DIVISIONE ELETTRONICA E SISTEMI

UHR4N

DIGITAL MULTIFUNCTION PROTECTION RELAY
100% AND 95%
GENERATOR STATOR EARTH FAULT

USER MANUAL

P500D824 **September 2004**

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1 GENERAL CHARACTERISTICS

The multifunction protection relay UHR4N belongs to SIGMA-N digital protection line and it performs functions as generator protection relay against stator earth faults in generator systems; the user can select one or more of the functions listed in the table below

Functions	ANSI
Stator earth fault 100%	64S - 100%
Stator earth fault 95% - residual overvoltage	64S - 95% 59N 59Vo

All the functions of the relay are fully programmable by the front panel keyboard or through the RS485 serial interface; set-up and measured parameters can be visualized on the front panel display and transmitted on the RS485 communication serial port.

> **WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the generator terminals even at generator standstill.**

THRESHOLDS - the following thresholds are available:

- 100% stator earth fault thresholds (minimum resistance thresholds) R1<, R2<, R<<
- 95% stator earth fault thresholds (residual overvoltage) Uo>, Uo>>

The available settings for each threshold are listed in Table A.

TRIP DELAYS - each threshold have a programmable definite time delay TI; for each threshold it is available an additional time delay (TA). The additional time delay is added to time delay TI and its activation is controlled by the digital inputs.

The available settings for each timers are listed in Table A.

OUTPUT RELAYS - the UHR4N controls 4 output relays (named R1, R2, R3 and R4); these relays can be programmed to be activated on START or TRIP conditions of one or more thresholds.

START — instantaneous activation of the output relay when at least one of the measured current or parameter exceeds the programmed threshold value

TRIP — activation of the output relay when the programmed time delay (TI or TI+TA) related to a threshold expires.

The quiescent state of each single relay R1, R2, R3 and R4 can be programmed as normally energized (ON) or normally de-energized (OFF).

An additional relay R5 (normally energized) is controlled by the self-diagnosis routines to report detected fault conditions.

Related to each threshold, partial and total counters of TRIP conditions are available.

DIGITAL INPUTS - there are available 3 digital inputs to activate the following functions (when enabled by the programmed set-up):

- additional time delay (related to one or more thresholds)
- on/off thresholds
- STATUS function (recording of measures on external event)
- pilot wire fault monitoring

For each digital input can be programmed the condition that activates the related functions:

HI voltage =	> 20 V dc / ac
LO voltage =	0 ÷ 10 V dc / ac

The digital input acquisition is valid when the voltage value stays in the range HI or LO for at least 40 ms.

DISPLAY OF MEASURES - the user can select the continuous display one of the measured or computed parameters (primary values). All measures can be transmitted to an external controller.

EVENTS - information related to the last 8 events (TRIP or STATUS) are recorded in the EEPROM memory.

Information includes the threshold set-up and activated relays (TRIP event only), the measured parameters, the digital input status, date and time of the event.

SELF-DIAGNOSIS - the software includes a non stop monitoring module that controls the functionality of all hardware and software resources of the protection relay.

Detected fault conditions are reported by:

- diagnostic message on the display
- glow of a red LED on front panel
- R5 output relay drop-off

The fault condition signaling stays until faults are pointed out by the monitoring module; during this condition the protection functions are suspended to avoid unsuitable tripping.

STATUS FUNCTION - when the STATUS function is activated by one of the digital input (when programmed) the protection relay memorizes information related to measured currents and digital input status (see par. 5.10 - EVENTS). The recorded information allows an analysis of trip causes in co-operative protection relays systems.

PILOT WIRE FAULT MONITORING - when the function is programmed, the digital input DIG2 is used to control the correct functionality of the pilot wire. Digital input DIG2 is always expected to be complementary of DIG1 input (HI-LO or LO-HI) to identify faults on pilot wire.

The fault condition is reported as detected by the self-diagnosis module but the protection functions are not suspended; only the functions related to DIG1 digital input are suspended as the DIG1 status cannot be longer considered as true.

The fault condition is reported when DIG1 and DIG2 signals are not complementary for more then 100 ms.

REMOTE COMMUNICATION - the opto-insulated serial port RS485 can communicate with a personal computer or a remote control and monitoring system equipped with an RS485 interface or with a standard RS485/RS232 converter.

It is possible to select the communication standard between STANDARD (ASCII 7 bit - Seb protocol) or MODBUS (ASCII mode, SLAVE).

All the set-up and measured parameters can be transmitted on the RS485 communication serial port; when communication is active (LED REMOTE glows), the operator on front panel can visualize the relay set-up but changes of parameters are disabled (ENTER and ⊕) buttons disabled).

1.1 100% Stator earth fault operation

The UHR4N relay performs the function of 100% stator earth fault using the 12.5 Hz voltage injection principle on the stator windings.

The 12.5 Hz signal is generated by the GHS module and injected on the generator stator windings through a coupling circuit connected to the generator earthing transformer or to the open delta voltage transformer on generator busbar.

> **WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the generator terminals even at generator standstill.**

When a stator earth fault occurs the equivalent zero sequence impedance of the generator stator windings (normally capacitive only) will also present a resistive component; the **UHR4N** protection relay measures the resistive component of the zero sequence current (**IR** in phase with the injected voltage) to detect the fault condition without influences due to stator capacities.

From the measurement of the resistive component (**IR**) of the 12.5 Hz measured current (**IB**) and from the measured 12.5 Hz voltage, the protection relay computes the zero sequence resistance of the generator stator circuits.

The resistance value is referred to the primary circuit of the earthing transformer or to the primary circuits of the voltage transformer and it represents the value of the resistance to earth of the generator stator circuits.

The resistance measurement is performed only if the current vector **IB** presents a phase angle from the 12.5 Hz voltage lower than ±90°; this allows to measure only the resistive component of the current generated by the GHS injection module and to avoid the measurement of currents related to 12.5 Hz harmonics on the generator circuits (e.g. due to frequency static converters for gas turbine start up).

The resistive components of currents with phase angle (from the 12.5 Hz voltage) higher than 90° a negative sign will be associated (presented with negative sign on the front display) and they will not be considered for the minimum resistance thresholds.

When the 12.5 Hz signal in injected through earthing transformer, the **IR** current is measured using a current transformer as in presence of earth fault close to the generator terminals, the current which will appear on the secondary winding of the earthing transformer could reach quite high values (as function of the earth resistance on the low voltage side of the earthing transformer and of the transformer ratio).

It is available a programmable angle compensation **ANG-CO** of the angle error related to the current transformer or due to the earthing transformer; the programmed value **ANG-CO** will be algebraically added to the angle of the current vector (see paragraph 5.5, ref. D7).

It is available a programmable compensation of the measured resistance (**RES-COMP**) to compensate the resistance due to the parasitic parameters of the earthing transformer, normally equivalent to a resistance parallel connected to the earth resistance of the generator stator circuits (see paragraph 5.5, ref. D8).

It is also available a 50 Hz residual overvoltage programmable threshold **U>50Hz** to disable the 100% stator earth fault protection operation when an high value of 50 Hz voltage signal in detected on the same transducer which is measuring the 12.5 Hz voltage signal. In this case the 50 Hz voltage signal is due to the presence of an earth fault close to the generator terminals and the 95% stator earth fault protection relay will have to operate (see paragraph 1.2).

The output relay R1, R2, R3 and R4 can be programmed to “copy” the status detected by the digital input DIG3 (DIG3 active – output relay activated, DIG3 not active – output relay released); this function can be used to disable the operation of the **GHS** module to avoid the injection of the 12.5 Hz signal when the protection relay is disabled from an external command (using digital inputs). This functionality can avoid the presence of dangerous voltages on the generator terminals when the generator is at standstill or, in general, when the 100% stator earth fault protection is disabled.

Two definite time minimum insulation resistance thresholds are available and programmable in ohm (**R1<**, **R2<**).

The resistance measurement is done when the 12.5 Hz voltage on the stator circuit is greater than the **U<** programmable threshold. If the measured voltage is lower than **U<**,

only the **IB current module** measurement will be taken into consideration (referred to the primary circuit) and:

- current module **≥ IS** - trip threshold **R<<**
- current module **< IS** - ANSI 64S-100% function inhibition (loss of injection signal)

where **IS** is the current flowing to ground in presence of 400 ohm earth fault resistance.

In the second case it is possible to program an output relay to signal the condition (possible loss of auxiliary supply of the **GHS** module).

When the generator is operative, the 100% function will normally protect 20% of the stator windings from the neutral point against earth faults. The remaining part of the stator windings will be protected by the 95% stator earth fault function.

The protection relay is operative at generator standstill; in this case the protection function covers 100% of the stator windings.

> **WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the primary circuits of the voltage transformer even at generator standstill.**

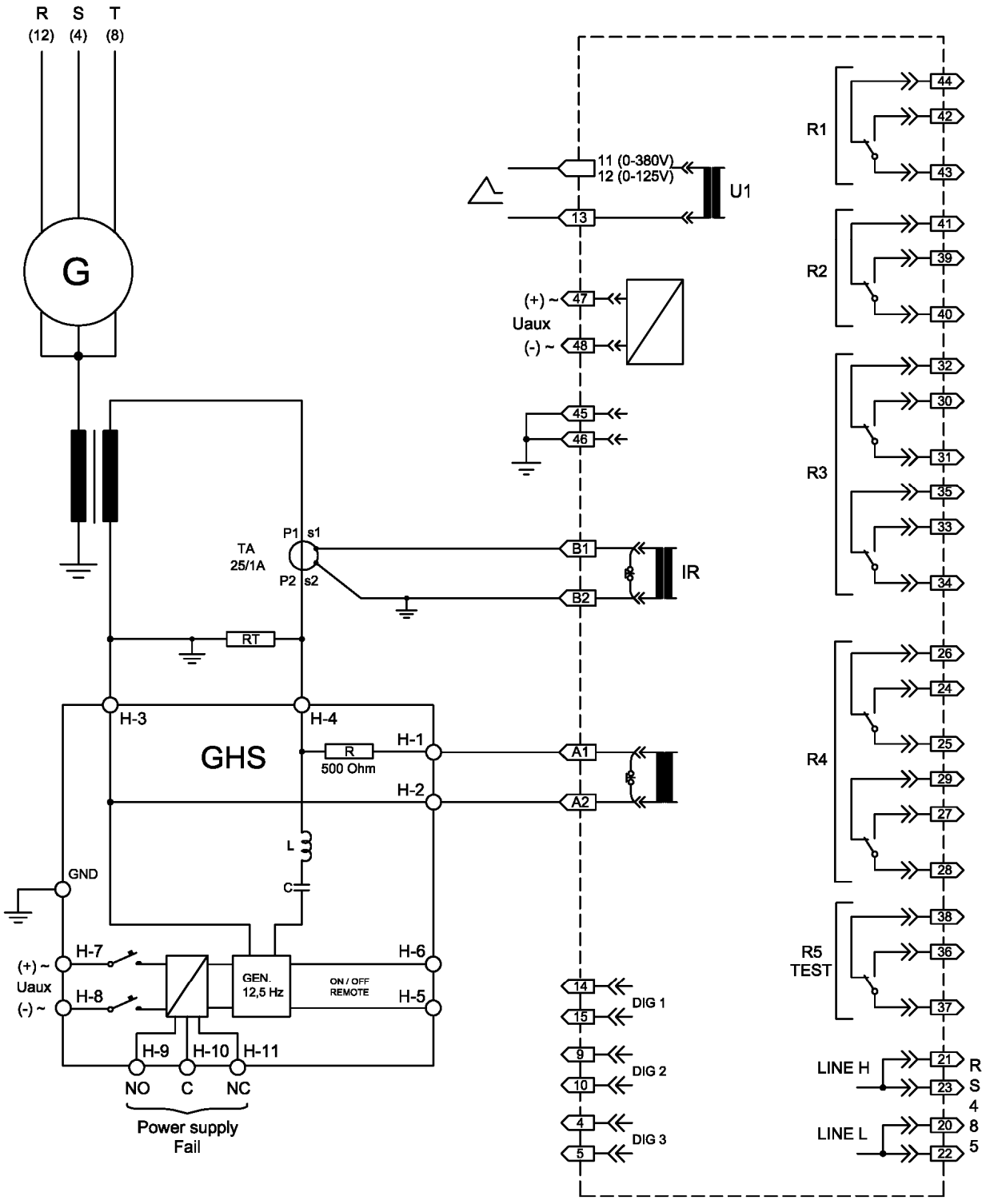


Figure A – Earthing transformer insertion

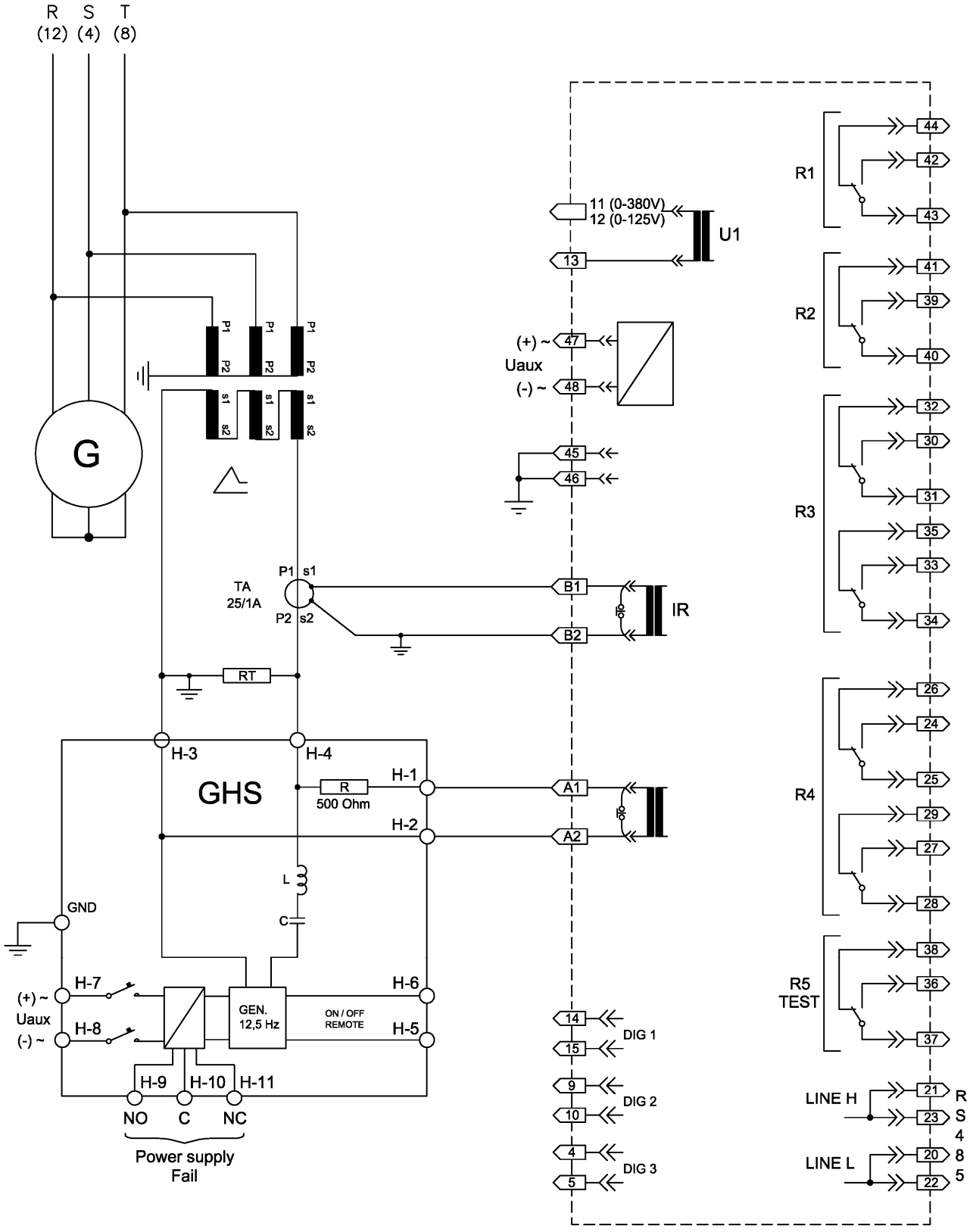


Figure B – Insertion on residual voltage TV

1.1.1 GHS module

The **GHS** module and the coupling circuits are installed:

- in the neutral point cabinet for generator equipped with earthing transformer

- in the protection cabinet for injection through open delta VT

In figure A it is presented the insertion of the **GHS** module for injection through the earthing transformer.

The value of the **R, L** and **C** components (and the possible CT characteristics) are defined as function of the electrical characteristics and earth fault current of the installation.

The **GHS** module requires an auxiliary power supply 24 vdc / 20 A; the auxiliary power can be supplied from an external power supply.

The auxiliary power of the **GHS** module and the 12.5 Hz signal generation enabling can be remotely controlled.

> **WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the primary circuits of the voltage transformer even at generator standstill.**

1.2 95% Stator earth fault operation

The **UHR4N** protection relay measures the fundamental components of the generator residual voltage; the presence of a voltage higher than the programmed threshold is due to an earth fault of the stator winding.

The relay can protect only 95% of the stator winding from the generator terminals. The threshold does not detect earth faults in the 5% of the winding at the neutral end zone.

Two definite time residual overvoltage thresholds (**Uo>**, **Uo>>**) are available

2 FRONT PANEL KEYS

The 5 push-buttons on the front panel allow to visualize all the protection parameters and to modify the protection set-up.

right arrow

down arrow

programming session activation or parameter confirmation

change or increment of the selected parameter

reset of the protection relay (ref. par. 4.3)

VISUALIZATION OF PARAMETERS

- all visualizations are circular and they can be displayed using the two arrow push-buttons.
- the structure of the visualizations and their contents are showed in Figures 1 to 3.
- when the sealable transparent front panel is installed only the arrow push-buttons and the RESET push-button are accessible to prevent unauthorized modification of the protection set-up.

MODIFICATION OF PARAMETERS

- remove the transparent sealable front panel to access [ENTER] and  push-buttons.

3 FRONT PANEL LED SIGNALLING

POWER (green)	⊗	auxiliary supply available
FAIL (red)	⊗	fault condition detected by SELF-DIAGNOSIS software or by PILOT WIRE FAULT MONITORING function
REMOTE (red)	⊗	communication session active on RS485 port
R< (red)	⊗	trip condition on ANSI 64S – 100% (thresholds R1< and R2<)
Uo> (red)	⊗	trip condition on ANSI 64S – 95% (thresholds Uo> and Uo>>)
R<< (red)	⊗	trip condition on R<< threshold

The last trip condition (threshold indication) is also showed on front panel display; more information on trip condition are presented in the recorded EVENT (see par. 5.10).

4 PROGRAMMING AND TEST

The protection relay is easily programmable following the instructions in the next paragraphs:

- HOW TO PROGRAM THE PROTECTION RELAY
- HOW TO MODIFY A VISUALISED PARAMETER

All parameters can be freely modified; the proper protection set- up as required by the plant management is submitted to the operator's judgment.

4.1 How to program the protection relay

The programmable parameters are showed in Figures 1 to 3 at the following references:

B2 ÷ B7	relay protocol, address (RS485) and date/time
C1	enabled protection functions
D1 ÷ D10	nominal values, contrast etc.
E1 ÷ E5	thresholds and time delays (R1<, R2<)
F1 ÷ F9	thresholds and time delays (R<< and U>)
G1 ÷ G5	thresholds and time delays (Uo>, Uo>>)
H1 ÷ H9	output relays functions
K1 ÷ K3	digital input functions
R1 ÷ R10	partial trip counters reset

The programming sequence is the following:

1) **SELECT** the visualization (on display) of the parameter to be modified using the arrow push-buttons

2) **ACTIVATE** the PARAMETER MODIFICATION session depressing the [ENTER] push-button and modify the parameter value

3) **END** the parameter modification session depressing again the [ENTER] push-button

4) **REPEAT** the procedure from 1) to 3) for all the parameters required to obtain the new protection relay set-up

5) **CONFIRM** the new protection relay set-up at the visualization CONFIRM PROG? (Figure 1, ref. J1) within 5 minutes depressing the push-buttons [ENTER] and [+] up to visualize **YES** and [ENTER] again to confirm.

NOTE: The protection relay continues to operate using the previous set-up until the new set-up is confirmed as at point 5) above; the visualization of the modified parameters before the new set-up confirmation is only temporary to allow an easy definition of the new protection set-up.

If the new set-up is not confirmed within 5 minutes from the last pressed push-button, the protection relay visualizes again the previous set-up (the parameters set-up that the protection relay is still using).

4.2 How to modify a visualized parameter

When the parameter to be modified is visualized on front panel display do the following sequence:

1) **PRESS [ENTER]** to activate the parameter modification session

If one or more parameters are modifiable, on the first of them will appear a blinking cursor.

If no parameters are modifiable, no blinking cursor will appear.

2) **MODIFY THE PARAMETER** pressing the arrow push-buttons and

when two parameters are modifiable, the push-button allows to point-out the parameter to be modified (the selected parameter will blink)

when numerical parameters are pointed-out the push-button allows to select the digit to be modified

increasing of the parameter

a) the digits are increased by 1 unit

b) the other parameters are presented following the selection list

3) **PRESS [ENTER]** to end parameter modification session

The modification session is ended and the parameter stops to blink

NOTE: if a numerical parameter is selected out of the accepted range (as shown in Table A) when the push-button [ENTER] is pressed for few seconds an error message will be displayed as:

```
Data
Error
```

and the parameter will be displayed again with the former value.

4.3 Reset

When the push-button [**RESET**] is pressed, the protection relays returns to the standard condition:

- reset of glowing LED's

- drop-off of tripped relays
- reset of any parameter changed but not confirmed (parameters are shown as confirmed at the end of the last programming session)
- display on STANDARD MODE (Figure 1, ref. A1 - par. 5.1)

4.4 Test of output relays

When the output relays test is selected (Figure 2, ref. H10) it is possible to command an output relay (one at the time) to trip from the current status allowing functional tests on electrical plants.

The output relays are activated with the following sequence:

1) **SELECT THE VISUALIZATION** of the desired output relay to be tested

```
TEST R1
OFF
```

2) **PRESS [ENTER]** to activate the test session; the message OFF will start to blink.

3) **PRESS** [+]; and the message on the display will change as:

```
TEST R1
ON
```

4) **PRESS [ENTER]** to command the instantaneous trip of the output relay (change of the current status).

The relay will stay on the new condition until:

- the [⇨] or [**RESET**] push-button is pressed
- the [**ENTER**] push-button is pressed and the sequence at points 3 and 4 is repeated (presenting OFF condition)

The same procedure will be used for R2, R3 and R4 relays.

5 DISPLAY AND PROGRAMMING

The contents and the structure of the displayed messages are shown in figures from 1 to 3; the references A1, B1, B2 etc. identify specific displayed messages in the figures.

5.1 Standard display

A1 - STANDARD DISPLAY

It is the standard displayed message without operator's intervention (no push-buttons pressed for at least 5 minutes) or when the RESET push-button has been pressed.

The displayed information is function of the protection relay status.

NORMAL FUNCTIONING
During this state the following information can be visualized (as defined by set-up):

- **Protection function (ANSI code)** - the display shows the ANSI codes of the enabled functions (ref. C1 – FUNCTION SELECTION).

- **Measured parameters** - the display shows one of the measured or computed parameters. If the parameter programmed to be visualized will be not measured as function of the selection at ref. C1, no parameters will be displayed.

ON TRIP CONDITION
When a trip condition occurs the protection relay visualizes the TRIP message that includes the threshold related to the trip; the displayed messages are as the following:

TRIP R1<	TRIP R2<	TRIP R<<	TRIP Uo>

The information of the trip, as well the glowing of the related LED's, is displayed until the [RESET] push-button is pressed.

If a new trip condition occurs, the displayed information will be updated; information related to previous trips are recorded in EVENTS memory.

FAULT CONDITION
When a permanent or temporary fault condition is detected by the self-diagnosis module, the following message is displayed:

FAIL eeeeeeee

The string eeeeeeee can be:

F.PILOT Detected fault condition on pilot wire; the function related to DIG1 digital input is suspended
Corrective action - verify pilot wire (short or open circuit)

HARDWARE Detected fault condition on hardware or software resources of the protection relay; all functions are suspended.

Corrective action - replace the protection relay and contact SEB post sales service

5.2 Visualization structure

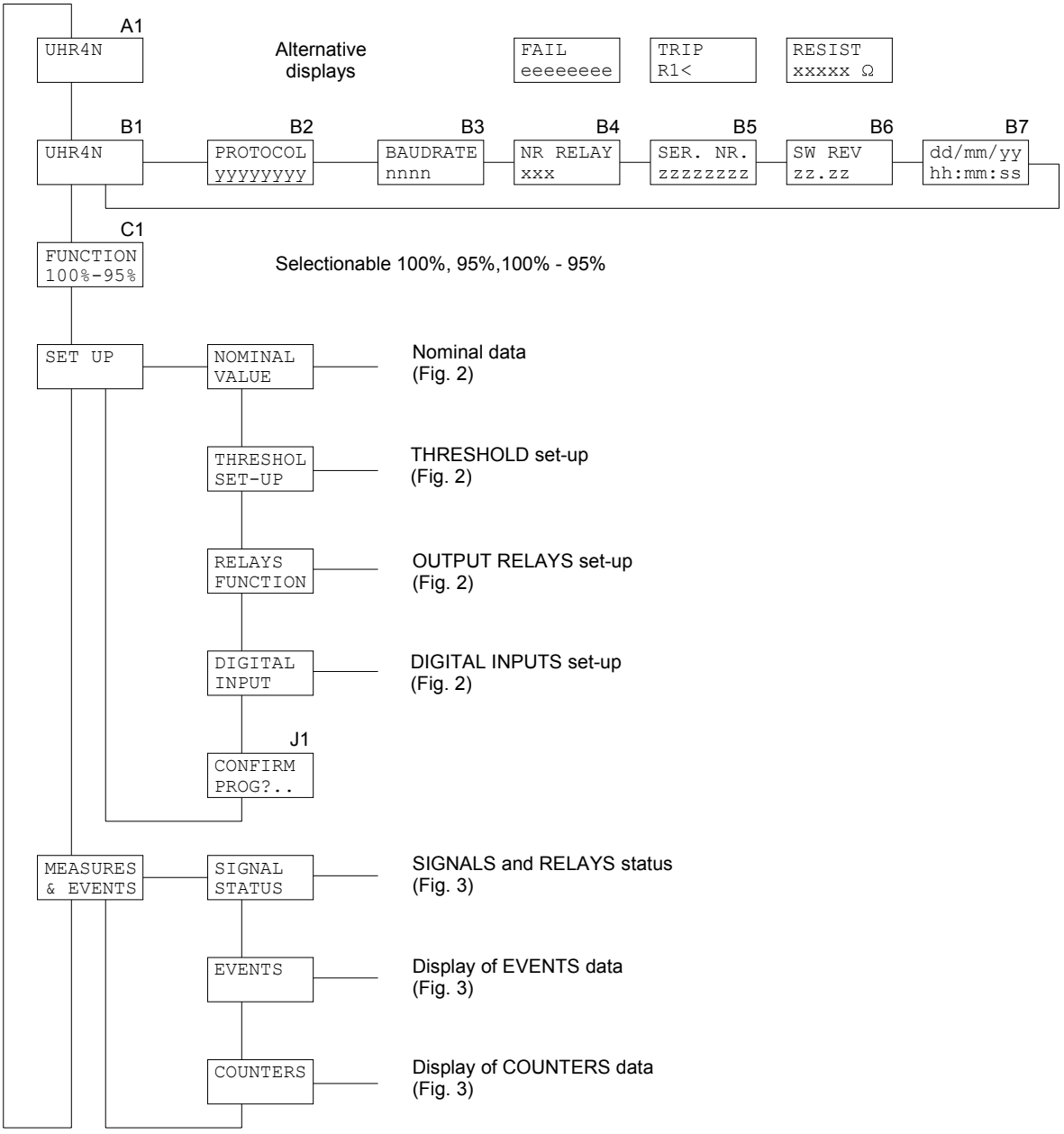


Figure 1

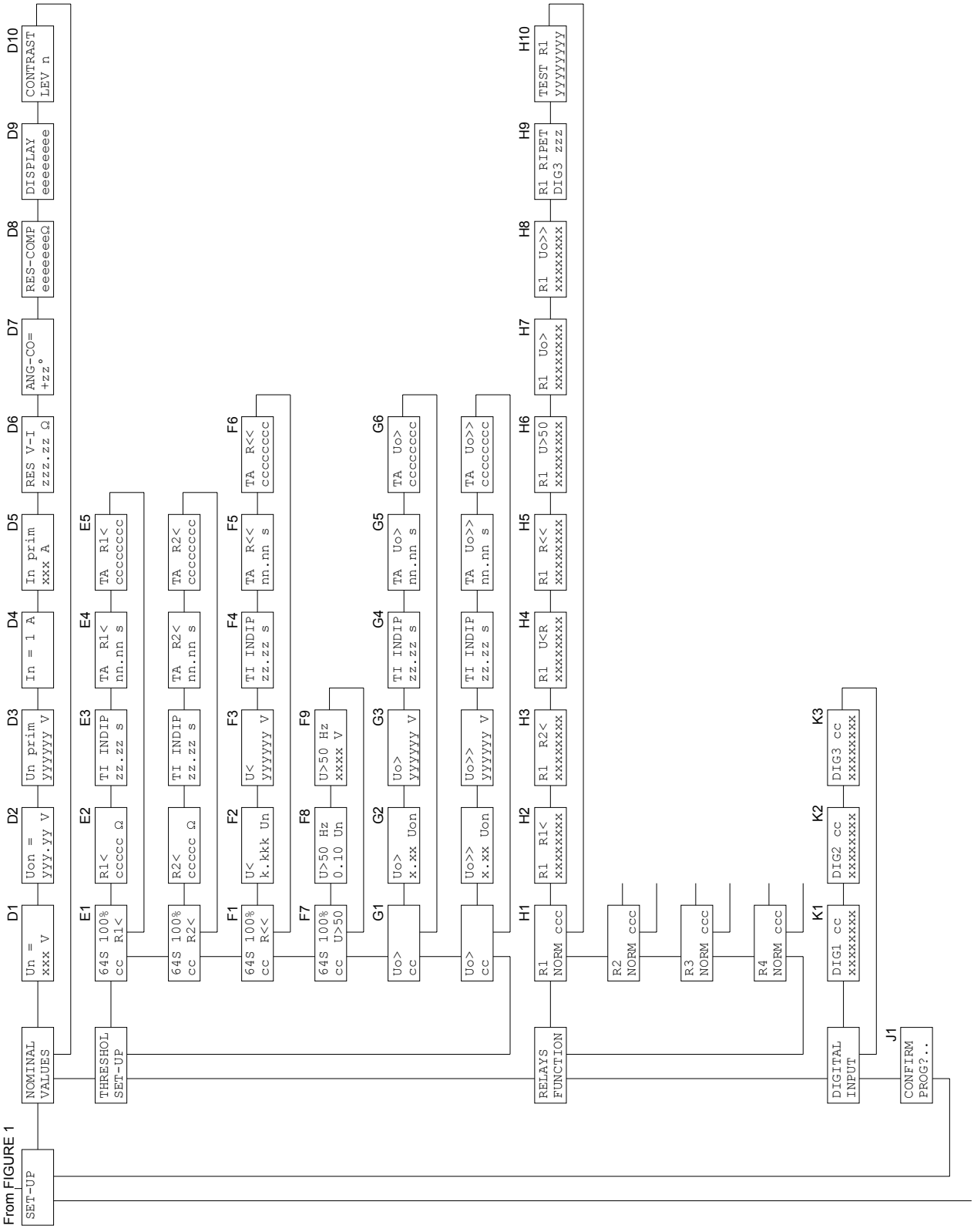

From FIGURE 1
SET-UP
NOMINAL VALUES
THRESHOL SET-UP
RELAYS FUNCTION
DIGITAL INPUT
CONFIRM PROG?..
D1 Un = xxx V
D2 Uon = yyy.yy V
D3 Un prim yyyyyy V
D4 In = 1 A
D5 In prim xxx A
D6 RES V-I zzz.zz Ω
D7 ANG-CO= +zz°
D8 RES-COMP eeeeeeeΩ
D9 DISPLAY eeeeeeee
D10 CONTRAST LEV n
E1 64S 100% cc R1<
E2 R1< ccccc Ω
E3 TI INDIP zz.zz s
E4 TA R1< nn.nn s
E5 TA R1< ccccccc
F1 64S 100% cc R2<
F2 R2< ccccc Ω
F3 TI INDIP zz.zz s
F4 TA R2< nn.nn s
F5 TA R2< ccccccc
F6 64S 100% cc R<<
F7 U< k.kkk Un
F8 TI INDIP zz.zz s
F9 TA R<< nn.nn s
G1 64S 100% cc U>50
G2 U>50 Hz 0.10 Un
G3 U>50 Hz xxxx V
G4 Uo> x.xx Uon
G5 Uo> yyyyyy V
G6 TI INDIP zz.zz s
TA Uo> nn.nn s
TA Uo> ccccccc
Uo> cc
Uo>> x.xx Uon
Uo>> yyyyyy V
TI INDIP zz.zz s
TA Uo>> nn.nn s
TA Uo>> ccccccc
H1 R1 NORM ccc
H2 R1 R1< xxxxxxxx
H3 R1 R2< xxxxxxxx
H4 R1 U<R xxxxxxxx
H5 R1 R<< xxxxxxxx
H6 R1 U>50 xxxxxxxx
H7 R1 Uo> xxxxxxxx
H8 R1 Uo>> xxxxxxxx
H9 R1 RIPET DIG3 zzz
H10 TEST R1 yyyyyyyy
R2 NORM ccc
R3 NORM ccc
R4 NORM ccc
K1 DIG1 cc xxxxxxxx
K2 DIG2 cc xxxxxxxx
K3 DIG3 cc xxxxxxxx
J1

Figure 2

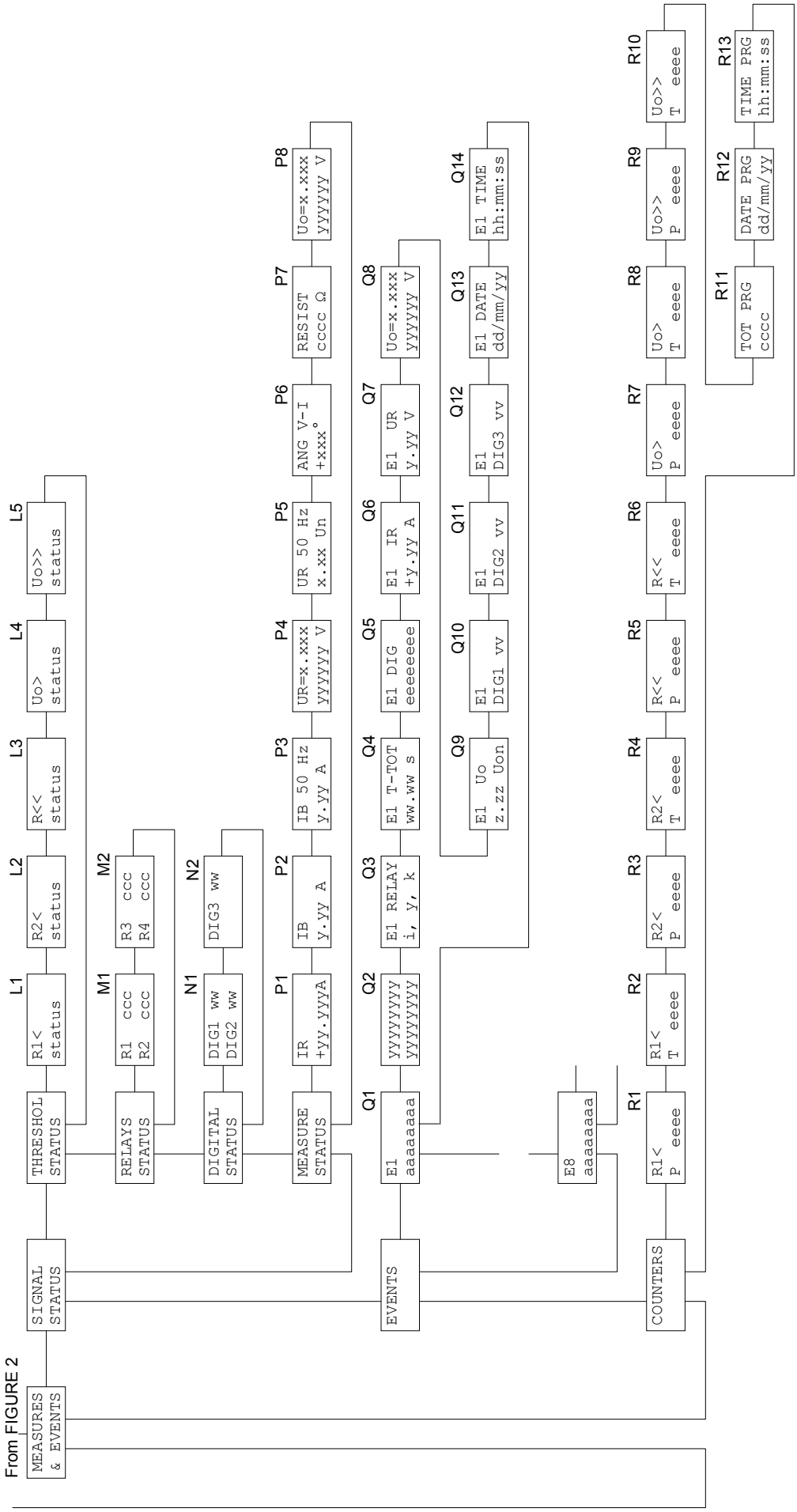

From FIGURE 2
MEASURES & EVENTS
SIGNAL STATUS
THRESHOL STATUS
L1 R1< status
L2 R2< status
L3 R<< status
L4 Uo> status
L5 Uo>> status
RELAYS STATUS
M1 R1 ccc R2 ccc
M2 R3 ccc R4 ccc
DIGITAL STATUS
N1 DIG1 ww DIG2 ww
N2 DIG3 ww
MEASURE STATUS
P1 IR +yy.yyyA
P2 IB y.yy A
P3 IB 50 Hz y.yy A
P4 UR=x.xxx yyyyyy V
P5 UR 50 Hz x.xx Un
P6 ANG V-I +xxx°
P7 RESIST cccc Ω
P8 Uo=x.xxx yyyyyy V
EVENTS
Q1 E1 aaaaaaaa
Q2 yyyyyyyy yyyyyyyy
Q3 E1 RELAY i, y, k
Q4 E1 T-TOT ww.ww s
Q5 E1 DIG eeeeeeee
Q6 E1 IR +y.yy A
Q7 E1 UR y.yy V
Q8 Uo=x.xxx yyyyyy V
Q9 E1 Uo z.zz Uon
Q10 E1 DIG1 vv
Q11 E1 DIG2 vv
Q12 E1 DIG3 vv
Q13 E1 DATE dd/mm/yy
Q14 E1 TIME hh:mm:ss
E8 aaaaaaaa
COUNTERS
R1 R1< P eeee
R2 R1< T eeee
R3 R2< P eeee
R4 R2< T eeee
R5 R<< P eeee
R6 R<< T eeee
R7 Uo> P eeee
R8 Uo> T eeee
R9 Uo>> P eeee
R10 Uo>> T eeee
R11 TOT PRG cccc
R12 DATE PRG dd/mm/yy
R13 TIME PRG hh:mm:ss

Figure 3

5.3 Address and time (figure 1)

B1 - RELAY MODEL (not programmable)

```
UHR4N
```

B2 - B3 - COMMUNICATION PROTOCOL (programmable)

B2

```
PROTOCOL
xxxxxxxx
```

The communication protocol is programmable between the followings:

STANDARD	ASCII SEB protocol
MODBUS	Modbus protocol (SLAVE)

When the MODBUS protocol is selected the following display is showed to allow the selection of the transmission speed:

B3

```
BAUDRATE
xxxx
```

The xxxx parameter is selectable between the followings:

300 - 600 - 1200 - 2400 - 4800 - 9600

When the STANDARD protocol is selected the baud rate is automatically selected by the protection relay.

B4 - ADDRESS (programmable)

```
NR RELAY
001
```

Programmable address from 001 to 255.

The number is used on RS485 port to address a specific relay when two or more protection relays are linked on the same serial line.

B5 - RELAY SERIAL NUMBER (not programmable)

```
SER. NR
0012345
```

B6 - SOFTWARE REVISION LEVEL (not programmable)

```
SW REV
zz.zz
```

B7 - TIME / DATE (programmable)

```
dd/mm/yy
hh:mm:ss
```

Time and date are programmable and they are used to mark recorded events.

NOTE: the clock is not provided with back-up battery, therefore a loss of auxiliary supply will force time/date to the following condition:

```
01/01/90
00:00:00
```

5.4 Function selection (figure1)

C1 - PROTECTION FUNCTION SELECTION (programmable)

```
FUNCTION
xxxxxxxx
```

The functions performed by the protection relay are programmable between the followings:

100%	100% stator earth fault protection only
95%	95% stator earth fault protection only
100% - 95%	100% and 95% stator earth fault protections

Examples:

```
FUNCTION
100%
```

```
FUNCTION
95%
```

```
FUNCTION
100%-95%
```

5.5 Nominal values set-up (figure2)

D1 - SECONDARY INJECTION NOMINAL VOLTAGE Un (programmable)

```
Un =
xxx V
```

Un nominal value of the secondary 12.5 Hz injection voltage (secondary voltage of the earthing transformer or secondary voltage of the open delta voltage transformer)

It represents the nominal value of the transformer winding where the 12.5 Hz voltage will be injected; the value is programmable from 100 V to 600 V, resolution 1 V.

D2 - NOMINAL RESIDUAL VOLTAGE - Uon (programmable)

```
Uon =
xxx.xx V
```

Uon nominal residual voltage (nominal secondary voltage of plant open delta voltage transformer) selectable between the followings:

57.73 - 63.50 - 72.16 - 100 - 110 - 125 - 190 - 220 - 230 - 380 - 400

The **Uon selection is not visualized** when only the 100% stator earth fault function has been selected at reference C1.

D3 - PRIMARY VT's RESIDUAL VOLTAGE (programmable)

```
Un prim
xxxxxx V
```

Primary voltage of the installed earthing transformer or of the installed open delta voltage transformer; the value is programmable from 000001 to 999999 V.

D4 - NOMINAL CURRENT In (not programmable)

```
In  = 1A
```

The value is 1 A fixed.

D5 - PRIMARY NOMINAL CURRENT In (programmable)

```
In prim
xxx  A
```

Primary phase current value of the CT installed on the secondary of the earthing transformer; the value is programmable from 1 to 100 A, resolution 1 A.

If the CT is not installed, please select In prim = 1 A.

D6 - RESISTANCE FOR 12.5 Hz MEASUREMENT (programmable)

```
RES V-I
xxx.xx Ω
```

Value of the resistance **R** (please refer to figure A) used for the measurement of the 12.5 Hz voltage; the value is programmable from 50.00 Ω to 999.99 Ω, resolution 0.01 Ω.

For the best definition of the value to be programmed it is necessary made the measurement of the total resistance of the circuit where the resistance **R** is connected, in order to take into consideration the cabling resistance; the measured value represents the value to be programmed.

D7 - COMPENSATION ANGLE ANG-CO (programmable)

```
ANG-CO
+xx°
```

Value of the compensation angle (see paragraph 1.1) to compensate the angle error introduced by the earthing transformer (or open delta transformer) and by the current transformer; the value is programmable from 0° to ± 60°, resolution 1°.

For the best definition of the compensation angle value to be programmed it is necessary made some measurements with the earthing transformer or the open delta transformer disconnected from the installation and connected on some resistors

For these measurements, please contact the SEB - Barlassina (Italy).

If no measures are available, please program 0°.

WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the primary circuits of the voltage transformer even at generator standstill.

D8 - COMPENSATION RESISTANCE RES-COMP (programmable)

```
RES-COMP
xxxxxx Ω
```

Value of the compensation resistance (see paragraph 1.1) to compensate the parasitic resistance of the earthing transformer (or open delta transformer); the value is programmable from 1000 Ω to 999999 Ω, resolution 1 Ω.

For the best definition of the compensation resistance value to be programmed it is necessary program RES-COMP equals to 999999 Ω and check the resistance measured by the protection relay (see paragraph 5.9, ref. P7) with the earthing transformer or the open delta transformer disconnected from the installation.

WARNING – the 12.5 Hz signal used for the 64S-100% protection function could be the cause of dangerous voltages on the primary circuits of the earthing transformer or on the primary circuits of the voltage transformer even at generator standstill.

D9 - STANDARD DISPLAY SELECTION (programmable)

```
DISPLAY
eeeeeeee
```

It allows to select the standard displayed information (ref. A1) when no trip condition occurs and no fault condition have been detected by the self-diagnosis module; the available selections are the following (depending on the selection at ref. C1):

ANSI	displays of ANSI code
RESIST	displays the measured resistance (64S-100%)
IR	displays the measured resistive 12.5 Hz current (64S-100%)
I	displays the measured 12.5 Hz current (64S-100%)
UR	displays the measured 12.5 Hz voltage (64S-100%)
Uo	displays the measured residual voltage (64S-95%)

D10 - DISPLAY CONTRAST LEVEL (programmable)

```
CONTRAST
LEV x
```

The display contrast level is programmable from 0 to 9. The backlighted display is switched off if no push-button is pressed for at least 5 minutes; when one of the front panel push- button is pressed the display is switched on.

5.6 Threshold and time delays set-up

5.6.1 100% stator earth fault (figure 2)

The information and set-ups related to threshold **R1<** in the following points are effective for the threshold **R2<** just taking into consideration the change of the threshold identification.

E1 - ON / OFF THRESHOLD (programmable)

```
64S 100%
cc  R1<
```

R1< threshold identification (R1<, R2<)

cc ON - enabled threshold
OFF - disabled threshold (available but not active)

E2 - THRESHOLD SET-UP (programmable)

```
R1<
nnnnn Ω
```

nnnnn threshold value expressed in Ω

The available settings of the threshold are listed in Table A.

Examples:

```
R2<
 8500 Ω
```

```
R1<
15000 Ω
```

E3 – TIME DELAY SET-UP (programmable)

```
TI INDIP
xx.xx  s
```

Set-up of time-delay to the activation (TRIP) of the programmed output relays when the measured resistance exceeds the threshold level.

xx.xx time delay value programmable from 00.02 to 99.99 seconds

Example:

```
TI INDIP
02.50  s
```

E4 - ADDITIONAL TIME DELAY SET-UP (programmable)

```
TA   R1<
xx.xx s
```

The additional time delay TA is programmable from 00.00 to 99.99 seconds; please note that at least one of the digital inputs should be programmed to activate time delay function (ref. K1, K2, K3 - paragraph 5.8).

E5 - DIGITAL INPUT ACTIVE ON THRESHOLD (not programmable)

```
TA  R1<
eeeeeeee
```

It shows the digital input programmed to activate the additional time delay TA on the displayed threshold.

The parameter eeeeeeee can show one of the following values:

DISABLED	none of the digital inputs has been programmed to activate an additional time delay related to threshold R1<
DIG1	digital input DIG1 activates the TA delay on threshold R1<
DIG2	digital input DIG2 activates the TA delay on threshold R1<
DIG3	digital input DIG3 activates the TA delay on threshold R1<

More than one digital input can activate the same additional time delay (e.g. DIG 1,3).

Please note that to activate the additional time delay at least one of the digital inputs should be programmed (ref. K1, K2, K3 - paragraph 5.8).

5.6.2 Threshold R<< and 64S-100% function disabling

F1 - ON / OFF THRESHOLD (programmable)

```
64S 100%
cc   R<<
```

R<< threshold identification

cc ON - enabled threshold
OFF - disabled threshold (available but not active)

This threshold will not be active when the 12.5 Hz measured voltage is higher than **U<** threshold (see ref. F2).

If the measured 12.5 Hz voltage is lower than **U<**, only the module of the measured current will be taken into consideration (referred to the primary circuit) and:

- current module **≥ IS** - trip threshold **R<<** (if the threshold is programmed ON)
- current module **< IS** - ANSI 64S-100% function inhibition (loss of injection signal)

where **IS** is the current flowing to ground in presence of 400 Ohm earth fault resistance.

F2 - F3 - VOLTAGE THRESHOLD U< (programmable)

F2	F3
U< 0.nnn Un	U< xxxxxx V

0.nnn threshold level expressed as Un (programmable)

xxxxxxxx threshold value expressed as primary voltage (not programmable)

The available settings of the threshold are listed in Table A.

F4 - TIME DELAY SET-UP (programmable)

```
TI INDIP
xx.xx  s
```

Set-up of time-delay to the activation (TRIP) of the programmed output relays when the measured resistance exceeds the threshold level.

xx.xx time delay value programmable from 00.02 to 99.99 seconds

Example:

```
TI INDIP
02.50  s
```

F5 - ADDITIONAL TIME DELAY SET-UP (programmable)

```
TA   R<<
xx.xx s
```

The additional time delay TA is programmable from 00.00 to 99.99 seconds; please note that at least one of the digital inputs should be programmed to activate time delay function (ref. K1, K2, K3 - paragraph 5.8).

F6 - DIGITAL INPUT ACTIVE ON THRESHOLD (not programmable)

```
TA   R<<
eeeeeeee
```

It shows the digital input programmed to activate the additional time delay TA on the displayed threshold.

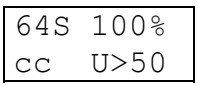
The parameter eeeeeeee can show one of the following values:

DISABLED	none of the digital inputs has been programmed to activate an additional time delay related to threshold R<<
DIG1	digital input DIG1 activates the TA delay on threshold R<<
DIG2	digital input DIG2 activates the TA delay on threshold R<<
DIG3	digital input DIG3 activates the TA delay on threshold R<<

More than one digital input can activate the same additional time delay (e.g. DIG 1,3).

Please note that to activate the additional time delay at least one of the digital inputs should be programmed (ref. K1, K2, K3 - paragraph 5.8).

F7 - THRESHOLD U>50 ENABLING (programmable)



U>50 threshold identification

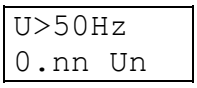
cc ON - enabled threshold
OFF - disabled threshold (available but not active)

Programming of the residual 50 Hz voltage threshold to disable the 64S-100% protection function (see chapter 1.1).

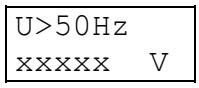
The available settings of the threshold are listed in Table A. No time delays are available on the disabling function.

F8 - F9 - THRESHOLD U>50 SET-UP (programmable)

F8



F9



0.nn threshold level expressed as Un (programmable)

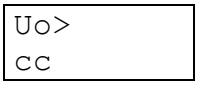
xxxxxxxx threshold value expressed as primary voltage (not programmable)

The available settings of the threshold are listed in Table A.

5.6.3 Residual overvoltage thresholds 64S - 95%

The information and set-up related to threshold **Uo>** in the following points are effective for the threshold **Uo>>** just taking into consideration the change of the threshold identification

G1 - ON / OFF THRESHOLD (programmable)

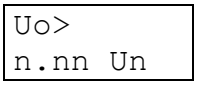


Uo> threshold identification (Uo>, Uo>>)

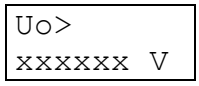
cc ON - enabled threshold
OFF - disabled threshold (available but not active)

G2 - G3 - VOLTAGE THRESHOLD Uo> (programmable)

G2



G3



n.nn threshold level expressed as Un (programmable)

xxxxxxxx threshold value expressed as primary voltage (not programmable)

The available settings of the threshold are listed in Table A.

G4 - TIME DELAY SET-UP (programmable)

```
TI INDIP
xx.xx  s
```

Set-up of time-delay to the activation (TRIP) of the programmed output relays when the measured resistance exceeds the threshold level.

xx.xx time delay value programmable from 00.02 to 99.99 seconds

Example:

```
TI INDIP
02.50  s
```

G5 - ADDITIONAL TIME DELAY SET-UP (programmable)

```
TA   Uo>
xx.xx s
```

The additional time delay TA is programmable from 00.00 to 99.99 seconds; please note that at least one of the digital inputs should be programmed to activate time delay function (ref. K1, K2, K3 - paragraph 5.8).

G6 - DIGITAL INPUT ACTIVE ON THRESHOLD (not programmable)

```
TA   Uo>
eeeeeeee
```

It shows the digital input programmed to activate the additional time delay TA on the displayed threshold.

The parameter eeeeeeee can show one of the following values:

DISABLED	none of the digital inputs has been programmed to activate an additional time delay related to threshold Uo>
DIG1	digital input DIG1 activates the TA delay on threshold Uo>
DIG2	digital input DIG2 activates the TA delay on threshold Uo>
DIG3	digital input DIG3 activates the TA delay on threshold Uo>

More than one digital input can activate the same additional time delay (e.g. DIG 1,3).

Please note that to activate the additional time delay at least one of the digital inputs should be programmed (ref. K1, K2, K3 - paragraph 5.8).

5.7 Output relays programming (figure 3)

The session allows to program the activation of the output relays R1, R2, R3 or R4 on START or TRIP conditions of the out-of-step protection functionalities.

Only the information related to the functionalities enabled at reference C1 (see paragraph 5.4) will be presented.

Equivalent information and set-up related to relay R1 is available for the relays R2, R3 and R4 just changing the relay identification.

H1 - OUTPUT RELAY R1 QUIESCENT STATUS (programmable)

```
R1
NORM xxx
```

Programming of the R1 relay status when no START or TRIP conditions are activated.

NORM OFF	normally de-energized (energized status on activation)
NORM ON	normally energized (de-energized status on activation)

H2 - OUTPUT RELAY ACTIVATION ON THRESHOLD R1< (programmable)

```
R1    R1<
xxxxxxxx
```

Programming of the R1 output relay activation (START or TRIP) on the R1< threshold.

The parameter xxxxxxxx is selectable as the following:

START	R1 output relay activation on the R1< threshold
TRIP	R1 output relay activation on the R1< threshold
NONE	no activation related to the R1< threshold

H3 ÷ H8 - OUTPUT RELAY ACTIVATION ON THRESHOLDS STATUS R2<, R<<, U<R, R<<, U>50, Uo>, Uo>> (programmable)

Examples:

H4
```
R1    U<R
xxxxxxxx
```

H5
```
R1    R<<
xxxxxxxx
```

H7
```
R1    Uo>
xxxxxxxx
```

Programming of the R1 output relay activation (NONE, START, TRIP) on the thresholds status as threshold R1< at reference H2.

The **U<R** identify the possibility to activate an output relay when the measured voltage related to 64S-100% protection function is lower than the threshold **U<** and the measured current is lower than **IS** (see references F2 and F3).

H9 - OUTPUT RELAY ACTIVATION ON DIGITAL INPUT STATUS (programmable)

```
R1 RIPET
DIG3 zzz
```

Activation of the R1 output relay function to copy the digital input DIG3 status (DIG3 HI - R1 ON, DIG3 LO - R1 - OFF).

The parameter zzz is selectable as the following:

ON	function enabled
OFF	function disabled

H10 - TEST OF OUTPUT RELAY R1

```
TEST  R1
xxxxxxxx
```

See paragraph 4.4

5.8 Digital inputs function programming (figure 2)

For each digital input one of the following functions are selectable:

a) additional time delay (related to one or more thresholds - only time definite threshold)

b) ON / OFF threshold

c) STATUS function (recording of measures on external command)

d) pilot wire fault monitoring (only DIG2 monitors DIG1)

e) output relay activation on digital input status (ref. H8, paragraph 5.7).

When function a) is programmed, a message is displayed at references E5, F6 and G6.

When the function of more than one digital input refers to a threshold, the priority will be the following:

a) OF selection (threshold disabled) has the priority on TA function (additional time delay)

b) the ALL selection (ALL the thresholds) has the priority on single threshold selection.

K1 - DIGITAL INPUT DIG1 SET-UP (programmable)

```
DIG1  cc
xxxxxxxx
```

Programming of the function related to digital input channel 1 (DIG1).

Parameter cc: programming of the condition that activates the function related to digital input DIG1; the condition is selectable between HI and LO.

Parameter xxxxxxx: programming of the function related to digital input DIG1; the following functions are selectable (only the active threshold are presented):

NONE	no functions active related to digital input DIG1
TA R1<	additional time delay on the threshold R1<
TA R2<	additional time delay on the threshold R2<
TA R<<	additional time delay on the threshold R<<
TA Uo>	additional time delay on the threshold Uo>
TA Uo>>	additional time delay on the threshold Uo>>
TA ALL	additional time delay on all thresholds
OF F100%	thresholds R1<, R2<, R<< (64S-100%) disabled
OF F95%	thresholds Uo>, Uo>> (64S-95%) disabled
OF R1<	threshold R1< disabled
OF R2<	threshold R2< disabled
OF R<<	threshold R<< disabled
OF Uo>	threshold Uo> disabled
OF Uo>>	threshold Uo>> disabled
OF ALL	all thresholds disabled
STATUS	activation of status function (see paragraph 1)

K2 - DIGITAL INPUT DIG2 SET-UP (programmable)

```
DIG2  cc
xxxxxxxx
```

Programming of the function related to digital input channel 2 (DIG2); the selections available are the same as presented for DIG1 (ref. K1) plus the following:

MONITOR	activation of pilot wire monitor function.

K3 - DIGITAL INPUT DIG3 SET-UP (programmable)

```
DIG3  cc
xxxxxxxx
```

Programming of the function related to digital input channel 3 (DIG3); the selections available are the same as presented for DIG1 (ref. K1).

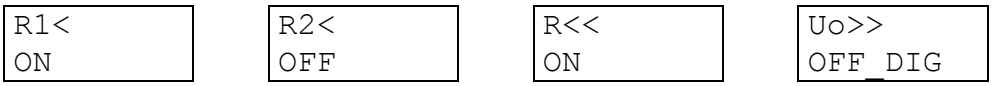
5.9 Parameter values visualization (figure 3)

L1 ÷ L5 - THRESHOLDS STATUS

The actual status of each threshold is displayed. For each threshold are displayed the threshold identification (R2<, Uo> etc.) and the threshold status; the status can show one of the following values:

ON	active threshold
OFF	disabled threshold (programmed OFF at ref. D1 - par. 5.6)
OFF_DIG	threshold programmed active but momentary disabled by a digital input actual status (ref. K1, K2, K3 see par. 5.8).

Examples:



M1 - M2 - OUTPUT RELAY STATUS

The actual status of each output relay is displayed; for each relay the following information is displayed:

- relay identification (R1, R2, R3, R4)
- relay status (ON - activated, OFF - non activated)

Note that ON/OFF do not necessary mean energized or de-energized (see ref. H1).

N1 - N2 - DIGITAL INPUT STATUS

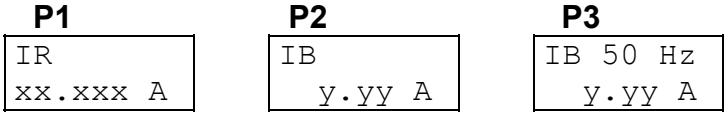
The actual status of each digital input is displayed.

For each digital input the following information is presented:

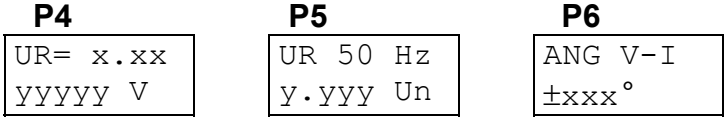
- digital input identification (DIG1, DIG2, DIG3)
- digital input status (HI or LO)

P1 ÷ P8 - MEASUREMENT DISPLAY

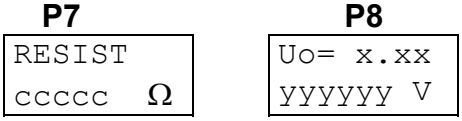
The actual values of the measured parameters are displayed; the parameters related to disabled thresholds are not displayed.



IR	resistive component of the 12.5 Hz measured current
IB	12.5 Hz measured current
IB 50 Hz	50 Hz measured current



UR	12.5 Hz measured voltage
UR 50 Hz	50 Hz measured voltage
ANG V-I	angle between the 12.5 Hz current and 12.5 Hz voltage



RESIST	stator to earth measured resistance
Uo	measured 50 Hz residual voltage (only for 64S-95% function)

When the 12.5 Hz voltage is lower then a minimum value, and therefore the 12.5 Hz current will be too small to guarantee a good measurement, the angle between the voltage and the current (ANG V-I), the IR current and the RESIST value will be presented as below:

```
RESIST
****
```

When the resistance is greater than 20 kΩ it will displayed the following:

```
RESIST
>20000 Ω
```

5.10 Events (figure 3)

On the display are shown the memorized information related to the last 8 TRIP or STATUS events.

The 8 events are recorded and identified with a progressive number from 1 to 8; the more recent event shows a lower number.

Q1 - EVENT NUMBER

```
E1
cccccccc
```

The index E1, E2 ... E8 identifies the memorized event.

The parameter cccccccc gives information on the kind of event and it can show one of the following values:

NONE	no event memorized
R1<	event on trip threshold R1<
R2<	event on trip threshold R2<
R<<	event on trip threshold R<<
Uo>	event on trip threshold Uo>
Uo>>	event on trip threshold Uo>>
STATUS	information recorded on external command
POWER ON	switch-on of the protection relay (auxiliary power)

For the events NONE and POWER ON no other information is presented: for the other events the following displays give more detailed information on the event.

Q2 - PROGRAMMED THRESHOLD

This information will not be presented in case of STATUS event. For the other thresholds the displayed information will be:

Thresholds 64S-100% - R1<, R2<

```
R1<
6400 Ω
```

Not present in STATUS event

Thresholds 64S-100% - R<<

```
R<<
```

Not present in STATUS event

Thresholds 64S-95% - Uo>, Uo>>

```
Uo>>
1.24 Uon
```

Not present in STATUS event

Q3 - ACTIVATED OUTPUT RELAYS

```
E1 RELAY
nnnnnnn
```

It shows the list of the output relay activated by the threshold trip.

Examples:

```
1 RELAY
1,3,4
```

```
E3 RELAY
1,4
```

When no output relays have been activated (no relays programmed to TRIP on the threshold) the following message will be displayed:

```
E1 RELAY
NONE
```

Q4 - TOTAL TIME DELAY ON TRIP

```
E1 T-Tot
www.ww s
```

It is shown the total delay to the TRIP of the output relays from the fault detection; when additional delays are activated, the change of the status of the digital input that controls the additional delay during the delay itself could bring to a total time different from the sum of the programmed delays. If the total time is greater than 999 seconds the display of tenths is omitted.

When the event is memorized on external command (STATUS), the message N/A (Not Applicable) is shown instead of the number of seconds.

```
E1 T-Tot
  N/A
```

Q5 - DIGITAL CHANNELS RELATED TO MEMORIZED EVENT

```
E1 DIG
1, 3, 4
```

The list of the digital inputs related to the memorized event is displayed (STATUS function command or additional time TA enabled - rif. par. 5.8).

If no digital inputs were activated, the message NONE is displayed.

Q6 - Q7 - Q8 - Q9 - MEMORIZED MEASURES ON EVENT

Q6

```
E1     IR
y.yy   A
```

Q7

```
E1     UR
y.yy   V
```

Q8

```
E1     R
zzzzz Ω
```

Q9

```
E1     Uo
z.zz Uon
```

The values of the measured parameters at the event are displayed.

IR , UR:	12.5 Hz current (resistive component) and voltage
R	stator to earth resistance
Uo	50 Hz residual overvoltage

Q10 - Q11 - Q12 - DIGITAL INPUTS STATUS ON EVENT

```
E1
DIG1   vv
```

```
E1
DIG2   vv
```

```
E1
DIG3   vv
```

The status of the digital inputs at the event are displayed.

The parameter **vv** can assume the value HI or LO.

Q13 - Q14 - DATE AND TIME OF THE EVENT

```
E1  Date
dd/mm/yy
```

```
E1  Time
hh:mm:ss
```

The date and time of the event are showed

5.11 TRIPS COUNTERS (figure 3)

In this section are displayed the total and partial counters of the output relay activation (on TRIP conditions) for each thresholds and the numbers of programming sessions with the date and time of the last confirmed programming session.

The total counters, the number of confirmed programming sessions and the date and time of the last confirmed programming session are not modifiable or resettable; the information related to the last programming session are used to control unauthorized access.

The partial counter can be modified following the standard set-up procedure for parameters as described at paragraph 4.2; the partial counters are immediately modified in the memory (the recorded values are immediately resetted without the need of the programming confirmation).

R1 ÷ R10 - TRIP COUNTERS

R1

```
R1<
P  cccc
```

R2

```
R1<
T  cccc
```

Display of the partial (P) and total (T) counters of the TRIP condition related to each threshold.

When the value exceed 9999 the counter starts again from 0000. The counters are identified by the threshold name (R1<, R2<, R<<, Uo>, Uo>>); there are presented only the counters related to the active thresholds.

The partial counters are modifiable in the range from 0000 to 9999 following the standard set-up procedure (paragraph 4.2).

R11 ÷ R13 - TOTAL PROGRAMMING SESSIONS AND DATE/TIME OF THE LAST PROGRAMMING SESSION

TOT PRG	DATE PRG	TIME PRG
eeee	dd/mm/yy	hh:mm:ss

Display of the number of confirmed programming sessions (from the factory set-up) and the date and time of the last confirmed programming session.

6 INSTALLATION

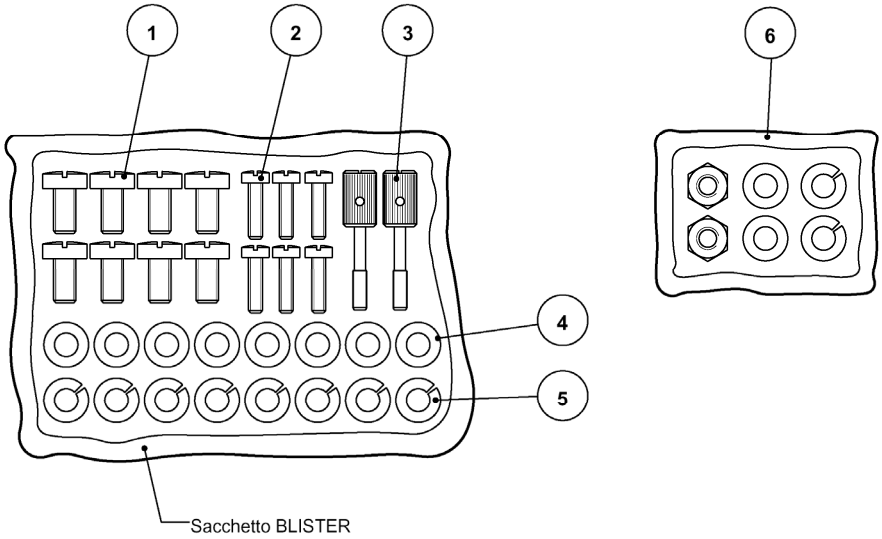
6.1 Supplied kit

RK VERSION - 19" rack installation (the proper rack is supplied by SEB)

- protection relay module UHR4N with rear socket
- transparent front panel for rack installation
- blister with items 1-2-3-4-5

CS VERSION - flush mounting installation

- protection relay module UHR4N with rear socket
- transparent front panel for rack flush mounting installation
- n° 2 brackets for flush mounting
- blister with items 1-2-3-4-5
- blister with item 6



1) n° 8 screws to fix wire terminals of current circuits
2) n° 4 screws to fix the relay rear socket on the 19" rack (or on the two brackets for flush mounting) n° 2 screws to fix (optionally) the protection relay on the front of the 19" rack
3) n° 2 knobs to fix the transparent front panel
4) n° 8 washers to be used to fix current wire terminals
5) n° 8 growers to be used to fix current wire terminals
6) items to fix the brackets for flush mounting (only with CS version)

The knobs to fix the transparent front panel must be screwed through the panel the front panel itself; the operation will create a screw thread in the plastic material and the knobs will never be missed.

NOTE: The items related to current inputs are the standard supplied items with all SIGMA-N protection relays but for the UHR4N model they are partially used.

GHS MODULE
The **GHS module** configuration is function of the installation (coupling circuit, presence of current transformer etc.).

All these components will be installed in the generator earthing cabinet or in the protection cabinet (in the last case only for injection through open delta transformer)

For the evaluation of the above mentioned components, please refers to the SEB technical department.

6.2 Cabling

For the terminal numbers on the rear sockets please refers to next figure.

Current circuits
It is suggested to terminate the current wiring using eyelet terminals.

Minimum suggested wire cross section: 2,5 mm^2

US	terminals A1 - A2
IS	terminals B1 - B2

Voltage circuits
It is suggested to terminate the voltage wiring using plug terminals.

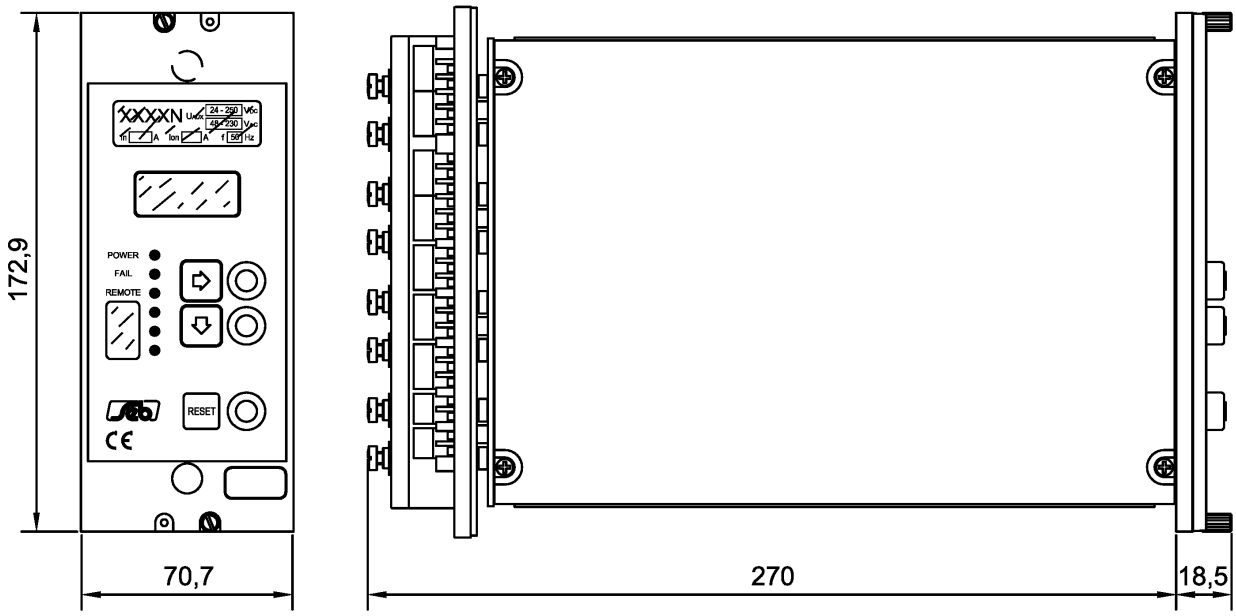
Minimum suggested wire cross section: 1,5 mm^2

With reference to the insertion diagram, the voltage input terminals must be selected as function of the programmed Uon value.

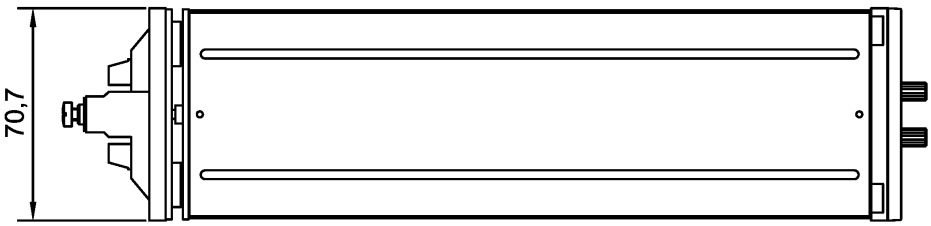
Uo	terminals 16 - 18	voltages with Uon programmed from 190 to 400 V
	terminals 17 - 18	voltages with Uon programmed from 0 to 125 V

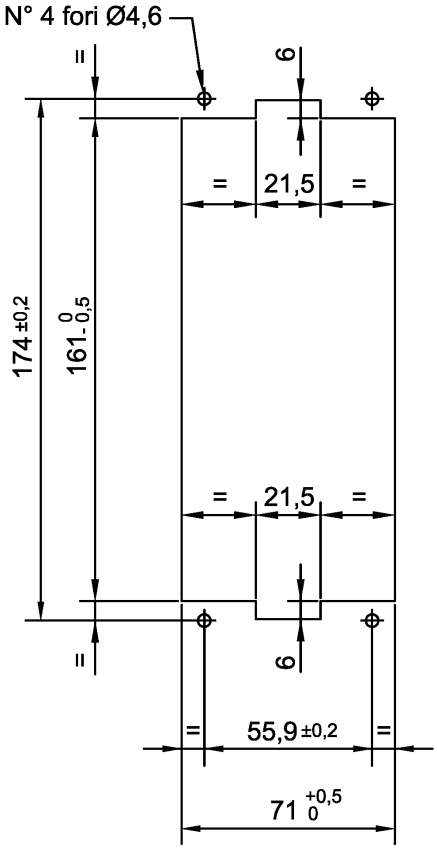
Other circuits (output relays etc.)
It is suggested to terminate the wiring using plug terminals.

Minimum suggested wire cross section: 1,5 mm^2



Dimensioni meccaniche
Case outlines





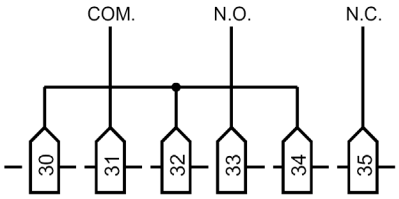
Dima montaggio da incasso
Flush mounting panel cut - out

Montaggio incassato / Flush mounting
Dimensioni pannello frontale trasparente :
Transparent front panel sizes :
208 x 89,5 mm.

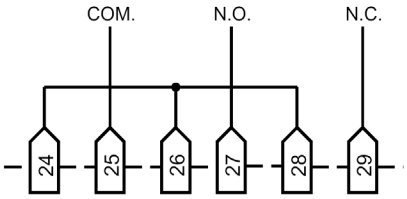
6.3 Relays R3 and R4 - Signaling / Command set-up

The protection relay is supplied with R3 and R4 relays configured as **SIGNALING RELAYS**, with 2 change-over output contacts with breaking capability equals to 0.2 A at 110 Vdc, L/R = 40 ms, 100000 operations.

Each R3 and R4 relay can be configured as **COMMAND RELAY** with 1 change-over output contact with breaking capability equals to 0.5 A at 110 Vdc, L/R = 40 ms, 100000 operations.
The new configuration is obtained with the following cabling:



R3



R4

6.4 RS485 serial communication port

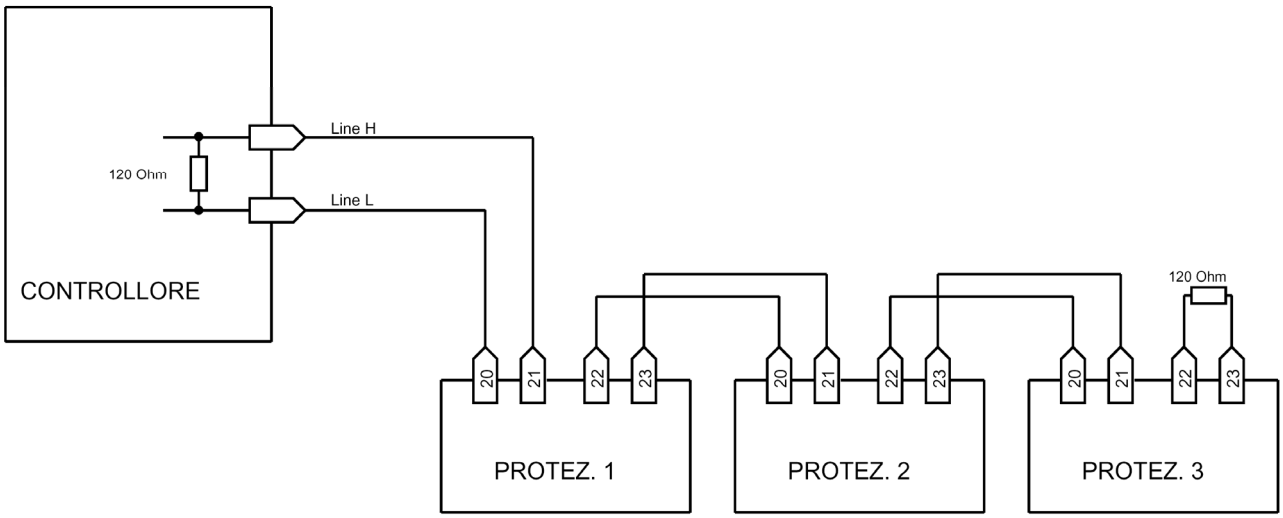
The digital protection relay UHR4N presents an insulated serial interface RS485 half-duplex that allow the multi-drop connection up to 31 protection units. There are available 2 selectable communication protocols (ref. B2 paragraph 5.3).

When the STANDARD SEB communication protocol is selected, the transmission speed is automatically selected between 300 to 9600 bauds and the protocol is ASCII-HEX.

When the MODBUS communication protocol is selected, the transmission speed can be programmed between 300 to 9600 bauds (ref. B3, par. 5.3).

It is suggested to use a shielded twisted pair AWG22; terminal 19 (not connected internally) can be used for shields connections.

To integrate the protection relay in control systems, the documentation related to the protocol is freely available on request.



It is suggested to terminate the serial line with a resistance 120 Ω, 1/4 W.

7 TECHNICAL CHARACTERISTICS

Measuring inputs (ANSI 64S – 95%)

Rated voltage (Un)	57.73 - 63.50 - 72.16 - 100 - 110 V
programmable	125 - 190 - 220 - 230 - 380 - 400 V
Thermal withstand continuously	2 Un
Thermal withstand for 1 s	2 Un
Rated frequency	50 / 60 Hz
Primary VT's voltage	1 - 999999 V

Output contacts ratings

Number of relays (note 1)	4 + 1
Rated current	5 A
Rated voltage	250 V
Contact configuration	change over
Breaking capability (note 2)	
- tripping relays (R1, R2)	0.5 A
- signaling relays (R3, R4, R5) (note 3)	0.2 A
Mechanical life	> 10^6

Digital inputs

Number of inputs	3
External control voltage	as Uaux
Typical current (sink)	2 mA

Data transmission

Standard	RS485 half duplex
Communication protocol	MOD-BUS ASCII
Transmission speed	300 - 9600 baud selectable
Optional	fibre optic module

Auxiliary supply

Range	24 ÷ 320 Vdc ± 20% 48 ÷ 230 Vac ± 20%
Frequency (Vac)	47 ÷ 63 Hz
Burdens (min/max)	5 / 10 W

Environmental conditions

Operation	- 10 / +60 °C
Transport and storage	- 25 / +80 °C
Relative humidity (without condensation)	< 95%
Protection degree for flush mounting (optional)	IP 52 (IP 54)
Weight	2.5 kg

Note 1) The additional relay R5 is controlled by self-test program
Note 2) Breaking capability at 110 Vdc, L/R 40 ms, 100.000 operations
Note 3) The output contacts of R3 and R4 relays can be configured as signaling or tripping relays

8 TABLES

Table A Settings

ANSI	THRESHOLDS		Setting	Resolution
64S 95%	**Uo>**	Residual overvoltage	0.01 ÷ 0.20 Uon	0.01 Uon
	Uo>>		0.01 ÷ 1.60 Uon	0.01 Uon
64S 100%	**R1< and R2<**	Minimum resistance thresholds	500 ÷ 20000 Ω	100 Ω
		50 Hz voltage inhibition threshold	0.01 ÷ 1.00 Un	0.01 Un
		Measuring resistance RES V-I	50.00 ÷ 999.99 Ω	0.01 Ω
		Compensation angle ANG-CO	-60° ÷ +60°	1°
		Compensation resistance RES-CO	1000 ÷ 999999 Ω	1 Ω
	R<<	Undervoltage threshold U<	0.004 ÷ 0.050 Un	0.001 Un
		Trip R<<	if I ≥ IS	
		Inhibition ANSI 64S-100%	if I < IS	
Definite delay		Thresholds R1<, R2<, R<<	0.50 ÷ 99.99 s	0.01 s
		Thresholds Uo>, Uo>>	0.10 ÷ 99.99 s	0.01 s
All thresholds		Additional delay	0.00 ÷ 99.99 s	0.01 s
Drop-off ratio			≥ 0.95 or ≤ 1.05	
Output relays R1, R2, R3, R4		Programmable for each threshold - START / TRIP and normally ON/OFF		
Burden referred to rated value			0.3 VA	

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