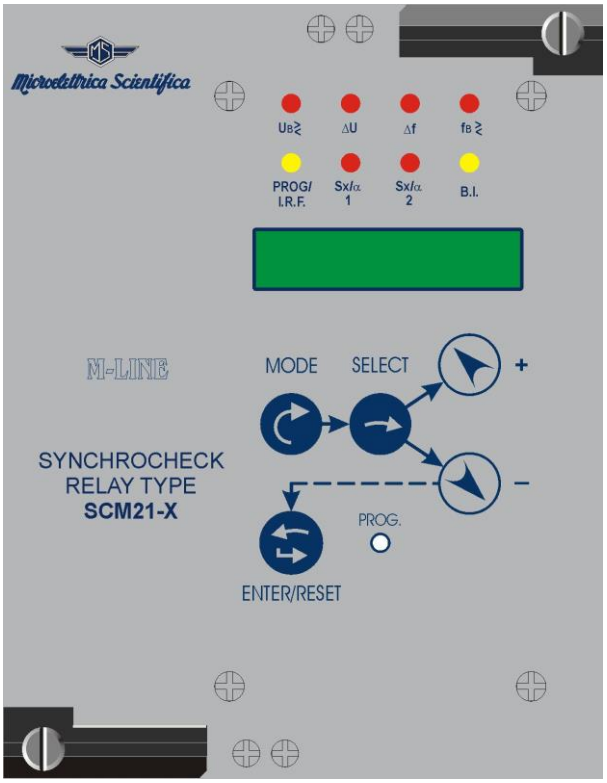
MULTIFUNCTION MICROPROCESSOR SYNCHROCHECK RELAY

TYPE
SCM21-X

OPERATION MANUAL



CE

- Control of one or two separate lines on a common bus
- Check of voltage, frequency and phase displacement
- Dead bus and dead line operation programmable
- Additional over/under voltage and over/under frequency function
- Continuous self supervision with built-in autodiagnostic
- Serial communication interface
- Local display of measurements, settings, events recordings and operation counters
- Local and remote programming of settings, operation modes and output relays configuration

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

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a. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
b. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit tracks or connectors.
c. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.
d. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
e. Store or transport the module in a conductive bag.
More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF.

1.10 - Maintenance

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

1.11 - Waste Disposal of Electrical & Electronic Equipment

(Applicable throughout the European Union and other European countries with separate collection program).
This product should not be treated as household waste when you wish dispose of it. Instead, it should be handed over to an applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequence to the environment and human health, which could otherwise be caused by inappropriate disposal of this product. The recycling of materials will help to conserve natural resource.

1.12 - Fault Detection and Repair

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

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

2. General Characteristics

Input quantities are supplied to 3 Potential Transformers each measuring a phase-to-phase voltage.
Rated voltage input is adjustable from 100 through 240V - 50 or 60Hz.
Make electric connection in conformity with the diagram reported on relay's enclosure.
Check that input quantities are same as reported on the diagram and on the test certificate.
The auxiliary power is supplied by a built-in interchangeable module fully isolated and self protected.

2.1 - Power Supply

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

a) - 24V(-20%) / 110V(+15%) a.c.
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 the supply voltage is within the allowed limits.

2.2 – Operation Configuration

The relay can be programmed to operate in four different system's conditions:

1	-	DB	=	OFF	DL	=	OFF
2	-	DB	=	ON	DL	=	OFF
3	-	DB	=	OFF	DL	=	ON
4	-	DB	=	ON	DL	=	ON

2.2.1 - DB = OFF (Dead Bus not allowed) - DL = OFF (Dead Line not allowed)

In this configuration closing of the C/B can only take place if all the following conditions exist:

- Bus voltage BU is within the set limits : [U<]<BU<[U>]
- Voltage difference is below the set limit : 1ΔU<[1ΔU], 2ΔU<[2ΔU]
- Frequency difference is below the set limit : 1Δf<[1Δf], 2Δf<[2Δf]
- Phase displacement is below the set limit : 1α<[1α], 2α<[2α]

2.2.2 - DB = ON (Dead Bus allowed) - DL = OFF (Dead Line not allowed)

The closing conditions are :

- If Bus voltage BU<UR (Dead Bus)
  Line voltage in the limits : [U<]<1U<[U>], [U<]<2U<[U>]
  Line frequency in the limits : [f<]<1f<[f>], [f<]<2f<[f>]

- If Bus voltage BU>UR normal conditions as §2.2.1

2.2.3 - DB = OFF (Dead Bus not allowed) - DL = ON (Dead Line allowed)

The closing conditions are :

- If Line voltage 1U<UR, 2U<UR (Dead Line)
  Bus voltage in the limits : [U<]<BU<[U>]
  Bus frequency in the limits : [f<]<Bf<[f>]

- If Line voltage 1U>UR, 2U>UR normal conditions as at § 2.2.1

2.2.4 - DB = ON (Dead Bus allowed) - DL = ON (Dead Line allowed)

The closing conditions are :

- If Bus is dead while one or both the lines are live : same as § 2.2.2
- If Bus and one or both the lines are live : same as § 2.2.1
- If Bus is live while one or both lines are dead : same as § 2.2.3
- If Bus and both lines are dead : closing inhibited

2.3 - Operation

The device check the synchronising conditions respectively between inputs “BU-1UL” and “BU-2UL”.
Closing digital inputs “SX1” (terminals 1-2) for “BU-1UL” and “SX2 (terminals 1-3) for “BU-2UL” respectively, the synchrocheck procedure is started.
Through a dedicated Digital Input “BF” (terminal 1-14) is possible to select between automatic (1-14 closed) and manual (1-14 open) operation.
In the Automatic operation, the synchrocheck is executed according to the setting 1ΔU, 1Δf, 1α; the parameter DB is always considered ON (closing on dead bus allowed) independently from the real setting.
In the Manual operation, the synchrocheck is executed according to the setting 2ΔU, 2Δf, 2α; the parameter DB is considered ON or OFF according to the setting.
All the other settings which do not have 1 or 2 prefix, remain unchanged in the two operation modes-

2.3.1 – Automatic Operation (Terminals 1 – 14 shorted)

The relay is in stand-by status (SX1 and SX2 open) with terminals 1-14 closed via external contact for enabling the automatic operation mode
On receipt of a start signal (terminals 1-2 shorting for SX1or terminals 1-3 for SCX2) the device starts checking the synchronising conditions for the breaker of line 1UL (voltages 1UL-BU(SX1)) or of line 2UL (voltages 2UL-BU (SX2)).
In this operation there is a dynamic condition where one or both compared voltages, change very quickly in module and angle.
This is the typical case of a bus transfer from main (failing) to back-up source, over of a bus feeding rotating loads
The aim of this operation is to transfer the source in the minimum possible time to avoid the restart of the rotating machines or anyhow dangerous transients in the system.
Herebelow 4 different cases of bus transfer conditions are described:

1 – Fast bus transfer with voltages phase displacement lower then set level [1α], provided that both values “ΔU” e “Δf” are lower then the set values “1ΔU” e “1Δf”
The phase displacement at the moment of breaker closure, is computed tacking into account: the set breaker closing time [tcb], the frequency difference (“Δfo”) and phase difference (“αo”) eventually existing at source voltage lost and also the frequency change.

$$\alpha_s = \alpha_o + \Delta f_o (t_{cb} + t_c r) \cdot 360 + \frac{1}{2}\frac{\Delta f}{\Delta t}(t_{cb} + t_{cr})^2 \cdot 360$$

where **tcr** = 0.07sec is the activation time of the relay contact used to close the breaker.
Therefore the closing signal is issued if αs ≤ [1α].

2 - Change over at the first phase coincidence of the voltage vectors.
If the condition described at point 1 is not accomplished the closing of the stand-by source Circuit Breaker takes place at the first phase coincidence of the busbar voltage with the source voltage, provided that the values “ΔU” e “Δf” are within the set values “1ΔU” e “1Δf” . Also in this case the closing command is given with a proper advance to recover the circuit breaker closing time.

3- Transfer on residual voltage

If none of the above conditions (1 or 2) is present, the transfer can take place as soon as the busbar residual voltage drops below the set value [UR].

4– Transfer after a set time “tk”

If none of the above conditions are satisfied, the SCX can be programmed to execute the transfer after a set time tk.

2.3.2 –Manual Operation (Terminals 1 – 14 Open)

The SCX is in stand-by condition, as soon as the start signal is given by means of shorting terminals 1-2 relevant to SX1 or terminals 1-3 relevant to SX2, the device starts the synchrocheck procedure relevant respectively to the input 1 (“BU-1UL”) SX1 or to the input 2 (“BU-2UL”) SX2.
In this operation mode there is a static condition where the compared voltages are stable in module and almost synchronous.
This is the typical case where a transfer from one source to the other is executed for maintenance reason or due to a particular system configuration
The SCX check the parameters [2ΔU], [2Δf] e [2α] and issue the closing command when all the following conditions are satisfied:

$$\begin{cases} \Delta U < [2\Delta U] \\ \Delta f < [2\Delta f] \\ \Delta \alpha < [2\alpha] \end{cases}$$

Also the permissible conditions relevant to each compared voltage must be satisfied .

In this operation mode the closing time of the circuit breaker is not taken into account.

Also the transfer forced after set time “tk” is disabled in this operation mode.

2.4 – C/B closing command

A closing command, when issued, remains active (if the closing conditions are present) up to 200ms after the C/B close signal is detected (status inputs SX1, SX2 shorted). When a closing command is issued, the next command can not take place before the wait time [to] is expired.

2.5 – Change of Setting Input

When the digital input “B.I.“, terminals “1-14”, is shorted, the Automatic
Transfer mode is enabled. Vice versa, when not active, “1-14 Open” the Manual transfer mode is active.

2.6 - Clock and Calendar

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

2.6.1 - Clock synchronization.

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

2.6.2 - Date and time setting.

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

2.6.3 - Time resolution

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

2.6.4 - Operation during power off.

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

2.6.5 - Time tolerance.

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

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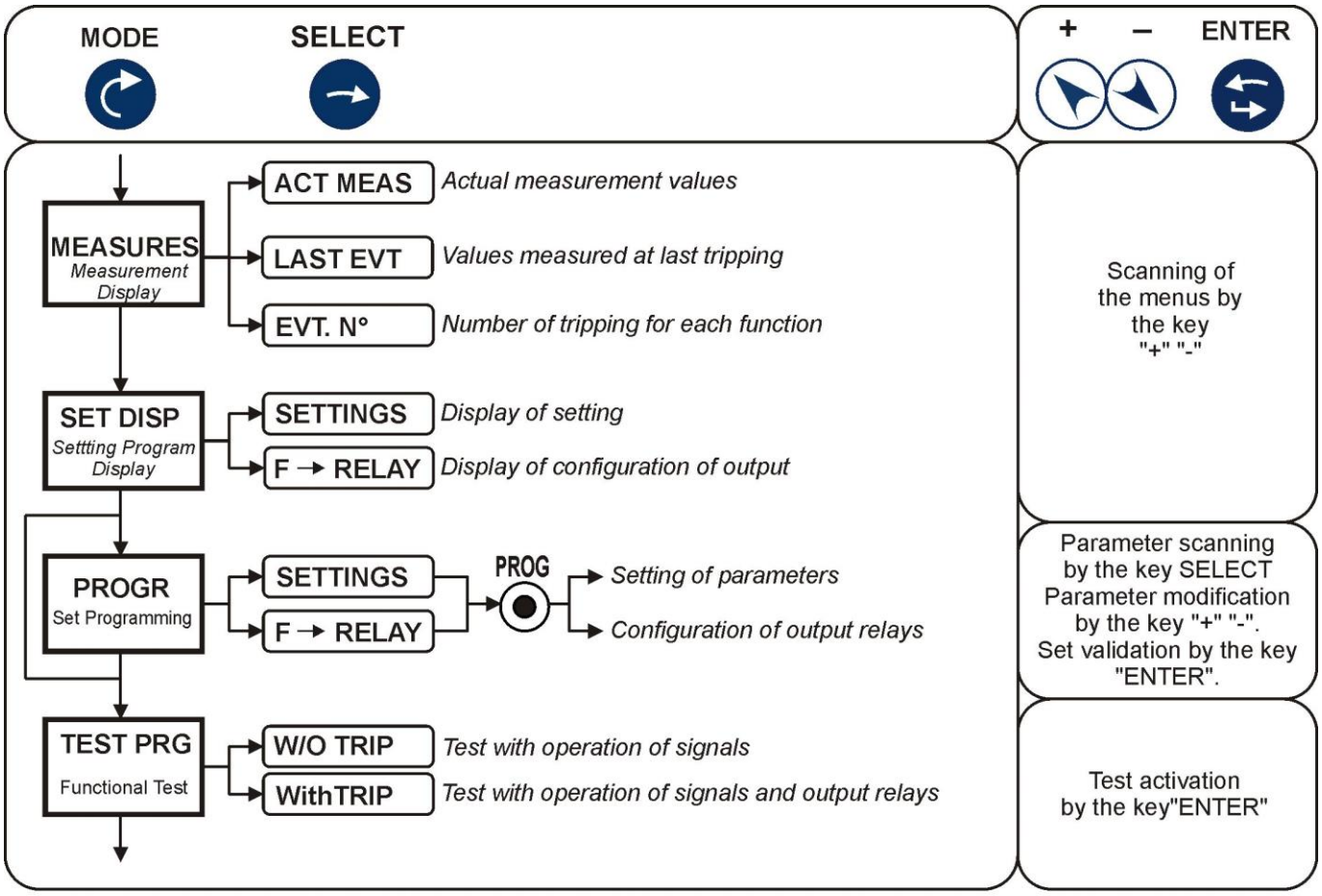
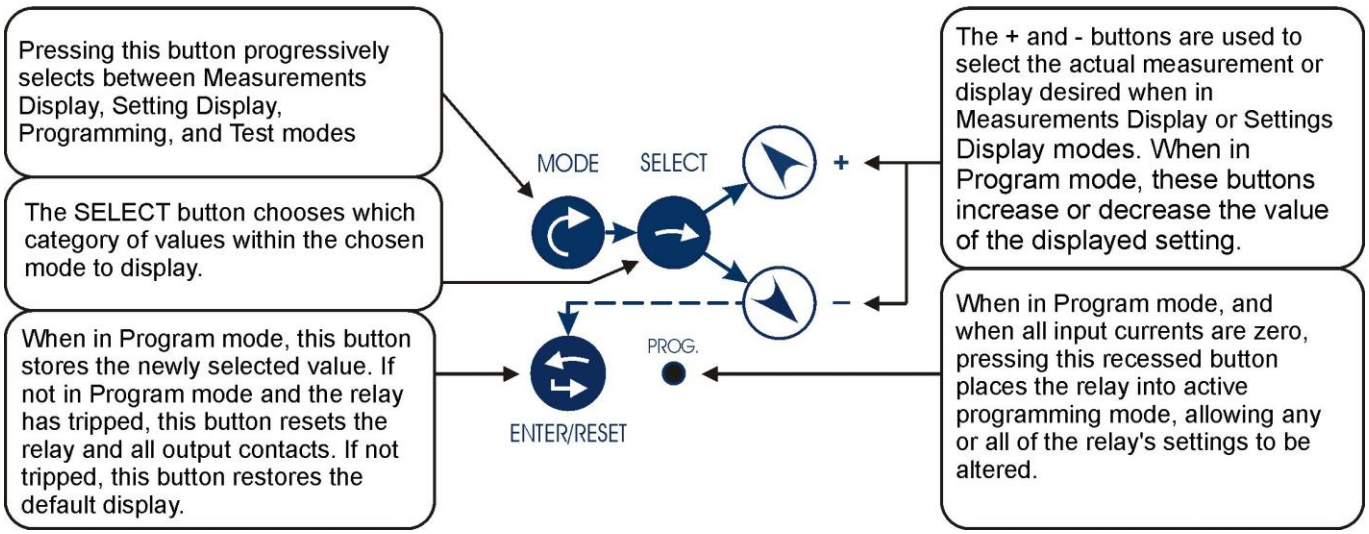
3. Controls and Measurements

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

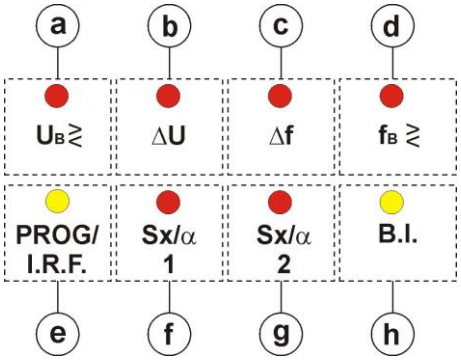
FIG.1





4. Signalizations

Eight signal leds provide information on relay actual status:



a)	Red led	$U_B \gtrless$	: • Off when BU is in limits • If BU exceeds the limits: • Flashing during the time delay [tU<] or [tU>]. • Illuminated at the end of trip time delay
b)	Red led	**ΔU**	: • If SX1 shorted the led is illuminated when voltage difference 1U-BU>[ΔU]. • If SX1 shorted the led is illuminated when voltage difference 2U-BU>[ΔU].
b)	Red led	**Δf**	: • If SX1 shorted the led is illuminated when frequency difference 1Hz-BHz >[Δf]. • If SX2 shorted the led is illuminated when frequency difference 2Hz-BHz >[Δf].
d)	Red led	$f_B \gtrless$	: • Same operation as led U_B> but referred to bus frequency compared with the levels [f>], [f<] and time delay [tf>], [tf<].
e)	Yellow led	**PROG./I.R.F.**	: • Lit-on when any internal relay Fault is detected. • Flashing when in the programming mode.
f)	Red led	**SX/α1**	: • Lit-on when Voltages phase displacement is within the set limits • Flashing when digital input SX1 is active
g)	Red led	**SX/α2**	: • Lit-on when Voltages phase displacement is within the set limits • Flashing when digital input SX2 is active
h)	Yellow led	**B.I.**	: • Flashing when a blocking input is present.

5. Output Relays

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

a) - The relays **R1,R2,R3,R4** are normally deenergized (energized on trip): these output relays are user programmable and any of them can be associated to any of the following SCM21's functions:

SX1	(close C/B L1)	SX2	(close C/B L2)
tU<	(time delayed undervoltage)	tU>	(time delayed overvoltage)
tf<	(time delayed underfrequency)	Tf>	(time delayed overfrequency)

Any relay associated to SX1 and/or SX2 does not accept to be also associated to any other function. Relays associated to SX1 and/or SX2 are automatically reset.
The reset of the relays associated to the function tU<, tU>, tf<, tf> can be programmed as Automatic or Manual or Time delayed.

- Automatic instantaneous : Rxtr = Aut. (x = 1, 2, 3, 4)
- Manual (reset only by reset key or serial) : Rxtr = Man. (x = 1, 2, 3, 4)
- Automatic with adjustable time delay : Rxtr = (0,1 - 9,9)s

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

- internal fault
- power supply failure
- during the programming

6. Serial Communication

The relay has an RS485 interface and can be connected directly to a PC (type IBM or compatible) via a dedicated cable or to a RS485 serial bus.
In this second case it is possible to have many relays exchanging data with a single master PC using the same physical serial line.
All the functionalities that are locally available(for example reading of input measurement and changing of relay's settings) are also available via the serial communication interface.
The communication protocol is MODBUS RTU.
Each relay is identified by its programmable address node (NodeAd) which identify it when connected to a PC. 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.

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7. Digital Inputs

Three digital inputs are available. They are active when the relevant terminals are shorted by cold contacts:

- **SX1**	(terminals 1 - 2)	:	initiate 1UL – BU synchrocheck
- **SX2**	(terminals 1 - 3)	:	initiate 2UL-BU synchrocheck
- **BI**	(terminals 1 - 14)	:	Set Automatic or Manual operation (1-14 shorted = Automatic, 1-14 open = Manual)

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 auxiliary Power supply 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" lits-on and the relay R5 is deenergized.
- Complete test activated by the keyboard or via the communication bus. The test can be carried out with or without tripping of the output relays.

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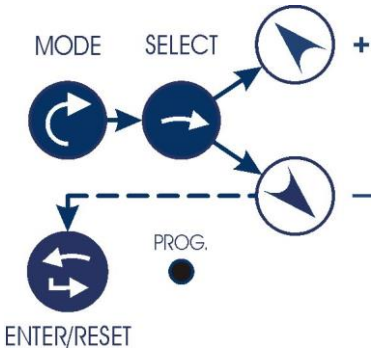
9. Keyboard and Display Operation

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) -	**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) -	**SELECT**	:	When operated it selects one of the menus available in the actual operation MODE When in the program mode scroll the parameters.
c) -	"**+**" AND "**-**"	:	The + and - buttons are used to select the actual measurement or display desired when in Measurements Display or Settings Display modes. When in Program mode, these buttons increase or decrease the value of the displayed setting.
d) -	**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) -	**PROG.**	:	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
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
1U	xxx	**%Un**	Line voltage measured at input 1UL (terminals 25-26)
2U	xxx	**%Un**	Line voltage measured at input 2UL (terminals 27-28)
BU	xxx	**%Un**	Bus voltage measured at input BU (terminals 29-30)
1Hz	xxxxx		Line frequency measured at input 1UL
2Hz	xxxxx		Line frequency measured at input 2UL
BHz	xxxxx		Bus frequency measured at input BU
1ΔU	xx	**%BU**	Voltage difference 1UL-BU
2ΔU	xx	**%BU**	Voltage difference 2UL-BU
1Δf	xxx	**Hz**	Frequency difference 1f-Bf
2Δf	xxx	**Hz**	Frequency difference 2f-Bf
1α	xxxxx	**°**	Phase displacement angle between 1UL-BU
2α	xxxxx	**°**	Phase displacement angle between 2UL-BU

10.2 - LASTEVT

Display of the function which caused the last pick-up of any output relay plus values of the parameters at the moment of tripping. The memory buffer is refreshed at each new relay pick-up.

Display			Description
xxXXXxx			Date : Day, Month, Year
xx:xx:xx			Hour : Hours, Minutes, Seconds
EVT:	xxxx		SX1, SX2, tU>, tU<, tf>, tf<.
BU	xxx	**%Un**	As recorded at the moment of the last pick-up command
BHz	xxxxx		As recorded at the moment of the last pick-up command
1ΔU	xx	**%BU**	As recorded at the moment of the last pick-up command
2ΔU	xx	**%BU**	As recorded at the moment of the last pick-up command
1Δf	xxx	**Hz**	As recorded at the moment of the last pick-up command
2Δf	xxx	**Hz**	As recorded at the moment of the last pick-up command
1α	xxxxx	**°**	As recorded at the moment of the last pick-up command
2α	xxxxx	**°**	As recorded at the moment of the last pick-up command

10.2 - EVT. N°

Counters of the number of operations for each of the relay functions.
The N° is increased at each next operation of the function.
The memory is non-volatile and can be cancelled only with a secret procedure.

Display		Description
SX1	xxxxx	Closing command to C/B Line 1
SX2	xxxxx	Closing command to C/B Line 2
tU>	xxxxx	Tripping of time delayed overvoltage element
tU<	xxxxx	Tripping of time delayed undervoltage element
tf>	xxxxx	Tripping of time delayed overfrequency element
tf<	xxxxx	Tripping of time delayed underfrequency element

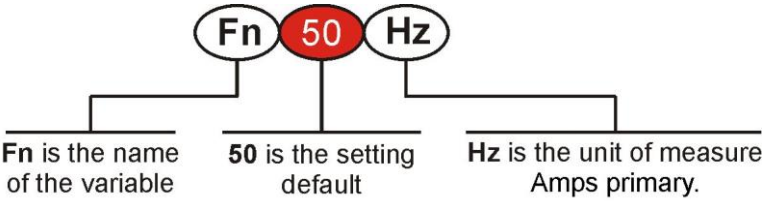
11. Reading of Programmed Settings and Relay's Configuration

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

12. Programming

The relay is supplied with the standard default programming used for factory test [Values here below reported in the " Display " column].
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
As soon as programming is enabled, the Led PRG/IRF flashes and the relay R5 is deenergized.
Operation of the synchrocheck is blocked during programming.
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. Enter MODE "PROG" and SELECT either "SETTINGS" for programming of parameters or "F→RELAY" for programming of output relays configuration; enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT while "+" or "-" are pressed.
Press key "ENTER/RESET" to validate the set values.

12.1 - Programming of Functions Settings



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

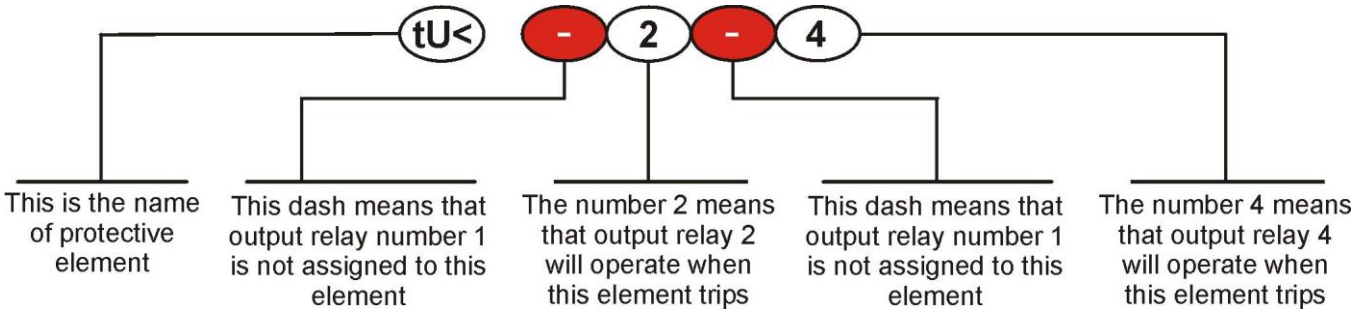
Display			Description	Setting Range	Step	Unit
xxxxxxx			Current date	DDMMMYY	-	-
xx:xx:xx			Current time	HH:MM:SS	-	-
Fn	50	**Hz**	System frequency	50 - 60	10	Hz
UnS	100	**V**	Rated input voltage	100 - 240	1	V
U<	85	**%Un**	Minimum Bus voltage (Line voltage if Dead Bus detected) to allow C/B closure, system undervoltage level when at least one C/B closed.	15 - 120	1	%Un
tU<	5.0	**s**	Trip time delay of undervoltage function. If no C/B closed timer is not started	0.1 - 30	0.1	s
U>	110	**%Un**	Maximum Bus voltage (Line voltage if Dead Bus detected) to allow C/B closure, system overvoltage level when at least one C/B closed.	20 - 150	1	%Un
tU>	5.0	**s**	Trip time delay of overvoltage function. If no C/B closed timer is not started.	0.1 - 30	0.1	s

Display			Description	Setting Range	Step	Unit
f<	49.5	**Hz**	Minimum Bus frequency (Line frequency if Dead Bus detected) to allow C/B closure, system underfrequency level when at least one C/B closed.	45 - 60	0.1	Hz
tf<	10.0	**s**	Trip time delay of underfrequency function. If no C/B closed timer is not started.	0.1 - 30	0.1	s
f>	50.5	**Hz**	Maximum Bus frequency (Line frequency if Dead Bus detected) to allow C/B closure, system overfrequency level when at least one C/B closed.	50 - 65	0.1	Hz
tf>	10.0	**s**	Trip time delay of overfrequency function. If no C/B closed timer is not started.	0.1 - 30	0.1	s
DB	OFF		Dead Bus operation allowed (ON) or not (OFF). (see § 2.2)	ON - OFF	-	-
DL	OFF		Dead Line operation allowed (ON) or not (OFF). (see § 2.2)	ON - OFF	-	-
UR	80	**% Un**	Residual voltage to consider a bus or a Line as Dead	0 – 100	1	%Un
1ΔU	10	**%BU**	Maximum permissible voltage difference for closing of C/B L1. Not considered when Dead Bus, (BU<UR) or Dead Line 1 (1U<UR) condition is detected	1 - 50	1	%BU
1Δf	0.20	**Hz**	Maximum permissible frequency difference for closing of C/B L1. Not considered when Dead Bus, (BU<UR) or Dead Line 1 (1U<UR) condition is detected.	0.02 – 9.9	0.01	Hz
2ΔU	10	**%BU**	Maximum permissible voltage difference for closing of C/B L2. Not considered when Dead Bus, (BU<UR) or Dead Line 2 (2U<UR) condition is detected.	1 - 50	1	%BU
2Δf	0.20	**Hz**	Maximum permissible frequency difference for closing of C/B L2. Not considered when Dead Bus, (BU<UR) or Dead Line 2 (2U<UR) condition is detected.	0.02 – 9.9	0.01	Hz
1α	15	**°**	Maximum permissible displacement angle 1U/BU for closing C/B L1.	3 - 90	1	°
2α	15	**°**	Maximum permissible displacement angle 2U/BU for closing C/B L2.	3 - 90	1	°
ts	10.0	**s**	Minimum permanence time of voltage and frequency closing conditions to start checking of angle. Active only during manual operation.	0 - 60	0.1	s
tk	5.0	**s**	Time after which closing is forced if angle remains steady within the max. permissible without searching α_{CB} (automatic adjusted angle)	0.1 - 30 - Dis	0.1	s
tcb	Dis		Closing time of C/B for automatic adjusting of the closing angle	0 - 0.2 - Dis	0.01	s
to	5	**s**	Minimum reclose time.	0 - 600	1	s
Tsyn	Dis	**m**	Synchronisation Time	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.

Parameters with index "1" (1ΔU, 1Δf, 1α) are active only in the automatic operation mode
Parameters with index "2" (2ΔU, 2Δf, 2α) are active only in the manual operation mode

12.2 - Programming the Configuration of Output Relays



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

Display	Description
SX1 - 2 - -	Closing command of C/B L1
SX2 - - 3 -	Closing command of C/B L2
tU< 1 - - -	Time delayed undervoltage
tU> - - 4	Time delayed overvoltage
tf< 1 - - -	Time delayed underfrequency
tf> - - - 4	Time delayed overfrequency
R1tr Aut	Reset time delay of output relay R1 can be : - instantaneous (R1tr = Aut.) (*) - time delayed (R1tr = 0,1- 9,9 s) step 0,1s - manual (R1tr = Man.) **(*) Selection is made via the keys +/-**
R2tr Aut	As above for relay R2.
R3tr Aut	As above for relay R3.
R4tr Aut	As above for relay R4.

13. Manual Test Operation

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

Operation of the yellow key activates a complete test of the electronics and the process routines.
All the leds are lit-on and the display shows (TEST RUN).
If the test routine is successfully completed the display switches-over to the reading existing after the test. 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.

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

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

❑	Dielectric test voltage	IEC 60255-5	2kV, 50/60Hz, 1 min.
❑	Impulse test voltage	IEC 60255-5	5kV (c.m.), 2kV (d.m.) – 1,2/50μs
❑	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 for measure 0,2% On 2% +/- 10ms for times
❑	Rated Voltage	Un = 100 – 240V, 50 – 60Hz
❑	Voltage overload	2 Un continuous
❑	Burden on voltage input	0.2 VA at Un
❑	Average power supply consumption	8.5 VA
❑	Output relays	rating 5 A; Vn = 380 V A.C. resistive switching = 1100W (380V max) make = 30 A (peak) 0,5 sec. break = 0.3 A, 110 Vcc, L/R = 40 ms (100.000 op.)

Microelettrica Scientifica S.p.A. - 20089 Rozzano (MI) - Italy - Via Alberelle, 56/68
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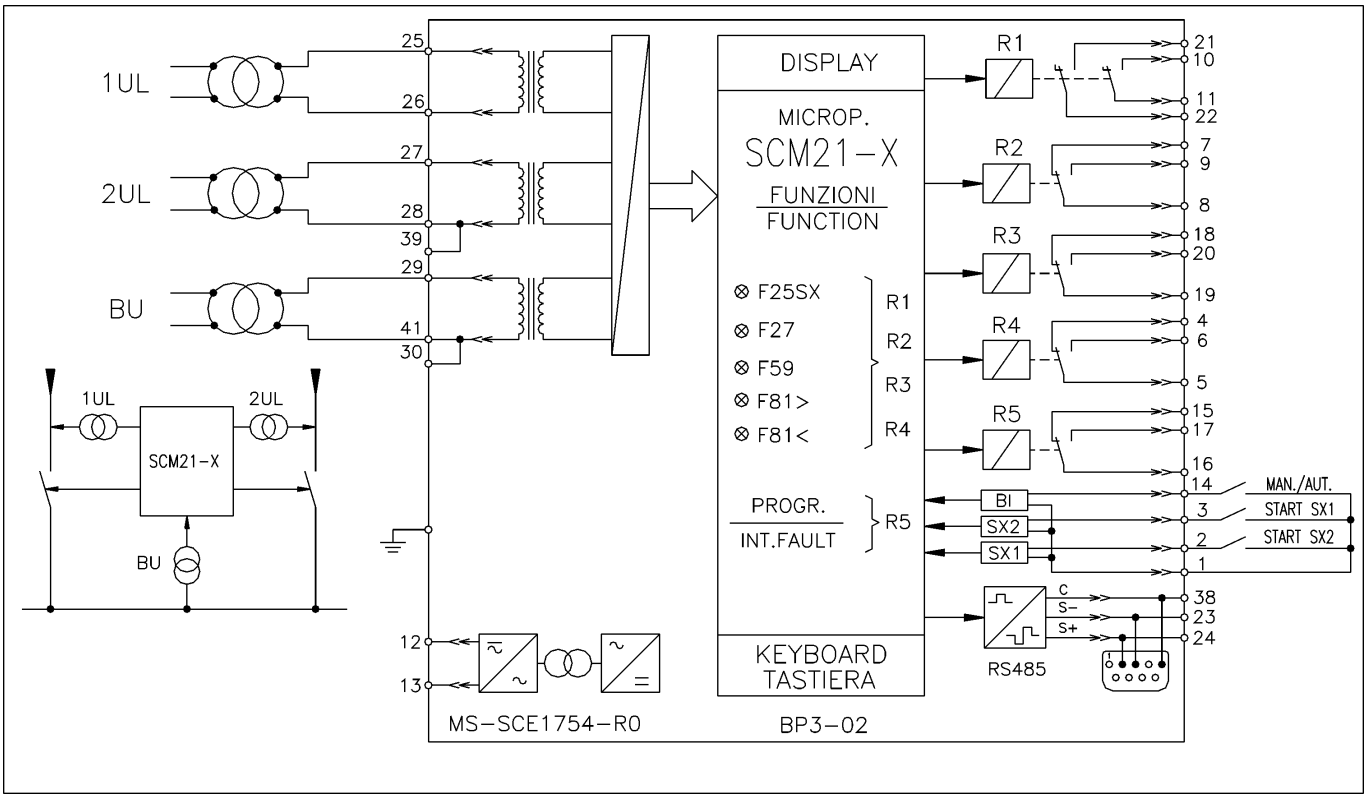
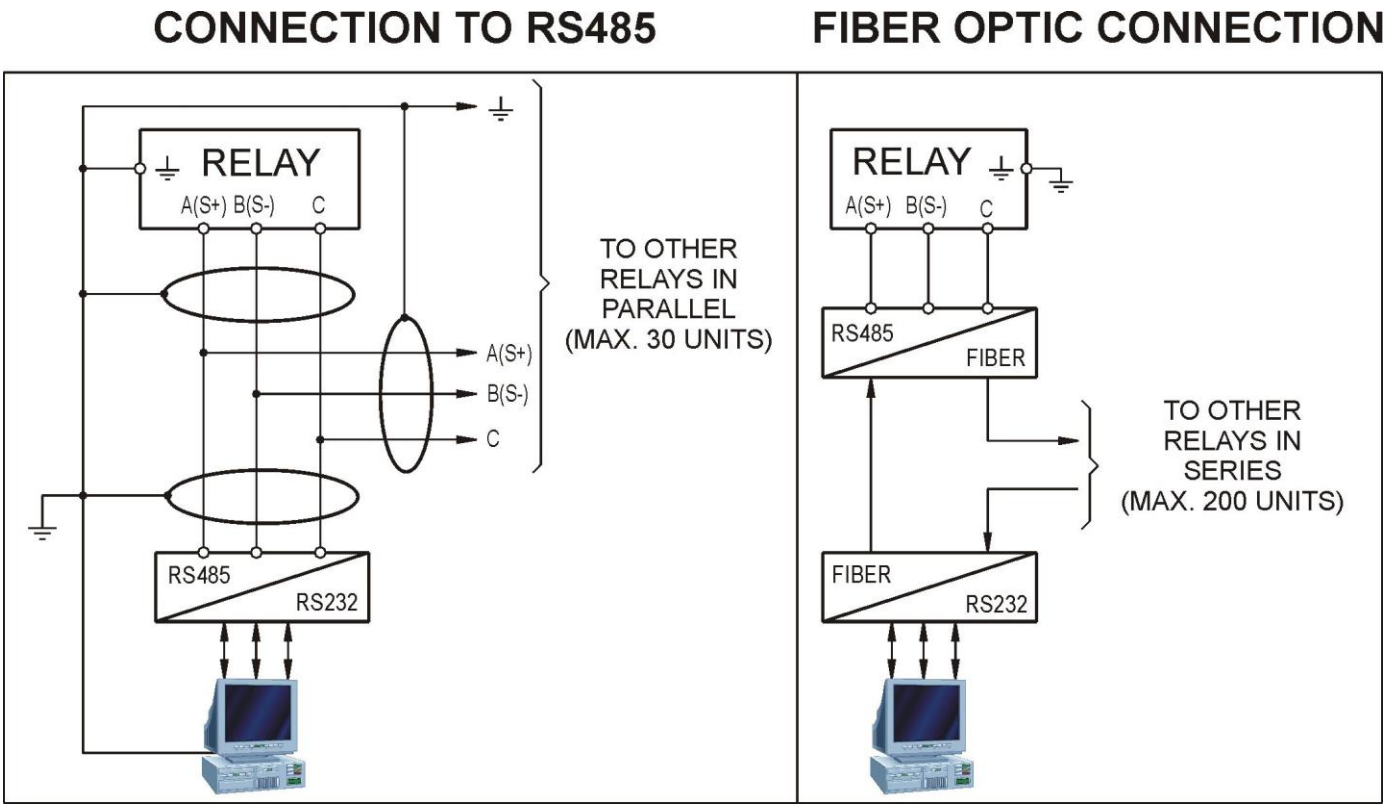
http://www.microelettrica.com **e-mail :** sales.relays@microelettrica.com

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

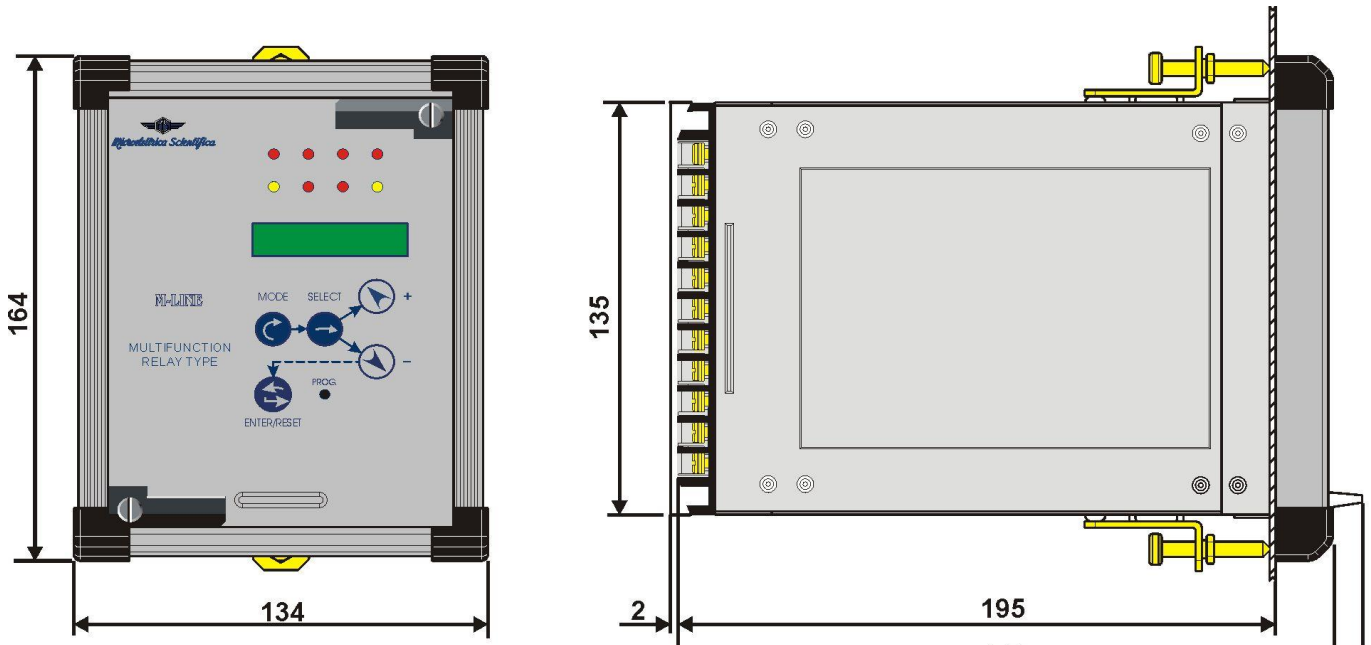
17. Connection Diagram



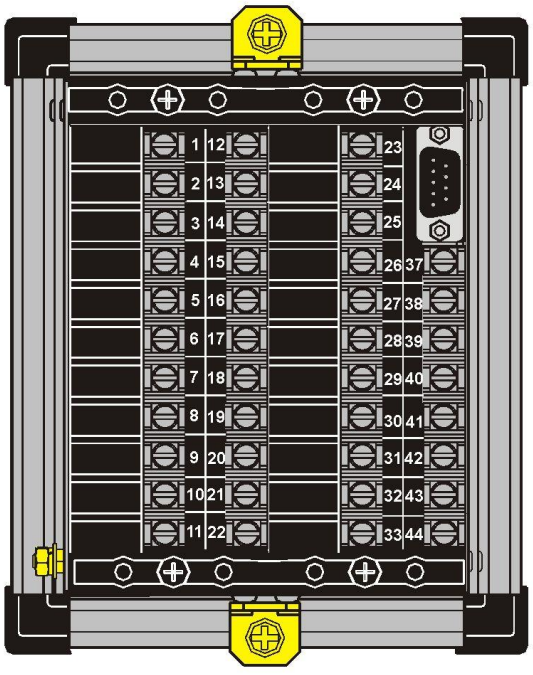
18. Wiring the Serial Communication Bus



19. Overall Dimensions



FORATURA PANNELLO
PANEL CUT-OUT
115x137 (LxH)



VISTA POSTERIORE - MORSETTI DI CONNESSIONE
VIEW OR REAR - TERMINAL CONNECTION

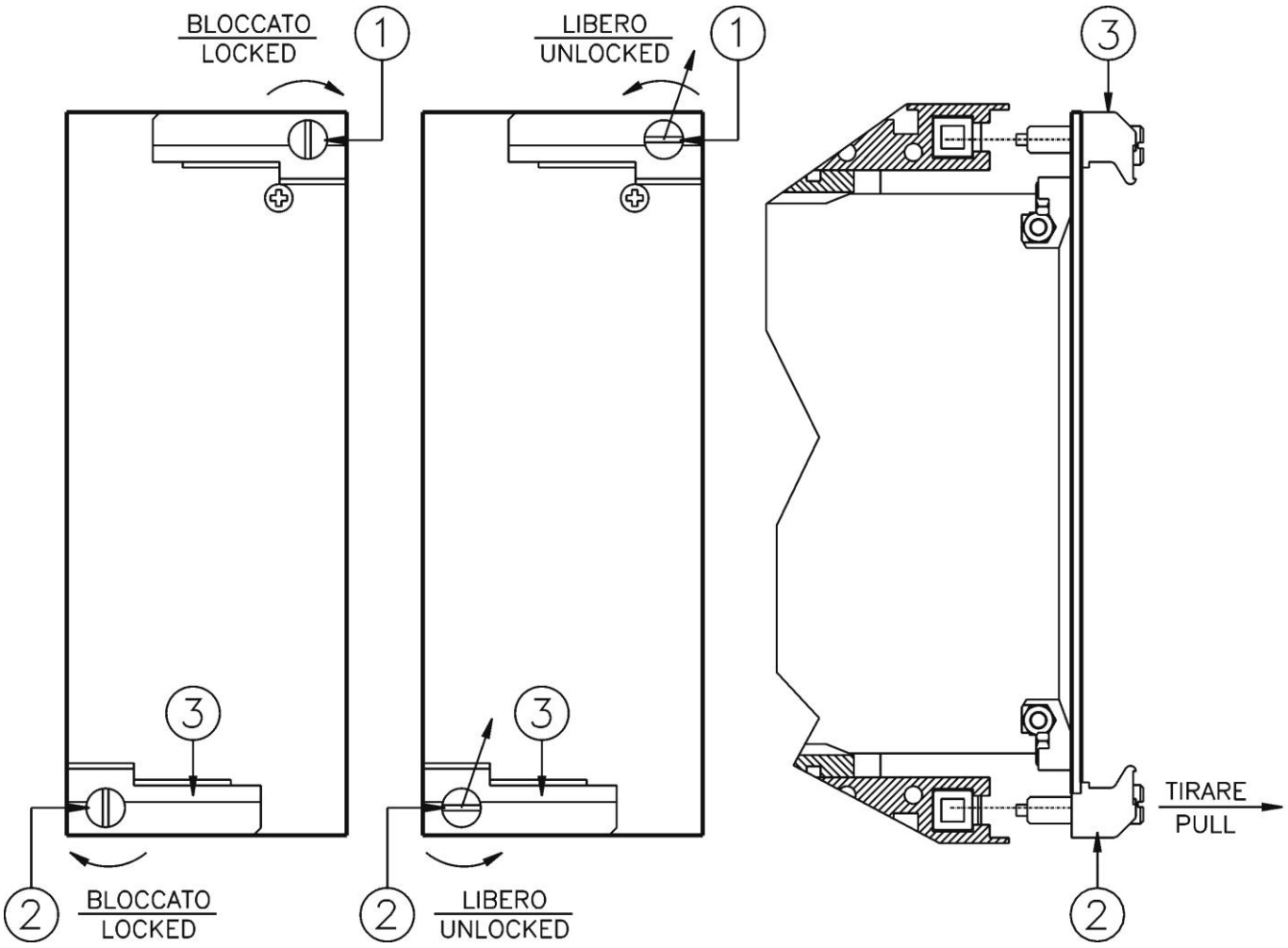
20. Direction for Pcb's Draw-Out and Plug-In

20.1 - Draw-Out

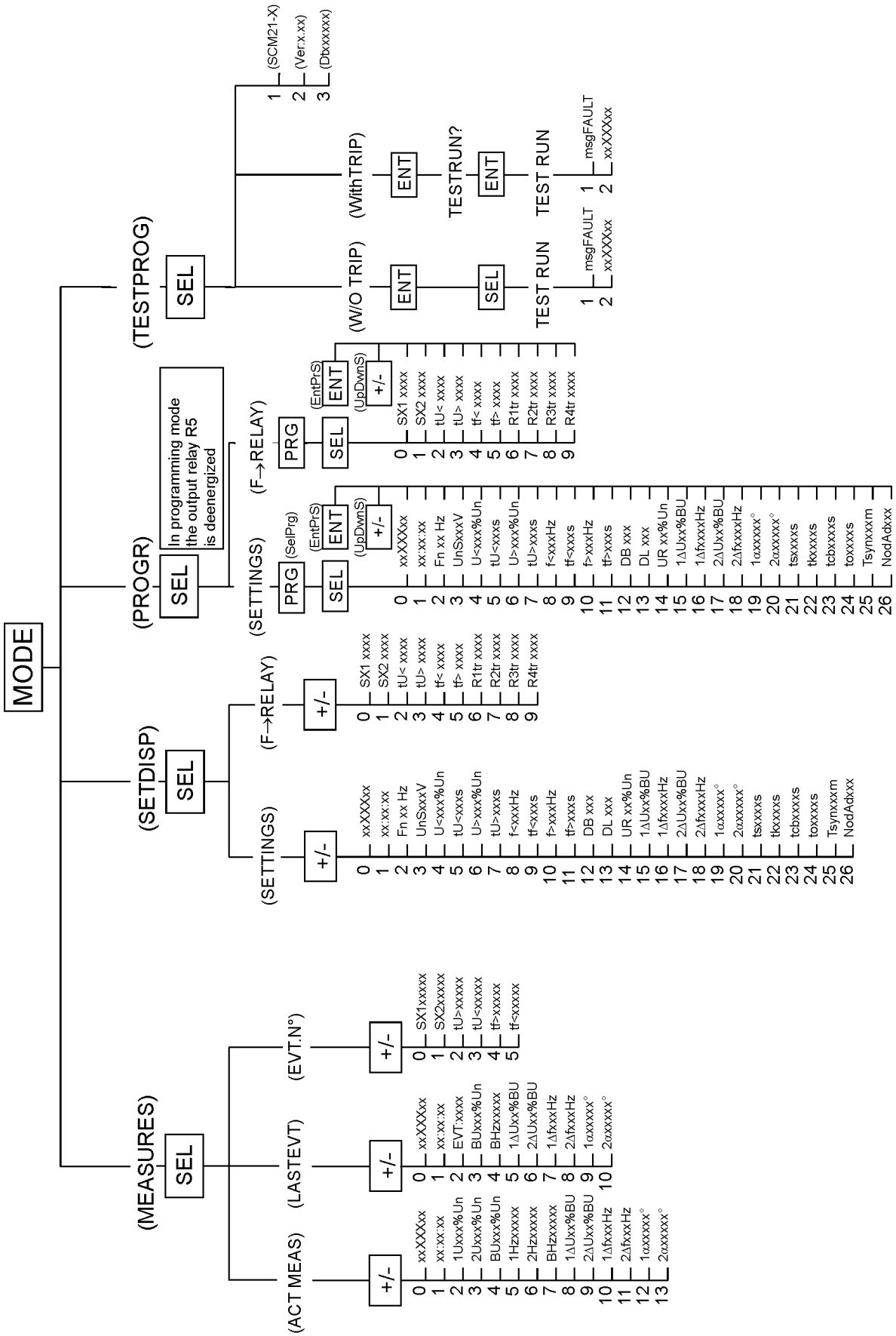
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

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. Setting's Form

Relay Type **Date :**	**SCM21-x** | **Station :** **/ / FW Version:**	**Circuit :** **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.	**Rated Voltage :**	

RELAY PROGRAMMING

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result	
						Pick-up	Reset
xxxxxxx	Current date	DDMMMYY	-	random			
xx:xx:xx	Current time	HH:MM:SS	-	random			
Fn	Mains frequency	50 or 60	**Hz**	50			
UnS	Rated input voltage	100 - 240	**V**	100			
U<	Minimum Bus voltage	15 - 120	**%Un**	85			
tU<	Trip time delay of undervoltage function.	0.1 - 30	**s**	5.0			
U>	Maximum Bus voltage	20 - 150	**%Un**	110			
tU>	Trip time delay of overvoltage function.	0.1 - 30	**s**	5.0			
f<	Minimum Bus frequency	40 - 60	**Hz**	49.5			
tf<	Trip time delay of underfrequency function.	0.1 - 30	**s**	10.0			
f>	Maximum Bus frequency	50 - 65	**Hz**	50.5			
tf>	Trip time delay of overfrequency function.	0.1 - 30	**s**	10.0			
DB	Dead Bus operation allowed (ON) or not (OFF)	ON - OFF	**-**	OFF			
DL	Dead Line operation allowed (ON) or not (OFF)	ON - OFF	**-**	OFF			
UR	Residual voltage under which Dead Bus and Dead Line conditions are detected	0 – 100	**%Un**	80			
1ΔU	Max. permissible voltage diff. for closing of C/B L1.	1 - 50	**%BU**	10			
1Δf	Maximum permissible frequency difference for closing of C/B L1	0.02 – 9.9	**Hz**	0.20			
2ΔU	Maximum permissible voltage difference for closing of C/B L2.	1 - 50	**%BU**	10			
2Δf	Maximum permissible frequency difference for closing of C/B L2.	0.02 – 9.9	**Hz**	0.20			
1α	Maximum permissible displacement angle 1U/BU for closing C/B L1.	3 - 90	**°**	15			
2α	Maximum permissible displacement angle 2U/BU for closing C/B L2.	3 - 90	**°**	15			
ts	Minimum permanence time of voltage and frequency closing conditions to start checking of angle	0 - 60	**s**	10.0			
tk	Time after which closing is forced if angle remains steady within the max. permis. without searching α_{CB}	0.1 - 30 - Dis	**s**	5.0			
tcb	Closing time of C/B for automatic adjusting of the closing angle	0.02	**-**	Dis			
to	Minimum reclose time	0 - 600	**s**	5			
Tsyn	Synchronisation Time	5 - 60 - Dis	**m**	Dis			
NodAd	Identification number for serial connection	1 - 250	-	1			

CONFIGURATION OF OUTPUT RELAYS

Default Setting						Actual Setting					
Prot Elem.	Output Relays				Description	Prot. Elem.	Output Relays				
SX1	-	2	-	-	Closing command of C/B L1	**SX1**					
SX2	-	-	3	-	Closing command of C/B L2	**SX2**					
tU<	1	-	-	-	Time delayed undervoltage	**tU<**					
tU>	-	-	-	4	Time delayed overvoltage	**tU>**					
tf<	1	-	-	-	Time delayed underfrequency	**tf<**					
tf>	-	-	-	4	Time delayed overfrequency	**tf>**					
R1tr	Aut				Reset time delay of output relay R1	**R1tr**					
R2tr	Aut				Reset time delay of output relay R2	**R2tr**					
R3tr	Aut				Reset time delay of output relay R3	**R3tr**					
R4tr	Aut				Reset time delay of output relay R4	**R4tr**					

Commissioning Engineer : _____ **Date:** _____

Customer Witness : _____ **Date :** _____

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