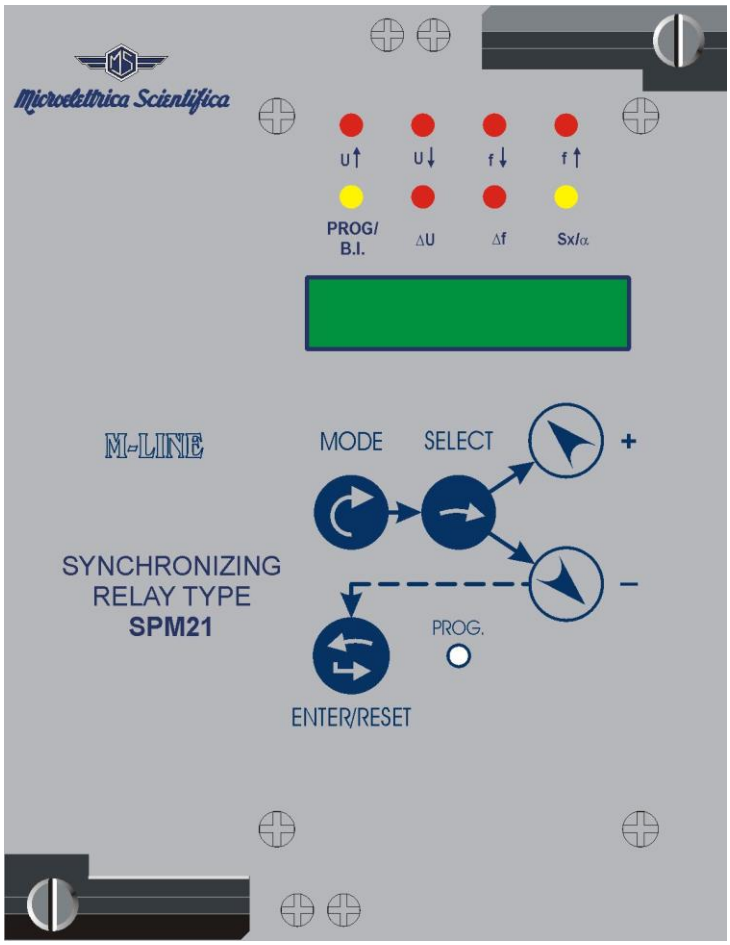
MULTIFUNCTION MICROPROCESSOR SYNCHRONIZING RELAY

TYPE

SPM21

OPERATION MANUAL



CE

- Check of voltage, frequency and phase displacement
- Proportional control of speed and voltage regulators
- Fast synchronizing with antimotoring and kicker pulse control
- Dead bus operation programmable
- Continuous self supervision with built-in autodiagnostic
- Serial communication interface
- Local display of measurements, settings, event recording and operation counters
- Local and remote programming of settings and operation modes

INDEX

1. General utilization and commissioning directions

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

1.1 - Storage and Transportation

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

1.2 - Installation

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

1.3 - Electrical Connection

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

1.4 - Measuring Inputs And Power Supply

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

1.5 - Outputs Loading

must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its 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 - 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 altered or replaced.
For repair please ask the Manufacturer or its authorised Dealers.

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

2. GENERAL CHARACTERISTICS AND OPERATION

Input quantities are supplied to 2 Potential Transformers each measuring a phase-to-phase voltage.
Rated voltage input is adjustable from 100 through 125V - 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 supply voltage is within the allowed limits.

2.2 - System configuration

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

1 - DB = OFF
2 - DB = ON

2.2.1 - DB = OFF (Dead Bus not allowed)

In this configuration closing of the C/B can only take place if :

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

2.2.2 - DB = ON (Dead Bus allowed)

The closing condition are :

A) - If bus voltage UB>5%Un. Normal conditions as at § 2.2.1

B) - When Dead Bus condition (UB<5%Un) is detected, the generator input is compared with the rated voltage (Un) and rated frequency (fn);
Closing takes place if :

$$(U_G - Un) < [\Delta U]$$
$$(f_G - fn) < [\Delta f]$$

2.3 – C/B closing conditions

Checking of the phase displacement condition for closing the C/B (angle below the set level and decreasing) is initiated only if the voltage and frequency closing conditions have been permanently present for longer than the set time [ts].
After expiry of [ts] the angle starts to be checked. Closing command is anyhow inhibited for the set time [to] from last opening of the C/B or from removal of the external Blocking Input (see § 2.6) and during the pulse time (tf, tu) of the controls of speed regulator and voltage regulator.

2.3.1 - C/B closing time (tcb)

The angle where C/B closing command is issued (energization of the output relay R1) can be different according to the programming of the parameter [t_{CB} = 0,05 - 0,50 / Dis.] which represents the closing time of the C/B for automatic selection of the closing angle.

- If t_{CB} = Dis.

Closing command is issued as soon as phase difference α between Generator voltage and Bus voltage, while decreasing, is below the set value [α]: (see fig.A)

- If a t_{CB} time is set (programming of t_{CB} not = Dis.):

Closing command is issued as soon as the phase difference α, while decreasing comes within the limits $1{,}1\alpha_S > \alpha > 0{,}9\alpha_S$ where :

- α_S = $\Delta f \bullet 360 \bullet (t_{CB} + tr)$
- t_{CB} = time value as set
- Δf = measured frequency difference $f_G - f_B$
- tr = output relay operating time ($\cong$ 25ms) - (see fig.B)

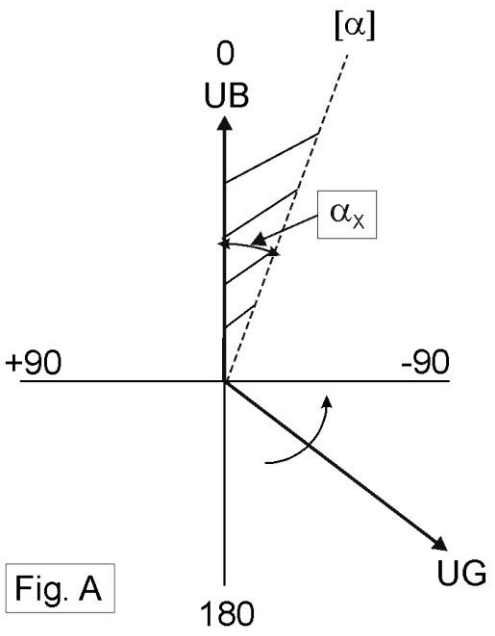


Fig. A

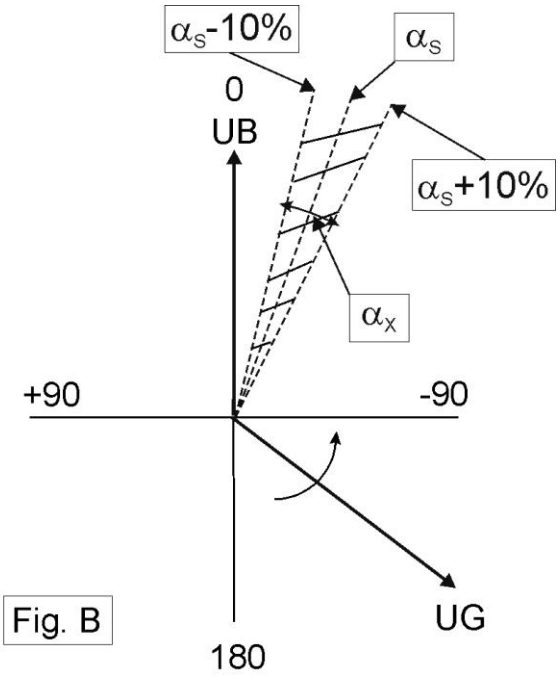


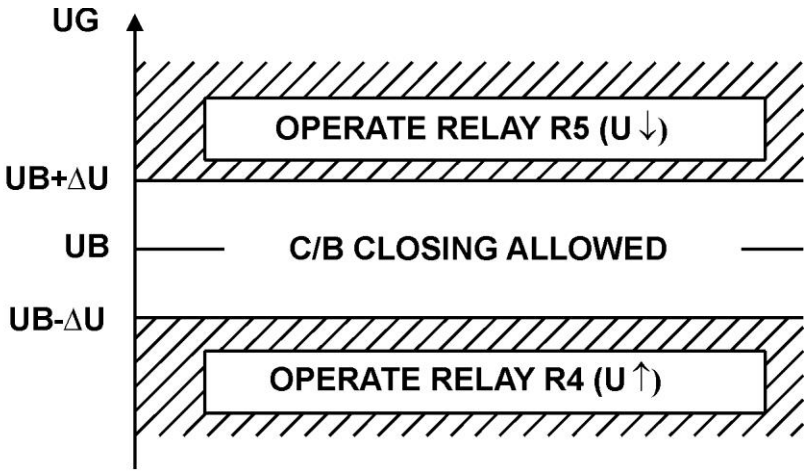
Fig. B

2.4 - C/B closing command

A closing command when issued remains active (if the closing conditions are present) up to 100ms after the C/B close signal is detected (status input SX, shorted). When a closing command is issued, the next command can not take place before the wait time [to] is expired.

2.5 - Voltage regulator control

Operates when the voltage of the generator UG is below or above the Bus voltage UB besides the allowed limit [ΔU]: UG<UB-[ΔU]; UG>UB+[ΔU]



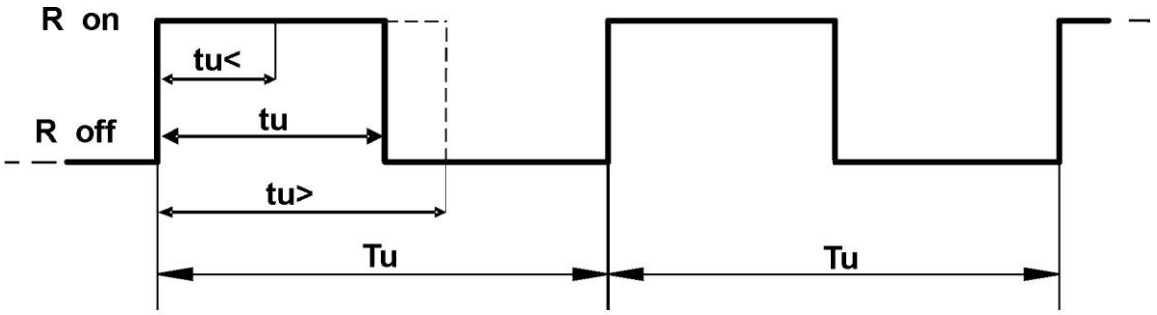
N.B. Voltage regulation is inhibited :

- when the Bus voltage is out of the set limits: UB≤[U<], UB≥[U>].
- when the C/B closing command is active (R1 ON)
- when C/B closed status is detected. (Terminals 1-2 shorted) (see also § 2.8)

2.5.1 - Operation of Voltage Control Relays R4-R5

When the operation condition is detected (zone U↑ or U↓) the pulse cycle Tu of the appropriate relay is started.

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

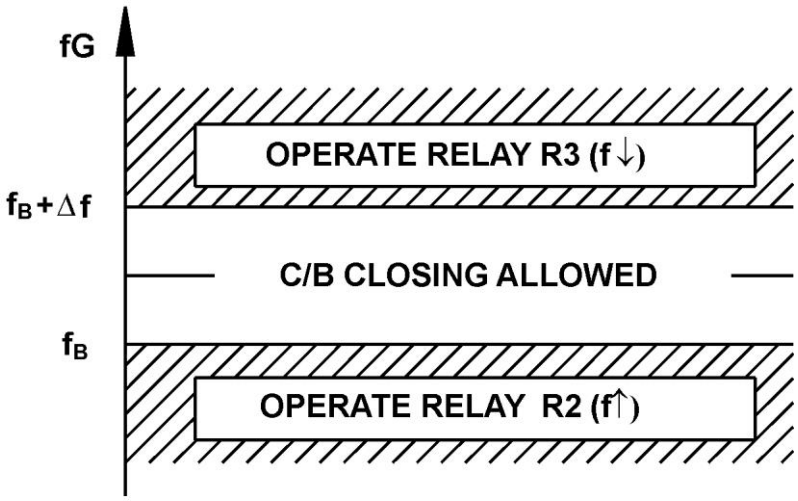


tu=[tu<]+[Gs/V] x ΔU ≤ [tu>] if **[Gs/V] = 0 → tu = tu<**

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

2.6 - Speed regulator control

Operates when the frequency of the generator f_G is below that of the Bus f_B or above allowed limit fG> fB+[Δf]. It means that to allow closing of the C/B the speed of the generator has to be higher than that of the bus thus avoid a **motoring** condition



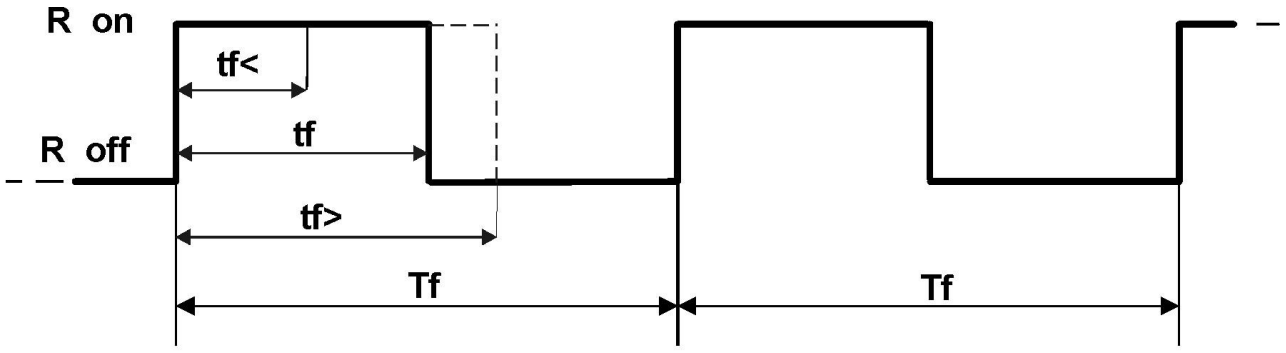
N.B. Speed regulation is inhibited :

- when the Bus voltage is out of the set limits: $f_B \leq [f<]$, $f_B \geq [f>]$.
- when the C/B closing command ON (R1 ON)
- when C/B closed status is detected. (Terminals 1-2 shorted) (see also § 2.8)

2.6.1 - Operation of frequency control relays R3 – R4

When operation condition is detected (zone f↓ or f↑) the pulse cycle Tf of the appropriate relay is started.

- The cycle is repeated at every period [Tf].
- The relay is energized at the beginning of "Tf"
- The relay remains energized (pulse duration) not less than the time [tf<] and not longer than the time [tf>].
- The actual pulse duration "tf" is proportional to the measure frequency difference according to the set value of the gain [Gs/Hz].



tf=[tf<]+[Gs/Hz] x Δf ≤ [tf>]

if **[Gs/Hz] = 0 → tf = tf<**

if **([Gs/Hz] x Δf) >(tf> - tf<) → tf = tf>**

2.6.2 - Kicker Pulse

When the slip frequency is null or very small and the phase displacement is not in the set limits, it could result impossible (or it would take a long time) to reach the C/B's closing condition.
When such a situation is detected a " increase speed " pulse is generated even if the frequency is within the set limits. It makes the generator to accelerate and then quickly reach the closing displacement angle.
The algorithm operates as follows :
If the closing conditions $\Delta U<[\Delta U]$, $\Delta f<[\Delta f]$ exist but $\alpha \neq \alpha_x$ (α_x closing angle) the device computes the time t_k needed to cover a 60° angle at the maximum allowed slip frequency $[\Delta f]$

$$t_K = \frac{60}{360\ [\Delta f]}$$

When t_K is expired if the slip frequency measured is less then 1/4$[\Delta f]$, one " speed increase " pulse is issued to the relay R2.

2.7 - F/V regulator

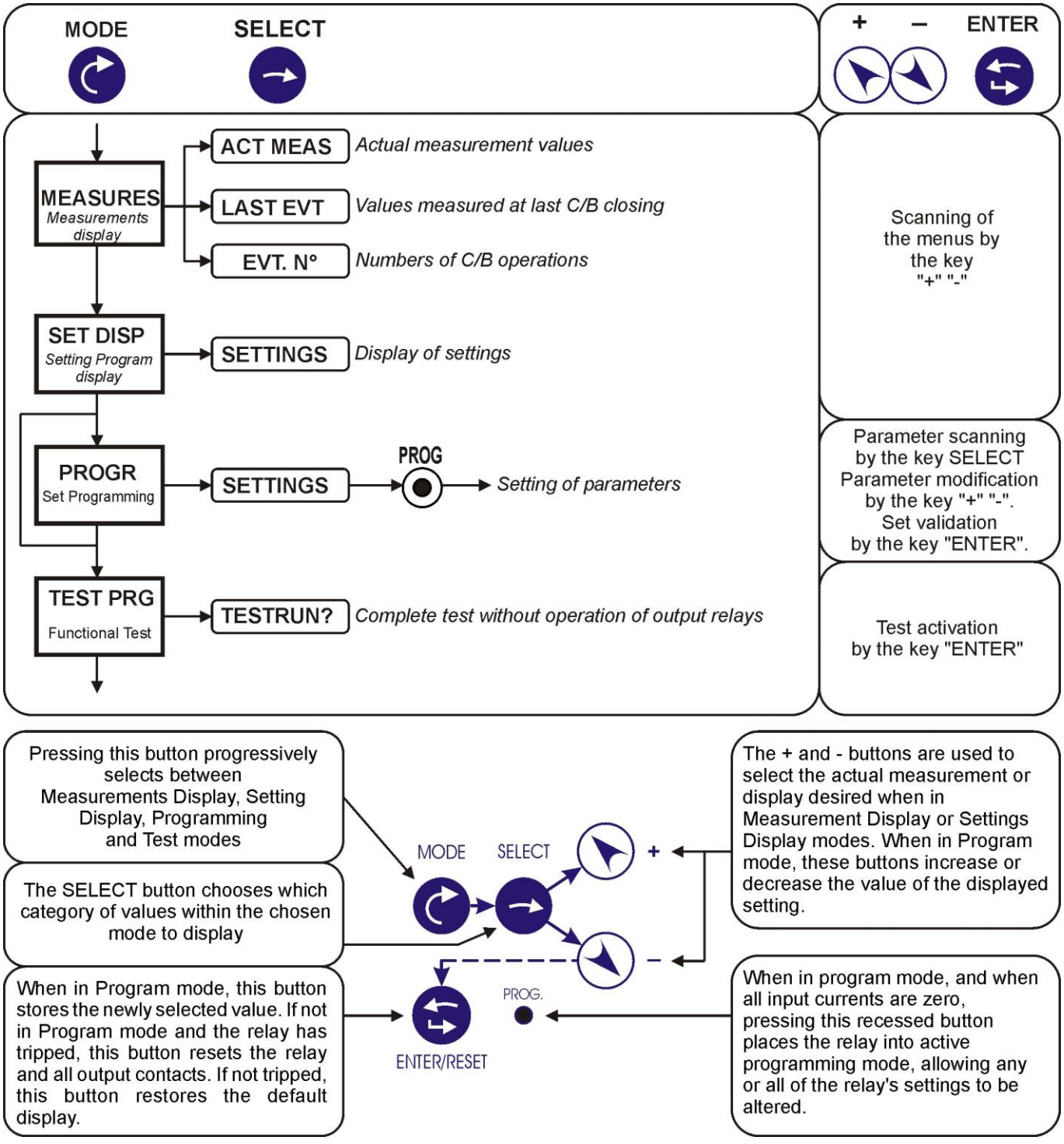
It is possible to make the SPM21 work as a voltage and frequency regulator related to the rated voltage Un and rated frequency Fn:

- Program DB=ON
- Open C/B status digital input (Terminals 1-2)
- Disconnect bus voltage's measuring input (disconnect terminal 29 or 30/41)

3. CONTROLS AND MEASUREMENTS

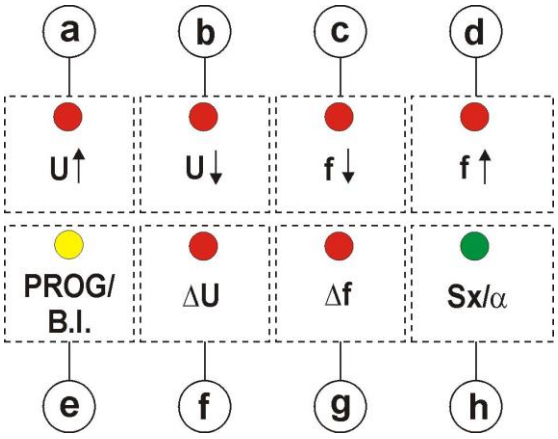
Five key buttons allow for local management of all relay's functions.
A 8-digit high brightness alphanumerical display shows the relevant readings **(xxxxxxxx)**
(see synoptic table fig.1)

FIG.1



4. SIGNALIZATIONS

Eight signal leds provide information on relay actual status:



a)	Red led	**U↑**	❑ Lit-on when increase voltage control relay R4 is energized (pulse time) ❑ Flashing during the pause time of the pulse period Tu
b)	Red led	**U↓**	❑ Same as above with reference to decrease voltage control relay R5
c)	Red led	**f↓**	❑ Same as above with reference to decrease speed control relay R3
d)	Red led	**f↑**	❑ Same as above with reference to increase speed control relay R2
e)	Yellow led	**PROG/ B.I.**	❑ Flashing when in programming mode. ❑ Lit-on when a Blocking Input signal is present at terminals 1-14 and/or 1-3 and whenever a relay internal fault is detected.
f)	Red led	**ΔU**	❑ Lit-on if UB>[U>] or UB<[U<] ❑ Flashing if ΔU≥[ΔU] ❑ OFF when ΔU<[ΔU]
g)	Red led	**Δf**	❑ Lit-on if fB>[f>] or fB<[f<] ❑ Flashing if Δf≥[Δf] ❑ OFF when Δf<[Δf]
h)	Yellow led	**SX/α**	❑ Lit-on when C/B is closed (terminals 1-2 shorted) ❑ Flashing when $\alpha \neq \alpha_X$ or $\alpha \geq [\alpha]$ ❑ OFF when $\alpha = \alpha_X$ or $\alpha < [\alpha]$

5. OUTPUT RELAYS

Five normally deenergized relays are available

❑	**R1**	:	is energized when the conditions for closing of the generator's Circuit Breaker are present. It is deenergized 0,1s after closing of C/B (Input 1-2 shorted).
❑	**R2**	:	energized to increase speed
❑	**R3**	:	energized to decrease speed
❑	**R4**	:	energized to increase voltage
❑	**R5**	:	energized to decrease voltage

All relays are anyhow deenergized when in mode " PROGRAMMING " and whenever a Internal Relay Fault is detected.

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

❑	**SX**	(terminals 1 - 2)	:	detection of the status of C/B (C/B closed when 1-2 shorted).
❑	**BR**	(terminals 1 - 3)	:	it blocks the operation of the regulator's control relays (R2-R3-R4-R5).
❑	**BX**	(terminals 1 - 14)	:	it blocks the operation of the closing relay R1 and when removed starts the timing **(to).**

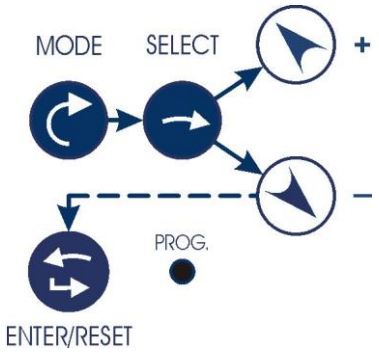
8. TEST

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 ≤4ms). If any internal fault is detected, the display shows a fault message and the Led "PROG/IRF" illuminates.
- ❑ 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) -		**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
c) -		"**+**" AND "**-**"	:	When operated they allow to scroll the different information available in the menu entered by the key SELECT
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 (Indirect key).

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
UG	xxx	**%Un**	Generator voltage measured at input UG (terminals 25-26)
UB	xxx	**%Un**	Bus voltage measured at input UB (terminals 29-30)
HzG	xxxxx		Generator frequency measured at input UG
HzB	xxxxx		Bus frequency measured at input UB
ΔU	xxx	**%UB**	Voltage difference (UG-UB)
Δf	xxxx	**Hz**	Frequency difference (fG-fB)
α	xxxxxx	**°**	Phase displacement angle between UG-UB

10.2 - LAST EVT

Display of the values of the parameters at the moment of C/B closing.
The memory buffer is refreshed at each new C/B closure.

	Display		Description
UG	xxx	**%Un**	As recorded at the moment of the C/B closing.
UB	xxx	**%Un**	As recorded at the moment of the C/B closing.
HzG	xxxxx		As recorded at the moment of the C/B closing.
HzB	xxxxx		As recorded at the moment of the C/B closing.
ΔU	xxx	**%UB**	As recorded at the moment of the C/B closing.
Δf	xxxx	**Hz**	As recorded at the moment of the C/B closing.
α	xxxxxx	**°**	As recorded at the moment of the C/B closing.

10.3 - EVT. N°

Counter of the number of operations of the C/B.
The N° is increased at each next operation.
The memory is non-volatile and can be cancelled only with a secret procedure.

	Display	Description
SX	xxxxxx	Closing of C/B (Terminals 1-2).

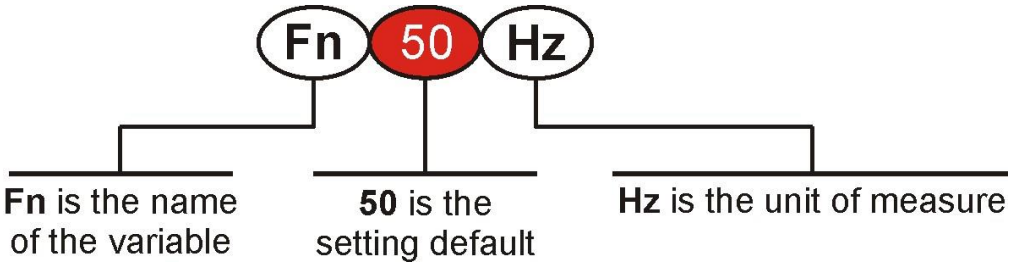
11. READING OF PROGRAMMED SETTINGS

Enter the mode "SET DISP", select the menu "SETTINGS", scroll information available in the menu by keys "+" or "-".
SETTINGS= values of relay's operation parameters as programmed.

12. PROGRAMMING

The relay is supplied with the standard default programming used for factory test.
[Values here below reported in the " Display " column].
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
Programming via the serial port is always enabled but a password is required to access the programming mode. The default password is the null string; in the standard application program for communication "MS-COM" it is also provided an emergency password which can be disclosed on request only.
As soon as programming is enabled, the Led PRG/BI flashes
Operation of the output relays is blocked during programming.
Enter MODE "PROG" and SELECT either "SETTINGS" for programming of parameters ;
enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT while "+" or "-" are pressed.
Press key "ENTER/RESET" to validate the set values.

12.1 - Programming of Functions Settings



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

	Display		Description	Setting Range	Step	Unit
Fn	50	**Hz**	Mains frequency: setting range	50 o 60	-	Hz
Un	100	**V**	Rated input voltage	100 - 240	1	V
U<	80	**%Un**	Minimum Bus voltage to start voltage regulation	15 - 120	1	%Un
U>	120	**%Un**	Maximum Bus voltage to start voltage regulation	20 - 150	1	%Un
ΔU	10	**%UB**	Maximum permissible voltage difference for closing of C/B. Related to Un when Dead Bus, (UB<5%Un) condition is detected	1 - 20	1	%UB
Tu	10.0	**s**	Period of pulse to voltage regulator	0.5 - 60	0.1	s
tu<	0.5	**s**	Minimum pulse duration	0,1 - 60	0.1	s
tu>	6.0	**s**	Maximum pulse duration	0,1 - 60	0.1	s
Gs/V	0.2		Gain for proportional pulse duration (voltage regulator)	0 – 9.9	0.1	-
f<	49.0	**Hz**	Minimum Bus frequency to start speed regulation	45 - 60	0.1	Hz
f>	51.0	**Hz**	Maximum Bus frequency to start speed regulation	50 - 65	0.1	Hz
Δf	0.20	**Hz**	Maximum permissible frequency difference for closing of C/B. Related to Fn when Dead Bus, (UB<5%Un) condition is detected.	0.05 – 0.6	0.01	Hz
Tf	10.0	**s**	Period of pulse to speed regulator	0.5 – 60	0.1	s
tf<	0.2	**s**	Minimum pulse duration	0.1 – 60	0.1	s
tf>	6.0	**s**	Maximum pulse duration	0.1 – 60	0.1	s
Gs/Hz	1.0		Gain for proportional pulse duration (speed regulator)	0 – 9.9	0.1	-

Display			Description	Setting Range	Step	Unit
α	15	°	Maximum permissible displacement angle UG/UB for closing C/B. Not considered if DB condition is detected and permitted	3 - 30	1	°
DB	ON		Dead Bus operation allowed (ON) or not (OFF). (see § 2.2)	ON - OFF	-	-
ts	3.0	**s**	Minimum permanence time of voltage and frequency closing conditions to start checking of angle (see § 2.3)	0 - 60	0.1	s
tCB	0.10	**s**	Closing time of C/B for automatic adjusting of the closing angle (see § 2.3.1)	0.01 - 0.5 - Dis	0.01	s
to	10	**s**	Minimum reclose time after C/B opening or a block-out input (see § 2.3)	0 - 600	1	s
NodAd	1		Identification number for connection on serial communication bus	1 - 250	1	s

The setting Dis indicates that the function is disactivated.

13. MANUAL AND AUTOMATIC TEST OPERATION

❑	Mode "TESTPROG" select "TEST RUN?": Operation of the yellow key activates a complete test of the electronics and the process routines. All the leds are lit-on and the display shows (TEST RUN). If the test routine is successfully completed the display switches-over to the reading existing before the test. If an internal fault is detected, the display shows the fault identification code. This test can be carried-out even during the operation of the relay without affecting the relay functions. 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 relevant led is activated and the fault code is displayed. Detection of internal fault block the operation of the relay.
❑	Further operation of key SELECT instead of the TEST programs gives the indication of the version and production date of the firmware.

14. MAINTENANCE

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

WARNING

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

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

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 - 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 60068)					
❑ Operation ambient temperature		-10°C / +55°C			
❑ Storage temperature		-25°C / +70°C			
❑ Environmental testing	(Cold)	IEC60068-2-1			
	(Dry heat)	IEC60068-2-2			
	(Change of temperature)	IEC60068-2-14			
	(Damp heat, steady state)	IEC60068-2-78	RH 93% Without Condensing AT 40°C		
CE EMC Compatibility (EN61000-6-2 - EN61000-6-4 - EN50263)					
❑ Electromagnetic emission		EN55011	industrial environment		
❑ Radiated electromagnetic field immunity test		IEC61000-4-3 ENV50204	level 3	80-2000MHz 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 3	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	
❑ Immunity to conducted common mode disturbance 0Hz-150KHz		IEC61000-4-16	level 4		
❑ 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% Un 2% +/- 10ms	for measure 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.)			

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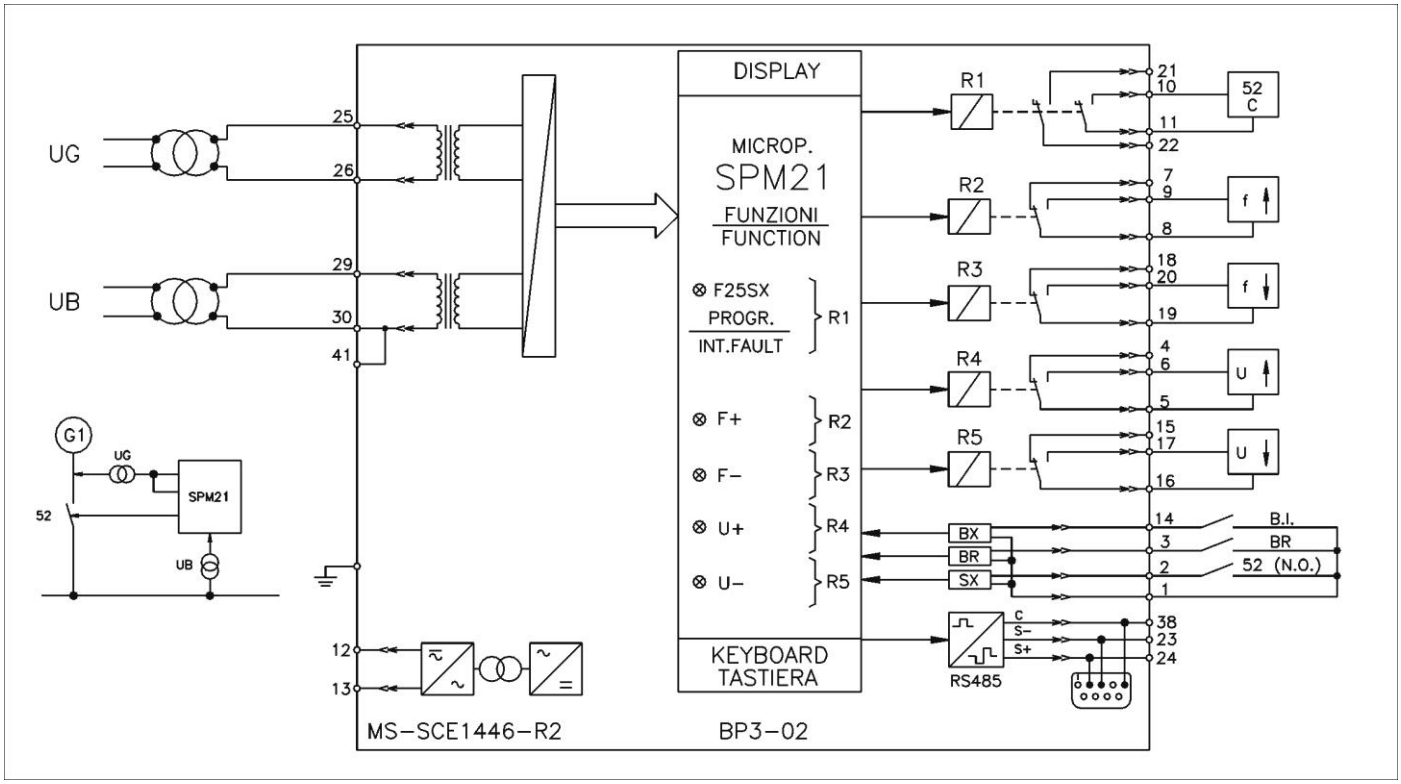
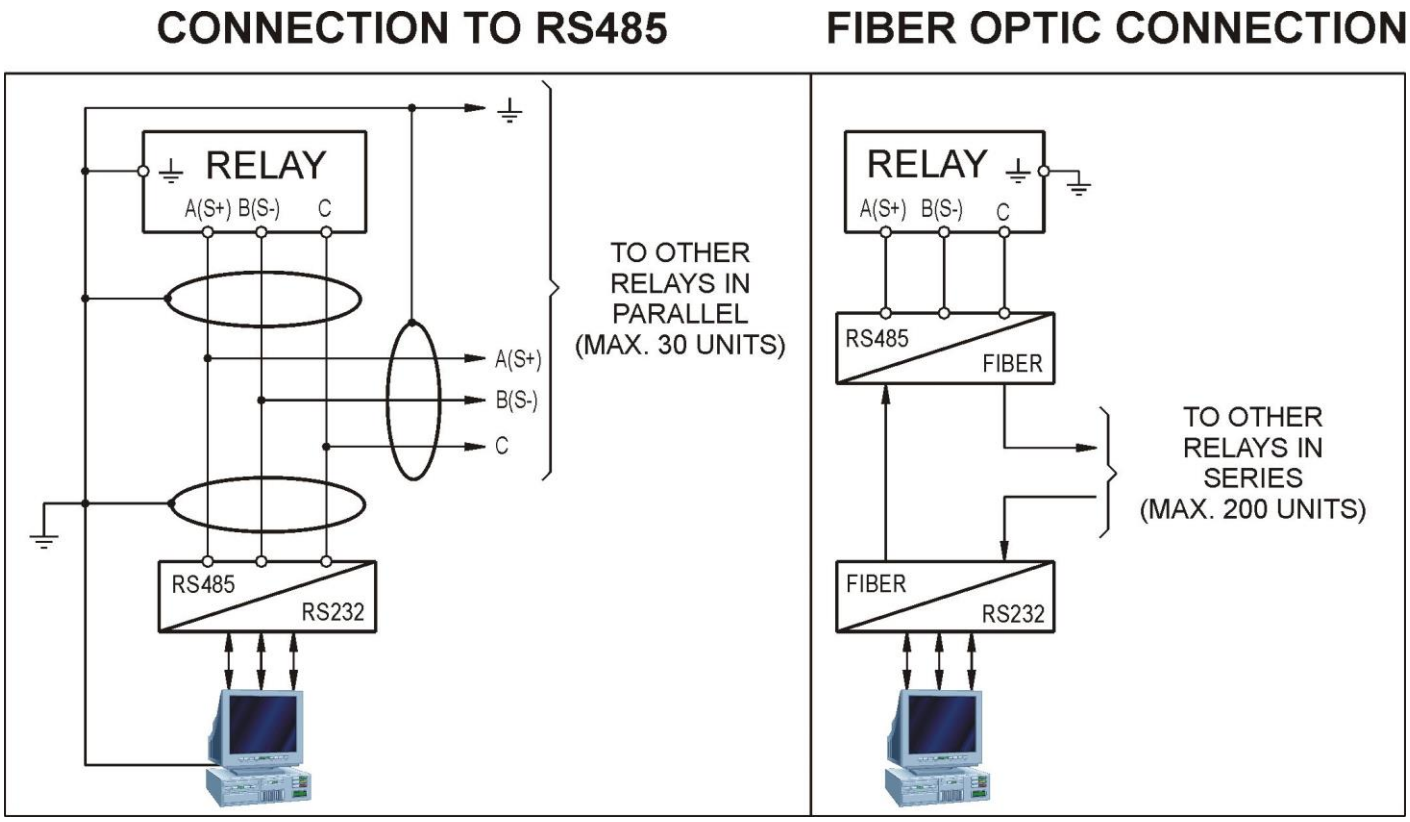
The performances and the characteristics reported in this manual are not binding and can modified at any moment without notice

17. CONNECTION DIAGRAM (SCE1446 Rev.2)



18. WIRING THE SERIAL COMMUNICATION BUS



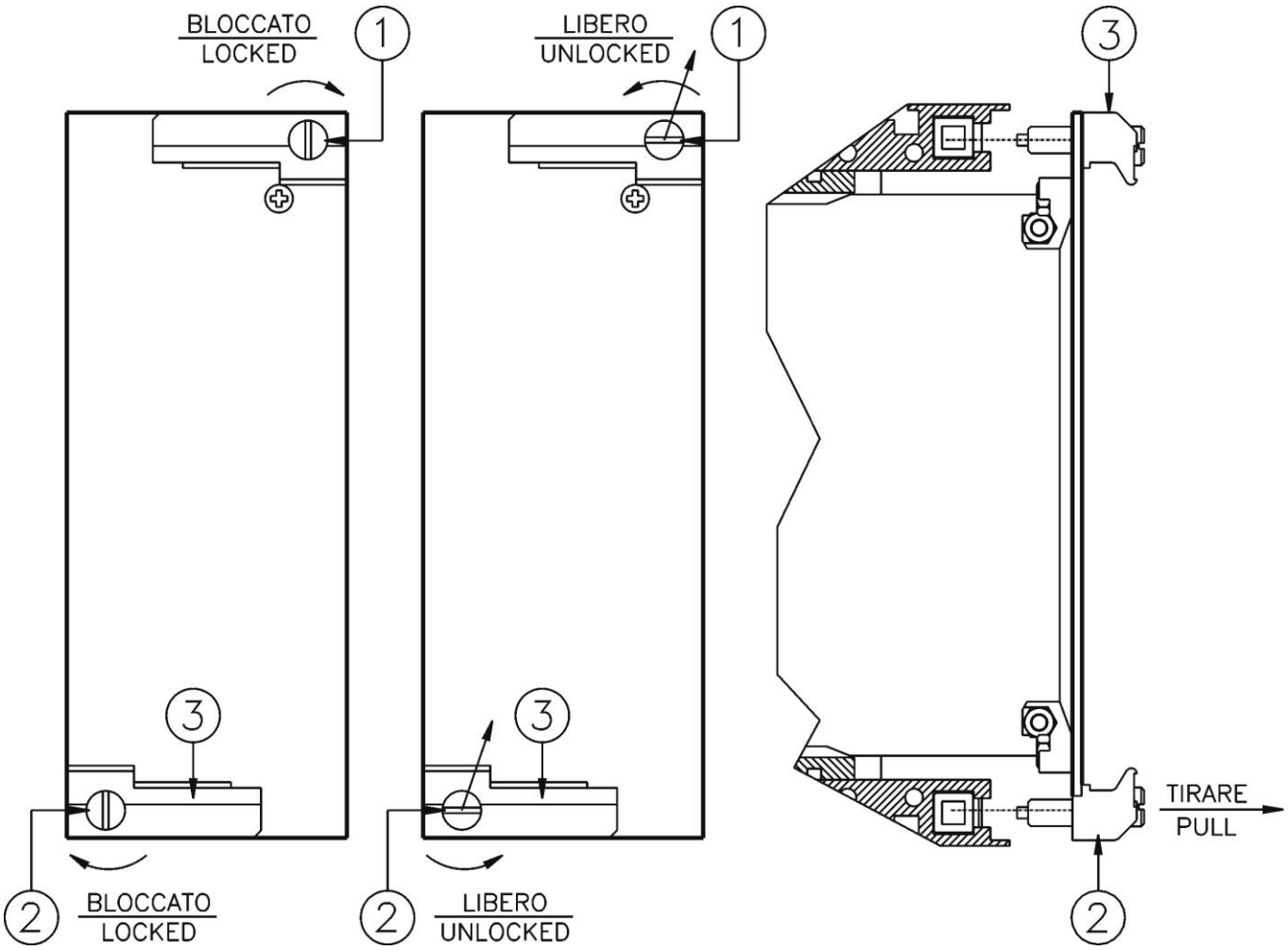
19. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

19.1 - Draw-out

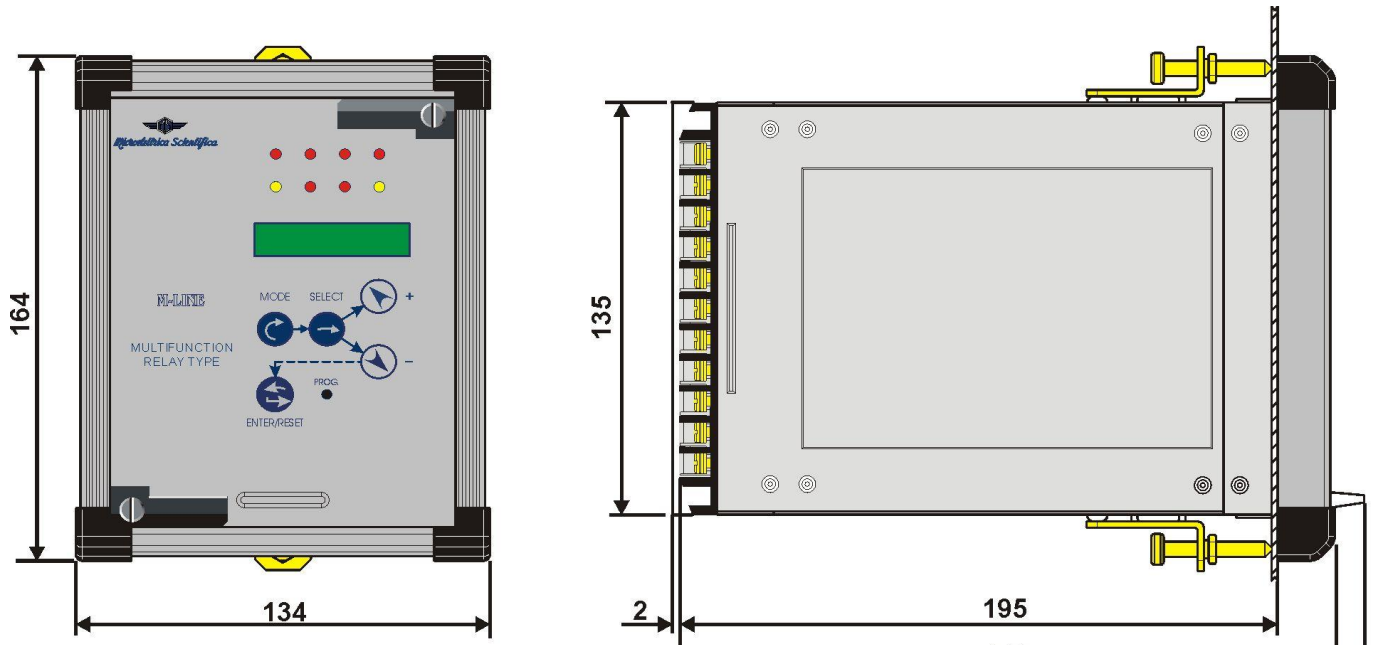
Rotate clockwise the screws ① and ② in the horizontal position of the screws-driver mark.
Draw-out the PCB by pulling on the handle ③

19.2 - Plug-in

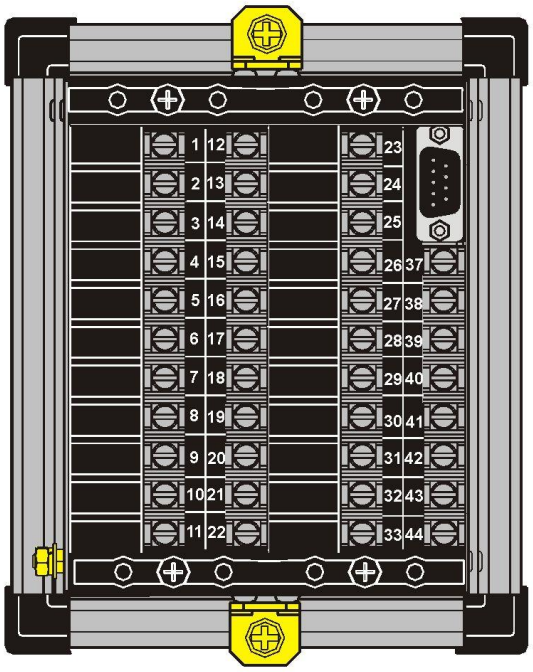
Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position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



20. OVERALL DIMENSIONS (mm)

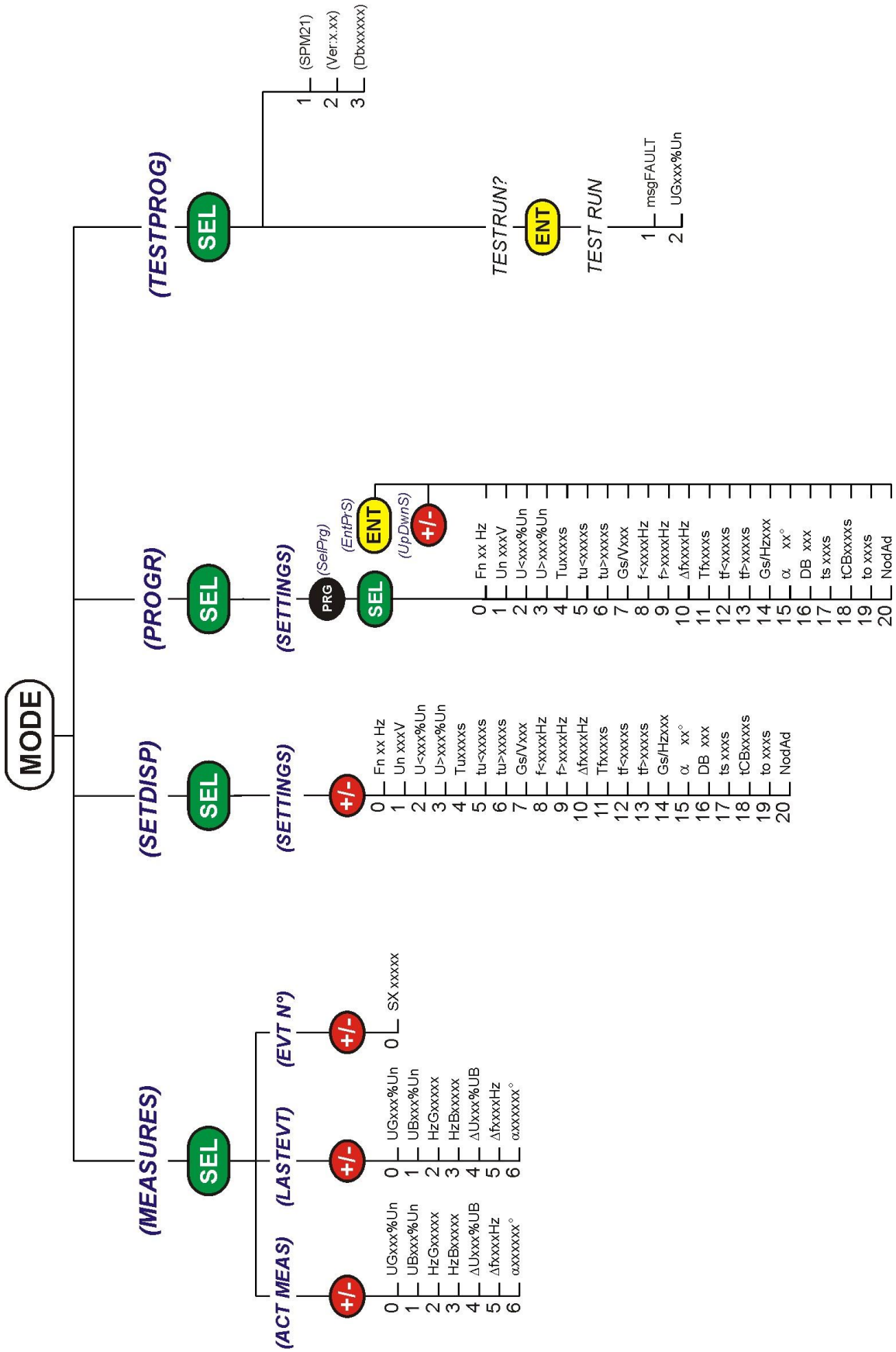


FORATURA PANNELLO
PANEL CUT-OUT
115x137 (LxH)



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

21. KEYBOARD OPERATIONAL DIAGRAM



22. SETTING'S FORM

Relay Type **Date :**	**SPM21** **/ /**	**Station :**	**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		
Fn	Mains frequency: setting range	50 o 60	**Hz**	50			
Un	Rated input voltage	100 – 240	**V**	100			
U<	Minimum Bus voltage to start voltage regulation	15 – 120	**%Un**	80			
U>	Maximum Bus voltage to start voltage regulation	20 – 150	**%Un**	120			
ΔU	Maximum permissible voltage difference for closing of C/B. Related to Un when Dead Bus, (UB<5%Un) condition is detected	1 - 20	**%UB**	10			
Tu	Period of pulse to voltage regulator	0,5 - 60	**s**	10.0			
tu<	Minimum pulse duration	0,1 - 60	**s**	0.5			
tu>	Maximum pulse duration	0,1 - 60	**s**	6.0			
Gs/V	Gain for proportional pulse duration	0 – 9.9	-	0.2			
f<	Minimum Bus frequency to start speed regulation	45 - 60	**Hz**	49.0			
f>	Maximum Bus frequency to start speed regulation	50 - 65	**Hz**	51.0			
Δf	Maximum permissible frequency difference for closing of C/B. Related to Fn when Dead Bus, (UB<5%Un) condition is detected.	0.05 – 0.6	**Hz**	0.20			
Tf	Period of pulse to speed regulator	0.5 – 60	**s**	10.0			
tf<	Minimum pulse duration	0.1 – 60	**s**	0.2			
tf>	Maximum pulse duration	0.1 – 60	**s**	6.0			
Gs/Hz	Gain for proportional pulse duration (speed regulator)	0 – 9.9	-	1.0			
α	Maximum permissible displacement angle UG/UB for closing C/B.Not considered if DB condition is detected and permitted	3 - 30	**°**	30			
DB	Dead Bus operation allowed (ON) or not (OFF).	ON - OFF	-	ON			
ts	Minimum permanence time of voltage and frequency closing conditions to start checking of angle	0 - 60	**s**	3.0			
tCB	Closing time of C/B for automatic adjusting of the closing angle	0.01-0.5-Dis	**s**	0.10			
to	Minimum reclose time after C/B opening or a block-out input	0 - 600	**s**	10			
NodAd	Identification number for connection on serial communication bus:	1 - 250	-	1			

Commissioning Engineer : _____ **Date :** _____

Customer Witness : _____ **Date :** _____