation

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

1.3 - Electrical Connection

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

1.4 - Measuring Inputs and Power Supply

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

1.5 - Outputs Loading

must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its efficiency.

1.7 - Setting and Calibration

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

1.8 - Safety Protection

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

1.9 - Handling

Notwithstanding the highest practicable protection means used in designing M.S. electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules. The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits 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 1 Potential Transformer and to 4 Current Transformers
(- three measuring phase current - one measuring the earth fault zero-sequence current).
Rated current input can be 1 or 5A
The zero sequence polarizing voltage input is rated 100V (from (100:3)V open delta connected V.Ts. secondary winding).
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 an 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 - 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.

2.2.1 - 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.

2.2.2 - 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.

2.2.3 - 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.

2.2.4 - 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.

2.2.5 - 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).

2.3 - Oscillographic recording

The relay continuously records in a circular buffer the samples of the input zero sequence current and voltage. The maximum recording capability is about 4000 total samples.
Being a cycle constituted of 12 samples, the maximum recording capability is about 166 current cycles and 166 voltage cycles.
The trigger can be internally activated by the pick-up of one or more protection functions.
Enabling / Disabling of the oscillographic recording is done via the parameter “Trg” (ON-OFF) associated to any protection function.
Once is started the oscillographic recording always fills up totally the recording buffers ignoring whichever trigger activated during the oscillographic recording.
The oscillographic recording is memorized until a new trigger produces a new oscillographic recording overwriting it to the firmware one in the memory.
The pre-trigger and post-trigger recorded samples can be chosen by adjusting the trigger level programming the parameter ITrg = (0-99)%

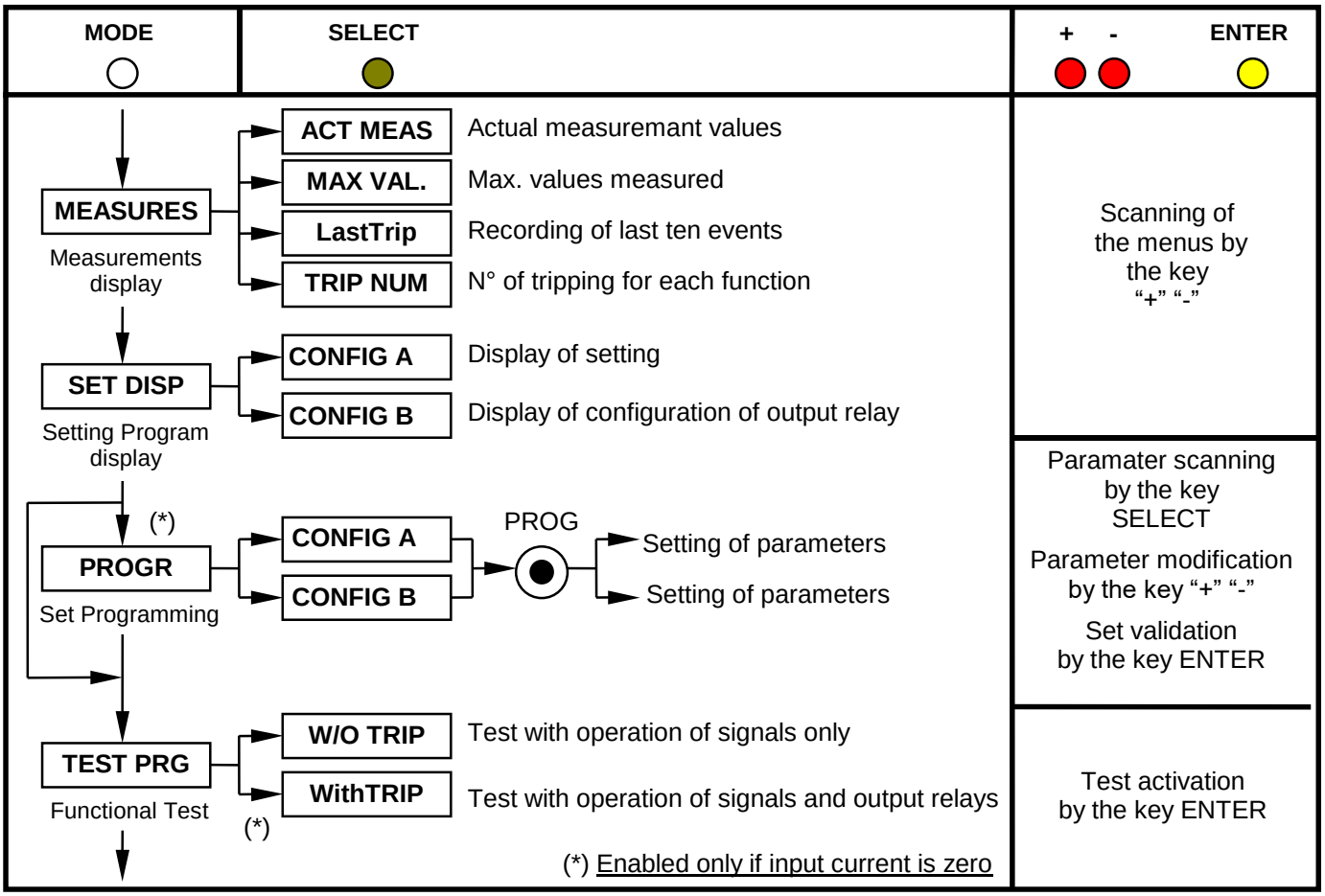
ITrg = 0% = Post-trigger samples recording only

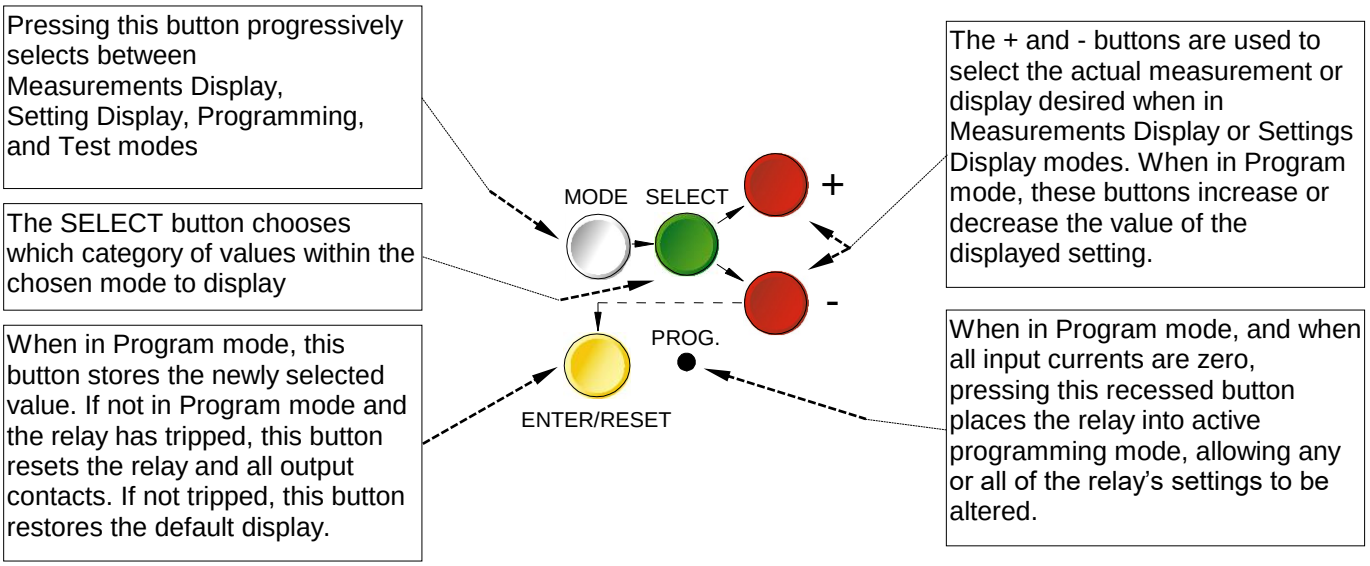
ITrg = 99% = Pre-trigger samples recording only

3. CONTROLS AND MEASUREMENTS

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

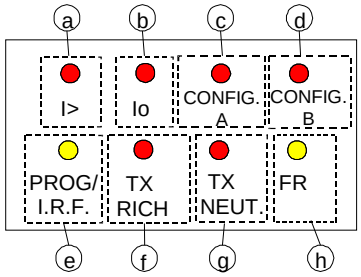
FIG.1





4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:



I>	=	50/51 Element Cumulative signalization
Io	=	67N Element Cumulative signalization
CONFIG. A	=	Program “A” active
CONFIG. B	=	Program “B” active
PROG/IRF	=	Programming/Internal Relay Fault
Tx RICH	=	Reclosing Time Interval of the Reclosing Shot x
Tx NEUT	=	Reclaim Time Interval after the Reclosing Shot x
FR	=	Failed Reclosure

a)	Red LED	**I>**	❑ Flashing when measured current exceeds the set trip level [1I o 2I]. ❑ Illuminated on trip after expiry of the set trip time delay [t1I o t2I].
b)	Red LED	**Io**	❑ Same as above related to [1Io], [2Io].
c)	Red LED	**CONFIG.A**	❑ Program “A” active
d)	Red LED	**CONFIG.B**	❑ Program “B” active
e)	Yellow LED	**PROG./ I.R.F.**	❑ Flashing during the programming of the parameters or in case of Internal Relay Fault.
f)	Red LED	**TX RICH.**	❑ Flashing during TX RICH. ❑ Illuminated when C/B is closed ❑ Lit-off when C/B is open
g)	Red LED	**TX NEUT.**	❑ Flashing during txN
h)	Yellow LED	**FR**	❑ Flashing after reclosure or after manual opening.

The reset of the leds takes place as follows:

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

Seven output relays are available (R1, R2, R3, R4, R5, R6, R7)

- ***R1*** = Normally deenergized : Open command
- ***R2*** = Normally deenergized : Close command
- ***R3*** = Normally deenergized : F50/51 elements Pick-up
- ***R4*** = Normally deenergized : F67N elements Pick-up
- ***R5*** = Normally energized : (deenergized on tripping) signals :
  - internal fault
  - power supply failure
  - Or any inoperative condition of the relay (for example when programming the relay)
- ***R6*** = Normally deenergized : Failed Reclosure signalization
- ***R7*** = : Setting program change signalization (energized=CONFIG. A – deenergized=CONFIG. B)

6. SERIAL COMMUNICATION

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

7. DIGITAL INPUTS

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

❑ **B** (terminals 1 - 2) **2**	: C/B Status	Closed = C/B closed Open = C/B open
❑ **B** (terminals 1 - 3) **3**	: Enable/Disable Automatic Control	Closed = Automatic Control Enabled Open = Automatic Control Disabled
❑ **B** (terminals 1 - 14) **4**	: Change setting program	- Terminals 1 –14 open = CONFIG. A active - Terminals 1 – 14 closed = CONFIG. B active Shifts from Setting program “CONFIG. A” to Setting program “CONFIG. B”.

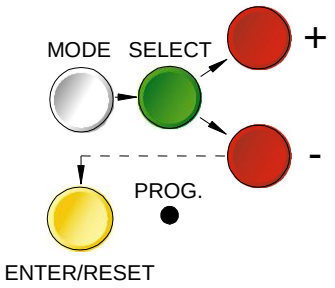
8. TEST

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

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

9. KEYBOARD AND DISPLAY OPERATION

All controls can be operated from relay's front or via serial communication bus.
The keyboard includes five hand operable buttons **(MODE) - (SELECT) - (+) - (-) - (ENTER/RESET)** plus one indirect operable key **(PROG)** (see synoptic table a fig.1):



a) - White key	**MODE**	:	when operated it enters one of the following operation modes indicated on the display :
	MEASURES	=	Reading of all the parameters measured and of those recorded in the memory
	SET DISP	=	Reading of the settings and of the configuration of the output relays as programmed.
	PROG	=	Access to the programming of the settings and of relay configuration.
	TEST PROG	=	Access to the manual test routines.
b) - Green key	**SELECT**	:	When operated it selects one of the menus available in the actual operation MODE
c) - Red key	"**+**" AND "**-**"	:	When operated they allow to scroll the different information available in the menu entered by the key SELECT
d) - Yellow key	**ENTER/RESET**	:	It allows the validation of the programmed settings - the actuation of test programs - the forcing of the default display indication - the reset of signal Leds.
e) - Indirect key	●	:	Enables access to the programming.

10. READING OF MEASUREMENTS AND RECORDED PARAMETERS

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

10.1 - ACT.MEAS

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

Display			Description
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
IA	xxxxx	**A**	True R.M.S. value of the current of phase A displayed as primary Amps. (0 – 99999)
IB	xxxxx	**A**	As above, phase B.
IC	xxxxx	**A**	As above, phase C.
Io	xxxxx	**A**	As above, earth fault current.
Uo	xxxxx	**V**	True R.M.S. value of the residual voltage displayed as secondary voltage
φo	xxxxx	**°**	Io/Uo phase displacement angle in degrees.
%Vn	xxx		Phase-to-Phase Voltage VAB as % of the rated input voltage
%Wn±	xx.xx		Active Power as % of the rated power

10.2 - MAX VAL

Highest values recorded starting from 100ms after closing of main Circuit Breaker plus inrush values recorded within the first 100ms from Breaker closing, (refreshed any time the breaker closes).

Display			Description
IA	xxxxx	**In**	Max demand of phase A current after the first 100ms, displayed as p.u. of C.Ts rated current
IB	xxxxx	**In**	As above, phase B.
IC	xxxxx	**In**	As above, phase C.
Io	xxxxx	**On**	As above, earth fault current.
Uo	xxxxx	**V**	Max value of Uo recorded after the first 100ms.
SA	xxxx	**In**	Max demand current of phase A during the first 100ms.
SB	xxxx	**In**	As above, phase B.
SC	xxxx	**In**	As above, phase C.
So	xxxx	**On**	As above, earth fault current.
SU	xxxx	**V**	Max value of Vo recorded during the first 100ms.

10.3 - LASTTRIP

Display of the function which caused the tripping of the relay plus values of the parameters at the moment of tripping. The last 10 events are recorded.
The memory buffer is refreshed at each new relay tripping with a decreasing numbering (FIFO logic).

Display			Description
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
LastTr-x			Indication of the recorded event (x= 0 to 9) Example: Last event (LastTr –0) Last but one event (LastTr-1) etc…
F:xxxxxx			Display of the function which caused the last tripping: **1I phA,B,C - 2I phA,B,C - 1O - 2O**
IA	xx.x	**In**	Current of phase A.
IB	xx.x	**In**	Current of phase B.
IC	xx.x	**In**	Current of phase C.
Io	xx.xx	**A**	Earth fault current.
Uo	xx.xx	**V**	Residual voltage.
φo	xxx	**°**	Io/Uo phase displacement.
SET	x		Active setting 1 (Config. A) o 2 (Config. B) on trip

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
T1I	xxxxx	**Total** N° of Low set timed overcurrent element [t1I] operations
P1I	xxxxx	**Partial** N° of Low set timed overcurrent element [t1I] operations
T2I	xxxxx	**Total** N° of High set timed overcurrent element [t2I] operations
P2I	xxxxx	**Partial** N° of High set timed overcurrent element [t2I] operations
T1o	xxxxx	**Total** N° of Low set timed directional earth fault element [t1o] operations
P1o	xxxxx	**Partial** N° of Low set timed directional earth fault element [t1o] operations
T2o	xxxxx	**Total** N° of High set timed directional earth fault element [t2o] operations
P2o	xxxxx	**Partial** N° of High set timed directional earth fault element [t2o] operations
1Rxxxxxx		N° of reclosure operated by the first reclosing shot 1C
2Rxxxxxx		N° of reclosure operated by the 2nd reclosing shot 2C
3Rxxxxxx		N° of reclosure operated by the 3rd reclosing shot 3C
4Rxxxxxx		N° of reclosure operated by the 4th reclosing shot 4C
FRxxxxxx		N° of failed reclosure.
OPSxxxxx		Number of Circuit Breaker's operations

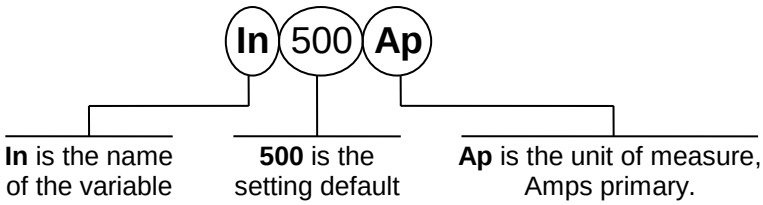
11. READING OF PROGRAMMED SETTINGS AND RELAY'S CONFIGURATION

Enter the mode "SET DISP", select the menu "CONFIG A" or "CONFIG B" or "F→RELAY", scroll information available in the menu by keys "+" or "-".
SETTINGS= values of relay's operation parameters as programmed
F→RELAY= output relays associated to the different functions as programmed.

12. PROGRAMMING

The relay is supplied with the standard default programming used for factory test.
[Values here below reported **(---)**]
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
Local Programming by the front face key board is enabled only if no input current is detected (main switch open). Programming via the serial port is always enabled but a password is required to access the programming mode. The default password is the null string; in the standard application program for communication "MS-Com" .
As soon as programming is enabled, the Led PRG/IRF flashes and the alarm relay R5 is deenergized..
Enter MODE "PROG" and SELECT either "CONFIG A" or "CONFIG B" 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	-	-
Fn	60	**Hz**	Mains frequency	50 – 60	10	Hz
In	1000	**Ap**	Rated primary current of the phase C.Ts.	1000	-	Ap
On	1000	**Ap**	Rated primary current of the C.Ts. or of the tore C.T. supplying the zero sequence current	1000	-	Ap
1I (51.1)	0.25	**In**	Trip level of first element 50/51 (p.u. of the rated current of the phase C.Ts.)	0.05 - 2- Dis	0.01	In
t1I (T51.1)	0.8	**s**	Trip time delay of the first element 51	0.05 - 60	0.01	s
1'I	100	**ms**	Reduced trip time delay of the first element 51 (See note **2**)	0 – 200-Dis	1	ms
1ITrg	OFF		Oscillographic recording enabling by trigger from element 1I pick-up	ON-OFF	-	-
2I (51.2)	0.9	**In**	Trip level of second element 50/51 (p.u. of the rated current of the phase C.Ts.)	0.05 – 2 – Dis	0.01	In
t2I (T51.2)	0.05	**s**	Trip time delay of the second element 51	0.05 – 60	0.01	s
2'I	100	**ms**	Reduced trip time delay of the second element 51 (See note **2**)	0 – 200-Dis	1	ms
2ITrg	OFF		Oscillographic recording enabling by trigger from element 2I pick-up	ON-OFF	-	-
1Uo	0.8	**V**	Starting level of the zero-sequence polarizing input voltage. This is the minimum level of Uo needed to enable the operation of the first directional element. (See note **3**)	0.4-20-Dis	0.1	V
1αA	260		Superior limit angle of the operating sector of the first directional element	0-359	1	°
1αB	350		Inferior limit angle of the operating sector of the first directional element	0-359	1	°
1o (67.1)	2	**mA**	Trip level of first element 67N (See note **4**)	1 - 40 - Dis	0.1	mA
t1o (67-S.1)	0.2	**s**	Trip time delay of the first element 67N	0.05 - 60	0.05	s
1'o	100	**ms**	Reduced trip time delay of the first element 67N (See note **2**)	0 – 200-Dis	1	ms
1oTrg	OFF		Oscillographic recording enabling by trigger from element 1o pick-up	ON-OFF	-	-

Display			Description	Setting Range	Step	Unit
2Uo	3.5	**V**	Starting level of the zero-sequence polarizing input voltage. This is the minimum level of Uo needed to enable the operation of the second directional element. (See note **3**)	0.4-20-Dis	0.1	V
2αA	100		Superior limit angle of the operating sector of the second directional element	0-359	1	°
2αB	280		Inferior limit angle of the operating sector of the second directional element	0-359	1	°
2o (67.2)	1	**mA**	Trip level of second element 67N (See note **4**)	1 - 40 - Dis	0.1	mA
t2o (67-S.2)	0.7	**s**	Trip time delay of the second element 67N	0.05 - 60	0.05	s
2'o	100	**ms**	Reduced trip time delay of the second element 67N (See note **2**)	0 – 200-Dis	1	ms
2oTrg	OFF		Oscillographic recording enabling by trigger from element 2o pick-up	ON-OFF	-	-
W	0,2	**%Wn**	Active power threshold for automatic setting program changing (See note **6**)	0.2 – 9.9	0.1	%Wn
tW	1	**s**	Automatic changing program time delay	0.1 – 30	0.01	s
MODULO RICHIUSURA						
1R	**- - - B A**		Selection of the function(s) selected to initiate the first reclosing shot 1R (See note **5**)	- - - - - A B C D	-	-
2R	**- - C - -**		As above for second reclosing shot 2R (See note **5**)	- - - - - A B C D	-	-
3R	**- - C B A**		As above for third reclosing shot 3R (See note **5**)	- - - - - A B C D	-	-
4R	**- - - - -**		As above for fourth reclosing shot 4R (See note **5**)	- - - - - A B C D	-	-
t1R	2	**s**	Reclosing time interval of first reclosing shot	0.1 – 600.00	0.1	s
t2R	4	**s**	As above for 2nd reclosing shot	0.1 – 600.00	0.1	s
t3R	6	**s**	As above for 3rd reclosing shot	0.1 – 600.00	0.1	s
t4R	8	**s**	As above for 4th reclosing shot	0.1 – 600.00	0.1	s
t1N	2	**s**	Reclaim time after first reclosure	1.0 – 600.0	0.1	s
t2N	4	**s**	Reclaim time after 2nd reclosure	1.0 – 600.0	0.1	s
t3N	6	**s**	Reclaim time after 3rd reclosure	1.0 – 600.0	0.1	s
t4N	8	**s**	Reclaim time after 4th reclosure	1.0 – 600.0	0.1	s
t1d	1	**s**	Discrimination time after first reclosure (See note **7**)	0 – 5.0	0.1	s
t2d	1	**s**	Discrimination time after 2nd reclosure (See note **7**)	0 – 5.0	0.1	s
t3d	1	**s**	Discrimination time after 3rd reclosure (See note **7**)	0 – 5.0	0.1	s
TNo	2	**s**	Discrimination time after 4th reclosure (See note **7**)	0.1 – 600.0	0.1	s
Tc	1	**s**	Reduced trip time delay	1.0 - 600.0	0.1	s
LO#	4		Lock-out number. Determines the number of shots to Lock-out (See note **8**)	1 – 2 – 3 – 4	1-2-3-4	-
ChSet	Dis		Change Setting. Determines when the relay automatically changes from setting "CONFIG. A" a "CONFIG B " (or viceversa) (See note **9**)	1-2-3-4-Dis	1-2-3-4-Dis	-
B1	- - - - -		After 1R during t1N this functions are disabled: A, B, C, D. (See note **10**)	- - - - - A B C D	-	-
B2	- - - - -		After 2R during t2N this functions are disabled: A, B, C, D. (See note **10**)	- - - - - A B C D	-	-
B3	- - - - -		After 3R during t3N this functions are disabled: A, B, C, D. (See note **10**)	- - - - - A B C D	-	-
B4	- - - - -		After 4R during t4N this functions are disabled: A, B, C, D. (See note **10**)	- - - - - A B C D	-	-
ITrg	50	%	Trigger (Oscillographic recording)	0 - 99	1	%
Tsyn	Dis		Synchronization Time Expected time interval between sync. pulses.	5-10 15-30 60-Dis	5-10 15-30-60-Dis	min
NodAd	1		Identification number for connection on serial communication bus	1 - 250	1	-

The setting Dis indicates that the function is disactivated.

(**2**) – After the reclosure, during the reclaim time, the trip time delay of the protection function is reduced from the programmed value "tx" to the value x'. If x' is Disabled there is no reduction.

(**3**) – When "1Uo" or "2Uo" are Disabled, the protection element trips if Uo> [1Uo] or [2Uo]. (non-directional operation):

Normal operation : [1Io] ≠ Dis , [2Io] ≠ Dis ; [1Uo] ≠ Dis , [2Uo] ≠ Dis

Tripping when: Io > [1o], Uo> [1Uo], 1α ok ; Io > [2o], Uo > [2Uo], 2α ok

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Case 1 : [1o] = Dis, [2o] = Dis

[1o] = Dis: tripping when : Uo>[1Uo]
[2o] = Dis: tripping when : Uo>[2Uo]

Case 2: [1Uo] = Dis, [2Uo] = Dis

[1Uo] = Dis tripping when: Io >[1o]
[2Uo] = Dis tripping when: Io >[2o]

Case 3 : [1o] = Dis e [1Uo] = Dis no trip
Case 4 : [2o] = Dis e [2Uo] = Dis no trip

(**4**) – When "1o" or "2o" are Disabled, the protection element trips if Uo> [1Uo] or [2Uo].

(**5**) – Letters indicate the following protection functions:

A = Trip time delay first overcurrent element	t1I (51.1)
B = Trip time delay second overcurrent element	t2I (51.2)
C = Trip time delay first directional earth fault element	t1o (67N.1)
D = Trip time delay second directional earth fault element	t2o (67N.2)

(**6**) – When measured Active power exceeds the set threshold [W] in the power flow sense, setting program "CONFIG A" is activated; When set threshold [W] is exceeded in the opposite sense of the power flow, setting program "CONFIG B" is activated. The setting change is done with the set time delay [tW].
At power-on, without active power, setting program "CONFIG A" is active.
Then, if measured power is positive, setting program "CONFIG A" remains active; viceversa, if measured power is negative and over the threshold, setting program "CONFIG B" is activated.

(**7**) – After any reclosure, together with the reclaim time "TxN", the discrimination time "txd" is activated:
whichever trip of any protection function within "txd" locks-out the automatic reclosure cycle and signalizes Failed Reclosure.

(**8**) – After the Failed Reclosure the apparatus is locked-out unless a manual closing is operated.

(**9**) – When setting program "CONFIG A" is active, the relay can automatically shift to the setting program "CONFIG B" after any reclosure shot during the reclosing cycle without short circuiting the relative digital input and independently from the direction of the active power flow. This operation mode can be disabled.

(**10**) – One or more protection functions can be disabled doting the reclaim time "txN" after the reclosure shot "xR".

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13. MANUAL AND AUTOMATIC TEST OPERATION

13.1 - Mode "TESTPROG" subprogram "W/O TRIP"

Operation of the yellow key activates a complete test of the electronics and the process routines.
All the leds are lit-on and the display shows (TEST RUN).
If the test routine is successfully completed the display switches-over to the default reading (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
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% In 0,2% On 2% +/- 10ms	for measure 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	0,04 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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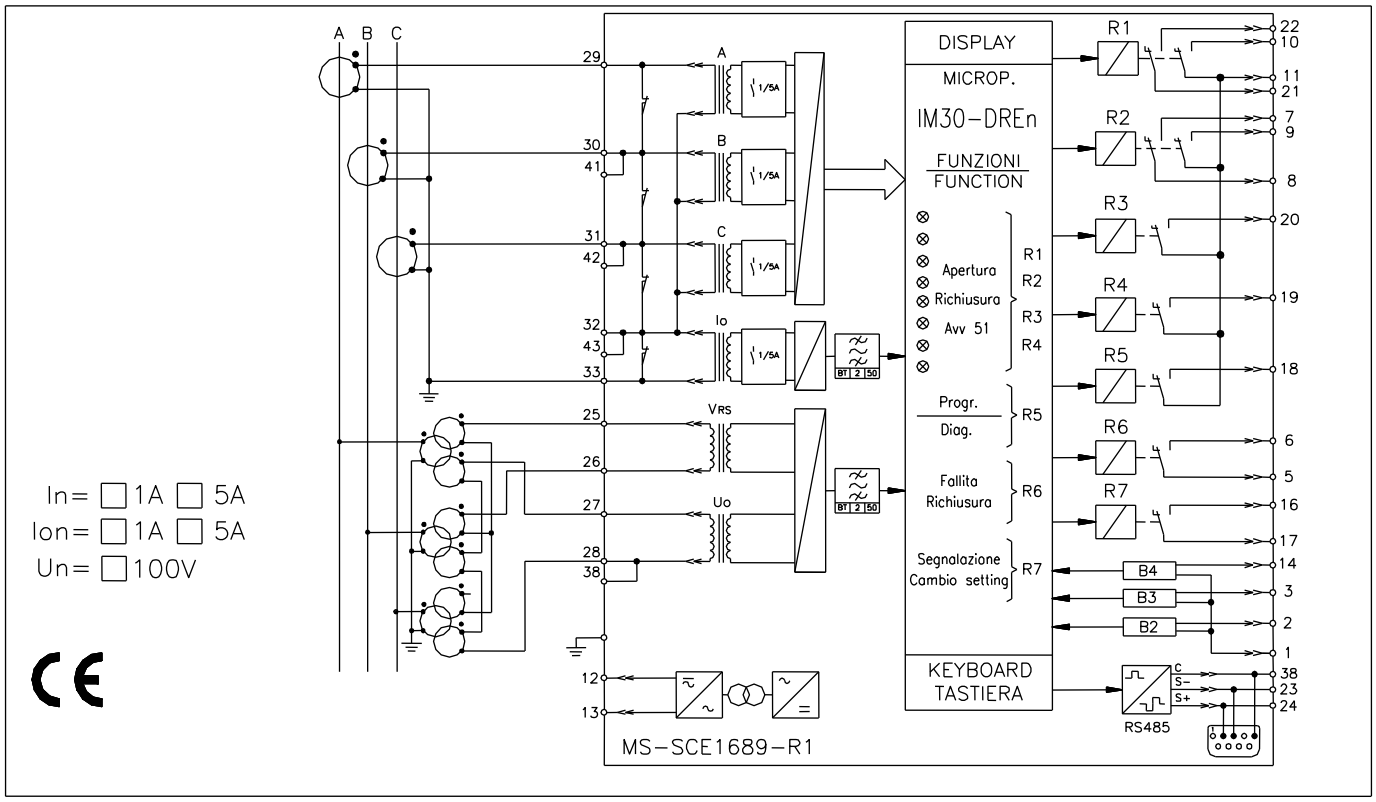
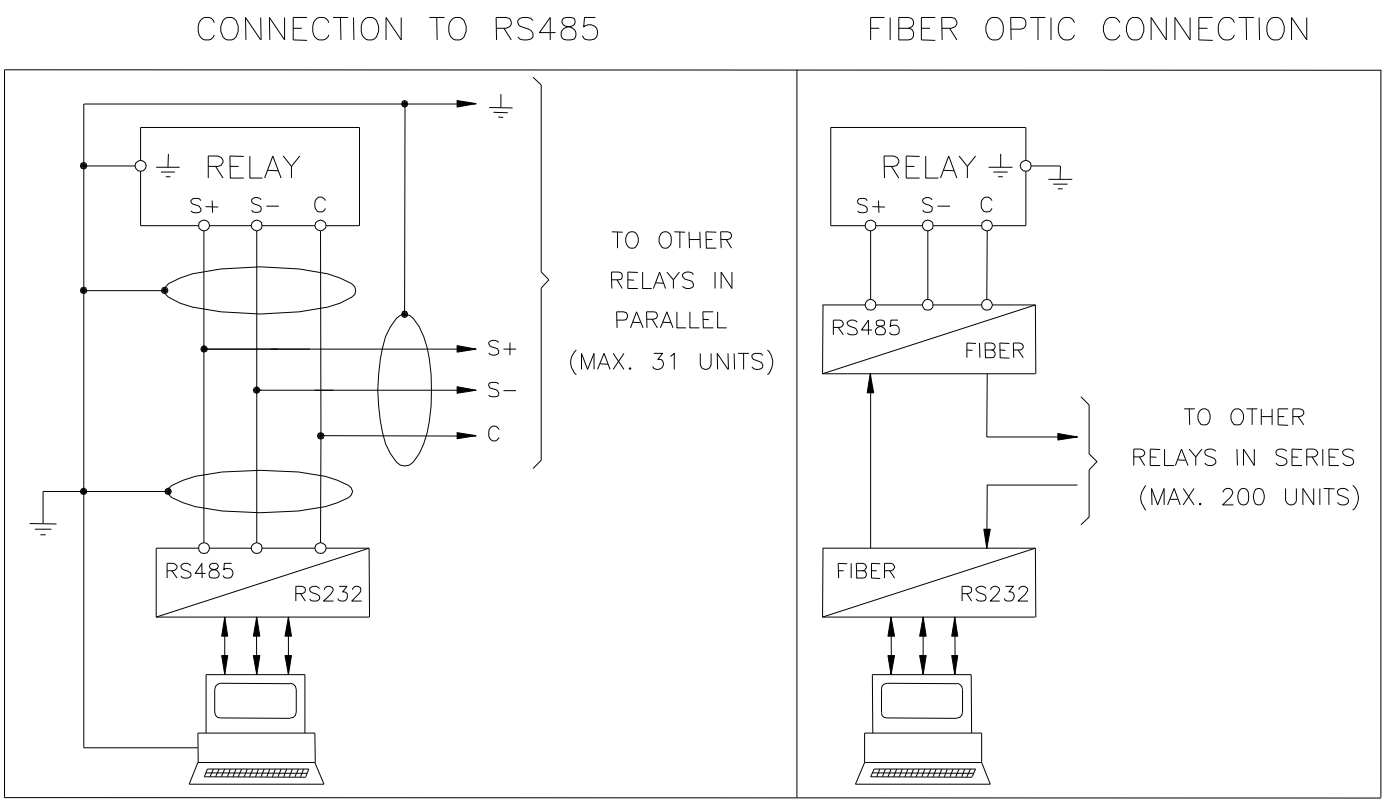
The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice

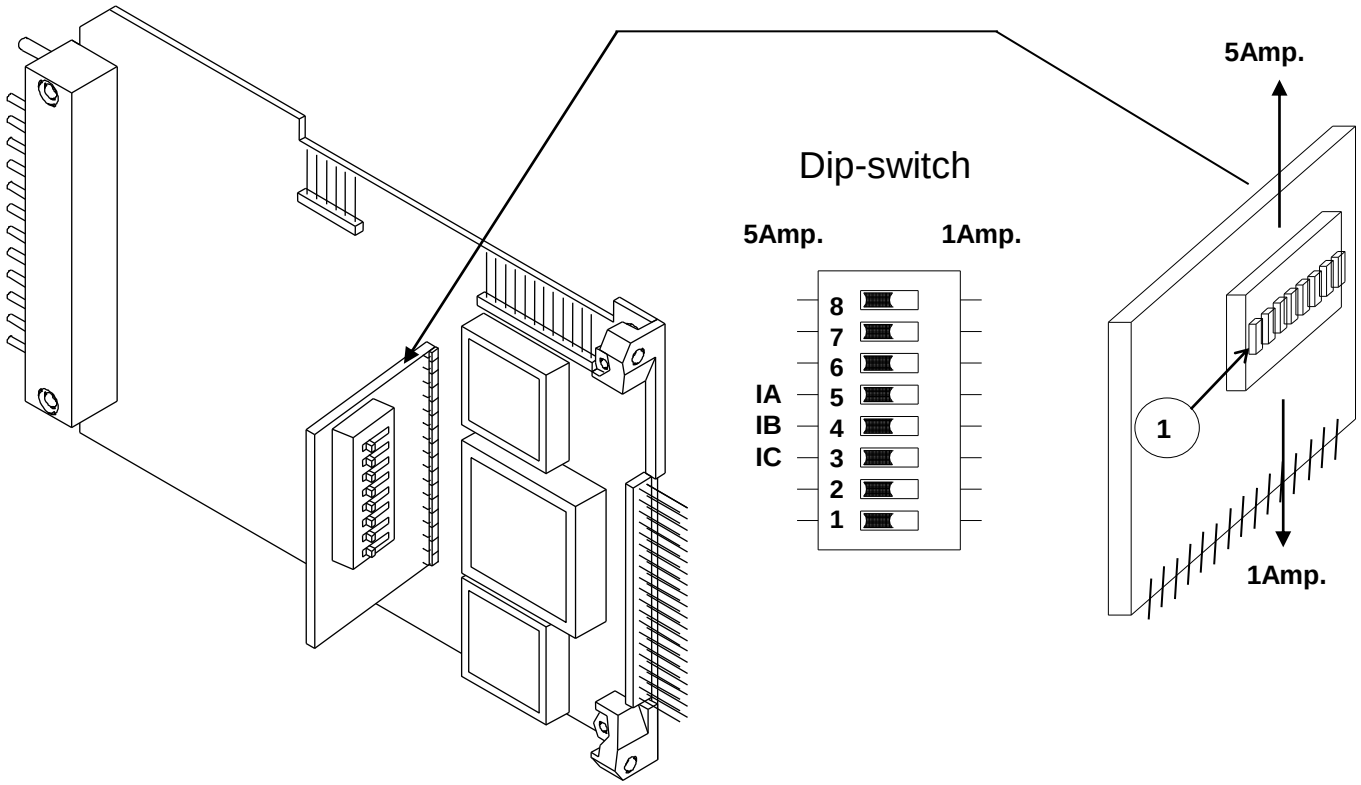
16. CONNECTION DIAGRAM (SCE1574 Rev.0 Double Output)



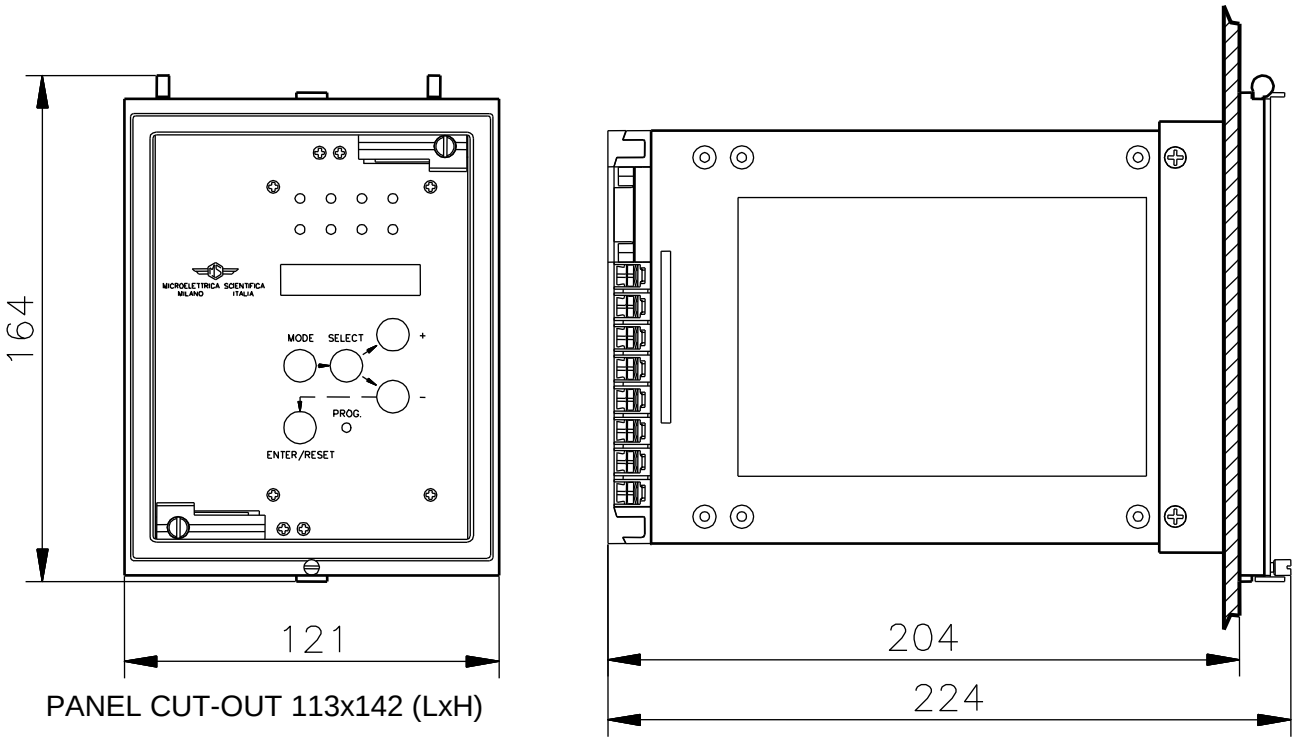
17. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)



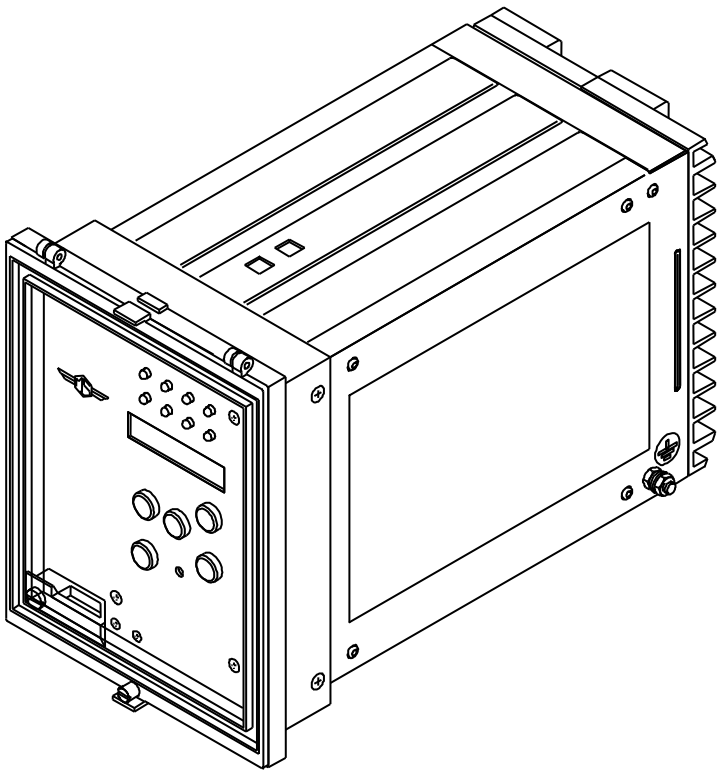
18. CHANGE PHASE CURRENT RATED INPUT 1 OR 5A



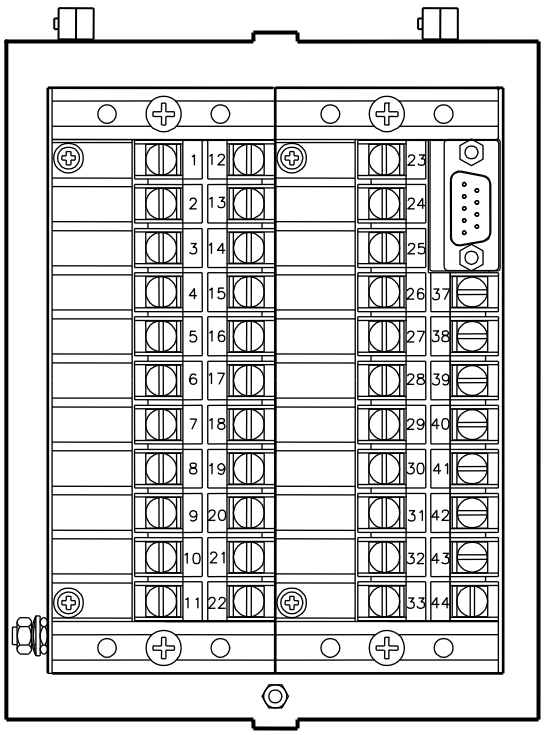
19. MOUNTING



PANEL CUT-OUT 113x142 (LxH)



View of Rear Terminal Connection



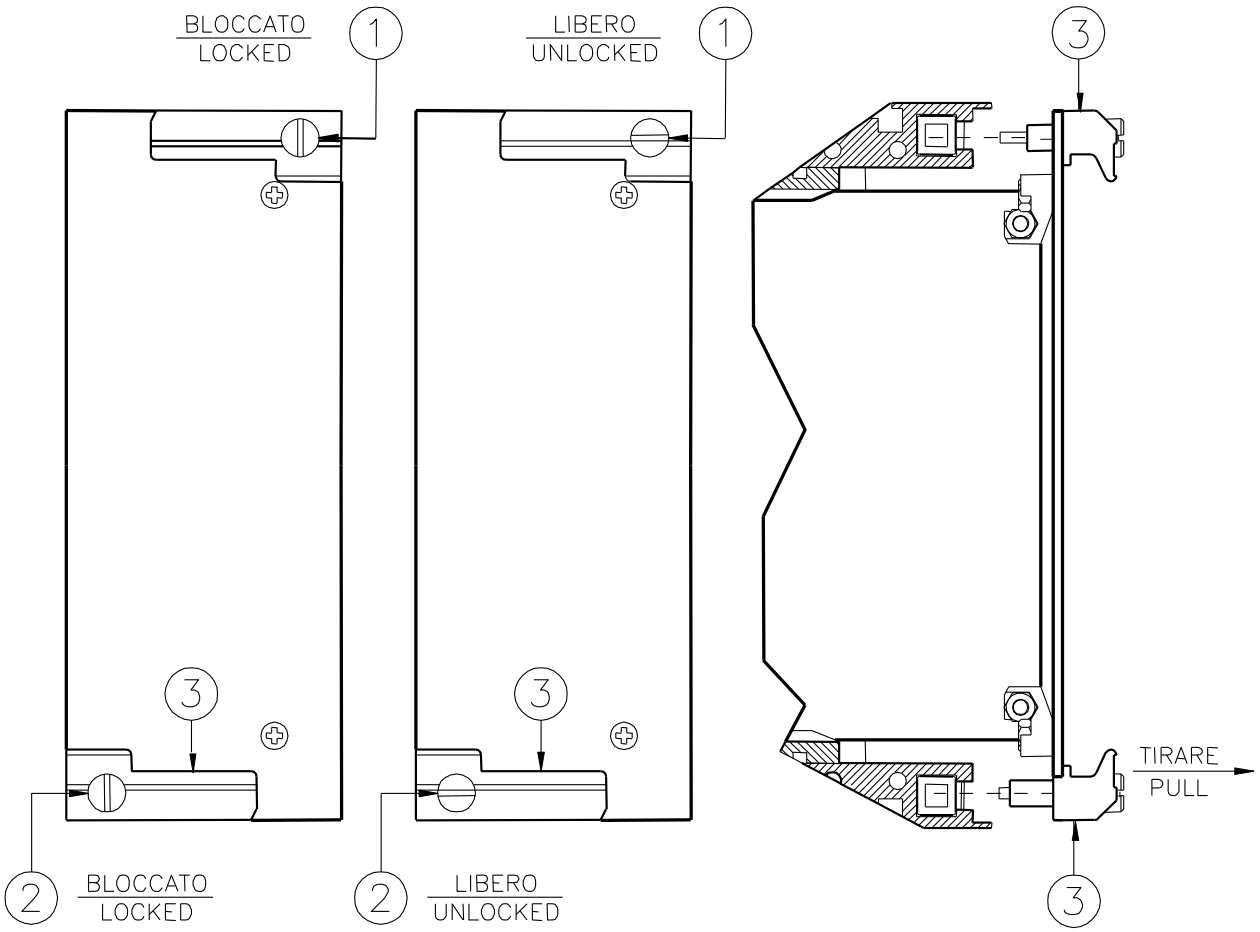
20. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

20.1 - Draw-out

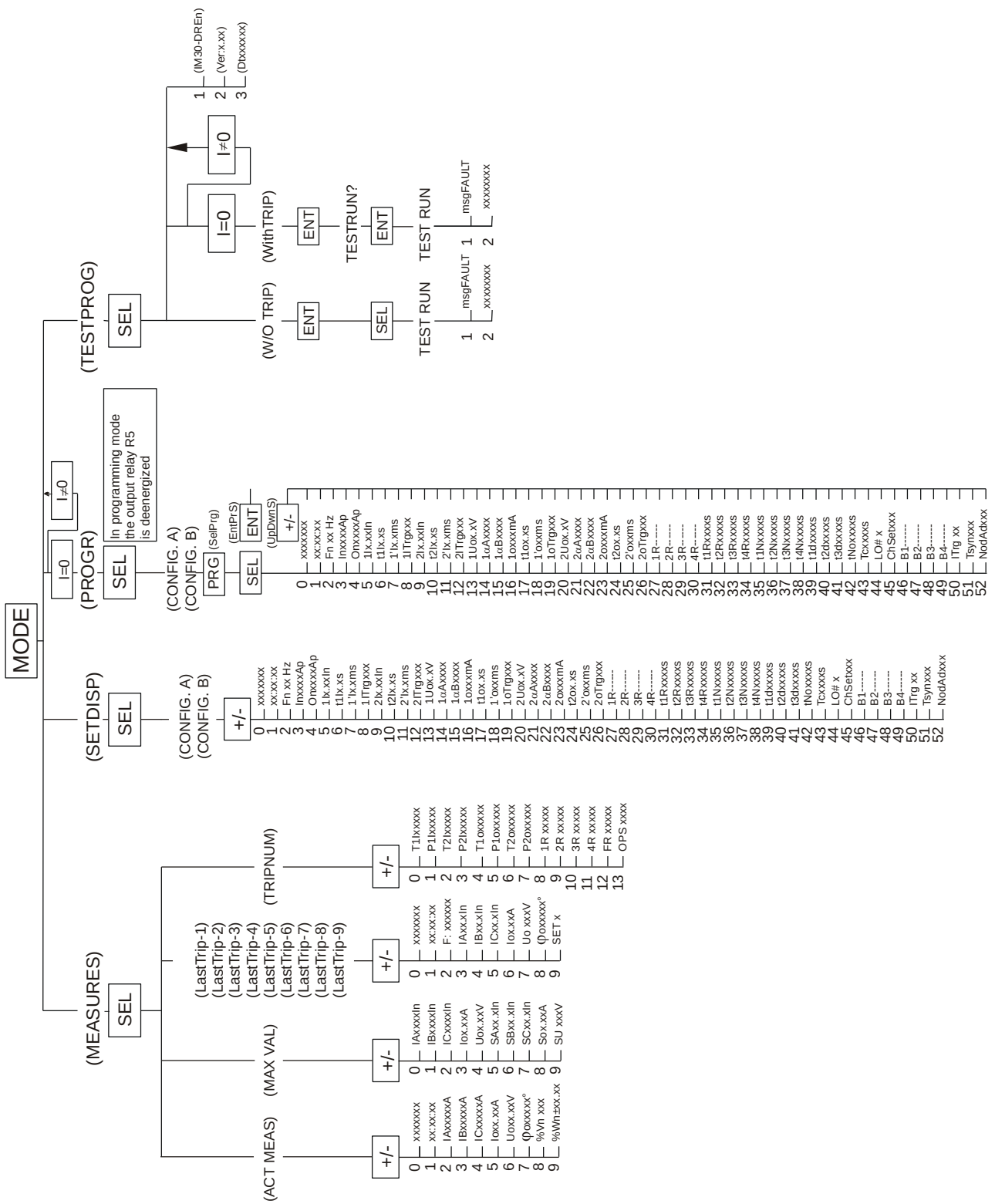
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

20.2 - 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).



21. KEYBOARD OPERATIONAL DIAGRAM



22. SETTINGS' FORM - Commissioning Test Record

Relay Type	**IM30-DREn**	**Station :**	**Circuit :**		
Date :	**/ /**		**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	GGMMMAA	**-**	Casuale			
xx:xx:xx	Current time	HH:MM:SS	**-**	Casuale			
Fn	Mains frequency	50 - 60	**Hz**	50			
In	Rated primary current of the phase C.Ts.	1000	**Ap**	1000			
On	Rated primary current of the C.Ts.	1000	**Ap**	1000			
1I	Trip level of first element 50/51	0.05 - 2- Dis	**In**	0.25			
t1I	Trip time delay of the first element 51	0,05 - 60	**s**	0.8			
1'I	Reduced trip time delay of the first element 51	0 – 200-Dis	**ms**	100			
1ITrg	Oscillographic recording enabling by trigger from element 1I pick-up	ON-OFF	-	OFF			
2I	Trip level of second element 50/51	0.05 – 2 – Dis	**In**	0.9			
t2I	Trip time delay of the second element 51	0,05 – 60	**s**	0.05			
2'I	Reduced trip time delay of the second element 51	0 – 200-Dis	**ms**	100			
2ITrg	Oscillographic recording enabling by trigger from element 2I pick-up	ON-OFF	-	OFF			
1Uo	Starting level of the zero-sequence polarizing input voltage.	0.4-20-Dis	**V**	0.8			
1αA	Superior limit angle of the operating sector of the first directional element	0-359	-	260			
1αB	Inferior limit angle of the operating sector of the first directional element	0-359	**mA**	350			
1o	Trip level of first element 67N	1 - 40 - Dis		2			
t1o	Trip time delay of the first element 67N	0,05 - 60	**s**	0.2			
1'o	Reduced trip time delay of the first element 67N	0 – 200-Dis	**ms**	100			
1oTrg	Oscillographic recording enabling by trigger from element 1o pick-up	ON-OFF	-	OFF			
2Uo	Starting level of the zero-sequence polarizing input voltage.	0.4-20-Dis	**V**	3.5			
2αA	Superior limit angle of the operating sector of the second directional element	0-359	-	100			
2αB	Inferior limit angle of the operating sector of the second directional element	0-359	-	280			
2o	Trip level of second element 67N	1 - 40 - Dis	**mA**	1			
t2o	Trip time delay of the second element 67N	0.05 - 60	**s**	0.7			
2'o	Reduced trip time delay of the second element 67N	0 – 200-Dis	**ms**	100			
2oTrg	Oscillographic recording enabling by trigger from element 2o pick-up	ON-OFF	-	OFF			
W	Active power treshold for automatic setting program changing	0.2 – 9.9	**% Wn**	0,2			
tW	Automatic changing program time delay	0.1 – 30	**s**	1			

MODULO RICHIUSURA							
1R	Selection of the function(s) selected to initiate the first reclosing shot 1R	A B C D	-	---BA			
2R	As above for second reclosing shot 2R	A B C D	-	--C--			
3R	As above for third reclosing shot 3R	A B C D	-	--CBA			
4R	As above for fourth reclosing shot 4R	A B C D	-	- - - - -			
t1R	Reclosing time interval of first reclosing shot	0.1 – 600.00	**s**	2			
t2R	As above for 2nd reclosing shot	0.1 – 600.00	**s**	4			
t3R	As above for 3rd reclosing shot	0.1 – 600.00	**s**	6			
t4R	As above for 4th reclosing shot	0.1 – 600.00	**s**	8			
t1N	Discrimination time after first reclosure	1.0 – 600.0	**s**	2			
t2N	Discrimination time after 2nd reclosure	1.0 – 600.0	**s**	4			
t3N	Discrimination time after 3rd reclosure	1.0 – 600.0	**s**	6			
t4N	Discrimination time after 4th reclosure	1.0 – 600.0	**s**	8			
t1d	Reclaim time after first reclosure	0 – 5.0	**s**	1			
t2d	Reclaim time after 2nd reclosure	0 – 5.0	**s**	1			
t3d	Reclaim time after 3rd reclosure	0 – 5.0	**s**	1			
TNo	Reclaim time after 4th reclosure	0.1 – 600.0	**s**	2			
Tc	Reduced trip time delay	1.0 - 600.0	**s**	1			
LO#	Lock-out number. Determines the number of shots to Lock-out	1 – 2 – 3 – 4	**-**	4			
ChSet	Change Setting.	1-2-3-4-Dis	**-**	Dis			
B1	After 1R during t1N this functions are disabled	A B C D	**-**	- - - - -			
B2	After 2R during t2N this functions are disabled	A B C D	**-**	- - - - -			
B3	After 3R during t3N this functions are disabled	A B C D	**-**	- - - - -			
B4	After 4R during t4N this functions are disabled	A B C D	**-**	- - - - -			
ITrg	Trigger (Oscillografic recording)	0 - 99	%	50			
Tsyn	Synchronisation Time Expected time interval between sync. pulses.	5-10-15-30 60-Dis	**-**	Dis			
NodAd	Identification number for connection on serial communication bus	1 - 250	**-**	1			

Commissioning Engineer: _____ **Date :** _____

Customer Witness: _____ **Date :** _____