MULTIFUNCTION FREQUENCY RELAY

TYPE
UFD34

OPERATION MANUAL

F1   F2   F3   F4

PROG/   df/dt   U   BI
I.R.F.   de/dt

MICROELETTRICA SCIENTIFICA
MILANO   ITALIA

MODE   SELECT   **+**

−

PROG.

MULTIFUNCTION
VOLTAGE-FREQ.
RELAY TYPE
UFD34

ENTER/RESET

CE

INDEX

1. GENERAL UTILIZATION AND COMMISSIONING DIRECTIONS

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

1.1 - Storage and Transportation

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

1.2 - Installation

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

1.3 - Electrical Connection

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

1.4 - Measuring Inputs and Power Supply

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

1.5 - Outputs Loading

must be compatible with their declared performance.

1.6 - Protection Earthing

When earthing is required, carefully check its efficiency.

1.7 - Setting and Calibration

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

1.8 - Safety Protection

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

1.9 - Handling

Notwithstanding the highest practicable protection means used in designing M.S. electronic circuits, the electronic components and semiconductor devices mounted on the modules can be seriously damaged by electrostatic voltage discharge which can be experienced when handling the modules. The damage caused by electrostatic discharge may not be immediately apparent but the design reliability and the long life of the product will have been reduced. The electronic circuits reduced by M.S. are completely safe from electrostatic discharge (8 KV IEC 255.22.2) when housed in their case; withdrawing the modules without proper cautions expose them to the risk of damage.

a. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.

b. Handle the module by its front-plate, frame, or edges of the printed circuit board. Avoid touching the electronic components, printed circuit tracks or connectors.

c. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.

d. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.

e. Store or transport the module in a conductive bag.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF.

1.10 - Maintenance

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

1.11 - Fault Detection and Repair

Internal calibrations and components should not be 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

The measured quantities are supplied from 3 Wye connected system's P.Ts to the 3 input transformers (1 of the system's P.Ts to the input transformer.)
The relay is normally provided for 100V phase-to-phase input.
Any different input voltage is available on request.
The rated input voltage is marked on the relay's P.C. board as well as on the connection diagram printed on its enclosure.
Check that input voltages are same as reported on the diagram and on the test certificate.
The auxiliary power is supplied by a built-in interchangeable module fully isolated an self protected.

2.1 - Power Supply

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

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

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

Before energising the unit check that supply voltage is within the allowed limits.

<table>
<tr><td>2.2 - Operation Principle of Frequency Element's</td></tr>
</table>

<table>
<tr><td>2.2.1 - Acquisition Principle of relay UFD34</td></tr>
</table>

The input voltage sinus signal is converted into a square wave where oscillations and pulses in the proximity of the zero crossing are filtered out.

Every microsecond (10^{-6} sec) the relay, via the high speed input of its microcontroller, samples the voltage wave and at any zero crossing associated with a leading edge produces a read out of the internal timer.

The time between two consecutive leading edges (1 cycle) is measured with a resolution of one microsecond and is used to calculate the frequency :

$$f_x = \left(t_x - t_{(x-1)} \right)^{-1}$$

The values of frequency thus measured are continuously stored into a FIFO (First in – First out) memory that contains as many values as the number of cycles "Ncy" programmed in the algorithms for the evaluation.

<table>
<tr><td>2.2.2 - Operating time</td></tr>
</table>

At relay's switch-on the minimum operating time is

$$t = \left[\frac{Ncy}{f} + 0.01 \right] s$$

During the operation the minimum operating time is t ≤ 30ms.

<table>
<tr><td>2.3 - Algorithm of the frequency control elements</td></tr>
</table>

<table>
<tr><td>2.3.1 - Frequency operation only</td></tr>
</table>

❑ Each frequency control stage "xf" (4 stages for UFD14 : 1f, 2f, 3f, 4f) can be individually programmed to operate as underfrequency, overfrequency or frequency balance by programming the operation mode (Fn – xf) or (Fn + xf) or (Fn ± xf).

❑ The operation level of each element can be individually adjusted by programming the value of the frequency difference xf (1f = stage 1--------- 4f = stage 4).

"xf" programmable from 0.05 to 9.99 Hz in steps of 0.01 Hz.

❑ The reset of each element takes place when the measured frequency difference equals (xf – 0.02)Hz.

❑ Each individual stage includes one instantaneous element and one time delayed element. The time delay "xt" is individually programmable for each stage
(1t = stage 1 ------- 4t = stage 4)

"xt" programmable from 0.05 to 99.99 sec in steps of 0.01s

❑ The number of cycles "Ncy" used in the frequency control algorithm is programmable (same for all the stages).

"Ncy" programmable from 3 to 10cy in steps of 1 cy

❑ The relay includes an undervoltage lock out element, which blocks the operation of any frequency element if the voltage is below an adjustable set level U<.

"E<" programmable from 30 to 90% Un in steps of 1% Un

This element is instantaneous and can also operate an output relay (30ms total trip time).

❑ Operation of each element (see example of page 10)

As already reported at paragraph 1, the frequency measured at every cycle is stored into a FIFO memory which contains as many values as the number of evaluation cycles "Ncy" programmed (see 2.1.5).

If among the "Ncy" number of frequency measurements evaluated

♦ at least **'Ncy-1'** are in the "evaluation" zone between the tripping and the reset value or in the tripping zone

and

♦ at least **1 value** among the "Ncy" evaluated is in the tripping zone

the instantaneous element of the stage is tripped (the relevant relay energized) and the timer of the time delayed element of the same stage is started.

As soon as at least one frequency measurement (1 cycle) is in the reset zone, the instantaneous element as well as the timer are reset.

If during the time delay no measurement is detected into the reset zone, the time delayed element is tripped and the relevant output relay is energized.

The reset after tripping of the relay associated to the time delayed element (when the reset condition is present) can be programmed to be

♦ Automatic instantaneous

♦ Manual by the reset button on relays front or by a command via serial communication port or by activation of the reset digital input D3.

♦ Time delayed with an adjustable time relay.

The reset time delay is individually adjustable for each frequency stage.

"XR" programmable from 0.05 to 99.99 s in steps of 0.01 sec.

Any time a tripping of a time delayed element takes place, the counter of n° of tripping of the stage is increased and the values of frequency, voltage and frequency rate of variation are recorded into the event recording memory.

❑ Minimum operation time of the instantaneous element

♦ If the frequency values of the former cycles were in the reset zone, the minimum trip time is the summation of the periods of the number of cycles programmed for the evaluation plus the pick-up time of the output relay.

♦ If the frequency values of at least Ncy-1 former cycles were in the evaluation zone, the trip time is <30ms : 1 cy plus the pick-up time of the output relay (<10ms).

♦ The reset time is always less than 30ms : 1 cy plus the drop-out of the output relay (<5ms).

2.4 - Frequency operation with df/dt control

Besides the functionality above described, the UFD model also includes the following programmable settings relevant to control of the "Rate of change" of the frequency.

2.4.1 - Additional settings on frequency control stages

❑ Each frequency stage can be individually programmed to operate without any df/dt control or with control from one of the two df/dt elements 1f', 2f'

&f' = OFF : no control
&f' = 1f'   : control from 1f' level
&f' = 2f'   : control from 2f' level

❑ Each frequency stage has a second trip time delay setting "xt&" individually adjustable which operates in conjunction with the df/dt control.

"xt&" programmable from 0.05 to 99,99 s in step of 0.01 s.

If the frequency control is activated and the rate of change of frequency is above the set level, the time delayed element of the frequency stage involved will trip after shortest between the set time delays "xt" and xt&".

If the frequency control is not activated (&f' = OFF) or it is activated but df/dt is below the set level, the time delay of the frequency stage will remain that corresponding to the set time "xt" (see § 2.1.4).

Example : Elements 3f and 4f with df/dt control respectively from 1f' and 2f'
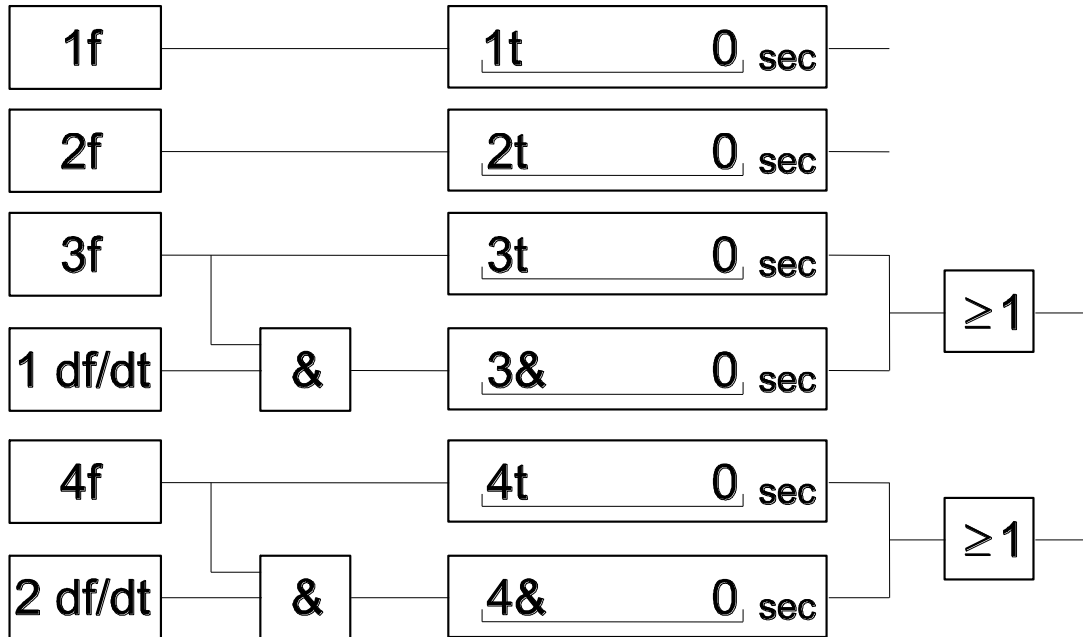
2.5 - Algorithm of the element for control of the "Rate of change" of the frequency (UFD models only)

The relay includes two programmable elements for df/dt detection : 1f', 2f'.

2.5.1 - The operation level of each df/dt element can be individually adjusted.

xf' programmable from 0.1 to 9.9 Hz/s in step of 0.1 Hz/s.

2.5.2 - Each df/dt element can be individually programmed to detect

- the "rate of rise"
$$\left(\mathbf{xdf} = + \rightarrow \frac{df}{dt} > 0 \right)$$

- the "rate of decrease"
$$\left(\mathbf{xdf} = - \rightarrow \frac{df}{dt} < 0 \right)$$

- the "rate of change"
$$\left(\mathbf{xdf} = +/- \rightarrow \left| \frac{df}{df} \right| > 0 \right)$$

2.5.3 - Operation of df/dt elements

According to the evaluation number of cycles (Ncy) programmed, at each cycle the relay computes the difference between the frequency measured and that measured Ncy cycles before and counts the time into which the variation has been detected.

Example : Ncy = 3

$$df_x = f_x - f_{x-3}$$

$$dt_x = \frac{1}{f_x} + \frac{1}{f_{(x-1)}} + \frac{1}{f_{(x-2)}}$$

$$fx' = \frac{df_x}{dt_x}$$
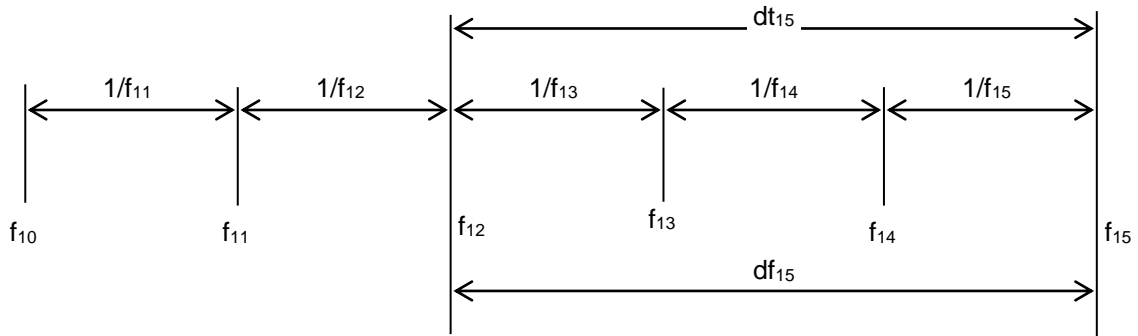
$$f'_{10} = (f_{10} - f_7) : \left(\frac{1}{f_{10}} + \frac{1}{f_9} + \frac{1}{f_8} \right) \ldots\ldots\ldots f'_{15} = (f_{15} - f_{12}) : \left(\frac{1}{f_{15}} + \frac{1}{f_{14}} + \frac{1}{f_{13}} \right)$$

EXAMPLE OF UNDERFREQUENCY OPERATION – Ncy=3
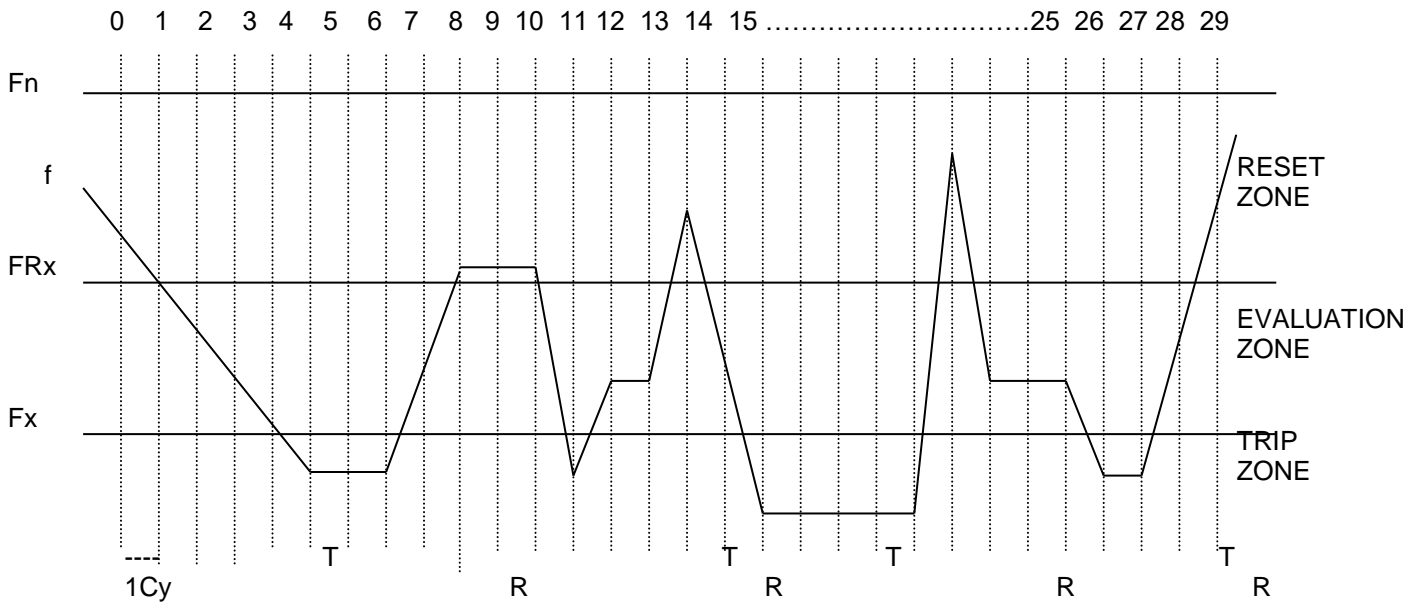
Fx = Trip Level ; FRx = Reset Level ; Fn = Rated Freq. ; f = Frequency ; f ' = df / dt

O = NO TRIPPING   T = TRIPPING   R = RESET

$(f_0, f_1, f_2) = 0$

$$f'_0 = (f_0 - f_{-3}) : \left(\frac{1}{f_0} + \frac{1}{f_{-1}} + \frac{1}{f_{-2}} \right)$$

$(f_1, f_2, f_3) = 0$

$$f'_1 = (f_1 - f_{-2}) : \left(\frac{1}{f_1} + \frac{1}{f_0} + \frac{1}{f_{-1}} \right)$$

$(f_2, f_3, f_4) = 0$

$$f'_2 = (f_2 - f_{-1}) : \left(\frac{1}{f_2} + \frac{1}{f_1} + \frac{1}{f_0} \right)$$

$(f_3, f_4, f_5) = T$

$$f'_3 = (f_3 - f_0) : \left(\frac{1}{f_3} + \frac{1}{f_2} + \frac{1}{f_1} \right)$$

$(f_4, f_5, f_6) = T$.

$(f_5, f_6, f_7) = T$.

$(f_6, f_7, f_8) = T$.

$(f_7, f_8, f_9) = R$.

. .

. .

$(f_{27}, f_{28}, f_{29}) = R$

$$f'_{27} = (f_{27} - f_{24}) : \left(\frac{1}{f_{27}} + \frac{1}{f_{26}} + \frac{1}{f_{25}} \right)$$

2.6 - Operation Principle of Voltage Element

2.6.1 - Acquisition of the voltage measurements

The input voltage of supplied to three adapting transformers.
In the time period one cycle the relay computes the RMS value of each of the three phase-to-neutral input voltages (E_A, E_B, E_C) as well as the RMS value of the phase-to-phase voltages ($U_A = U_{AB}$, $U_B = U_{BC}$, $U_C = U_{CA}$). The RMS value is update every 5ms and made available for the voltage control algorithms.
The RMS value of the above measurements is available in real time on the front face Display shown in primary voltage at System PTs terminals according to the rating programmed for the PTs primary and secondary voltage (see §12.1).

2.6.2 - Algorithm of the Voltage control elements

❑ Each voltage control stage "xu" (2 stages for UFD34 : 1u, 2u) can be individually programmed to operate as undervoltage, overvoltage or voltage balance by programming the operation mode (Un – xu) or (Un + xu) or (Un ± xu).

❑ The operation level of each element can be individually adjusted by programming the value of the voltage difference xu (1u = stage 1--------- 2u = stage 2).

"xu" programmable from 5% to 90% in steps of 1% of the rated input voltage Un

❑ The reset of each element takes place when the measured voltage difference is 5% less than the trip level.

❑ "xu" can also be programme as "Dis" which inhibits the operation of function.

❑ Each individual stage includes one instantaneous element and one time delayed element
The time delay "txu" is individually programmable for each stage
(1tu = stage 1 ------- t2t = stage 2)

"txu" programmable from 0.1 to 60.0 sec in steps of 0.1s

As soon as the RMS value of the input voltage exceeds the set operation level, the instantaneous element of the stage is tripped (the relevant relay energized) and the timer of the time delayed element of the same stage is started.

As soon as the voltage measurement drops below the reset level, the instantaneous element as well as the timer are reset.

If during the time delay no measurement is detected below the reset level, the time delayed element is tripped and the relevant output relay is energized.

The reset after tripping of the relay associated to the time delayed element (when the reset condition is present) can be programmed to be

♦ Automatic instantaneous

♦ Manual by the reset button on relays front or by a command via serial communication port or by activation of the reset digital input D3.

♦ Time delayed with an adjustable time relay.

The reset time delay is individually adjustable for each frequency stage.

"XR" programmable from 0.05 to 99.99 s in steps of 0.01 sec.

Any time a tripping of a time delayed element takes place, the counter of n° of tripping of the stage is increased and the values of frequency, voltage and frequency rate of variation are recorded into the event recording memory.

2.7 - Algorithm of the element for control of the "Rate of change" of the voltage

The relay includes one programmable element for de/dt detection : e'.

The operation level of the de/dt element can be adjusted.

" e' " programmable from 10 to 99 V/s in steps of 0.1 V/s.

The de/dt element can be programmed to detect

□ the "rate of rise" $\left(de = + \rightarrow \dfrac{df}{dt} > 0 \right)$

□ the "rate of decrease" $\left(de = - \rightarrow \dfrac{df}{dt} < 0 \right)$

□ the "rate of change" $\left(de = +/- \rightarrow \left| \dfrac{df}{df} \right| > 0 \right)$

2.7.1 - Operation of de/dt element

The evaluation is made on 5 cycles, at each cycle the relay computes the difference between the voltage measured and that measured 5 cycles before and counts the time into which the variation has been detected.

Example : Ncy = 5

$$df_x = f_x - f_{x-5}$$

$$dt_x = \frac{1}{f_x} + \frac{1}{f_{(x-1)}} + \ldots\ldots + \frac{1}{f_{(x-4)}} \left.\right\} \quad fx' = \frac{df_x}{dt_x}$$
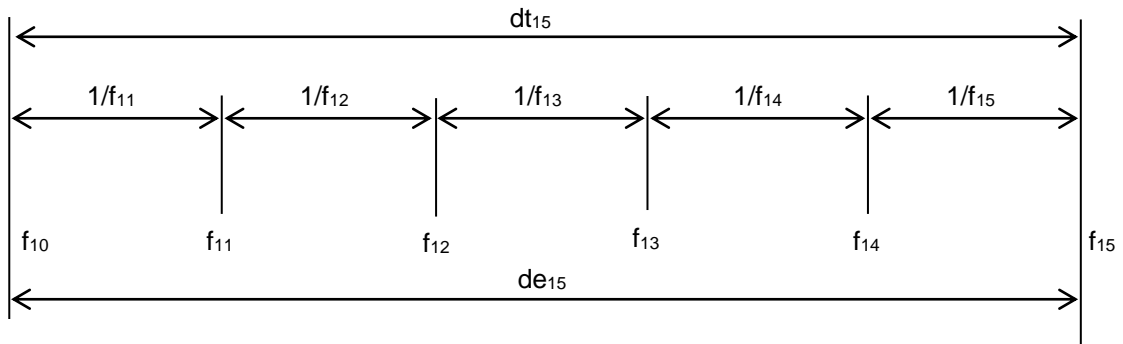
$$e'_{10} = (f_{10} - f_5) : \left(\frac{1}{f_{10}} + \frac{1}{f_9} + \ldots + \frac{1}{f_6} \right)\ldots\ldots\ldots e'_{15} = (f_{15} - f_0) : \left(\frac{1}{f_{15}} + \frac{1}{f_{14}} + \ldots + \frac{1}{f_{11}} \right)$$

As soon as the value of "de/dt" computed as above equals the set value "e'", the element trips and energizes the associated output relay.

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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

MODE ○	SELECT ●		+ - ENTER ● ● ○
MEASURES Measurements display	**ACT MEAS**	Actual measurement values	Scanning of the menus by the key "+" "-"
	LASTTRIP	Values measured at last tripping	
	TRIP NUM	N° of tripping for each function	
SET DISP Setting Program display	**SETTINGS**	Display of setting	
	F→RELAY	Display of configuration of output relay	
PROGR (*) Set Programming	**SETTINGS**	PROG ● → Setting of parameters	Paramater scanning by the key SELECT
	F→RELAY	→ Configuration of output relays	Parameter modification by the key "+" "-" Set validation by the key ENTER
TEST PRG Functional Test	**W/O TRIP**	Test with operation of signals only	Test activation by the key ENTER
	WithTRIP (*)	Test with operation of signals and output relays	
		(*) <u>Enabled only if input voltage is zero</u>	

Pressing this button progressively selects between Measurements Display, Setting Display, Programming, and Test modes

The SELECT button chooses which category of values within the chosen mode to display

When in Program mode, this button stores the newly selected value. If not in Program mode and the relay has tripped, this button resets the relay and all output contacts. If not tripped, this button restores the default display.

MODE   SELECT   + -

PROG.

ENTER/RESET
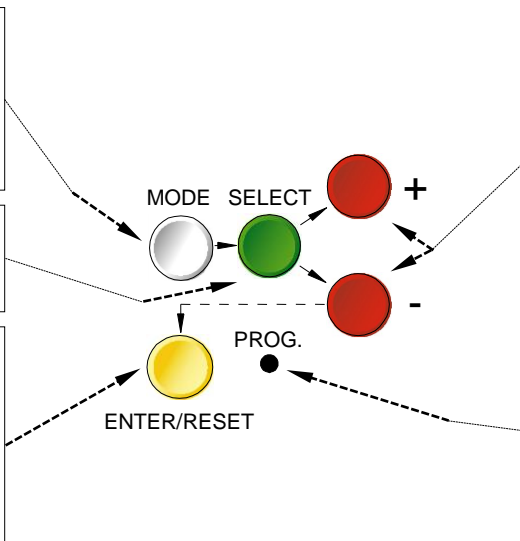
The + and - buttons are used to select the actual measurement or display desired when in Measurements Display or Settings Display modes. When in Program mode, these buttons increase or decrease the value of the displayed setting.

When in Program mode, and when all input currents are zero, pressing this recessed button places the relay into active programming mode, allowing any or all of the relay's settings to be altered.

4. SIGNALIZATIONS

Eight signal leds (normally off) are provided:
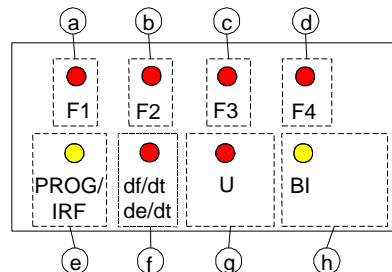
a)	Red LED	**F1**	□	Flashing as soon as the 1st frequency control element starts to operate
			□	Lit-on at the end of the set time delay

b)	Red LED	**F2**	□	As above for the 2nd frequency control element

c)	Red LED	**F3**	□	As above for the 3rd frequency control element

d)	Red LED	**F4**	□	As above for the 4th frequency control element

e)	Yellow LED	**PROG/IRF**	□	Flashing when programming
			□	Lit-on in case of internal fault detected during relay's autotest.

|				
f)	Red LED	**df/dt de/dt**	□	Flashing as soon as the df/dt element starts to operate
			□	Lit-on when the de/dt element trips

g)	Red LED	**U**	□	Flashing when one voltage element or the undervoltage lock-out element is operating.
			□	Lit-on when tripped

h)	Yellow LED	**BI**	□	Lit-on when a blocking signal input is present (BI).

The reset of the leds takes place as follows

□	Leds	a,b,c,d,e,f	□	From flashing to off, when the start cause disappears
			□	From lit-on to off, by the "ENTER/RESET" push button or via serial bus only if the tripping cause has been cleared.

□	Leds	g,h	□	From flashing to off, automatically when the lit-on cause disappears.

In case of auxiliary power supply failure the status of the leds is recorded and reproduced when power supply is restored.
At switch-on of auxiliary power the relay performs an automatic self diagnostic test routine during which all signal leds are lit-on and the display shows the type of the relay (UFD34).
If no internal fault has been detected, after a few seconds the leds are turned off and the display is turned to its default indication.

5. OUTPUT RELAYS

The unit UFD34 includes four (R1, R2, R3, R4) user programmable plus one diagnostic (R5) output relays.

In the version UFD34-X the number of output relays can be increased by the addition of one or two optional Relay Expansion modules REX-8.

The modules REX-8 are for protruding mounting and are controlled by the master module UFD34-X via a screened twisted pair of cables connecting dedicated RS485 serial ports (see diagram herebelow).

The module REX-8 includes eight (RA, RB, RC, RD, RE, RF, RH, RG) user programmable plus one (R-Diag) diagnostic output relays

The master module UFD34 can control altogether up to sixteen output relays

- 4   internal R1 – R2 – R3 – R4

- 8   from the first optional REX-8 module RA – RB – RC – RD – RE – RF – RG – RH

- 4   from a second optional REX-8 module RI(RA+RB) – RJ(RC+RD) – RK(RE+RF) – RL(RG+RH)

This second unit REX-8 is configured (by internal Dip-Switch) to operate the eight relays two by two in parallel (only four user programmable outputs with double number of available contacts)

<u>Any of the functions featured by the UFD34 can be programmed to control up to four</u> out of the sixteen user programmable output relays
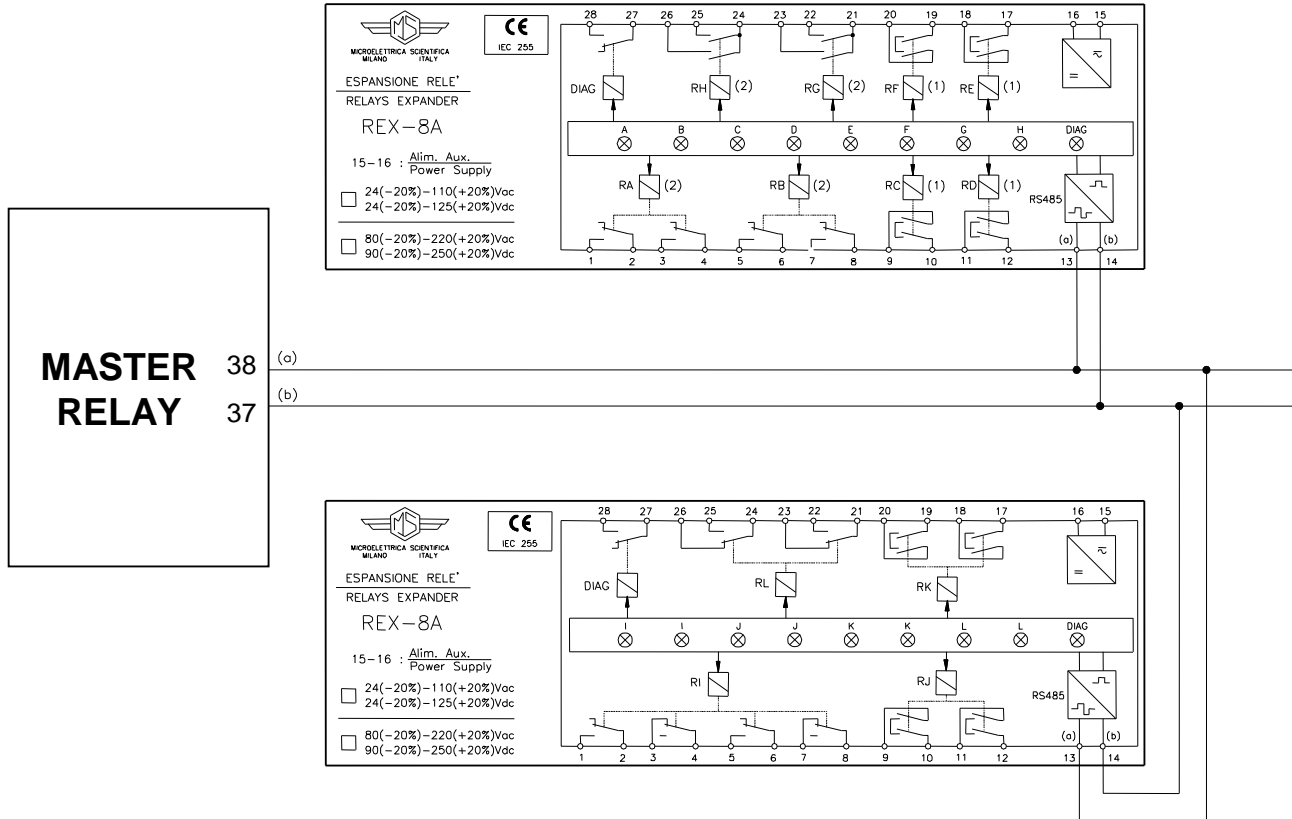
The user programmable relays (all but R5, DIAG) are normally deenergized, i.e. energized on trip. These relays pick-up as soon as the tripping cause appears (relays controlled by the instantaneous functions) or at the end of the set trip time delay (relays controlled by time delayed functions).

a) - The reset after trip can only take place if the relevant tripping cause has been cleared.
   The reset of the relays controlled by time delayed functions is programmable as follows :
   - <u>Automatic instantaneous</u> (Rxtr AUT.)
   - <u>Automatic after adjustable time delay</u> 0.05 to 99.99 (Rxtr xx,xx s)
   - <u>Manual</u> (Rxtr MAN.) : in this mode the reset is operated either by the ENTER/RESET push button on the relay's front face or via serial bus or via the digital input D3.
   - The reset of the relays controlled by instantaneous functions is automatic only.

b) - The relays R5, R DIAG are not user programmable; they are normally energized and get deenergized on :

R5 ⎰- internal fault of UFD34
⎨- UFD34 power supply failure
⎱- during the programming

R DIAG ⎰- Internal fault of REX-8
⎨- REX-8 power supply failure
⎱- Interruption/fault on the serial control communication

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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 blocking inputs activated by external cold contacts are available at relay's terminal board.

D1	terminals 1 – 2	:	❑	When active inhibits the operation of the time delayed output relays controlled by any (one or more as programmed) of the functions : 1f, 2f, 3f, 4f.
D2	terminals 1 – 3	:	❑	When active inhibits the operation of the output relays controlled by any (one or more as programmed) of the functions : 1f', 2f', e'.
D3	terminals 1 – 14	:	❑	When active it inhibits the operation of the delayed output relay (one or more as programmed) of the functions : 1u, 2u.

8. TEST

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

❑ Diagnostic and functional test, with checking of program routines and memory's content, run every time the aux. power is switched-on: the display shows the type of relay and its version number.

❑ Dynamic functional test run during normal operation every 15 min. (relay's operation is suspended for less than ≤4 ms). If any internal fault is detected, the display shows a fault message, the Led "PROG/IRF" illuminates and the relay R5 is deenergized.

❑ Complete test activated by the keyboard or via the communication bus either with or without tripping of the output relays.

9. KEYBOARD AND DISPLAY OPERATION

All controls can be operated from relay's front or via serial communication bus.
The keyboard includes five hand operable buttons **(MODE) - (SELECT) - (+) - (-) - (ENTER/RESET)**
plus one indirect operable key **(PROG)** (see synoptic table a fig.1):
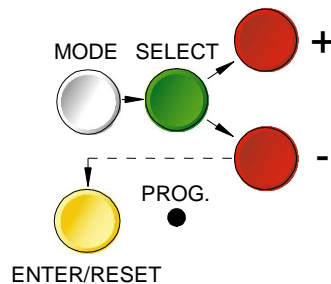
a)	-	White key	**MODE**	:	when operated it enters one of the following operation modes indicated on the display :
			MEASURES	=	Reading of all the parameters measured and of those recorded in the memory
			SET DISP	=	Reading of the settings and of the configuration of the output relays as programmed.
			PROG	=	Access to the programming of the settings and of relay configuration.
			TEST PROG	=	Access to the manual test routines.
b)	-	Green key	**SELECT**	:	When operated it selects one of the menus available in the actual operation MODE
c)	-	Red key	"**+**" AND "**-**"	:	When operated they allow to scroll the different information available in the menu entered by the key SELECT and to increase-decrease the settings.
d)	-	Yellow key	**ENTER/RESET**	:	It allows the validation of the programmed settings - the actuation of test programs - the forcing of the default display indication - the reset of signal Leds.
e)	-	Indirect key	●	:	Enables access to the programming.

10. READING OF MEASUREMENTS AND RECORDED PARAMETERS

Enter the MODE "MEASURE", SELECT the menu "ACT.MEAS" or "LAST TRIP" or
"TRIP NUM", scroll available information by key "+" or "-" .

10.1 - ACT.MEAS

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

Display			Description
F	xxxxx	**Hz**	Input frequency : 30.00 - 80.00 Hz
UA	xx	**V,kV**	R.M.S. value of system's phase-to-phase voltage UA-B : 0-999V or 0-9.99kV or 0-999kV with automatic scale selection (kV showed as K)
UB	xx	**V,kV**	R.M.S. value of system's phase-to-phase voltage UB-C : 0-999V or 0-9.99kV or 0-999kV with automatic scale selection (kV showed as K)
UC	xx	**V,kV**	R.M.S. value of system's phase-to-phase voltage UC-A : 0-999V or 0-9.99kV or 0-999kV with automatic scale selection (kV showed as K)
EA	xx	**V,kV**	R.M.S. value of system's phase A-to-neutral voltage : 0-999kV
EB	xx	**V,kV**	R.M.S. value of system's phase B-to-neutral voltage : 0-999kV
EC	xx	**V,kV**	R.M.S. value of system's phase C-to-neutral voltage : 0-999kV

10.2 - LASTTRIP

Display of the function which caused the tripping of the relay plus values of the parameters at the moment of tripping.

The last five events are recorded.

The memory buffer is refreshed at each new relay tripping with a decreasing numbering (FIFO logic)

Display	Description
LastTr-x	Indication of the recorded event (x=0 to 4) Example : Last event (LastTr-0) Last but one event (LastTr-1) etc…
Cau:xxxx	Display of the time delayed function which has operated the last tripping : **--1t** = 1st frequency element only **-1t&** = 1st frequency element with df/dt control **--2t** = 2nd frequency element only **-2t&** = 2nd frequency element with df/dt control **--3t** = 3rd frequency element only **-3t&** = 3rd frequency with df/dt control **--4t** = 4th frequency element only **-4t&** = 4th frequency element with df/dt control **--1u** = 1st voltage element (t1u) **--2u** = 2nd voltage element (t2u) **--e'** = de/dt element
F xxxx **Hz**	Frequency as measured at the instant of trip
UA xxx **%Un**	Voltage U_{A-B} as measured at the instant of trip
UB xxx **%Un**	Voltage U_{B-C} as measured at the instant of trip
UC xxx **%Un**	Voltage U_{C-A} as measured at the instant of trip
V/s xxx	Voltage rate variation as detected at the instant of trip
f' xxx	Frequency rate of variation as detected at the instant of trip

10.3 - TRIP NUM

Counters of the number of operations for each of the relay's functions.

The memory is non-volatile and can be cancelled only with a secret procedure.

Display	Description
1t xxxxx	1st frequency delayed element only
1t& xxxxx	1st frequency & df/dt delayed element
2t xxxxx	2nd frequency delayed element only
2t& xxxxx	2nd frequency & df/dt delayed element
3t xxxxx	3rd frequency delayed element only
3t& xxxxx	3rd frequency & df/dt delayed element
4t xxxxx	4th frequency delayed element only
4t& xxxxx	4th frequency & df/dt delayed element
1u xxxxx	1st voltage element
2u xxxxx	2nd voltage element
e' xxxxx	de/dt 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 relays associated to the different functions as programmed.

12. PROGRAMMING

The relay is supplied with the standard default programming used for factory test. [Values here below reported in the " Display " column].
Programming is enabled only if no input voltage is detected (main switch open).
All parameters can be modified as needed in the mode PROG and displayed in the mode SET DISP
Local Programming by the front face key board is enabled only if no input current is detected (main switch open). Programming via the serial port is always enabled but a password is required to access the programming mode. The default password is the null string; in the standard application program for communication "MS-COM" it is also provided an emergency password which can be disclosed on request only.
As soon as programming is enabled, the Led PRG/IRF flashes and the reclosing lock-out relay R5 is deenergized.
Enter MODE "PROG" and SELECT either "SETTINGS" for programming of parameters or "F→RELAY" for programming of output relays configuration; enable programming by the indirect operation key PROG.
The key SELECT now scrolls the available parameters. By the key (+) , (-) the displayed values can be modified; to speed up parameter's variation press the key SELECT <u>while</u> "+" or "-" are pressed.
Press key "ENTER/RESET" to validate the set values.

12.1 - PROGRAMMING OF FUNCTION SETTINGS

$$\text{Fn} \quad 50 \quad \text{Hz}$$

Fn is the name of the variable   **50** is the default setting   **Hz** is the unit of measure
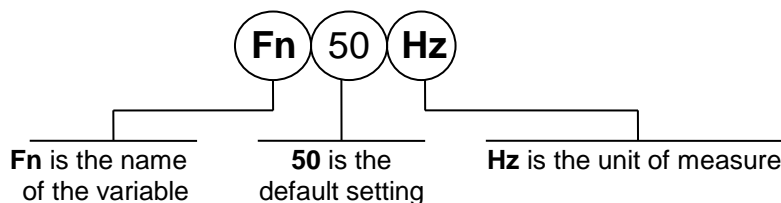
<u>Mode PROG menu SETTINGS. (Production standard settings here under shown).</u>

Display			Description	Setting Range	Step	Unit
Fn	50	**Hz**	System frequency	50 - 60	-	Hz
UnP	10	**kV**	Rated primary phase-to-phase voltage of system's P.Ts.	0.1 - 655	(0.1-1) 0,01 (1.1-9.9) 0,1 (10-655) 1	kV
UnS	100	**V**	Rated secondary phase-to-phase voltage of system's P.Ts.	100 - 125	1	V
Ncy	3		Number of cycles evaluated for f and df/dt tripping	3 - 10	1	Cy

Display			Description	Setting Range	Step	Unit
Fn	-	**1f**	Operation mode of the first frequency control element : **+** = overfrequency **-** = underfrequency **-/+** = under/over frequency **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
1f	0.50	**Hz**	Trip differential level of the 1st frequency control element	0.05 - 9.99	0.01	Hz
1t	2	**s**	Trip time delay of the first freq. element without df/dt control	0.05 – 99.99	0.01	s
1&f'	OFF		The first frequency element can be controlled by the first df/dt element = 1f' by the second df/dt element =2f' no df/dt = OFF	OFF 1f' 2f'	OFF 1f' 2f'	-
1&	1	**s**	Trip time delay of the first frequency element when df/dt control is operating	0.05 - 99.99	0.01	s
Fn	-	**2f**	Operation mode of the second frequency control element : **+** = overfrequency **-** = underfrequency **-/+** = under/over frequency **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
2f	1	**Hz**	Trip differential level of the 2nd frequency control element	0.05 - 9.99	0.01	Hz
2t	1.5	**s**	Trip time delay of the 2nd frequency element without df/dt control	0.05 – 99.99	0.01	s
2&f'	OFF		The second frequency element can be controlled by the first df/dt element = 1f' by the second df/dt element =2f' no df/dt = OFF	OFF 1f' 2f'	OFF 1f' 2f'	-
2&	2	**s**	Trip time delay of the second frequency element when df/dt control is operating	0.05 - 99.99	0.01	s
Fn	-	**3f**	Operation mode of the third frequency control element : **+** = overfrequency **-** = underfrequency **-/+** = under/over frequency **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
3f	1.5	**Hz**	Trip differential level of the 3rd frequency control element	0.05 - 9.99	0.01	Hz
3t	1	**s**	Trip time delay of the 3rd frequency element without df/dt control	0.05 – 99.99	0.01	s
3&f'	1	**f'**	The third frequency element can be controlled by the first df/dt element = 1f' by the second df/dt element =2f' no df/dt = OFF	OFF 1f' 2f'	OFF 1f' 2f'	-
3&	0.75	**s**	Trip time delay of the third frequency element when df/dt control is operating	0.05 - 99.99	0.01	s

Display			Description	Setting Range	Step	Unit
Fn	-	**4f**	Operation mode of the fourth frequency control element : **+** = overfrequency **-** = underfrequency **-/+** = under/over frequency **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
4f	1.50	**Hz**	Trip differential level of the 4th frequency control element	0.05 - 9.99	0.01	Hz
4t	0.75	**s**	Trip time delay of the 4th frequency element without df/dt control	0.05 – 99.99	0.01	s
4&f'	2	**f'**	The fourth frequency element can be controlled by the first df/dt element = 1f' by the second df/dt element =2f' no df/dt = OFF	OFF 1f' 2f'	OFF 1f' 2f'	-
4&	0.5	**s**	Trip time delay of the fourth frequency element when df/dt control is operating	0.05 - 99.99	0.01	s
1df	-/+		Operation mode of the first df/dt element : **+**df/dt > 0 = rate of rise **-** df/dt < 0 = rate of decrease **-/+** |df/dt| > 0 = rate of variation	+ - -/+	+ - -/+	-
1f'	0.2	**Hz/s**	Trip level of the first df/dt element	0.1 – 9.9	0.1	Hz/s
2df	-/+		Operation mode of the second df/dt element : **+**df/dt > 0 = rate of rise **-** df/dt < 0 = rate of decrease **-/+** |df/dt| > 0 = rate of variation	+ - -/+	+ - -/+	-
2f'	0.5	**Hz/s**	Trip level of the second df/dt element	0.1 – 9.9	0.1	Hz/s
E<	30	**%En**	Undervoltage operation lock-out	30 - 90	1	%En
Un	-/+	**1u**	Operation mode of the 1st voltage control element : **+** = overvoltage **-** = undervoltage **-/+** = under/over voltage **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
1u	10	**%Un**	Trip differential level of the 1st voltage control element	5 - 90	1	%Un
t1u	1.0	**s**	Trip time delay of 1st voltage control element	0.1 - 60	0.1	s
Un	+	**2u**	Operation mode of the 2nd voltage control element : **+** = overvoltage **-** = undervoltage **-/+** = under/over voltage **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
2u	20	**%Un**	Trip differential level of the 2nd voltage control element	5 - 90	1	%Un
t2u	2.0	**s**	Trip time delay of 2nd voltage control element	0.1 - 60	0.1	s
e'	50	**Vs/s**	Trip level of the element de/dt Variation is measured on the time base of 5 cycles. The rate of variation measured is the maximum of the three phases.	10 - 99	1	Vs/s
de	+/-		Operation of the function for de/dt **+** = positive only **-** = negative only **+/-** = positive/negative **Dis** = function is disactivated	+ - -/+ Dis	+ - -/+ Dis	-
NodAd	1		Identification number for connection on serial communication bus	1 - 250	1	-

The setting Dis indicates that the function is disactivated.

12.2 - PROGRAMMING THE CONFIGURATION OF OUTPUT RELAYS

| This is the name of protective element | This dash means that output relay number 1 is <u>not</u> assigned to this element | The number 2 means that output relay 2 will operate when this element trips | This dash means that output relay number 3 is not assigned to this element | The number 4 means that output relay 4 will operate when this element trips |
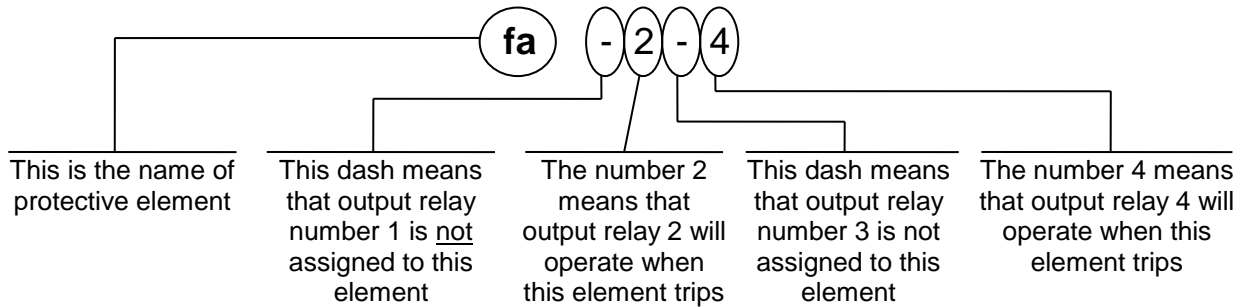
<u>Mode PROG menu F→RELAY</u>   (Settings out of production are here under shown).

The key "**+**" operates as cursor; it moves through the digits corresponding to the four relays programmable for any functions in the sequence 4-3-2-1-L-K-J-I-H-G-F-E-D-C-B-A (4=Relay R4 etc.) and makes start flashing the information actually present in the digit. The information present in the digit can be either the number/letter of the relay (if this was already associated to the function actually on programming) or a dot (-) if this place was not yet addressed.

The key "**-**" changes the existing status from the dot to the relay number or viceversa.

Display		Description			
1f	- - - -	Instantaneous element of 1st frequency level operates relays	R1, R2, R3, R4		RA,RB→RL
1t/&	1 - - -	As above, time delayed element.	R1, R2, R3, R4		RA,RB→RL
2f	- - - -	Instantaneous element of 2nd frequency level operates relays	R1, R2, R3, R4		RA,RB→RL
2t/&	- 2 - -	As above, time delayed element.	R1, R2, R3, R4		RA,RB→RL
3f	- - - -	Instantaneous element of 3rd frequency level operates relays	R1, R2, R3, R4		RA,RB→RL
3t/&	- - 3 -	As above, time delayed element.	R1, R2, R3, R4		RA,RB→RL
4f	- - - -	Instantaneous element of 4th frequency level operates relays	R1, R2, R3, R4		RA,RB→RL
4t/&	- - - 4	As above, time delayed element.	R1, R2, R3, R4		RA,RB→RL
E<	- - - -	Voltage lock-out element.	R1, R2, R3, R4	Only for Version UFD34-X	RA,RB→RL
1f'	- - - -	Element of 1st df/dt level operates relays	R1, R2, R3, R4		RA,RB→RL
2f'	- - - -	Element of 2nd df/dt level operates relays	R1, R2, R3, R4		RA,RB→RL
1u	- - - -	Instantaneous element of 1st voltage level operates relays	R1, R2, R3, R4		RA,RB→RL
t1u	- - - -	As above, time delayed element	R1, R2, R3, R4		RA,RB→RL
2u	- - - -	Instantaneous element of 2nd voltage level operates relays	R1, R2, R3, R4		RA,RB→RL
t2u	- - - -	As above, time delayed element	R1, R2, R3, R4		RA,RB→RL
e'	- - - -	Element de/dt operates relays	R1, R2, R3, R4		RA,RB→RL
1tr	Aut.	Reset time delay of output relay R1 can be : - instantaneous (R1tr Aut.) - time delayed (R1tr 0.01- 99.99 s) step 0.01 s - manual (R1tr Man.)			
2tr	Aut.	As above for relay R2.			
3tr	Aut.	As above for relay R3.			
4tr	Aut.	As above for relay R4.			
Atr	Aut.	As above for relay RA.			
Btr	Aut.	As above for relay RB.			
Ctr	Aut.	As above for relay RC.			
Dtr	Aut.	As above for relay RD.			
Etr	Aut.	As above for relay RE.			
Ftr	Aut.	As above for relay RF.			
Gtr	Aut.	As above for relay RG.			
Htr	Aut.	As above for relay RH.			
Itr	Aut.	As above for relay RI.			
Jtr	Aut.	As above for relay RJ.			
Ktr	Aut.	As above for relay RK.			
Ltr	Aut.	As above for relay RL.			
D1f	- - - -	Blocking input D1, when active, blocks the operation of the time delayed output associated to the functions 1f, 2f, 3f, 4f, as selected.			
D2f'	- - - -	Blocking input D2, when active, blocks the operation of the function 1f', 2f', e', as selected.			
D2e'	- - - -				
D3u	- - - -	Blocking input D3, when active, block the operation of the time delayed output relays associated to the functions 1u, 2u as detected.			

13. MANUAL AND AUTOMATIC TEST OPERATION

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

Operation of the yellow key activates a complete test of the electronics and the process routines.
All the leds are lit-on and the display shows (TEST RUN). If the test routine is successfully completed the display switches-over to the default reading (FxxxxxHz). 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 voltage measured 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 $\leq$ 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 – 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	level 3	80-1000MHz	10V/m
	ENV50204		900MHz/200Hz	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% Rated Input for trip levels 2% +/- 10ms for times
❑ Rated Voltage	Un = (100 ÷ 400)Vac
❑ Voltage overload	500Vac continuous
❑ Burden on voltage input	0,08 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.)

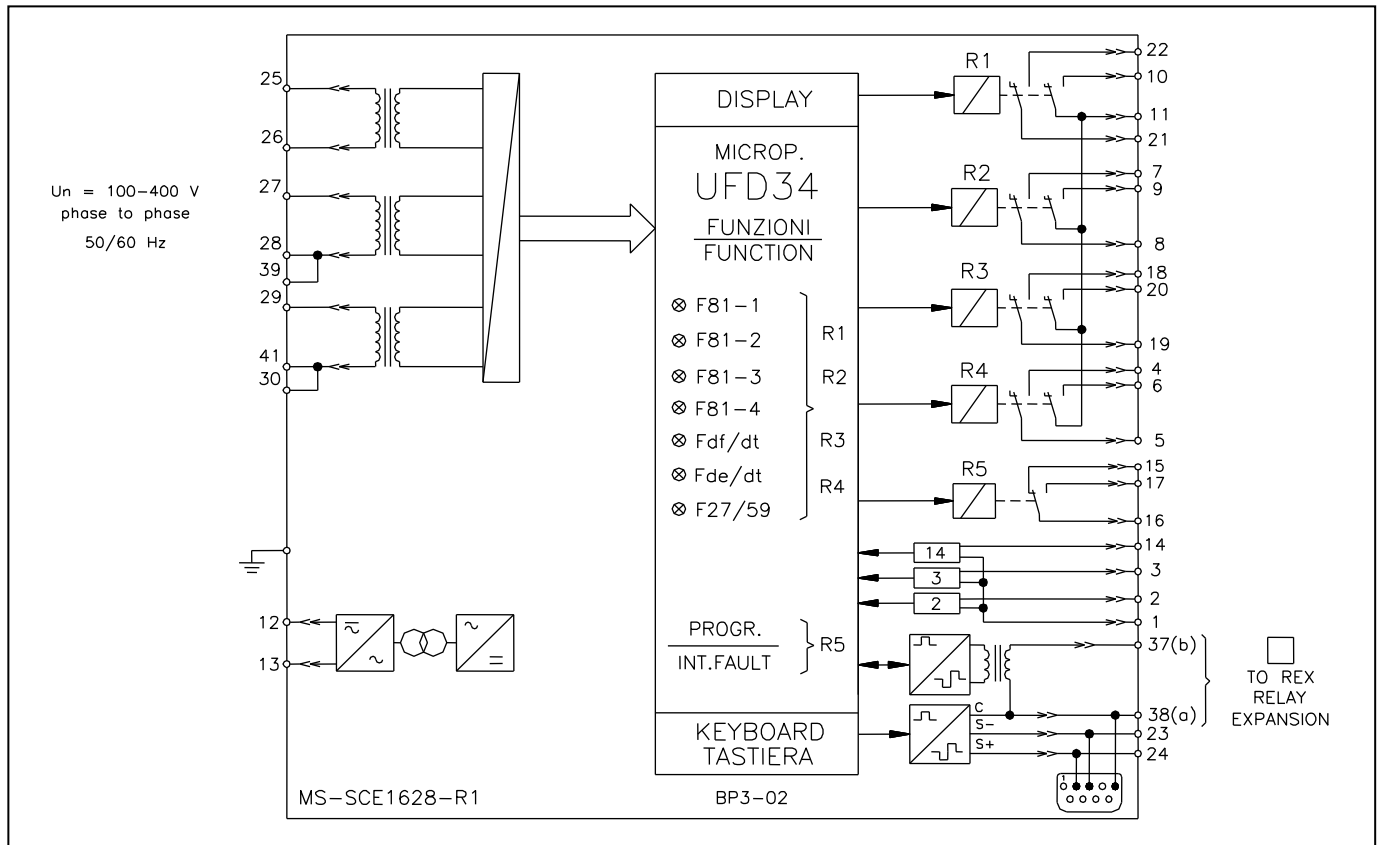## 17. CONNECTION DIAGRAM (SCE1627 Rev.1 Standard Output)
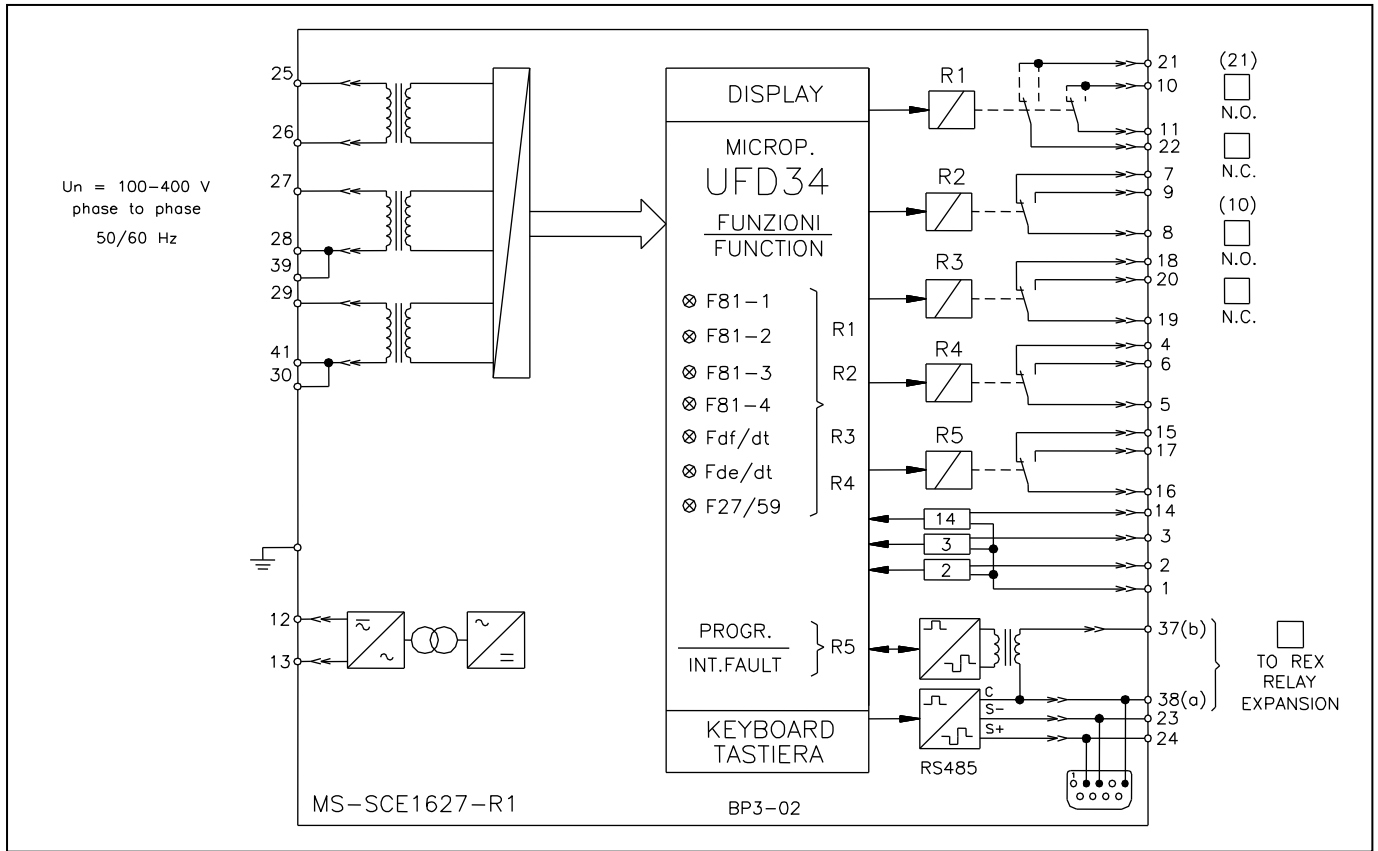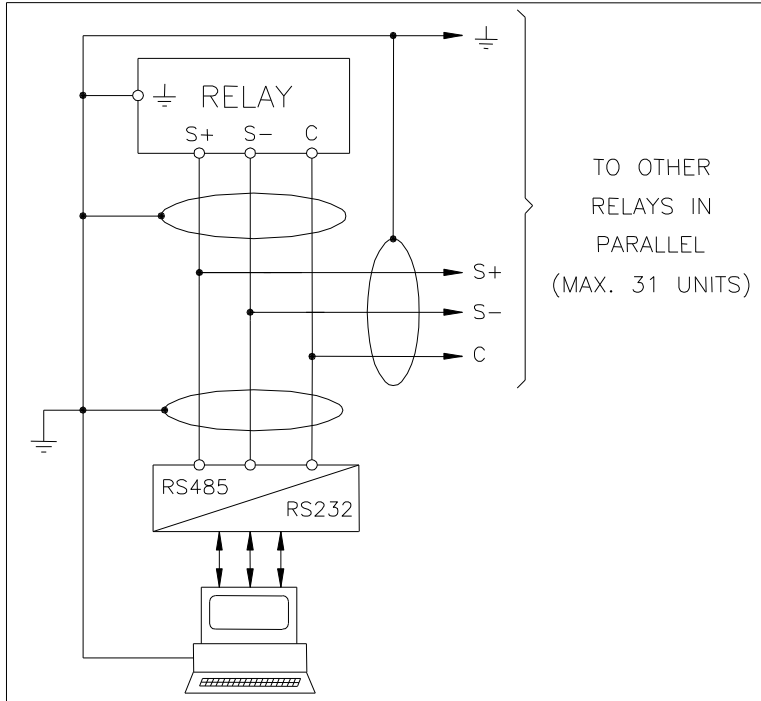

17.1 - CONNECTION DIAGRAM (SCE1628 Rev.1 Double Output)
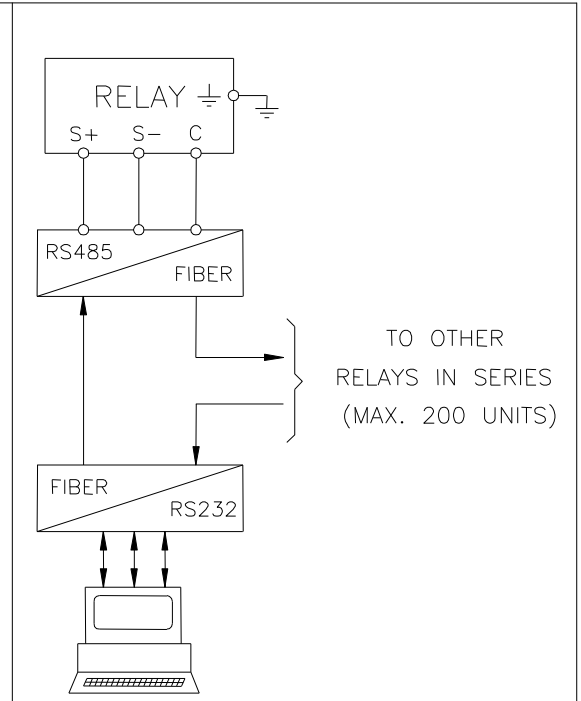
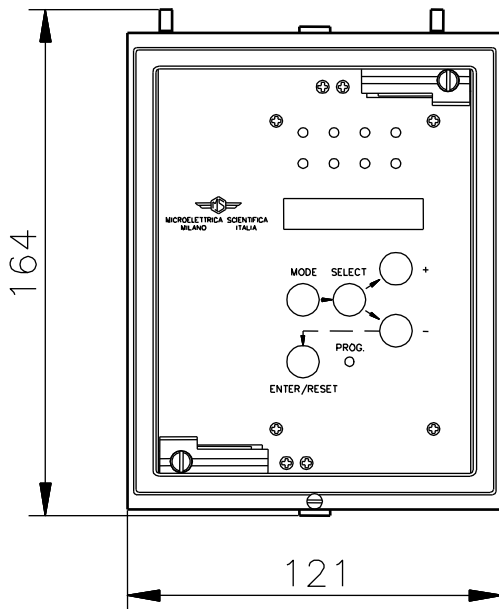## 18. WIRING THE SERIAL COMMUNICATION BUS (SCE1309 Rev.0)

CONNECTION TO RS485   FIBER OPTIC CONNECTION

19. OVERALL DIMENSIONS

PANEL CUT-OUT 113x142 (LxH)

164

121

204

224
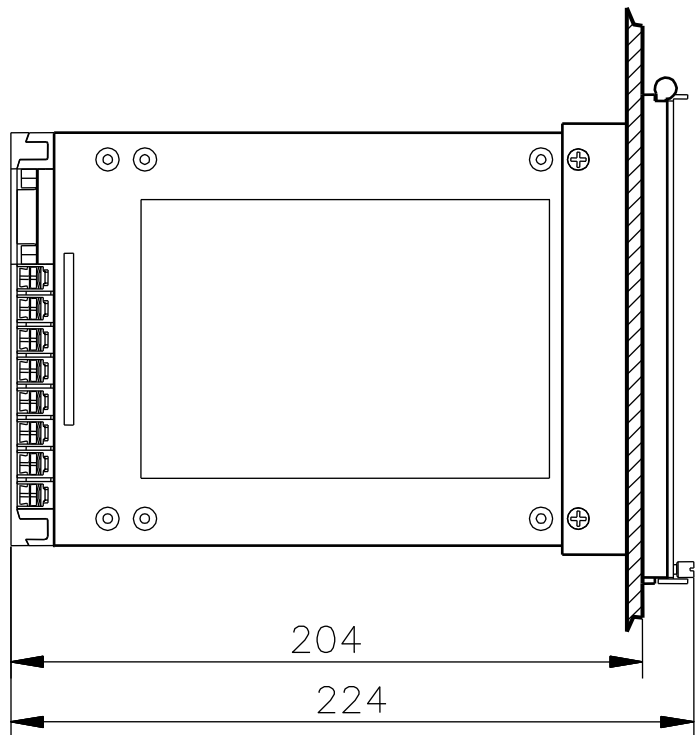
**View of Rear
Terminal Connection**
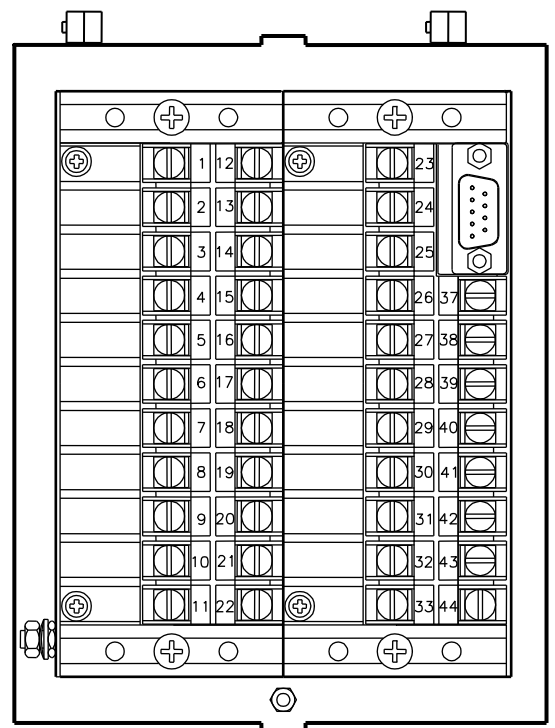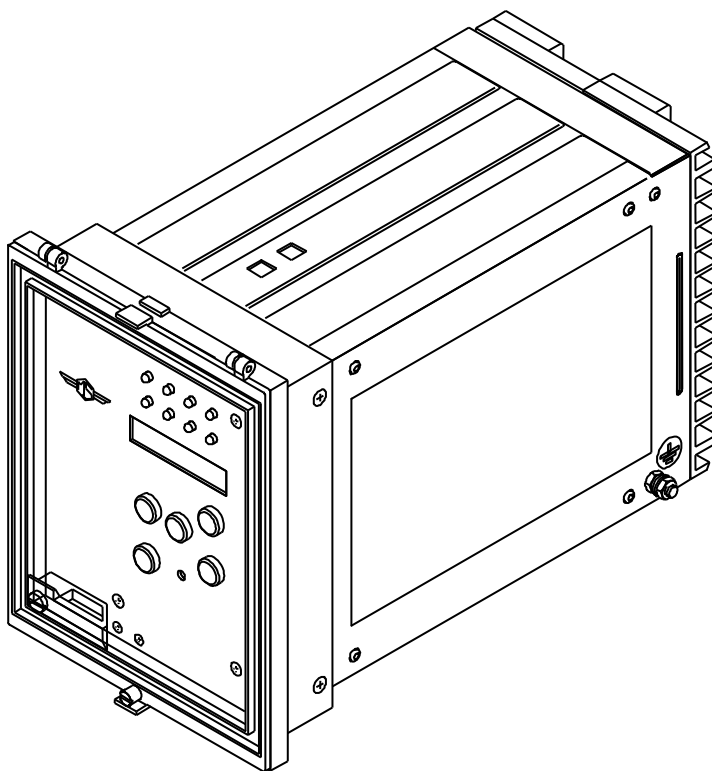
20. DIRECTION FOR PCB'S DRAW-OUT AND PLUG-IN

20.1 - DRAW-OUT

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

20.2 - PLUG-IN

Rotate clockwise the screws ① and ②in the horizontal position of the screws-driver mark.
Slide-in the card on the rails provided inside the enclosure.
Plug-in the card completely and by pressing the handle to the closed position.
Rotate anticlockwise the screws ① and ② with the mark in the vertical position (locked).
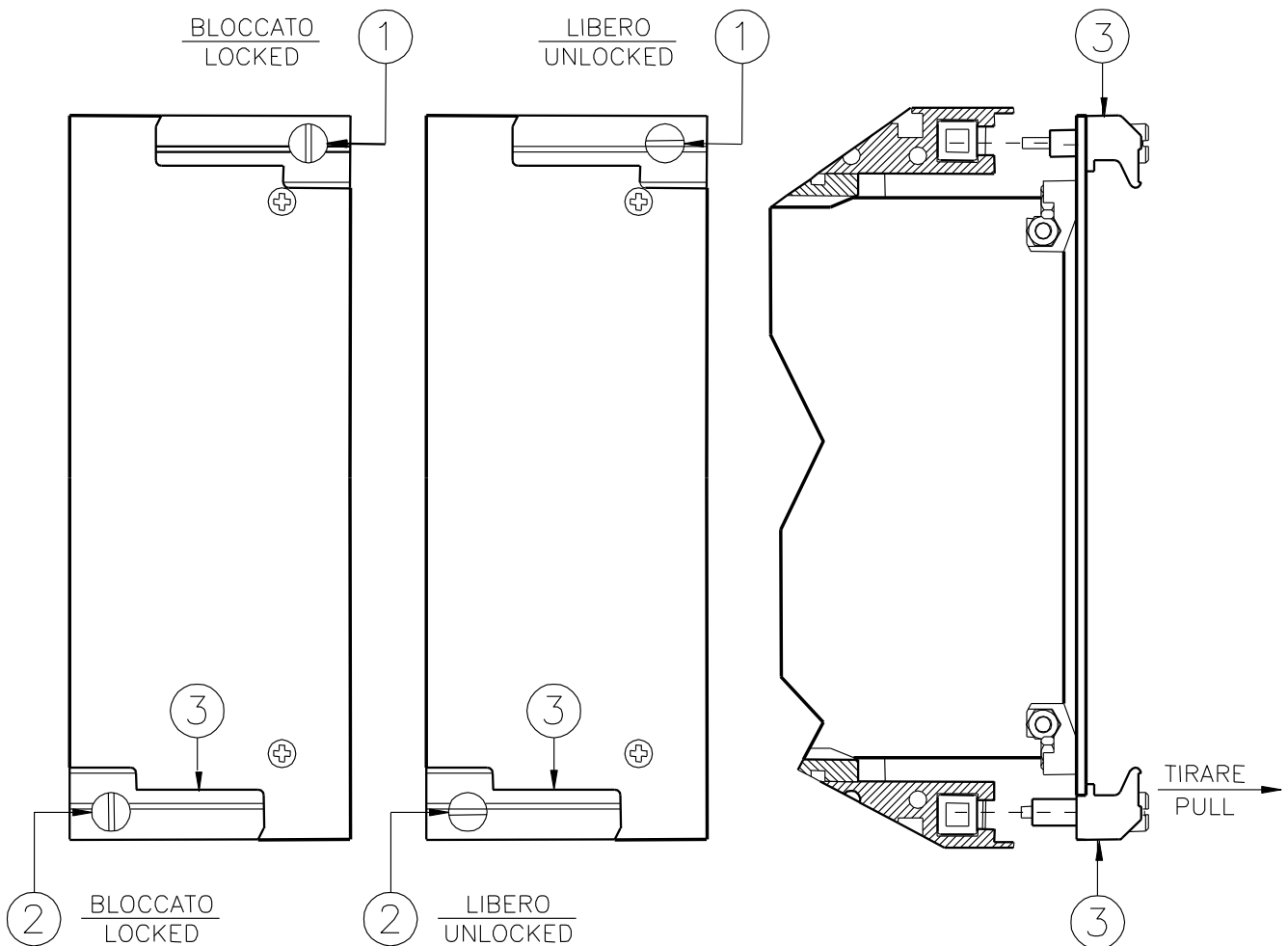
21. KEYBOARD OPERATIONAL DIAGRAM
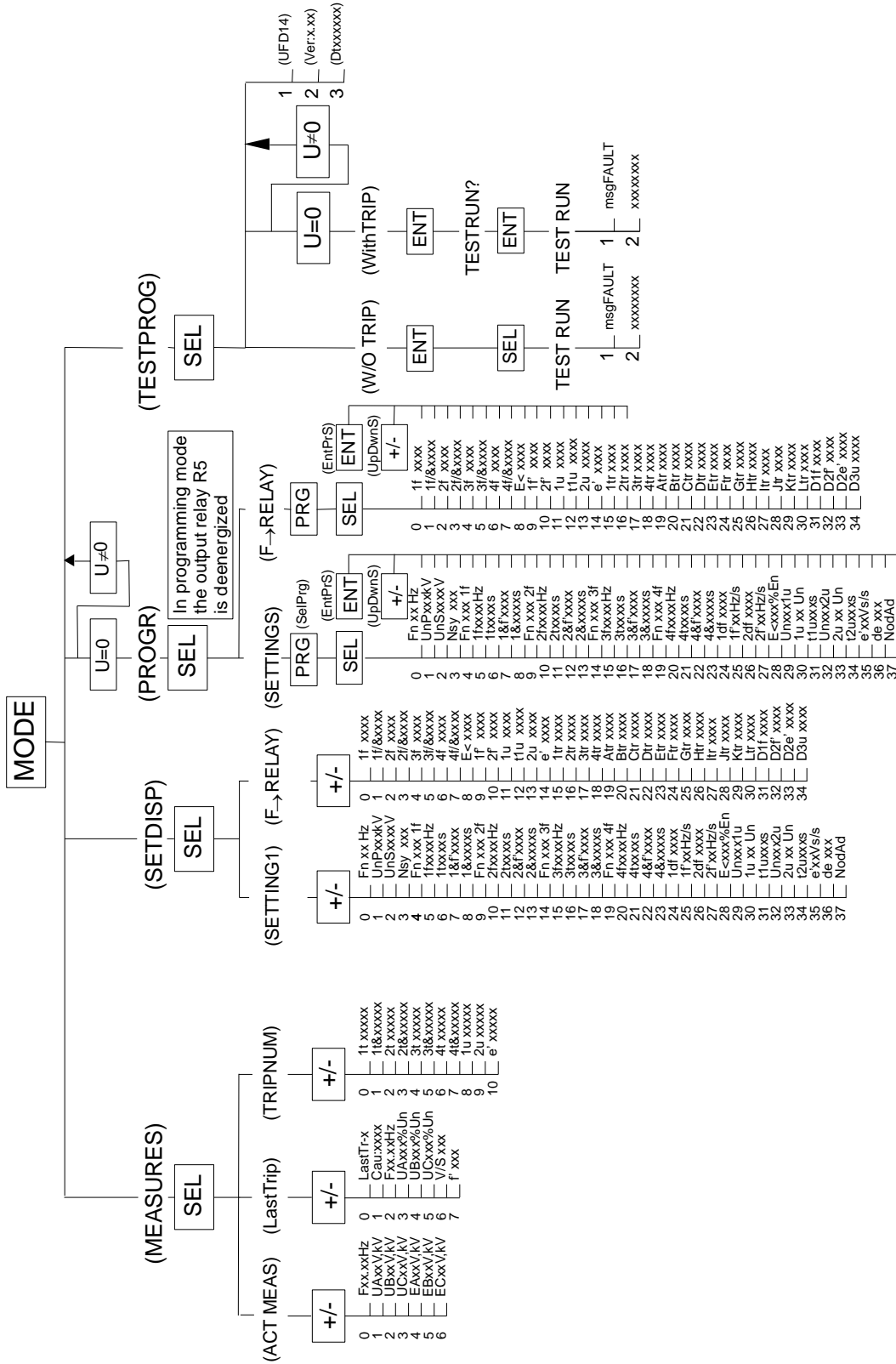
22. SETTING'S FORM

Relay Type	**UFD34**	Station :		Circuit :		
Date :	/ /	**Firmware Ver.**		**Relay Serial Number :**		
Power Supply	☐ 24V(-20%) / 110V(+15%) a.c. 24V(-20%) / 125V(+20%) d.c.			**Rated voltage :**		
	☐ 80V(-20%) / 220V(+15%) a.c. 90V(-20%) / 250V(+20%) d.c.					

		RELAY PROGRAMMING				

Variable	Description	Setting Range		Default Setting	Actual Setting	Test Result Pick-up	Test Result Reset
Fn	System frequency	50 - 60	Hz	50			
UnP	Rated primary phase-to-phase voltage of system's P.Ts.	0.1 - 655	kV	10			
UnS	Rated secondary phase-to-phase voltage of system's P.Ts.	100 - 125	V	100			
Ncy	Number of cycles evaluated for f and df/dt tripping	3 - 10	-	3			
Fn	Operation mode of the first frequency control element :	+, -. -/+, Dis	**1f**	-			
1f	Trip differential level of the 1st frequency control element	0.05 - 9.99	Hz	0.50			
1t	Trip time delay of the first freq. element without df/dt control	0.05 – 99.99	s	2			
1&f'	The first frequency element can be controlled	OFF, 1f', 2f'	-	OFF			
1&	Trip time delay of the first frequency element when df/dt control is operating	0.05 - 99.99	s	1			
Fn	Operation mode of the second frequency control element :	+, -. -/+, Dis	**2f**	-			
2f	Trip differential level of the 2nd frequency control element	0.05 - 9.99	Hz	1			
2t	Trip time delay of the 2nd freq. element without df/dt control	0.05 – 99.99	s	1.5			
2&f'	The second frequency element can be controlled	OFF, 1f', 2f'	-	OFF			
2&	Trip time delay of the second frequency element when df/dt control is operating	0.05 - 99.99	s	2			
Fn	Operation mode of the third frequency control element :	+, -. -/+, Dis	**3f**	-			
3f	Trip differential level of the 3rd frequency control element	0.05 - 9.99	Hz	1.5			
3t	Trip time delay of the 3rd freq. element without df/dt control	0.05 – 99.99	s	1			
3&f'	The third frequency element can be controlled	OFF, 1f', 2f'	-	1f'			
3&	Trip time delay of the third frequency element when df/dt control is operating	0.05 - 99.99	s	0.75			
Fn	Operation mode of the fourth frequency control element	+, -. -/+, Dis	**4f**	-			
4f	Trip differential level of the 4th frequency control element	0.05 - 9.99	Hz	1.50			
4t	Trip time delay of the 4th frequency element without df/dt control	0.05 – 99.99	s	0.75			
4&f'	The fourth frequency element can be controlled	OFF, 1f', 2f'	-	2f'			
4&	Trip time delay of the fourth frequency element when df/dt control is operating	0.05 - 99.99	s	0.5			
1df	Operation mode of the first df/dt element	+, -. -/+, Dis	-	-/+			
1f'	Trip level of the first df/dt element	0.1 – 9.9	Hz/s	0.2			
2df	Operation mode of the second df/dt element	+, -. -/+, Dis	-	-/+			
2f'	Trip level of the second df/dt element	0.1 – 9.9	Hz/s	0.5			
E<	Undervoltage operation lock-out	30 - 90	%En	30			
Un	Operation mode of the 1st voltage control element	+, -. -/+, Dis	**1u**	-/+			
1u	Trip differential level of the 1st voltage control element	5 - 90	%Un	10			
t1u	Trip time delay of 1st voltage control element	0.1 - 60	s	1.0			
Un	Operation mode of the 2nd voltage control element	+, -. -/+, Dis	**2u**	+			
2u	Trip differential level of the 2nd voltage control element	5 - 90	%Un	20			
t2u	Trip time delay of 2nd voltage control element	0.1 - 60	s	2.0			
e'	Trip level of the element de/dt	10 - 99	Vs/s	50			
de	Operation of the function for de/dt	+, -. -/+, Dis	-	+/-			
NodAd	Identification number for serial communication bus	1 - 250	-	1			

CONFIGURATION OF OUTPUT RELAYS										
Default Setting					Description	Actual Setting				
Protective Element	Output Relays					Protective Element	Output Relays			
1f	-	-	-	-	Instantaneous element of 1st frequency	1f				
1t/&	1	-	-	-	As above, time delayed element.	1t/&				
2f	-	-	-	-	Instantaneous element of 2nd frequency level	2f				
2t/&	-	2	-	-	As above, time delayed element.	2t/&				
3f	-	-	-	-	Instantaneous element of 3rd frequency level	3f				
3t/&	-	-	3	-	As above, time delayed element.	3t/&				
4f	-	-	-	-	Instantaneous element of 4th frequency level	4f				
4t/&	-	-	-	4	As above, time delayed element.	4t/&				
E<	-	-	-	-	Voltage lock-out element.	E<				
1f'	-	-	-	-	Element of 1st df/dt level operates relays	1f'				
2f'	-	-	-	-	Element of 2nd df/dt level operates relays	2f'				
1u	-	-	-	4	Instantaneous element of 1st voltage level	1u				
t1u	-	2	-	-	As above, time delayed element	t1u				
2u	-	-	-	4	Instantaneous element of 2nd voltage level	2u				
t2u	-	2	-	-	As above, time delayed element	t2u				
e'	-	2	-	-	Element de/dt operates relays	e'				
1tr	Aut.				Reset time delay of output relay R1	1tr				
2tr	Aut.				As above for relay R2.	2tr				
3tr	Aut.				As above for relay R3.	3tr				
4tr	Aut.				As above for relay R4.	4tr				
Atr	Aut.				As above for relay RA.	Atr				
Btr	Aut.				As above for relay RB.	Btr				
Ctr	Aut.				As above for relay RC.	Ctr				
Dtr	Aut.				As above for relay RD.	Dtr				
Etr	Aut.				As above for relay RE.	Etr				
Ftr	Aut.				As above for relay RF.	Ftr				
Gtr	Aut.				As above for relay RG.	Gtr				
Htr	Aut.				As above for relay RH.	Htr				
Itr	Aut.				As above for relay RI.	Itr				
Jtr	Aut.				As above for relay RJ.	Jtr				
Ktr	Aut.				As above for relay RK.	Ktr				
Ltr	Aut.				As above for relay RL.	Ltr				
D1f	-	-	-	-	Blocking input D1	D1f				
D2f'	-	-	-	-	Blocking input D2	D2f'				
D2e'	-	-	-	-	Blocking input D2	D2e'				
D3u	-	-	-	-	Blocking input D3	D3u				

Commissioning Engineer : _____ **Date :** _____

Customer Witness : _____ **Date :** _____