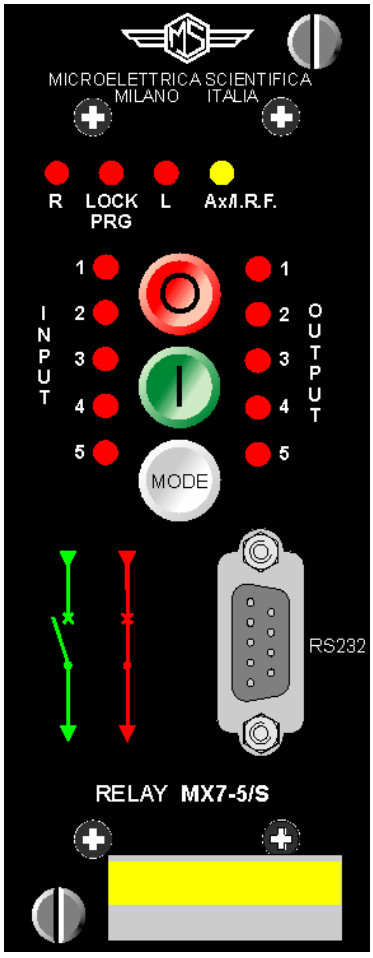
MATRIX INTERFACE MODULE

TYPE MX7-5/S

OPERATION MANUAL



CE

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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.

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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 - 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 AND OPERATION

2.1 - Digital inputs

- 7 optoisolated self-powered inputs controlled via cold contacts with antirebound logic:

Vout = 24V, Iout = 3.5mA
Max external resistance = 1000 Ω

Each input is sampled every 1ms. An input is considered to be in the 1 logic state when its terminals are shorted (<1000 Ω).
The logic state of an input is valid if it doesn't change for at least 5ms. As a consequence any input pulse shorter than 5ms is ignored by the unit.

2.2 - Output contacts

- Five output relays are available, each with one N/O contact (NC on request):

Rating : 5A 380V
AC resistive switching : 1100W max 380V
Make: 30A (peak) 0,5 sec.
Break: 0,5A 125VDC, L/R = 40ms, 10 ops.

- One output contact normally energized :

Rating : 5A 250V
AC resistive switching : 1100W max 380V - 150W DC (Resistive)

2.3 - Power supply

Power supply input (terminals 12-13) is multi-voltage autoranging 2kV isolated has no polarity and can accept any AC or DC voltage in the range a or b

- Consumption ≤ 5W \ 12VA (all outputs energized).

Type a) - { **24V(-20%) / 110V(+15%) a.c.** ; **24V(-20%) / 125V(+20%) d.c.** }

Type b) - { **80V(-20%) / 220V(+15%) a.c.** ; **90V(-20%) / 250V(+20%) d.c.** }

2.4 - Serial Communication

Two ports are available for serial communication:

- An RS232 serial communication port[1] is located on relay's front (9 pins SUB-D connector). Such port is active only when a dedicated cable (see also par. 0) is physically connected to it, thus allowing the user both to configure/test the unit and to completely monitor its status by means of a laptop P.C.

- A second RS485 serial communication port[1] (terminal blocks 1..2) allows the MX7-5 to be connected to a central supervision system. Such port is active only when the front panel port is not in use (cable physically disconnected) and makes the internal data base available to the central supervision system.

A communication software (MS-COM) for Windows 3.11 and Windows 95 is available, covering both the configuration and the monitoring tasks.
Please refer to the MS-COM instruction manual for more information.

2.4.1 - Supported MODBUS functions.

Both the communication ports support the following MODBUS RTU commands:

- Read N words (codes 3 and 4).
- Write N words (code 16).

Warning: the 'Write N words' command is limited to 4 words per message (due to internal memory limitations)

2.5 - Logic matrix.

The output contacts are operated according to a programmable AND/OR matrix (see Figure 1) whose inputs are:

- Digital inputs I1..I7.

- Front panel push buttons (On and Off).

- Internal fault diagnostic signal (I.R.F.)

Note that in remote mode the front panel push buttons are ignored. The relevant inputs to the internal matrix can only be changed via the serial communication interfaces. Also, in remote mode it is possible for the user to program the MX7-5 in such a way that the states of the digital inputs can be forced to 1 via the serial ports.

[1] MODBUS RTU protocol at 9600bps

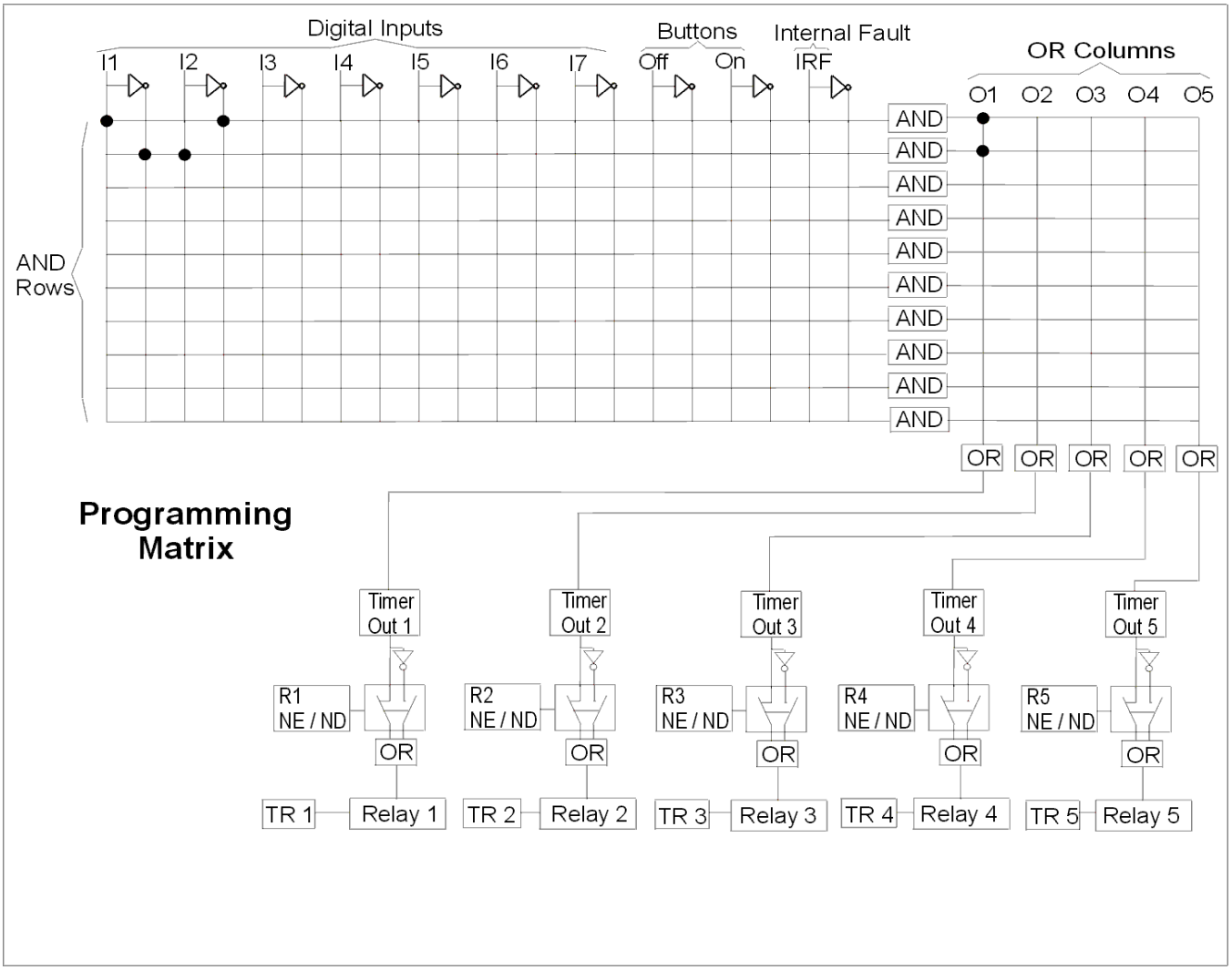


Figure 1: internal logic matrix

The states of AND rows are calculated as logic products of the inputs involved, while OR columns are obtained as logic sums of selected AND rows.
The user can program the internal logic matrix by setting the interconnections between inputs (which can also be taken as inverted), AND rows and OR columns.
If we consider Figure 1 again, we can have a simple programming example. The following logic function of I1 and I2 is implemented:

O1 = I1 XOR I2. (XOR ⇔ exclusive OR).

If we write down the truth table relevant to the XOR function we have:

I1	I2	O1
0	0	0
1	0	1
0	1	1
1	1	0

By examining such table we can say that O1 is TRUE when :

I1 is TRUE AND I2 is NOT TRUE. (1)
OR
I1 is NOT TRUE AND I2 is TRUE. (2)

If we now want to program the MX7-5 to implement the XOR function, we just reserve two AND rows for statements (1) and (2) and then connect those rows to the OR column corresponding to output O1. Generally speaking, a method for programming the internal logic matrix consists of the following steps:

- Write down the truth table relevant to the function which has to be implemented.
- Express the function as sums of products.
- Assign each logic product an AND row.
- Connect the resulting AND rows to the OR column corresponding to the output which has to be activated.

2.6 - Operating modes

Three main operating modes are available:

- Lockout mode (factory default): this allows the user to change the settings and to run the automatic self-test procedure. When this mode is entered, no change of state of the output contacts occurs regardless of the states of the inputs and the configuration of the logic matrix.
- Local mode: while running in this mode, all the inputs are always LOCAL. In other words the logic state of any matrix input is always equal to the physical state of the relevant digital input or push button. No change of configuration or test command via push buttons or serial ports is accepted.
- Remote mode: while running in this mode, all the digital inputs are LOCAL by default, but the unit can be programmed so that any of its inputs can be forced to the 1 logic state via the serial communication interface (REMOTE configuration). The front panel push buttons are ignored. Their logic state can be forced via the serial ports. Neither changes of configuration nor test commands via front panel or serial ports are accepted.

The following table summarizes the three operating modes' main features:

	Local mode	Remote mode	Lock-out mode
On/Off buttons	Enabled	Disabled	Enabled (On = test, Off ignored)
Mode button	Enabled	Enabled	Enabled
Digital inputs I1..I7	Enabled	Enabled	Ignored
Logic matrix inputs	= digital inputs	= digital inputs OR (bitwise) serial interface inputs	Ignored
Outputs	Enabled	Enabled	Blocked (never change)
Programming	Disabled	Disabled	Enabled
Event recording	Enabled	Enabled	Disabled
RS232 interface	Enabled when cable connected	Enabled when cable connected	Enabled when null-mode cable connected
RS485 interface	Enabled when cable disconnected	Enabled when cable disconnected	Enabled when cable disconnected

2.7 - Configuration of outputs.

All the output contacts can be configured as:

- Normally Energised or Normally De-Energised.
- Instantaneous or delayed (0.01 to 655s). Different values can be selected for set and reset time delays of all the contacts.

2.8 - Signalizations and controls.

Leds - Input 1 – 5

- Lit-on when the corresponding physical inputs are ON.

Leds - Output 1 – 5

- Lit-on when the corresponding outputs are active (LOGIC state 1) and during the reset time delay.
- Flashing during the corresponding output's set time delay.

Leds - C/B status display

- When the Digital Input "7" is active, "C/B Open" symbol appears.
- When the Digital Input "6" is active, "C/B Close" symbol appears.

N.B. See Connection Diagram.

Led - R

- Lit-on while working in remote mode.
- Flashing for 2s before entering remote mode when such mode is selected via push button.

Led - LOCK/PRG

- Lit-on while working in lock-out mode.
- Flashing for 2s before entering lock-out mode when such mode is selected via push button.

Led - L

- Lit-on while working in local mode.
- Flashing for 2s before entering local mode when such mode is selected via push button.

Led - Ax/I.R.F

- Lit-on during normal operation.
- Flashing in case of internal fault.

"O" - Push Button

- General purpose input in local mode. Different results can be obtained by changing the logic matrix configuration.
- Ignored while running in remote mode.

"I" - Push Button

- General purpose input in local mode. Different results can be obtained by changing the logic matrix configuration.
- Ignored while working in remote mode.
- Pressing the On button while working in lock-out mode makes the unit enter an automatic self-test procedure (see also par. 0)

"Mode" - Push Button

- Cyclically selects a new operating mode (Lock-out => Local => Remote => Lock-out => …), but the change is not immediate. If the button is pressed again within 2s, the operation is not confirmed and another mode is selected.

2.9 - Real time clock.

2.9.1 - Overview.

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

2.9.2 - 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 any synchronization command is ignored by the relay.
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 was 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.
Warning: if time is adjusted (via the serial port) while synchronization is enabled, the clock stops and can be restarted only by sending a sync. message.

2.9.3 - Latency time.

Latency time is the time taken by a synchronization message to reach destination. Such time (and generally speaking all known delays) can be automatically compensated by the unit. A special setting (TLat) is available for such purpose. TLat is added to the current time when a synchronization message is received.

2.9.4 - Resolution.

The clock has a 10ms resolution.

2.9.5 - Operation during power off.

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

2.9.6 - Time tolerance.

During power on, time tolerance depends on the on board crystal
(+/-50ppm[2] typ, +/-100ppm[2] max. over full temperature range).
During power off, time tolerance depends on the RTC's oscillator
(+/-50ppm[2] typ, +65 –270 ppm[2] max over full temperature range, ±5ppm[2]/year).

[2] 100ppm = 8.7 s/day

2.9.7 - Last events' recording – time stamping.

The last five events (opening/closing of any input/output) are time stamped with a 10ms resolution and stored into a non-volatile (E2PROM) memory. All the recorded events are available via the serial communication interface.

2.9.8 - Diagnostics

The unit features three different self-test procedures:

- Start-up test: this is activated at power-up. The on-board E2PROM and RTC are tested. The software also looks for stuck keys on the front panel.

- Periodic test: this is activated every 10mins and checks the contents of the on board E2PROM.

- User-requested test: this is activated whenever a test command is issued to the unit while working in lock-out mode (via front panel or serial communication interface).
  The E^2PROM is tested and all the leds are lit-on for 4 seconds.

In case errors are detected the lock-out mode is automatically entered and the Ax/I.R.F. green led starts flashing.

2.10 - Internal logic matrix configuration

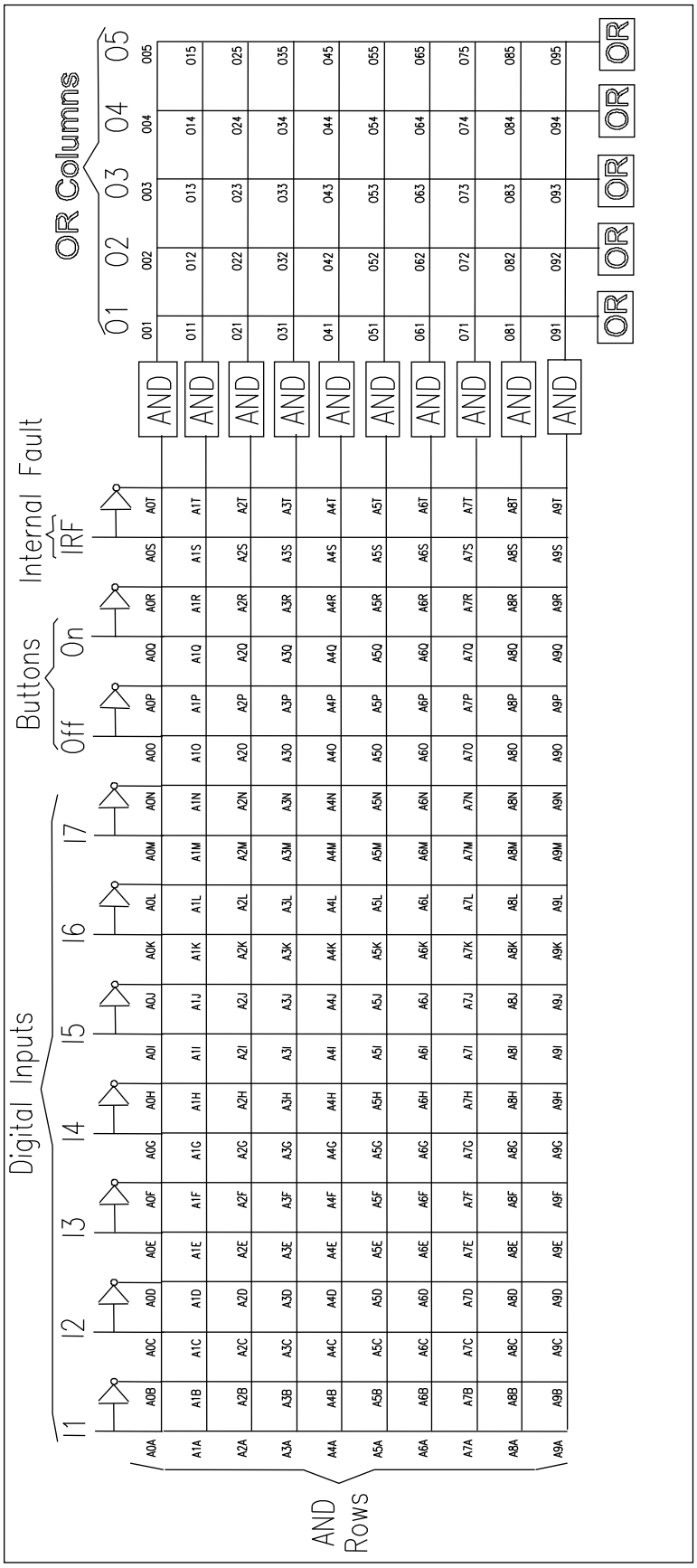
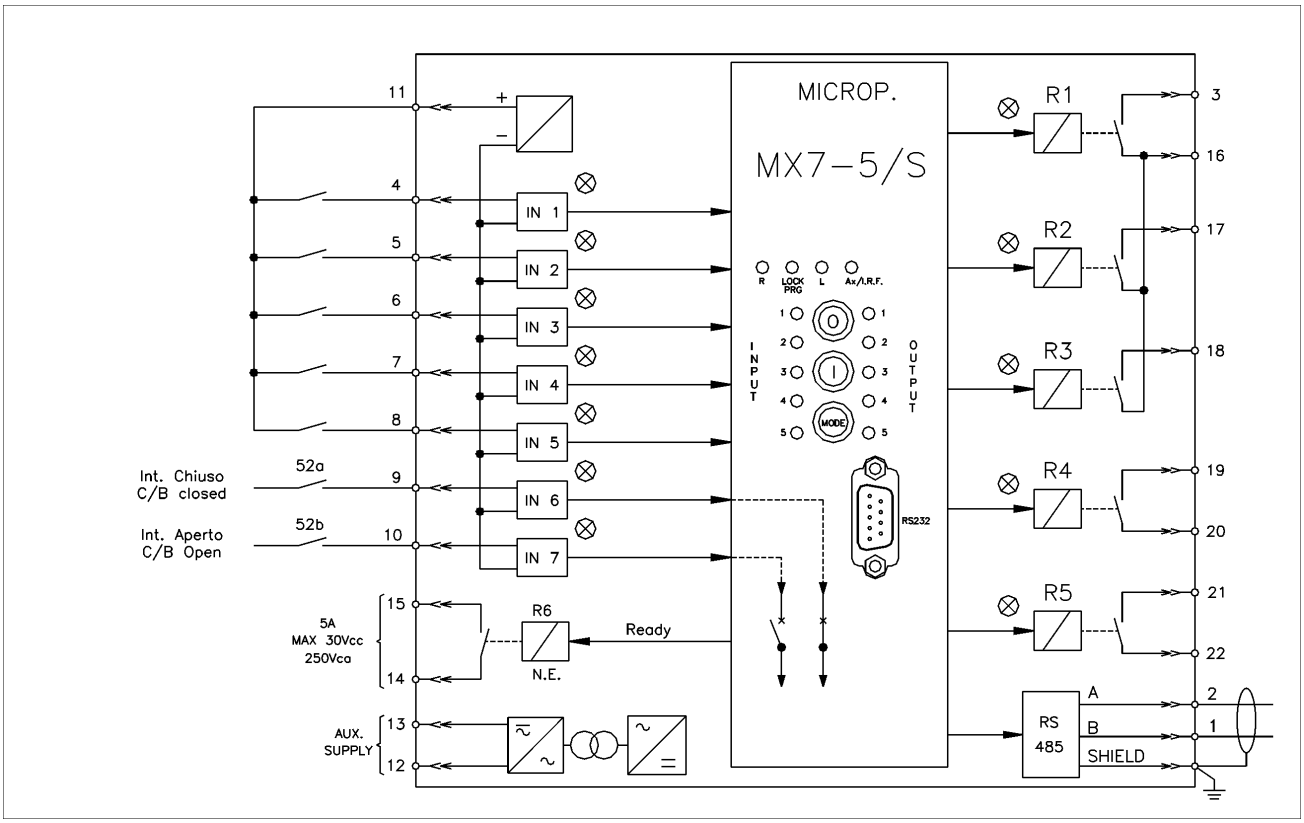
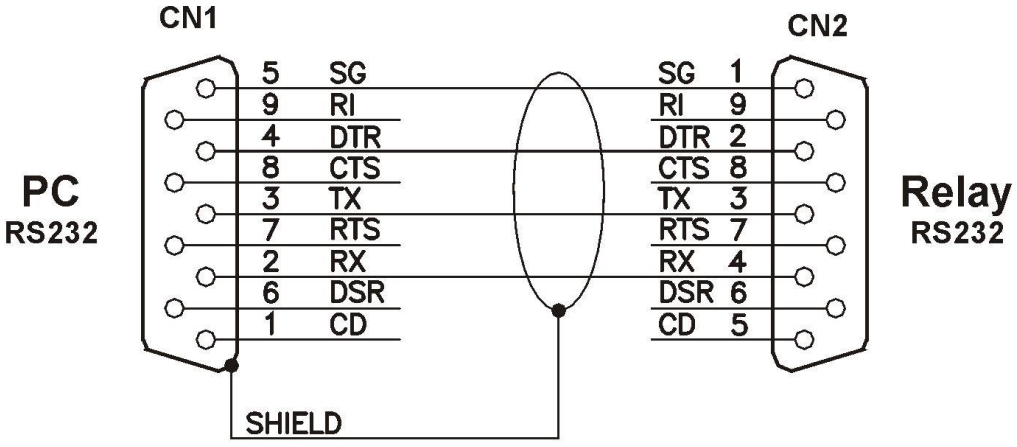


Figure 2

3. CONNECTION DIAGRAM



4. CABLE FOR FRONT PANEL SERIAL PORT (SCE1593 Rev.2)

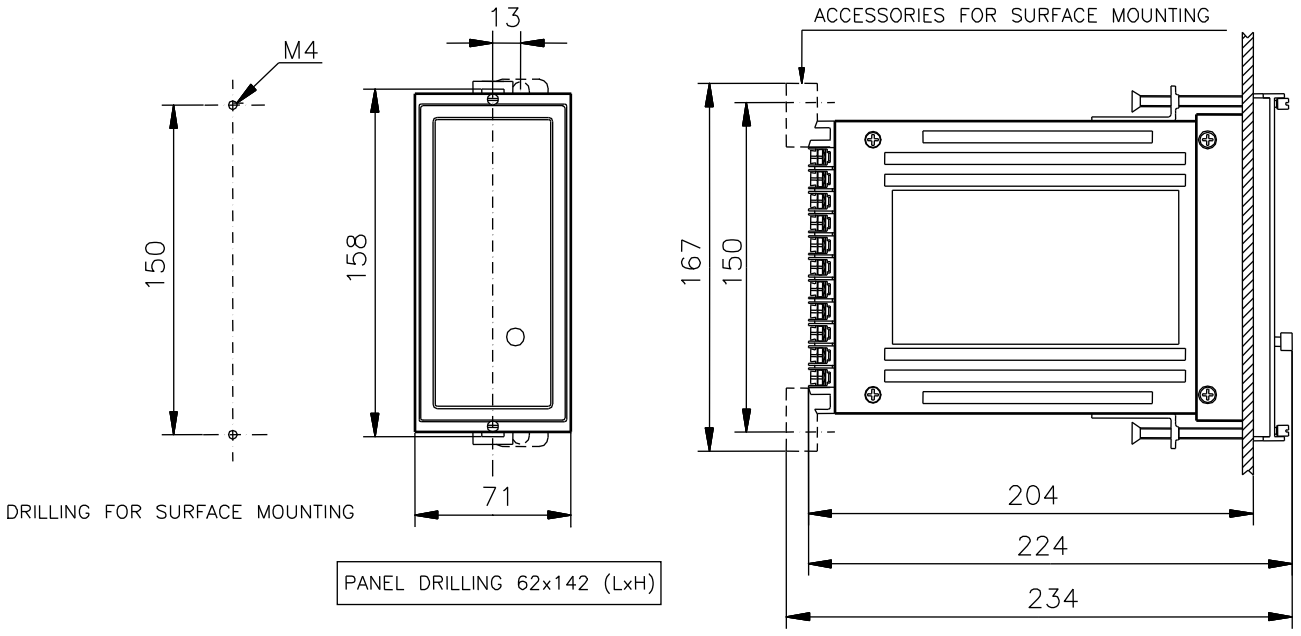


CABLE MAX LENGHT: 2 mt

9 PIN FEMALE

9 PIN MALE

5. OVERALL DIMENSIONS (D46030 Rev.1)



6. MAINTENANCE

No maintenance is required. Periodically a functional check-out can be made by operating the TEST button on relay's front. 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.

IMPORTANT NOTICE: in case of E2PROM error (green led Ax/I.R.F. flashing after power-up or a test) try the following recover procedure:

1. Run a user-requested test.
2. If the error is reset (green led Ax/I.R.F. lit) turn the relay off and then on again. Check relay's settings via the serial communication interface before restarting normal operation.
3. If the error is not reset repeat the operations listed at point 1.
4. If the error can't be corrected please contact Microelettrica Scientifica Service or the local Authorised Dealer

7. ELECTRICAL CHARACTERISTICS

APPROVAL: CE – RINA
REFERENCE STANDARDS IEC 60255 - EN50263 - CE Directive - EN/IEC61000 - IEEE C37

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

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

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

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

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

CHARACTERISTICS

❑	Average power supply consumption	5W / 12V
❑	Output Relays R1 – R2 – R3 – R4 – R5	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.)
❑	Output Relay R6	rating 5 A; 250V AC Max switching power = 1250VA Max switching current = 5A (resistive) Max switching voltage = 250V AC - 110V DC Max make current = 0,2A, 110V DC, L/R=40ms

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