DIVISIONE ELETTRONICA E SISTEMI

IDM8N

DIGITAL PERCENTAGE BIASED DIFFERENTIAL PROTECTION RELAY

USER MANUAL

P501D812 **June 2010**

INDEX

1 GENERAL CHARACTERISTICS

The protection relay **IDM8N** performs function as three-poles percentage biased transformer differential protection relay (ANSI 87T) to protect transformers or generator-transformer units; the user can select one or more of the functions listed in the table below:

FUNCTIONS	ANSI
Three-poles percentage biased differential protection for transformers	87T
Three-poles overcurrent protection	51
Residual overcurrent protection	51N

Each function is made by a set of threshold, which could be enabled or disabled in independent mode.

THRESHOLDS - the following thresholds are available:

- 1 differential percentage biased threshold (two branches)
- 1 absolute value differential threshold
- 6 overcurrent thresholds (three for each winding of the transformer)
- 3 residual overcurrent thresholds (secondary side)

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

All the set-up and measured parameters can be visualized on the front panel display and transmitted on the RS485 communication serial port.

TRIP DELAYS - All the thresholds are time definite. Relay trips are shown turning on LED and with a specific message on the display.

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

OUTPUT RELAYS - the IDM8N 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) 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 6 digital inputs to activate the following functions (when enabled by the programmed set-up):

- on/off ANSI function
- on/off thresholds (single threshold or all thresholds)
- STATO function (recording of measures on external event)

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

HI voltage =	> 20V 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 of a measured differential current or of a stabilizing current (primary values or relative values); all the measured currents can be transmitted to an external controller through the RS485 port.

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

Information includes the threshold set-up and activated relays (TRIP event only), the measured currents, 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 STATO 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.

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) and 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 Operation of the differential thresholds

The IDM8N relay performs functions as percentage biased differential protection relay for two windings transformers; the tripping characteristic is presented in figure A.

A differential protection relay operates on the principle of current comparison and with a healthy protected object the current leaving is the same as that which entered it. Any measured current difference is a clear indication of a fault condition within the protected zone.

Id - differential current - vectorial difference between the input current and the output current of the protected object

$$\left|Id_1\right| = \left|I_{1'} - I_{1''}\right|$$

Three differential current values are computed, one for each phase; the differential thresholds are verified for each differential current.

Ip - stabilizing current - half-sum of the vectors of the input and output currents of the protected object used to stabilize the protection relay operations in presence of faults external to the protected zone.

$$\left|Ip_1\right| = \frac{\left|I_{1'} + I_{1''}\right|}{2}$$

When short-circuit currents due to faults external to the protected zone are flowing through the protected object it is possible to have measured differential currents due to current transformer errors or saturation. The stabilizing current is used to stabilize the protection relay operation in these conditions.

Differential thresholds
Two differential thresholds are available:

Id> percentage biased differential threshold

Id>> second differential threshold (absolute value)

The relay operates when:

threshold **Id>>** the following disequation is verified

$$|Id| \geq Id >>$$

threshold **Id>** ALL the following disequations are verified:

$$|Id| \geq IB >$$

$$|Id| \geq (P1 * |Ip|)$$

$$|Id| \geq (P2 * |Ip| - DI)$$

where:

|Id|	module of the differential current
|Ip|	module of the stabilizing current
IB>	insensibility threshold
P1, P2:	slopes of the tripping characteristic
DI	intersection of the P2 straight line with Id/In axis

The listed disequations define the operating characteristic as presented in figure A and they are verified with all the differential currents (and their stabilizing currents) related to phase currents.

The differential threshold **Id>>** and the second branch of the operating characteristic related to **Id>** threshold (**slope P2**) can be programmed ON/OFF.

All the differential thresholds are definite time (0.03 ÷ 999.99 s).

The minimum activation time of the output relay is programmable in order to avoid short commands to switchgears when CT's saturate.

The differential thresholds **Id>** and **Id>>** are referred to the rated current of the protected transformer normalized with the ratio of the installed CT's in order that the value of measured currents on the primary and secondary windings can be directly compared.

For this purpose, two coefficients named **KTA1** and **KTA2** are used. They are referred to the primary winding and to the secondary winding of the transformer and they are the ratio between the rated value of the CT and the rated value of the related circuit.

In other words:

$$KTA1 = \frac{In_{TA1}}{In_1}$$

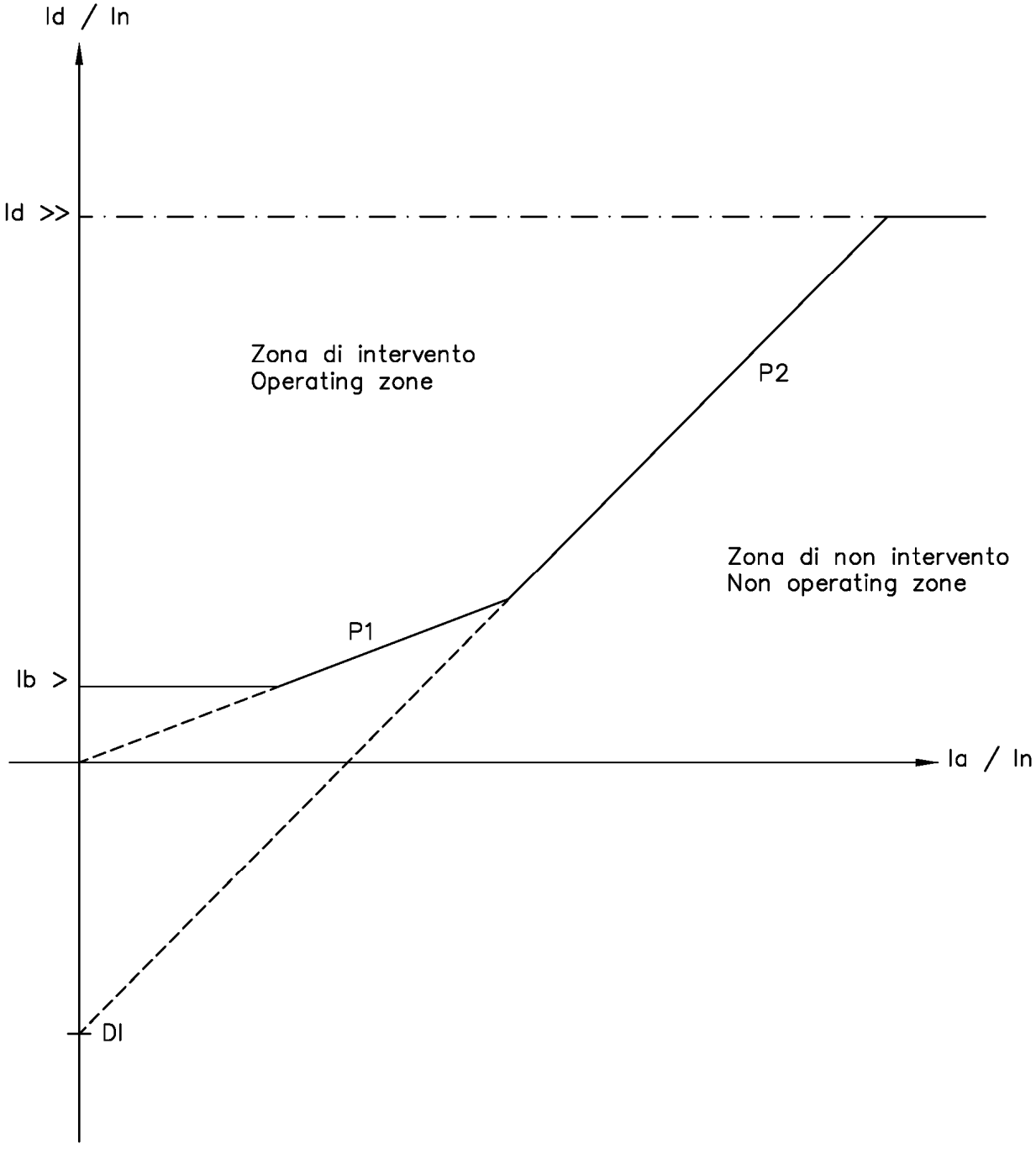
Where In_{TA1} is the rated value of CT (for example: 300, in case of a 300 / 5 CT) and In_1 is the rated value of the current in the primary side of the transformer, for example 250 A. In this case the value of KTA1 is: 300 / 250 = 1.2

The same argument is valid for secondary winding parameters.

The secondary rated value of phase CT is selectable 1 A or 5 A for each side of the transformer to be protected.

For its internal processing, the relay converts the measured currents as referred to 5 A value. This operation is irrelevant for the user.

Threshold values are referred in terms of the rated current **In** of the corresponding installed CT's.



Operating characteristic - figure A

1.2 Transformer differential protection (ANSI 87T)

The protection relay **IDM8N** has been designed to provide three-poles percentage biased differential protection function to transformer and generator-transformer units.

The relay **IDM8N** protects two windings transformers; in table A (see ref. D2) there are the vectorial groups of the transformers which can be protected by the relay.

The insertion of the protection relay is presented in figure 6. The CT's are installed on both sides of the protected transformer; in the case of generator-transformer unit, the CT's are installed on the HV side of the transformer and on the star-point side of the generator.

The differential relay **IDM8N** does not require the use of intermediate current transformers as the phase angle and the current amplitude compensation are carried out by the protection relay itself; the compensation is function of the programmed characteristics related to:

- coefficients KTA1 and KTA2
- power transformer vector group
- type of connection if the primary winding is Y (insulated or grounded)

The connection of the power transformer to the network may cause an inrush current which can be several times the rated current and, with a time constant up to several seconds. This transient condition appears as a differential current to the protection relay and it would make the relay trip.

A relatively high content of second harmonic components is typical for the inrush current while they are nearly absent in case of a short-circuit.

Likewise overexcitation conditions are cause of odd harmonic components (3^{rd} and 5^{th}).

To avoid unsuitable trips, on protection relay **IDM8N** it is possible to activate (ON/OFF) and to program (in terms of % Id) two harmonic thresholds (on 2^{nd} and 5^{th} harmonic components as the 3^{rd} harmonic components are often eliminated through the use of delta windings).

The harmonic stabilization is activated if at least for one of the phases the measured 2^{nd} and 5^{th} harmonic content of the differential current exceeds the programmed thresholds; when the harmonic stabilization is active, the trip related to **Id>** threshold will be blocked

The harmonic restrain does not effect the **Id>>** threshold operation.

1.3 Overcurrent thresholds (ANSI 51)

Six overcurrent thresholds are available and actionable, 3 for each side of the transformer, to guarantee a back-up protection against faults external to the protected transformer or generator-transformer unit. The function of the overcurrent thresholds is to give an additional protection to the transformer if the fault condition has not been eliminated by protection relays closer to the fault.

IH> 1^{st} primary winding overcurrent threshold
IH>> 2^{nd} primary winding overcurrent threshold

IH>>> 3rd primary winding overcurrent threshold

IL> 1st secondary winding overcurrent threshold
IL>> 2nd secondary winding overcurrent threshold
IL>>> 3rd secondary winding overcurrent threshold

All overcurrent thresholds are definite time; the available settings for each threshold and time delays are listed in Table B.

Overcurrent threshold values of function ANSI 51 are referred in terms of the rated current **In** of the corresponding installed CT's.

1.4 Residual overcurrent (ANSI 51N)

Three residual overcurrent thresholds are available and actionable, to guarantee protection against earth faults internal to the protected zone in the secondary side of the transformer.

IE> 1st residual overcurrent threshold
IE>> 2nd residual overcurrent threshold
IE>>> 3rd residual overcurrent threshold

All residual overcurrent thresholds are definite time; the available settings for each threshold and time delays are listed in Table B.

Residual threshold values of function ANSI 51N are referred in terms of the rated current **Ion** of the earth CT.

Note: the relay has two inputs to measure the residual current, one with rated value 1 A (D1-D2 on CB1) and one with rated value 5 A (D1-D2 on CB2). The earth CT has to be connected to the inputs referred to its own rated value and the relay has to be programmed according to the CT rated value (see rif. D11).

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 (rif. 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, 2, 3, 4 and 5.
- 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 SIGNALING

POWER (green)	⊕	auxiliary supply available
FAIL (red)	⊕	fault condition detected by SELF-DIAGNOSIS software
REMOTE (red)	⊕	communication session active on RS485 port
87 (red)	⊕	trip condition on Id> or Id>> threshold (ANSI 87T)
51 (red)	⊕	trip condition on overcurrent threshold IH>, IH>>, IH>>>, IL>, IL>> and IL>>> (ANSI 51)
51N (red)	⊕	trip condition on residual overcurrent threshold IE>, IE>> and IE>>> (ANSI 51N)

The last trip condition (threshold indication) is also shown on front panel display; if a trip of function 87 or 51 has occurred, also the fault phases are shown on the display.
More information on trip condition is 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 VISUALIZED 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, 2, 3, 4 and 5 at the following references:

B2 ÷ B7	relay address (RS485) and date/time
C1 ÷ C4	display and drop-off time
D1 ÷ D11	rated values of the protected transformer
E1D ÷ E10D	threshold set-up and time delays 87T
E1F ÷ E5F	threshold set-up and time delays 51
E1R ÷ E5R	threshold set-up and time delays 51N
G1 ÷ G14	output relays functions
H1 ÷ H6	digital input functions
S1 ÷ S22	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], [+] 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 D) when the push-button [ENTER] is pressed for few seconds an error message will be displayed as:

```
Errore
nei dati
```

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 LEDs

- 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. 3, ref. G9) 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 1, 2, 3, 4 and 5; 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 FUCTIONING
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 main functions (87T – 51 – 51N).

Measured current and parameters - the display shows one of the measured currents or one of the differential currents (IdR, IdS, IdT) or the stabilizing currents (IpR, IpS, IpT); the information to be visualized is selected by operator (ref. C1).

The currents are visualized as primary value and/or relative value (In).

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 Id> r	TRIP Id>> rs	TRIP IH> t	TRIP IE>

The information of the trip, as well the glowing of the related LEDs, is displayed until the [RESET] push-button is pressed.
For trip condition related to functions 87T or 51, it is shown also the information related to the fault phase(s).

Note: information related to fault phase (R, S, T) is referred to the insertion diagram in picture 6. In case of trip of threshold Id> or Id>>, the fault phase is according to compensation factors related to the transformer's vector (rif. D2).

If a new trip condition occurs, the displayed information will be updated; information related to previous trips is 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:

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

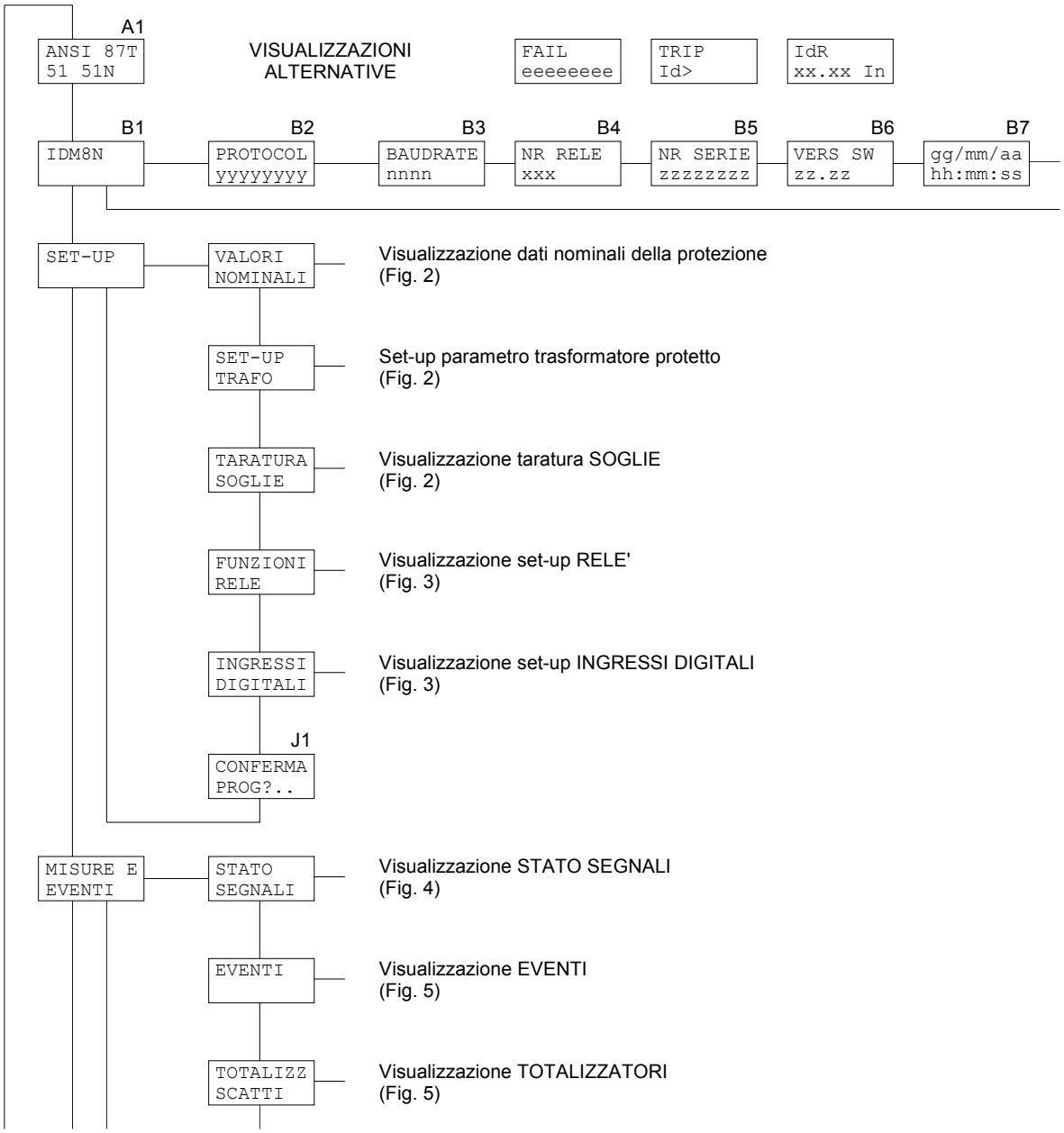


Figure 1

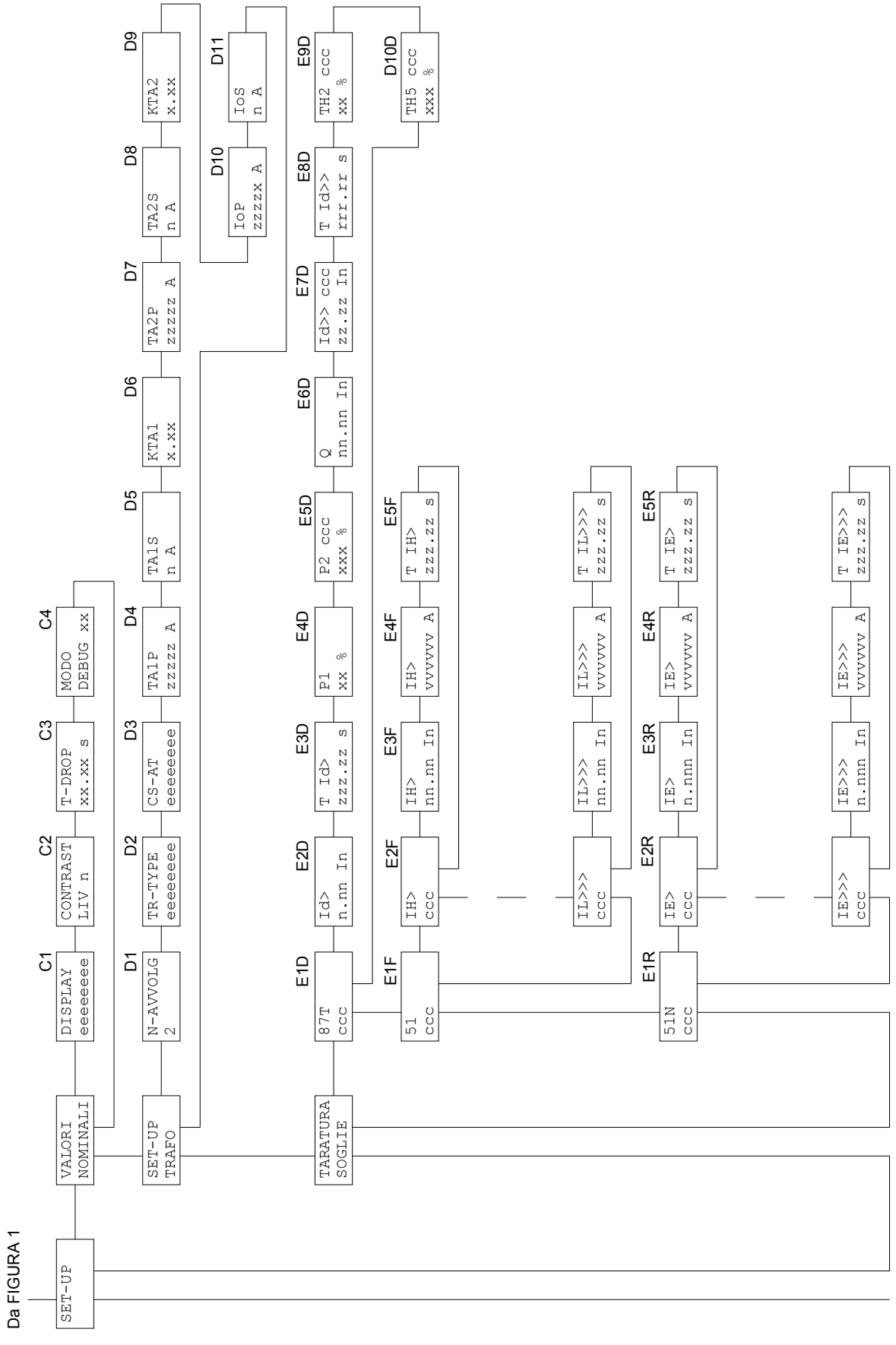

Da FIGURA 1
SET-UP
VALORI NOMINALI
SET-UP TRAFO
TARATURA SOGLIE
C1
DISPLAY eeeeeeee
C2
CONTRAST LIV n
C3
T-DROP xx.xx s
C4
MODO DEBUG xx
D1
N-AVVOLG 2
D2
TR-TYPE eeeeeeee
D3
CS-AT eeeeeeee
D4
TA1P zzzzz A
D5
TA1S n A
D6
KTA1 x.xx
D7
TA2P zzzzz A
D8
TA2S n A
D9
KTA2 x.xx
D10
IoP zzzzx A
D11
IoS n A
E1D
87T ccc
E1F
51 ccc
E1R
51N ccc
E2D
Id> n.nn In
E2F
IH> ccc
E2R
IE> ccc
IL>>> ccc
IE>>> ccc
E3D
T Id> zzz.zz s
E3F
IH> nn.nn In
E3R
IE> n.nnn In
IL>>> nn.nn In
IE>>> n.nnn In
E4D
P1 xx %
E4F
IH> vvvvvv A
E4R
IE> vvvvvv A
IL>>> vvvvvv A
IE>>> vvvvvv A
E5D
P2 ccc xxx %
E5F
T IH> zzz.zz s
E5R
T IE> zzz.zz s
T IL>>> zzz.zz s
T IE>>> zzz.zz s
E6D
Q nn.nn In
E7D
Id>> ccc zz.zz In
E8D
T Id>> rrr.rr s
E9D
TH2 ccc xx %
D10D
TH5 ccc xxx %
Alla FIGURA 3

Figure 2

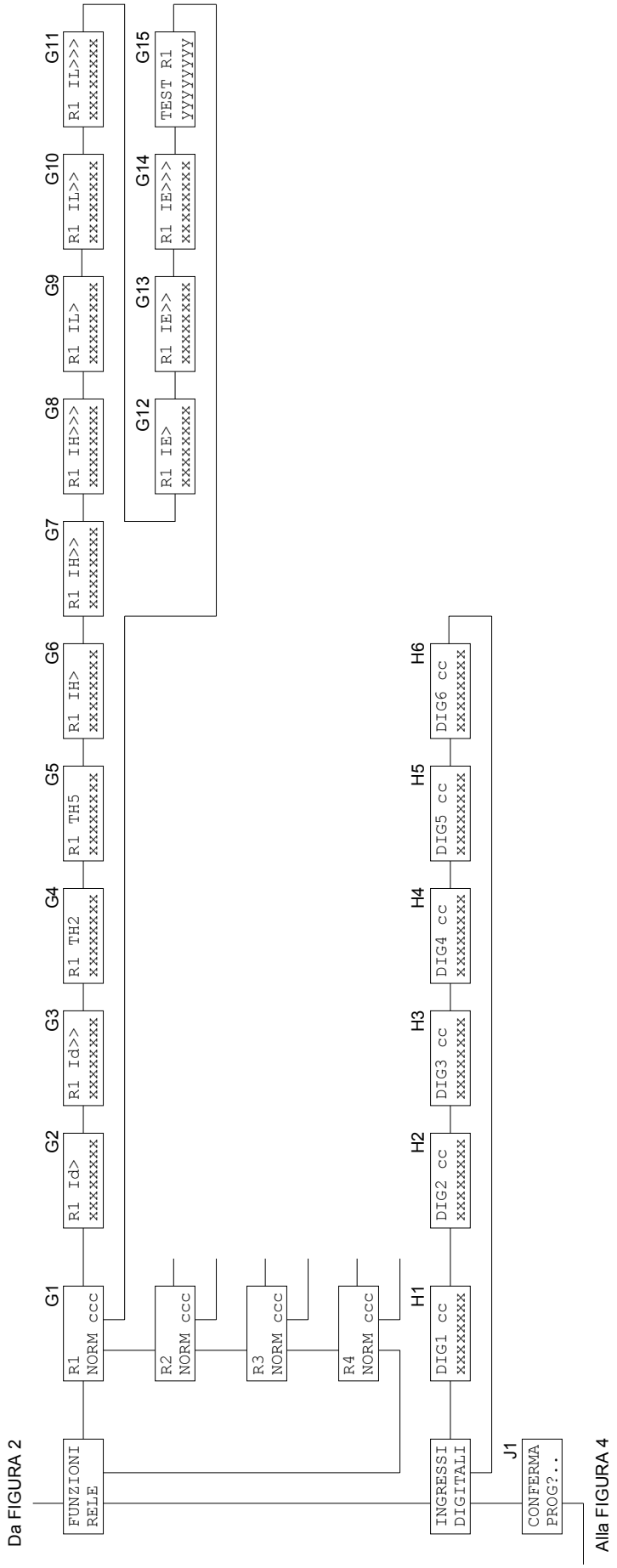

Da FIGURA 2
FUNZIONI RELE
INGRESSI DIGITALI
CONFERMA PROG?..
J1
Alla FIGURA 4
G1
R1 NORM ccc
R2 NORM ccc
R3 NORM ccc
R4 NORM ccc
G2
R1 Id> xxxxxxxxx
G3
R1 Id>> xxxxxxxxx
G4
R1 TH2 xxxxxxxxx
G5
R1 TH5 xxxxxxxxx
G6
R1 IH> xxxxxxxxx
G7
R1 IH>> xxxxxxxxx
G8
R1 IH>>> xxxxxxxxx
G9
R1 IL> xxxxxxxxx
G10
R1 IL>> xxxxxxxxx
G11
R1 IL>>> xxxxxxxxx
G12
R1 IE> xxxxxxxxx
G13
R1 IE>> xxxxxxxxx
G14
R1 IE>>> xxxxxxxxx
G15
TEST R1 yyyyyyyy
H1
DIG1 cc xxxxxxxxx
H2
DIG2 cc xxxxxxxxx
H3
DIG3 cc xxxxxxxxx
H4
DIG4 cc xxxxxxxxx
H5
DIG5 cc xxxxxxxxx
H6
DIG6 cc xxxxxxxxx

Figure 3

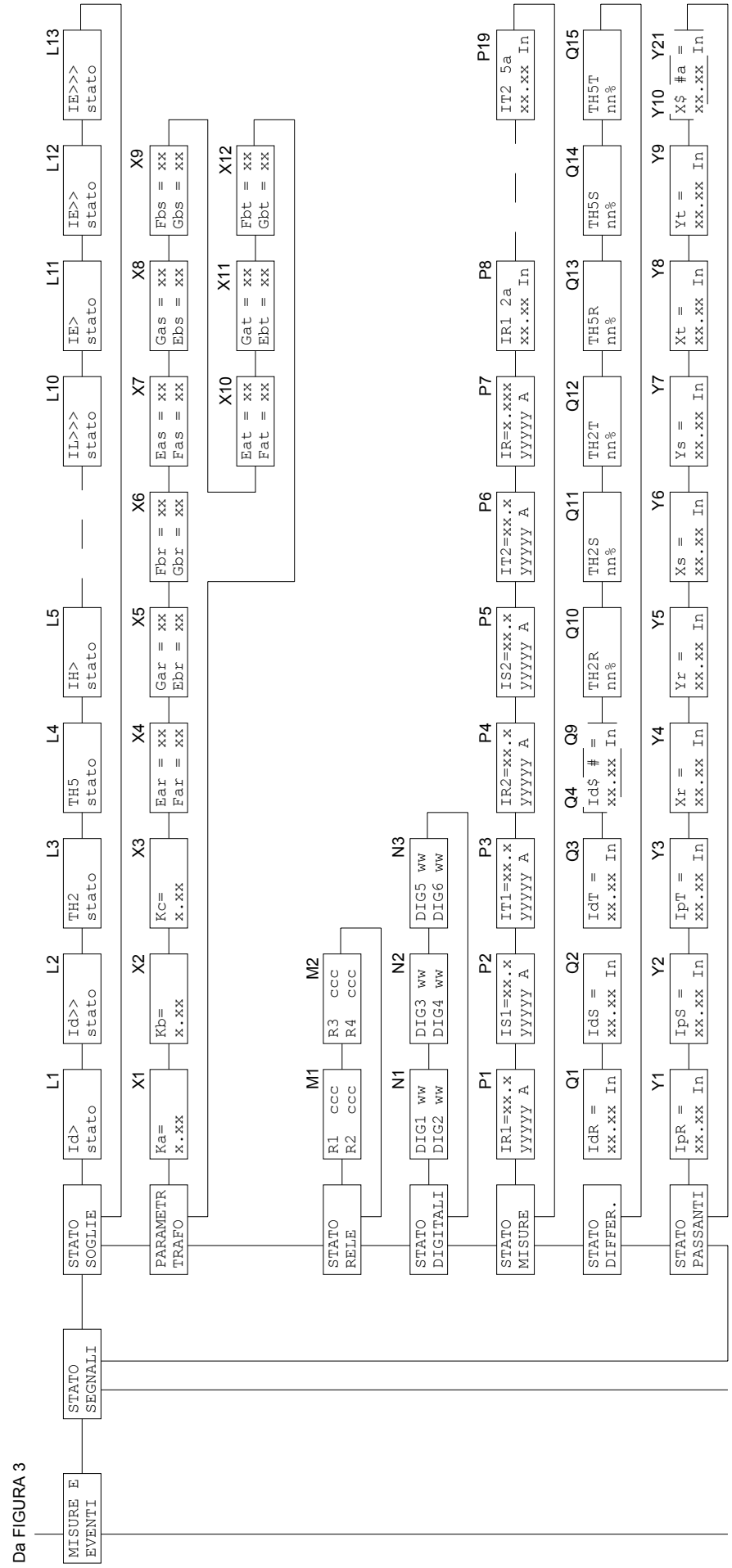

Da FIGURA 3
MISURE E EVENTI
STATO SEGNALI
STATO SOGLIE
PARAMETR TRAFO
STATO RELE
STATO DIGITALI
STATO MISURE
STATO DIFFER.
STATO PASSANTI
Id> stato
Id>> stato
TH2 stato
TH5 stato
IH> stato
IL>>> stato
IE> stato
IE>> stato
IE>>> stato
Ka= x.xx
Kb= x.xx
Kc= x.xx
Ear = xx Far = xx
Gar = xx Ebr = xx
Fbr = xx Gbr = xx
Eas = xx Fas = xx
Gas = xx Ebs = xx
Fbs = xx Gbs = xx
Eat = xx Fat = xx
Gat = xx Ebt = xx
Fbt = xx Gbt = xx
R1 ccc R2 ccc
R3 ccc R4 ccc
DIG1 ww DIG2 ww
DIG3 ww DIG4 ww
DIG5 ww DIG6 ww
IR1=xx.x yyyyy A
IS1=xx.x yyyyy A
IT1=xx.x yyyyy A
IR2=xx.x yyyyy A
IS2=xx.x yyyyy A
IT2=xx.x yyyyy A
IR=x.xxx yyyyy A
IR1 2a xx.xx In
IT2 5a xx.xx In
IdR = xx.xx In
IdS = xx.xx In
IdT = xx.xx In
Id$ # = xx.xx In
TH2R nn%
TH2S nn%
TH2T nn%
TH5R nn%
TH5S nn%
TH5T nn%
IpR = xx.xx In
IpS = xx.xx In
IpT = xx.xx In
Xr = xx.xx In
Yr = xx.xx In
Xs = xx.xx In
Ys = xx.xx In
Xt = xx.xx In
Yt = xx.xx In
X$ #a = xx.xx In
Alla FIGURA 5

Figure 4

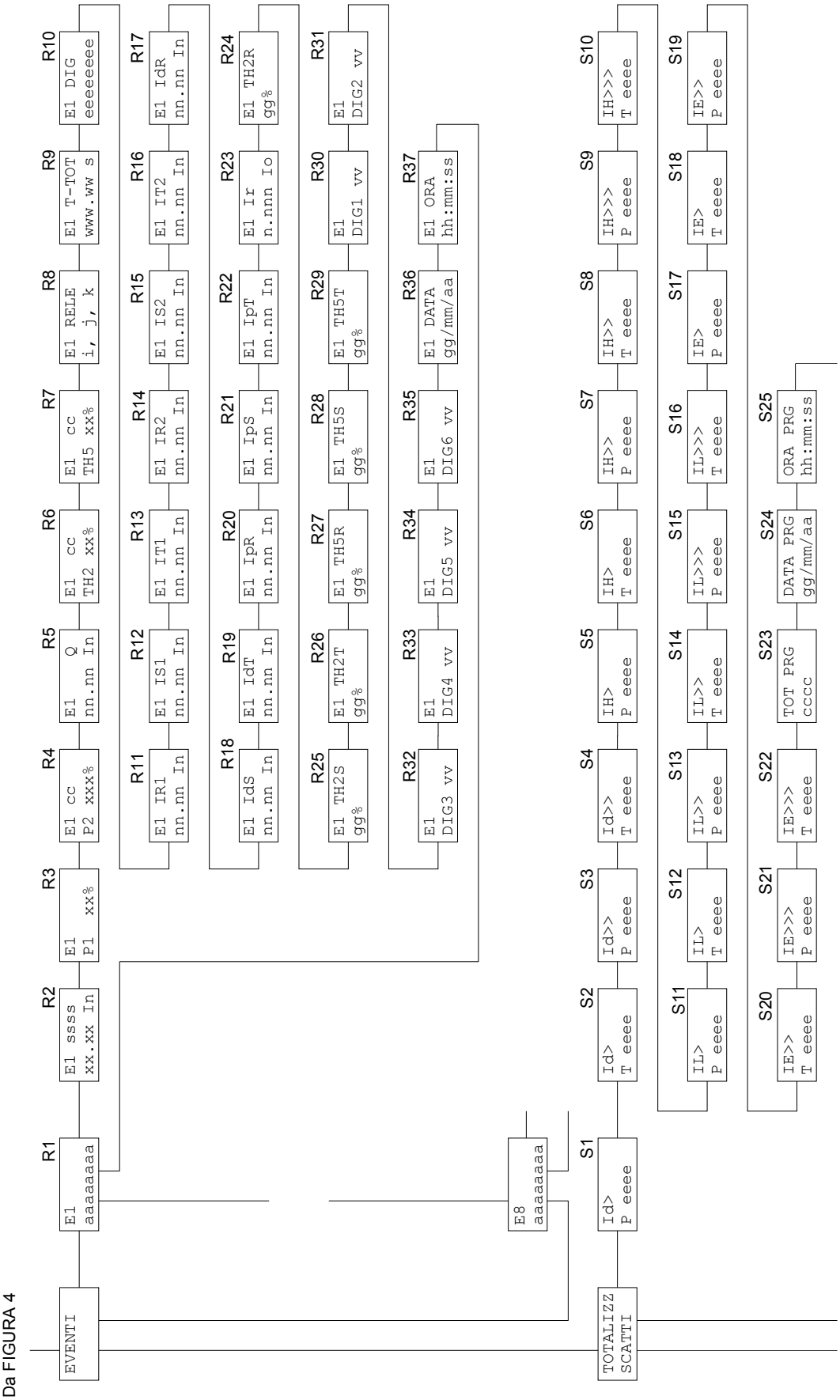

Da FIGURA 4
EVENTI
TOTALIZZ
SCATTI
R1
E1
aaaaaaaa
R2
E1 ssss
xx.xx In
R3
E1
P1 xx%
R4
E1 cc
P2 xxx%
R5
E1 Q
nn.nn In
R6
E1 cc
TH2 xx%
R7
E1 cc
TH5 xx%
R8
E1 RELE
i, j, k
R9
E1 T-TOT
www.ww s
R10
E1 DIG
eeeeeeee
R11
E1 IR1
nn.nn In
R12
E1 IS1
nn.nn In
R13
E1 IT1
nn.nn In
R14
E1 IR2
nn.nn In
R15
E1 IS2
nn.nn In
R16
E1 IT2
nn.nn In
R17
E1 IdR
nn.nn In
R18
E1 IdS
nn.nn In
R19
E1 IdT
nn.nn In
R20
E1 IpR
nn.nn In
R21
E1 IpS
nn.nn In
R22
E1 IpT
nn.nn In
R23
E1 Ir
n.nnn Io
R24
E1 TH2R
gg%
R25
E1 TH2S
gg%
R26
E1 TH2T
gg%
R27
E1 TH5R
gg%
R28
E1 TH5S
gg%
R29
E1 TH5T
gg%
R30
E1
DIG1 vv
R31
E1
DIG2 vv
R32
E1
DIG3 vv
R33
E1
DIG4 vv
R34
E1
DIG5 vv
R35
E1
DIG6 vv
R36
E1 DATA
gg/mm/aa
R37
E1 ORA
hh:mm:ss
E8
aaaaaaaa
S1
Id>
P eeee
S2
Id>
T eeee
S3
Id>>
P eeee
S4
Id>>
T eeee
S5
IH>
P eeee
S6
IH>
T eeee
S7
IH>>
P eeee
S8
IH>>
T eeee
S9
IH>>>
P eeee
S10
IH>>>
T eeee
S11
IL>
P eeee
S12
IL>
T eeee
S13
IL>>
P eeee
S14
IL>>
T eeee
S15
IL>>>
P eeee
S16
IL>>>
T eeee
S17
IE>
P eeee
S18
IE>
T eeee
S19
IE>>
P eeee
S20
IE>>
T eeee
S21
IE>>>
P eeee
S22
IE>>>
T eeee
S23
TOT PRG
cccc
S24
DATA PRG
gg/mm/aa
S25
ORA PRG
hh:mm:ss

Figure 5

5.3 Address and time (fig. 1)

B1 - RELAY MODEL (not programmable)

```
IDM8N
```

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 Display selection and drop-off delay (fig. 1)

C1 - STANDARD DISPLAY SELECTION (programmable)

```
DISPLAY
eeeeeeee
```

It allows selecting 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:

ANSI	displays of ANSI code
IdR	displays differential current phase R
IdS	displays differential current phase S
IdT	displays differential current phase T
IpR	displays stabilizing current phase R
IpS	displays stabilizing current phase S
IpT	displays stabilizing current phase T
IR1	displays current phase R, primary winding
IS1	displays current phase S, primary winding
IT1	displays current phase T, primary winding
IR2	displays current phase R, secondary winding
IS2	displays current phase S, secondary winding
IT2	displays current phase T, secondary winding
Ir	displays residual current

The current is displayed in primary values.

Selection examples:

```
DISPLAY
NORMALE
```

```
DISPLAY
IdR
```

```
DISPLAY
IR1
```

C2 - 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-buttons is pressed the display is switched on.

C3 - OUTPUT RELAY MINIMUM ACTIVATION TIME (programmable)

```
T-DROP
xx.xx s
```

The minimum output relay activation time can be programmed; the setting applies to all the output relays.

The activation time is programmable from 00.10 to 99.99 seconds.

Example:

```
T-DROP
01.00 s
```

C4 – DEBUG MODE (programmable)

```
MODO
DEBUG cc
```

Choices are ON or OF, which enable or not this function.

When this function is enabled (ON), a lot of information is available in section MISURE E EVENTI, to help troubleshooting for SEB technical staff.

Except to allow viewing information previously indicated, there are no further effects on the relay functions.

During normal operation of the relay, we suggest to set this parameter to OF; in such mode viewing in the section MISURE E EVENTI is more user friendly (see par. 5.9).

5.5 Rated values of the protected transformer (picture 2)

D1 - NUMBER OF WINDINGS

```
N-AVVOLG
2
```

Number of windings of the protected transformer; this parameter is not programmable and its value is 2.

D2 - TRANSFORMER VECTOR GROUP (programmable)

```
TR TYPE
psss
```

Programming of the vector group of the protected transformer.

The first character represents the primary winding type (side "**1**" in the insertion drawing), whilst the other characters represent the secondary winding type (side "**2**" in the insertion drawing) and the vector group.

The allowable selections are the following:

Table A

Primary (side 1)	Secondary (side 2)
Y	y0, y6, d1, d5, d7, d11 z1, z5, z7, z11
D	y1, y5, y7, y11, d0, d6, z0, z6

Examples:

```
TR TYPE
Yd11
```

```
TR TYPE
Yd1
```

```
TR TYPE
Dy5
```

When a not allowed selection is made, at [ENTER] the message **Errore Dati** will be displayed.

D3 – GROUNDING CONNECTION AT WINDING (programmable)

```
CS-AT
eeeeeeee
```

This parameter is shown only if the transformer's vector group has the primary windings connected as Y (example: Yd1, Yz1).

The parameter **eeeeeee** is settable according the values:

ISOLATO Grounding connection of the primary side is insulated from ground; no compensation is made for the residual current in the primary side.

A TERRA Grounding connection of the primary side is grounded; the protection relay evaluate the residual current for the primary side and calculating differential and stabilizing current is purged from the residual current.

D4 – RATED PRIMARY CURRENT OF THE "CT" ON PRIMARY SIDE OF THE TRANSFORMER (programmable)

```
TA1P
cccccc A
```

Value of the rated primary current of the CT's installed in the plant on the primary side of the transformer; the value is programmable from 0001 to 18500 A.

Example:

```
TA1P
00100 A
```

D5 - RATED SECONDARY CURRENT OF THE "CT" ON PRIMARY SIDE OF THE TRANSFORMER (programmable)

```
TA1S
n A
```

Value of the rated secondary current of the CT's installed in the plant on the primary side of the transformer; the value is programmable 1 A or 5 A.

D6 – COEFFICIENT FOR PRIMARY SIDE OF THE TRANSFORMER (programmable)

```
KTA1
x.xx
```

It is the ratio between the rated value of CT and the rated value of the current in the primary side of the transformer; the value is programmable in the range 0.50 ÷ 2.50.

Example:

```
KTA1
0.75
```

D7 - RATED PRIMARY CURRENT OF THE "CT" ON SECONDARY SIDE OF THE TRANSFORMER (programmable)

```
TA2P
cccccc A
```

Value of the rated primary current of the CT's installed in the plant on the secondary side of the transformer; the value is programmable from 0001 to 18500 A.

Example:

```
TA2P
01600 A
```

D8 - RATED SECONDARY CURRENT OF THE "CT" ON SECONDARY SIDE OF THE TRANSFORMER (programmable)

```
TA2S
n A
```

Value of the rated secondary current of the CT's installed in the plant on the secondary side of the transformer; the value is programmable 1 A or 5 A.

D9 – COEFFICIENT FOR SECONDARY SIDE OF THE TRANSFORMER (programmable)

```
KTA2
x.xx
```

It is the ratio between the rated value of CT and the rated value of the current in the secondary side of the transformer; the value is programmable in the range 0.50 ÷ 2.50.

Example:

KTA2
1.65

D10 - RATED PRIMARY CURRENT OF THE EARTH "CT" ON SECONDARY SIDE OF THE TRANSFORMER (programmable)

IoP
zzzzz A

Value of the rated primary current of the earth CT installed in the plant on the secondary side of the transformer; the value is programmable from 0001 to 18500 A.

D11 - RATED SECONDARY CURRENT OF THE EARTH "CT" ON SECONDARY SIDE OF THE TRANSFORMER (programmable)

IoS
n A

Value of the rated secondary current of the earth CT installed in the plant on the secondary side of the transformer; the value is programmable 1 A or 5 A.

Note: the relay has two inputs to measure the residual current, one with rated value 1 A (D1-D2 on CB1) and one with rated value 5 A (D1-D2 on CB2). The earth CT has to be connected to the inputs referred to its own rated value, according with this parameter.

If the protection relay is inserted according to diagram in figure 6, the values for IoP and IoS are the same as TA2P and TA2S.

5.6 Thresholds and time delays set-up (fig. 2)

5.6.1 Percentage biased differential thresholds (87T - fig. 2)

E1D – FUNCTION ENABLING (programmable)

87T
ccc

cc function enabling ON – function is enabled
OF – function is disabled

This selection affects all entities that are part of the 87T function, i.e.:
- Percentage bias differential threshold
- Absolute differential threshold
- Harmonic restrain thresholds

Percentage bias differential threshold
The programming of this threshold is achieved by the views from E2D until E6D.

E2D

Id>
n.nn In

E3D

T Id>
zzz.zz s

E4D

P1
dd %

E5D	E6D
P2 ccc ddd %	Q xx.xx In

E2D - INSENSIBILITY THRESHOLD SET-UP (programmable)

n.nn value of the threshold programmable from 0.10 to 2.00 **In**
For the value of **In** please refer to paragraph 1.1

E3D - TIME DELAY SET-UP (programmable)

E6D
T Id> zzz.zz s

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

zzz.zz time delay programmable from 00.03 to 999.99 s.

E4D - SLOPE OF THE FIRST PERCENTAGE BRANCH (programmable)

Slope of the first percentage branch expressed in terms of %.

xx slope value of the first percentage branch (0 ÷ 50 %)

E5D - ON/OFF and SETUP SECOND PERCENTAGE BRANCH (programmable)

cc ON - enabled branch
OF - disabled branch

xxx slope value of the second percentage branch (0 ÷ 100 %)

E6D - BASE POINT OF THE SECOND PERCENTAGE BRANCH WITH Id/In AXIS (programmable)

Value of the intersection of the straight line P2 with the Id/In axis (see figure par. 1.1).

nn.nn intersection value expressed in terms of differential current (0.00 ÷ 20.00 In).

Example:

E2D	E3D	E4D
Id> 0.10 In	T Id> 000.20 s	P1 20 %

E5D	E6D
P2 ON 050 %	Q 01.00 In

Note: the value of P2 should be greater than that of P1.

Second absolute differential threshold

The programming of this threshold is achieved by the views E7D and E8D.

E7D	E8D
Id>> ccc nn.nn In	T Id>> zzz.zz s

E7D - ON/OFF and SET-UP SECOND DIFFERENTIAL THRESHOLD (programmable)

cc ON - enabled threshold
OF - disabled threshold

nn.nn **Id>>** threshold value programmable from 0.50 to 30.00 **In**

For the value of **In** please refer to paragraph 1.1

E8D - TIME DELAY SET-UP (programmable)

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

zzz.zz time delay programmable from 00.03 to 999.99 s.

Example:

E7D	E8D
Id>> ON 05.00 In	T Id>> 000.50 s

Harmonic restrain thresholds (TH2, TH5)
The programming of these thresholds is achieved by the views E9D and E10D.

E9D	E10D
TH2 cc ee %	TH5 cc ee %

Programming of the harmonic restrain thresholds related to the **Id>** differential threshold. The thresholds are expressed in terms of percentage of the 2nd or 5th harmonic content of the differential current.

The value of the harmonic content is computed for each differential current related to phase R, S, T.

TH2 restrain on 2nd harmonic contents

TH5 restrain on 5th harmonic contents

cc ON - enabled threshold
OF - disabled threshold

ee threshold value programmable from 10% to 80%

5.6.2 Overcurrent thresholds (51 - fig. 2)

E1F - FUNCTION ENABLING (programmable)

```
51
ccc
```

cc function enabling ON – function is enabled
OF – function is disabled

This selection affects all entities that are part of the 51 function, i.e.:
- Overcurrent thresholds on primary side of the transformer (IH>, IH>>, IH>>>)
- Overcurrent thresholds on secondary side of the transformer (IL>, IL>>, IL>>>)

E2F – THRESHOLD ENABLING (programmable)

```
IH>
ccc
```

cc threshold enabling ON – threshold is active
OF – threshold is disabled (available but not active)

E3F – THRESHOLD LEVEL SET-UP (programmable)

```
IH>
xx.xx In
```

nn.nn threshold level IH> expressed in terms of In

For the value of **In** please refer to paragraph 1.1.

Examples:

```
IH>
01.50 In
```

```
IH>
12.00 In
```

E4F – THRESHOLD LEVEL IN PRIMARY VALUES (not programmable)

```
IH>
eeeeee A
```

eeeeee the programmed threshold (ref. E3F) is shown in terms of primary current; the value depends on the programmed CTs primary values

Examples:

```
IH>
00350 A
```

```
IH>
12500 A
```

E5F - TIME DELAY SET-UP (programmable)

```
T IH>
xxx.xx s
```

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

zzz.zz time delay programmable from 00.03 to 999.99 s.

The programmer views as regards the threshold **IH>** are then rescheduled for all other thresholds that are part of the function in question, simply substituting the name of the threshold (**IH>**) with that of other ones: **IH>>, IH>>>, IL>, IL>>, IL>>>**.

5.6.3 Residual overcurrent thresholds (51N - fig. 2)

E1R - FUNCTION ENABLING (programmable)

```
51N
ccc
```

cc function enabling ON – function is enabled
OF – function is disabled

This selection affects all entities that are part of the 51N function, i.e.:
- Residual overcurrent thresholds (IE>, IE>>, IE>>>)

E2R – THRESHOLD ENABLING (programmable)

```
IE>
ccc
```

cc threshold enabling ON – threshold is active
OF – threshold is disabled (available but not active)

E3R – THRESHOLD LEVEL SET-UP (programmable)

```
IE>
x.xxx In
```

n.nnn threshold level IH> expressed in terms of Ion

For the value of **Ion** please refer to paragraph 5.5

Examples:

```
IE>
0.010 In
```

```
IE>
1.000 In
```

E4R – THRESHOLD LEVEL IN PRIMARY VALUES (not programmable)

```
IE>
eeeeee A
```

eeeeee the programmed threshold (ref. E3R) is shown in terms of primary current; the value depends on the programmed earth CT primary values (rif. D10)

Examples:

IE>
00010 A

IE>
00250 A

E5R - TIME DELAY SET-UP (programmable)

T IE>
xxx.xx s

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

zzz.zz time delay programmable from 00.03 to 999.99 s.

The programmer views as regards the threshold **IE>** are then rescheduled for all other thresholds that are part of the function in question, simply substituting the name of the threshold (**IE>**) with that of other ones: **IE>>** and **IE>>>**.

5.7 Output relays programming (fig. 3)

The session allows to program the activation of the output relays R1, R2, R3 or R4 on START or TRIP conditions for each threshold.

In the programming session are displayed only the active thresholds depending on selections in the THRESHOLD SET-UP paragraph (see par. 5.6).

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

G1 - OUTPUT RELAY R1 QUIESCENT STATUS (programmable)

G1

R1
NORM xxx

Programming of the R1 relay status when no START or TRIP conditions are activated (none of the measured currents exceed their thresholds).

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

Example:

R1
NORM OFF

G2 ÷ G12 - OUTPUT RELAY ACTIVATION ON THRESHOLDS Id>, Id>>, TH2, TH5, IH>, IH>>, IH>>>, IL>, IL>>, IL>>>, IE>, IE>>, IE>>> (programmable)

G2

R1 Id>
xxxxxxxx

G3

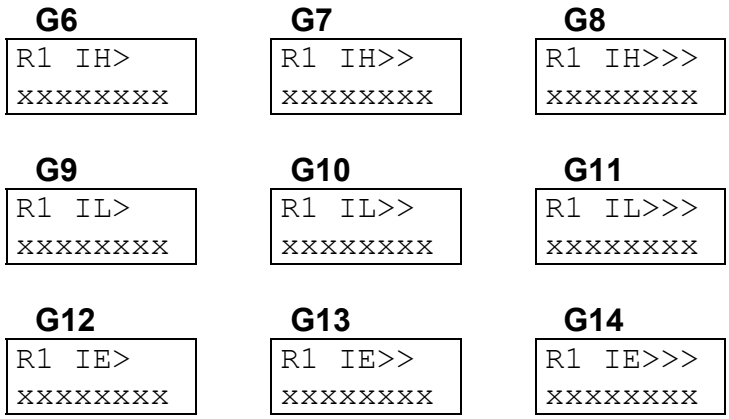
R1 Id>>
xxxxxxxx

G4

R1 TH2
xxxxxxxx

G5

R1 TH5
xxxxxxxx

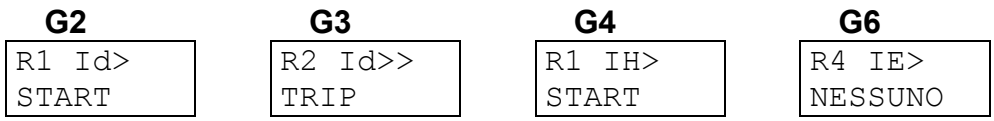


Programming of the R1 output relay activation (START or TRIP) on the Id>, Id>>, IH>, IH>>, IH>>>, IL>, IL>>, IL>>>, IE>, IE>>, IE>>> or on the harmonic restrain thresholds TH2 and TH5.

The parameter xxxxxxxx is selectable as the following:

START	instantaneous output relay R1 activation when one of the measured currents exceeds the programmed threshold (selection not present for TH2 and TH5)
TRIP	output relay R1 activation when one of the measured currents exceeds the programmed threshold level for at least TI seconds
NONE	no activation related to thresholds

Examples (related to several relays):



G15 - TEST OF OUTPUT RELAY R1

See paragraph 4.4

5.8 Digital inputs function programming (fig. 3)

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

a) disabling functions (87T, 51, 51N);

b) ON / OFF threshold;

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

When the function of more than one digital input refers to a threshold, keep in mind that the ALL selection (ALL the thresholds) has the priority on single threshold selection.

H1 - 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 xxxxxxxx: programming of the function related to digital input DIG1.

Parameters are selected using the key [+]; the following functions are selectable (only the active thresholds are displayed):

ESCLUSO	no functions active related to digital input DIG1
OF 87T	function 87T disabled (thresholds Id>, Id>>, TH2 and TH5)
OF 51	function 51 disabled (thresholds IH>, IH>>, IH>>>, IL>, IL>> and IL>>>)
OF 51N	function 51N disabled (thresholds IE>, IE>>, IE>>>)
OF Id>	threshold Id> disabled
OF Id>>	threshold Id>> disabled
OF P2	second percentage slope disabled - threshold Id>
OF TH2	2nd harmonic restrain threshold disabled (TH2)
OF TH5	5th harmonic restrain threshold disabled (TH5)
OF IH>	threshold IH> disabled
OF IH>>	threshold IH>> disabled
OF IH>>>	threshold IH>>> disabled
OF IL>	threshold IL> disabled
OF IL>>	threshold IL>> disabled
OF IL>>>	threshold IL>>> disabled
OF IE>	threshold IE> disabled
OF IE>>	threshold IE>> disabled
OF IE>>>	threshold IE>>> disabled
OF TUTTI	all thresholds disabled
STATO	activation of status function (see paragraph 1)

H2 ÷ H6 - DIGITAL INPUT DIG2-DIG6 SET-UP (programmable)

Programming of the function related to digital input channel from 2 (DIG2) to 6 (DIG6); the selections available are the same as presented for DIG1 (ref. H1).

5.9 Parameter values visualization (fig. 4)

L1 ÷ L13 - THRESHOLDS STATUS

L1

```
Id>
stato
```

L2

```
Id>>
stato
```

L3

```
TH2
stato
```

L4

```
TH5
stato
```

L5	L6	L7
IH> stato	IH>> stato	IH>>> stato
L8	**L9**	**L10**
IL> stato	IL>> stato	IL>>> stato
L11	**L12**	**L13**
IE> stato	IE>> stato	IE>>> stato

The actual status of each threshold is displayed, only for active functions (rif. E1D, E1F, E1R).

For each active function are displayed the threshold identification (Id>, Id>> etc.) and the threshold status; the status can show one of the following values:

ON	active threshold
OFF	disabled threshold (programmed OFF)
OFF_DIG	threshold programmed active but momentary disabled by a digital input actual status (ref. H1 ÷ H6, par. 5.8)

Examples:

Id> ON	Id>> ON	IH> OFF_DIG	TH5 OFF

X1 - X2 - X3 ÷ X12 - VECTORIAL COMPENSATION PARAMETERS

X1	X2	X3	
Ka = x.xx	Kb = x.xx	Ear = x Far = x	etc.

Parameters related to vectorial compensation.

The parameters are used to check the proper insertion and programming of the protection relay (use of the parameters is reserved to SEB protection relay engineers).

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 does not necessary mean energized or de-energized (see ref. M1).

Example:

M1

```
R1   ON
R2   OFF
```

M2

```
R3 OFF
R4   ON
```

N1 - N2 - N3 - DIGITAL INPUT STATUS

The actual status of each digital input is displayed.

For each digital input you can see the following information:

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

Example:

N1

```
DIG1   LO
DIG2   HI
```

N2

```
DIG3   LO
DIG4   HI
```

N3

```
DIG5   LO
DIG6   LO
```

P1 ÷ P19 - MEASUREMENT DISPLAY

The actual values of the measured currents in the primary and secondary side of the transformer, and also of the residual current are displayed (P1 ÷ P7). The remaining screens are viewable only if the Debug Mode function is enabled (Ref. C4) and they are used by SEB technical staff during the development of the system.

For each current the following information are displayed: current or parameter identification, actual values of the currents expressed as **In** and primary values (Amperes).

P1

```
IR1=xx.x
yyyyy A
```

P2

```
IS1=xx.x
yyyyy A
```

P3

```
IT1=xx.x
yyyyy A
```

P4

```
IR2=xx.x
yyyyy A
```

P5

```
IS2=xx.x
yyyyy A
```

P6

```
IT2=xx.x
yyyyy A
```

P7

```
IR=x.xxx
yyyyyy A
```

IR1, IS1, IT1: currents R, S, T in primary winding

IR2, IS2, IT2: currents R, S, T in secondary winding

IR: residual current

xx.x current values expressed as **In** of the installed CT's

yyyyy actual primary value of the currents (expressed as Amperes)

Screens from P8 to P19 allow visualization of the measure of the components of 2nd and 5th harmonic of the currents in the primary and secondary side of the transformer. Such

views are displayed only if the Debug Mode feature is enabled (Ref. C4) and are used by SEB technical staff during the development of the system.

Q1 ÷ Q14 – DIFFERENTIAL CURRENTS

Q1	**Q2**	**Q3**
IdR xx.xx In	IdS xx.xx In	IdT xx.xx In

IdR, IdS, IdT: differential currents R, S, T

xx.xx current values expressed as In (see par. 1.1)

Q10	**Q11**	**Q12**
TH2R nn %	TH2S nn %	TH2T nn %

Q13	**Q14**	**Q15**
TH5R nn %	TH5S nn %	TH5T nn %

TH2R, TH2S, TH2T: 2nd harmonic content of the differential currents R, S, T

TH5R, TH5S, TH5T: 5th harmonic content of the differential currents R, S, T

nn % harmonic content of the differential current expressed as %

Screens from Q4 to Q9 allow visualization of the measure of the components of 2nd and 5th harmonic of the differential currents. Such views are displayed only if the Debug Mode feature is enabled (Ref. C4) and are used by SEB technical staff during the development of the system.

Y1 ÷ Y21 - STABILIZING CURRENTS

Y1	**Y2**	**Y3**
IpR xx.xx In	IpS xx.xx In	IpT xx.xx In

IpR, IpS, IpT: stabilizing currents R, S, T

Y4	**Y5**	**Y6**	
Xr = xx.xx In	Yr = xx.xx In	Xs = xx.xx In	etc.

Intermediate parameters to calculate the stabilizing currents components.

The parameters are used to check the proper insertion and programming of the protection relay (use of the parameters is reserved to SEB protection relay engineers).

Screens from Y10 to Y21 allow visualization of the measure of the components of 2nd and 5th harmonic of the stabilizing currents. Such views are displayed only if the Debug Mode

feature is enabled (Ref. C4) and are used by SEB technical staff during the development of the system.

5.10 Events (fig. 5)

On the display are shown the stored 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.

R1 - EVENT NUMBER

R1

```
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:

NESSUNO	no event memorized
Id>	event on trip threshold Id>
Id>>	event on trip threshold Id>>
IH>	event on trip threshold IH>
IH>>	event on trip threshold IH>>
IH>>>	event on trip threshold IH>>>
IL>	event on trip threshold IL>
IL>>	event on trip threshold IL>>
IL>>>	event on trip threshold IL>>>
IE>	event on trip threshold IE>
IE>>	event on trip threshold IE>>
IE>>>	event on trip threshold IE>>>
STATO	information recorded on external command (function STATO, see par. 5.8)
POWER ON	switch-on of the protection relay (auxiliary power)

For the events NESSUNO and POWER ON no other information is presented: for the other events the following displays give more detailed information on the event.

If a event is related to a trip of a threshold belonging to the functions 87T and 51, in addiction to the threshold is also displayed the phase(s) involved in failure.

R2 - TRIP THRESHOLD

R2

```
E1  ssss
xx.xx In
```

It shows the threshold related to the TRIP condition (Id>, Id>>, IH>, IH>>, IH>>>, IL>, IL>>, IL>>>, IE>, IE>>, IE>>>) of the protection relay and the value of the threshold (in relative terms). The information is not shown on STATO or POWER ON events.

Example:

```
E1  Id>>
 4.60 In
```

R3 - R4 - R5 - PARAMETERS OF THE DIFFERENTIAL THRESHOLDS

This information is presented only on TRIP **Id>** event.

The parameters **P1**, **P2** and **DI** related to the **Id>** differential threshold are presented (the last two parameters only if programmed ON the **IP>>** threshold).

R3
```
E1
P1  xx%
```

R4
```
E1  cc
P2  xx%
```

R5
```
E1  DI
nn.nn In
```

To understand these parameters, see par. 5.6.1

Example:

R3
```
E1
P1  20%
```

R4
```
E1  ON
P2  50%
```

R5
```
E1  DI
 2.40 In
```

R6 - R7 - HARMONIC RESTRAIN THRESHOLDS

This information is not presented on STATO event.

The harmonic restrain thresholds value and status are presented.

R6
```
E1  ON
TH2  15%
```

R7
```
E1  OF
TH5  15%
```

R8 - ACTIVATED OUTPUT RELAYS

```
E1  RELE
nnnnnnn
```

Not presented for STATO event

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

Examples:

```
E1  RELE
1,3,4
```

```
E3  RELE
1,4
```

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

```
E1  RELE
NESSUNO
```

R9 - 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 overcurrent detection.

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

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

R10 - VISUALIZZAZIONE CANALE DIGITALE ASSOCIATO ALLO SCATTO

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

The list of the digital inputs related to the memorized event is displayed (STATO function command).

If no digital inputs were activated, the message NESSUNO is displayed.

R11 ÷ R23 - MEMORIZED MEASURED CURRENTS

Memorized measured current at the TRIP event; the values are expressed as In - see paragraph 1.1 and 1.2.

R11
```
E1  IR1
nn.nn In
```

R12
```
E1  IS1
nn.nn In
```

R13
```
E1  IT1
nn.nn In
```

R14
```
E1  IR2
nn.nn In
```

R15
```
E1  IS2
nn.nn In
```

R16
```
E1  IT2
nn.nn In
```

R15
```
E1  IR
n.nnn Io
```

R17
```
E1  IdR
nn.nn In
```

R18
```
E1  IdS
nn.nn In
```

R19
```
E1  IdT
nn.nn In
```

R20
```
E1  IpR
nn.nn In
```

R21
```
E1  IpS
nn.nn In
```

R22
```
E1  IpT
nn.nn In
```

IR1, IS1, IT1: measured primary winding currents R, S, T

IR2, IS2, IT2: measured secondary winding currents R, S, T

IR: measured residual current

IdR, IdS, IdT: differential currents R, S, T

IpR, IpS, IpT: stabilizing currents R, S, T

R24 ÷ R29 - MEMORIZED HARMONIC CONTENT OF THE DIFFERENTIAL CURRENTS

Memorized 2nd and 5th harmonic contents of the differential currents at TRIP event; the values are expressed as percentage of the measured differential current.

R24

```
E1  TH2R
gg  %
```

R25

```
E1  TH2S
gg  %
```

R26

```
E1  TH2T
gg  %
```

R27

```
E1  TH5R
gg  %
```

R28

```
E1  TH5S
gg  %
```

R29

```
E1  TH5T
gg  %
```

TH2R, TH2S, TH2T: 2nd harmonic content of the differential currents R, S, T

TH5R, TH5S, TH5T: 5th harmonic content of the differential currents R, S, T

R30 ÷ R35 - DIGITAL INPUTS STATUS ON EVENT

```
E1
DIG1  vv
```

```
E1
DIG2  vv
```

```
E1
DIG3  vv
```

```
E1
DIG4  vv
```

```
E1
DIG5  vv
```

```
E1
DIG6  vv
```

The status of the digital inputs at the event is displayed. The parameter **vv** can assume the value HI or LO.

R36 - R37 - DATE AND TIME OF THE EVENT

```
E1  Data
gg/mm/aa
```

```
E1  Ora
hh:mm:ss
```

The date and time of the event are showed

5.11 Trips counters (fig. 5)

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 changed without the need of the programming confirmation).

S1 ÷ S22 - TRIP COUNTERS

S1

```
Id>
P  cccc
```

S2

```
Id>
T  cccc
```

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

When the value exceeds 9999 the counter starts again from 0000.

The counters are identified by the threshold name (Id>, Id>>, IH>, IH>>, IH>>>, IL>, IL>>, IL>>>, IE>, IE>>, IE>>>); 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).

S23 ÷ S25 - TOTAL PROGRAMMING SESSIONS AND DATE/TIME OF THE LAST PROGRAMMING SESSION

```
TOT PRG
eeee
```

```
DATA PRG
gg/mm/aa
```

```
ORA PRG
hh:mm:ss
```

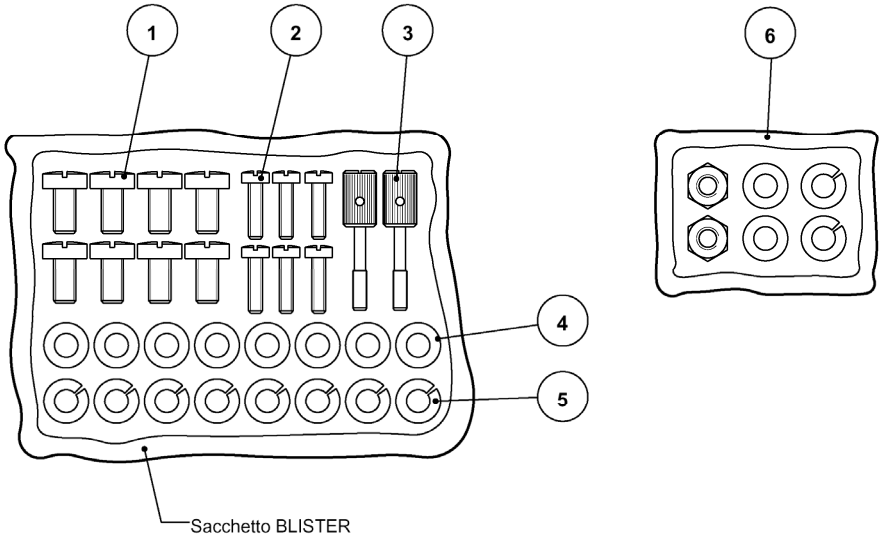
Display of the number of confirmed programming sessions (from the factory set-up) and the date and time of the last confirmed programming session.

6 INSTALLATION

6.1 Supplied kit

IDM8N protection relay is provided only in MR version (with minirack, which can be used for mounting on standard 19” frames according CEI/48 standard, or for wall mounting); this version includes the following accessories:

- mini-rack 4U
- protection relay module IDM8N with 2 rear sockets
- transparent front panel with push-buttons
- transparent front panel without push-buttons
- blister with items 1-2-3-4-5



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
3) n° 2 screws to fix (optionally) the protection relay on the front of the 19" rack
4) n° 2 knobs to fix the transparent front panel
5) n° 8 washers to be used to fix wire terminals (current)
6) n° 8 growers to be used to fix wire terminals (current)
7) items to fix the brackets for flush mounting (not applicable)

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.

6.2 Cabling

For the protection relay insertion please refer to figure 6.

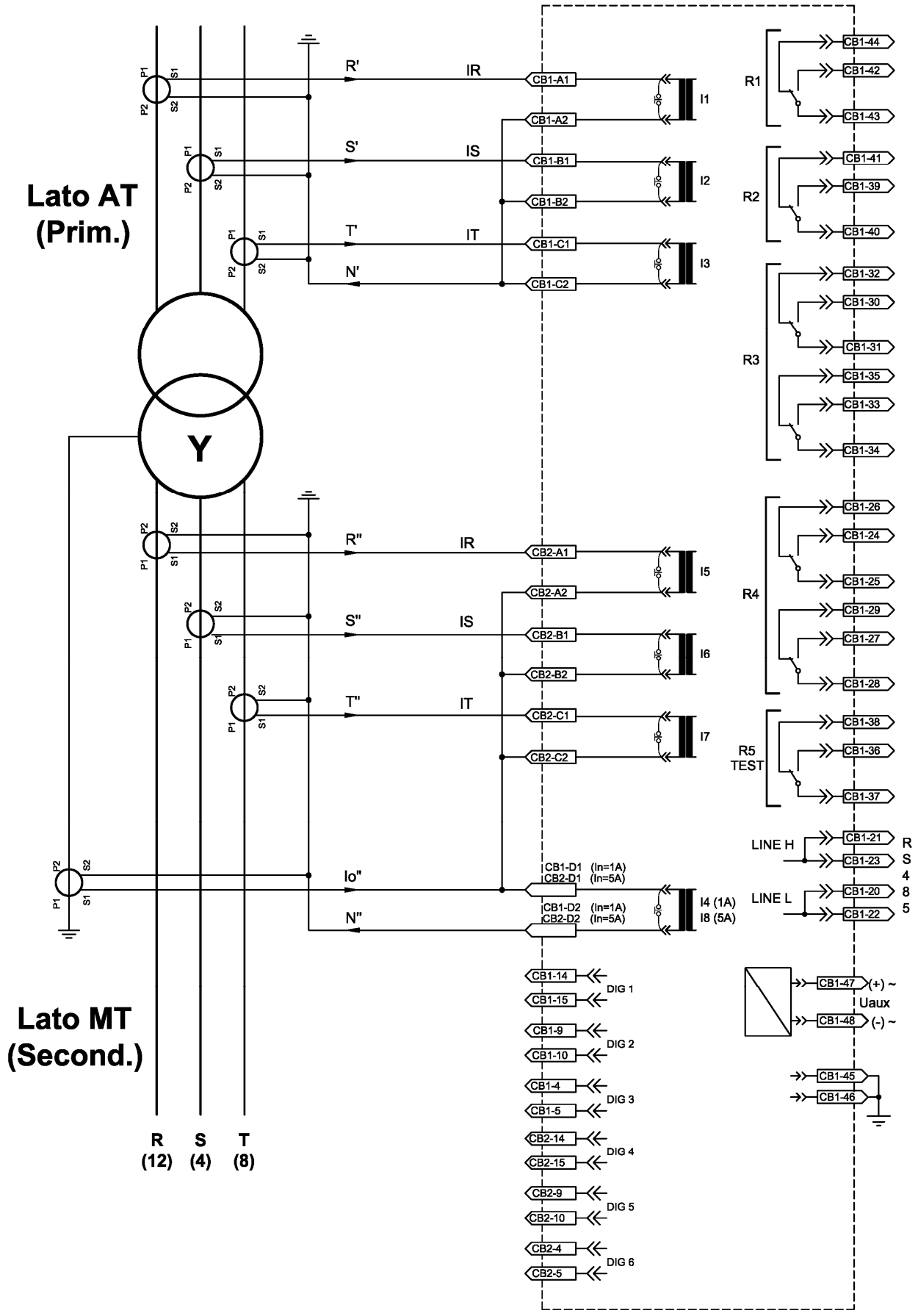
For insertion scheme related to different vectorial group, please contact SEB technical department.

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

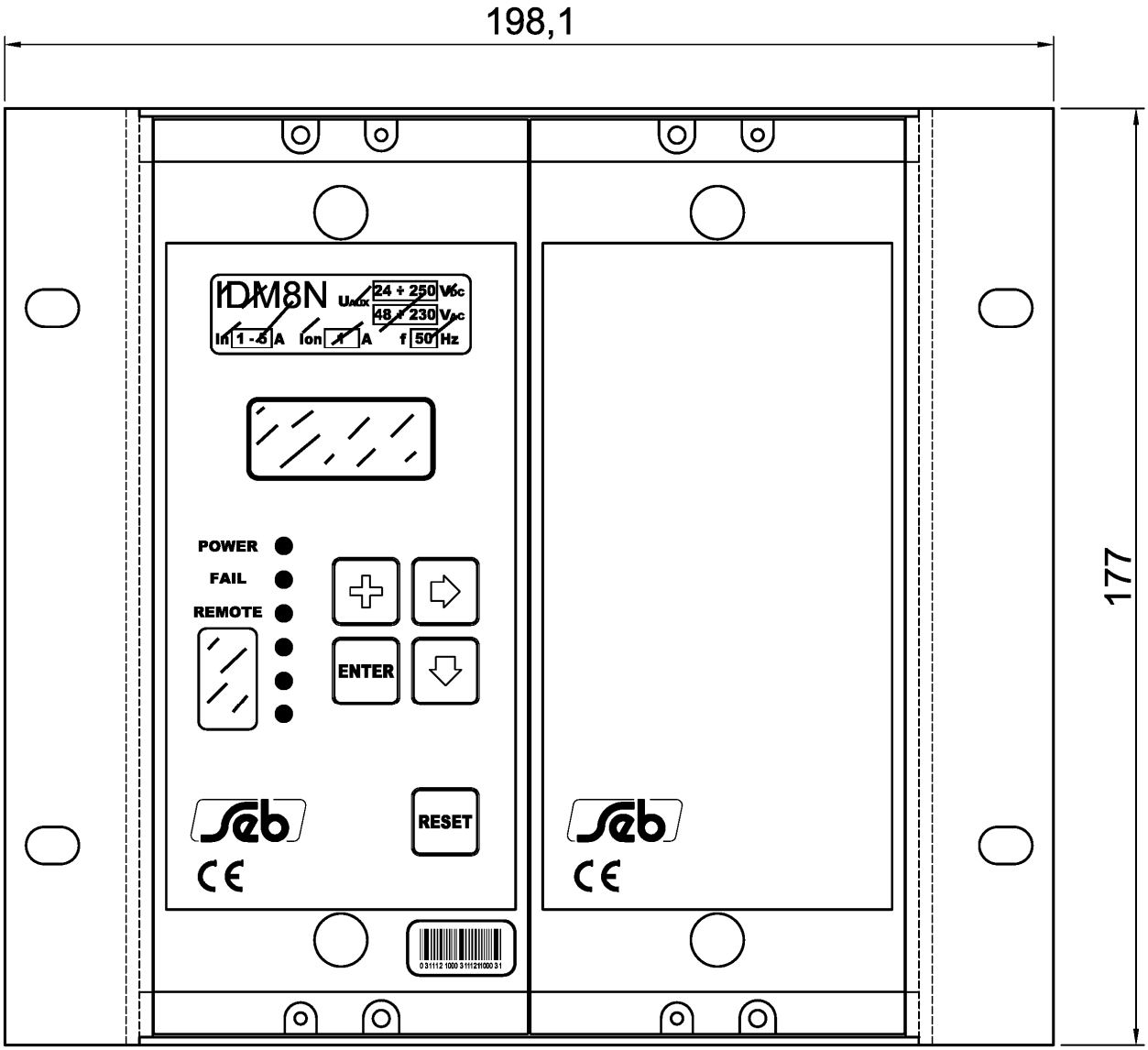
Minimum suggested wire cross section: 2,5 mm^2

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

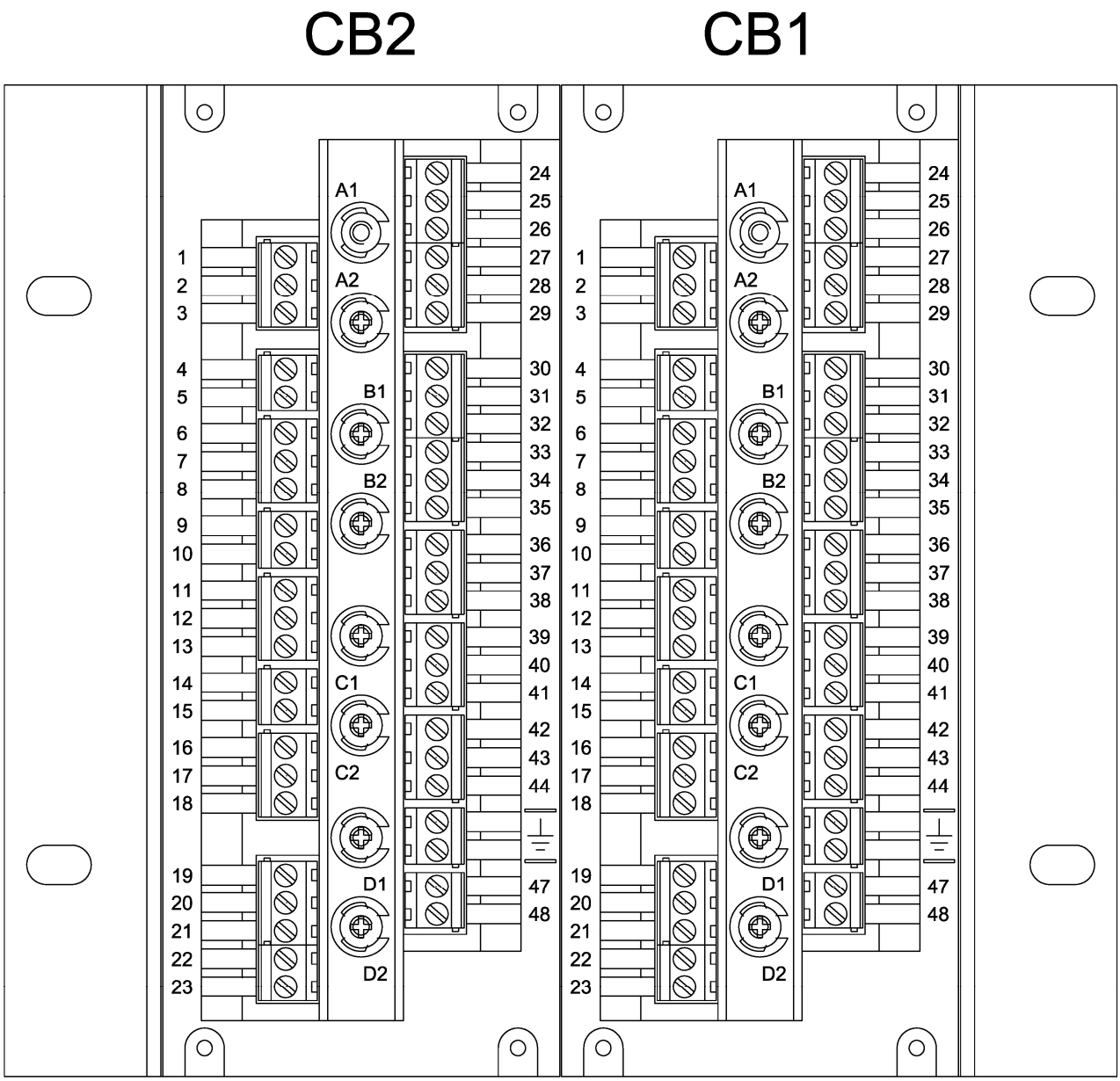
Minimum suggested wire cross section: 1,5 mm^2



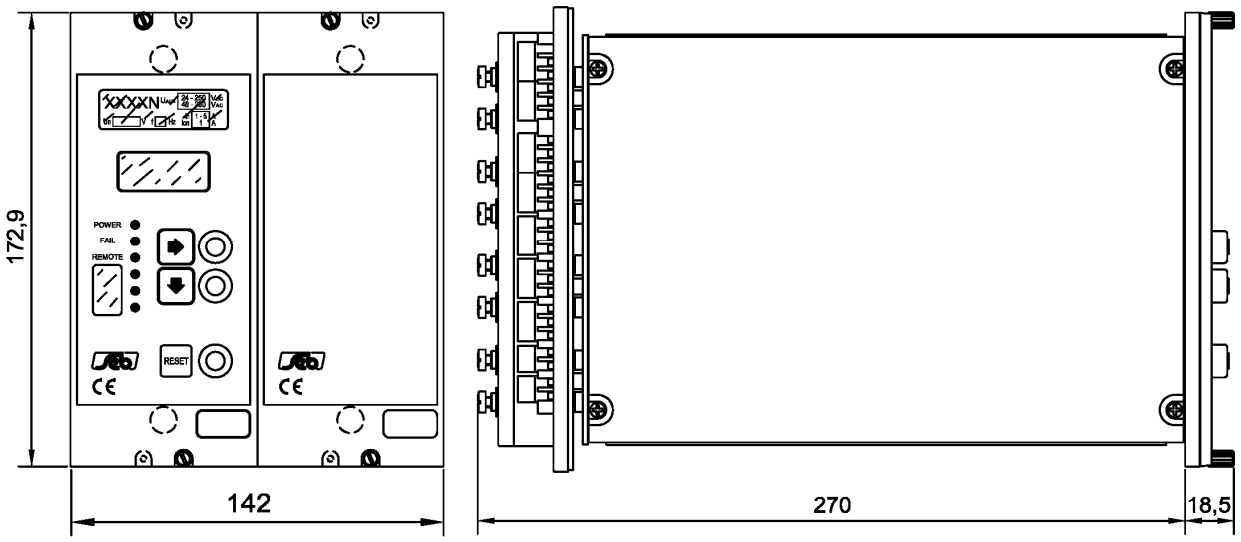
Insertion - Figure 6

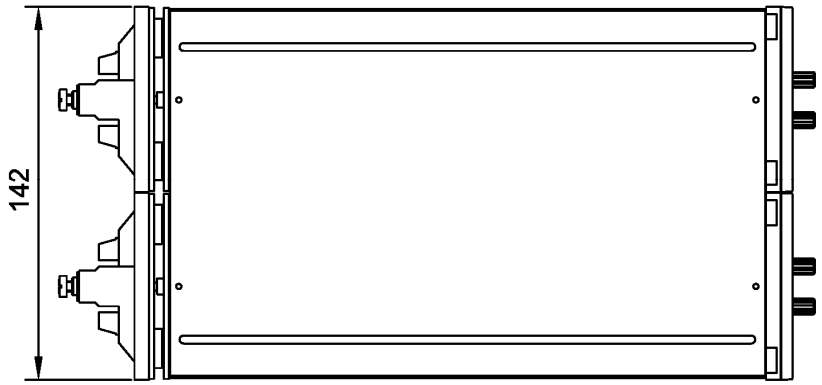


IDM8N on Minirack 19”
FRONT VIEW - Figure 7

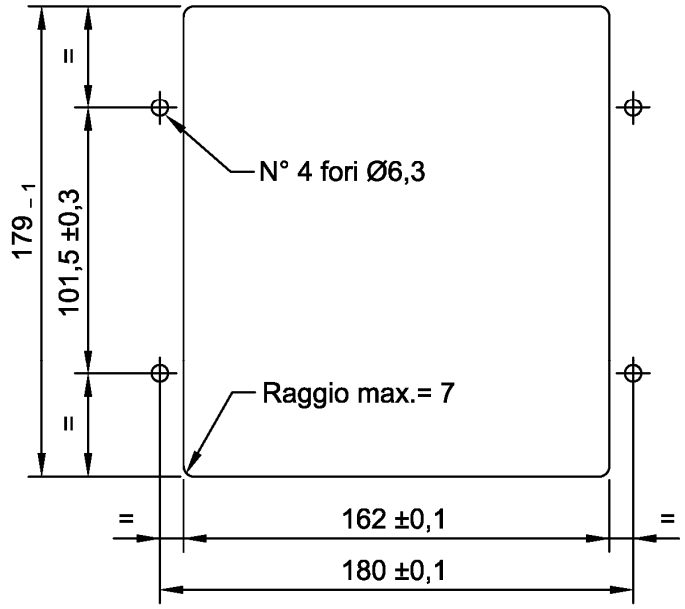


IDM8N on Minirack 19”
REAR VIEW - Figure 8





Dimensioni
meccaniche
Case outlines



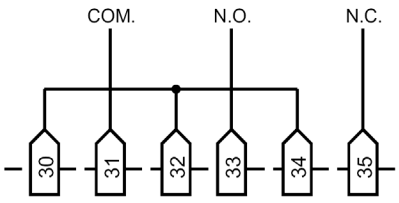
Dima montaggio da incasso
Flush mounting panel cut - out

Dimensioni frontali mini-rack per incasso
Mini-rack front sizes (flush mounting)
198.2 x 177 (4U) mm.

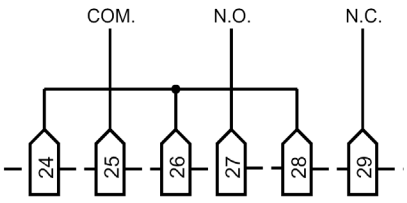
6.3 Relays R3 and R4 - Signaling / Command set-up

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

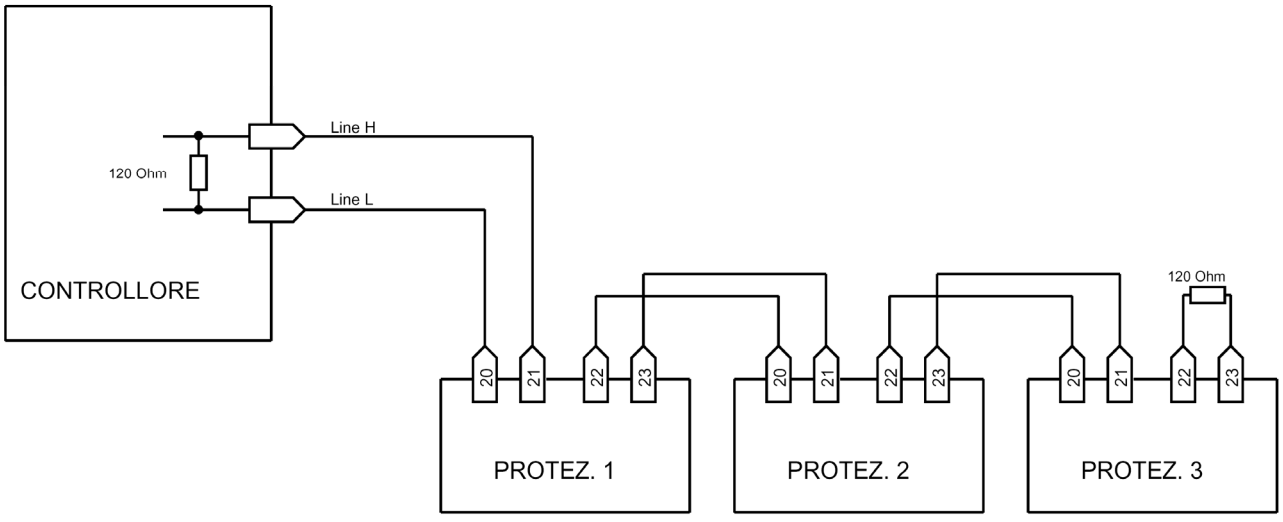
6.4 RS485 serial communication port

The digital protection relay IDM8N 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.



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

7 TECHNICAL DATA

Measuring inputs

Rated phase current (In)	1 A / 5 A programmable
Rated residual current (Ion) (note 1)	1 A / 5 A programmable
Thermal withstand continuously	5 In / 5 Ion
Thermal withstand for 1 s	100 In
Rated frequency	50 Hz
Primary CT's current	1 ÷ 18500 A

Output contacts ratings

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

Digital inputs

Number of inputs	6
External control voltage	as Uaux
Typical current (sink)	2 mA

Data transmission

Standard	RS-485 half duplex
Communication protocol	MOD-BUS ASCII
Transmission speed	300 - 9600 baud selectable

Auxiliary supply

Range	24 ÷ 320 Vdc ± 20% 48 ÷ 230 Vac ± 20%
Frequency (Vac)	47 ÷ 53 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 (mini rack)	IP 31
Weight	3.5 kg

Note 1) The residual current input connection depends according to the value of Ion
Note 2) The additional relay R5 is controlled by self-test program
Note 3) Breaking capability at 110 Vdc, L/R 40 ms, 100.000 operations.
Note 4) The output contacts of R3 and R4 relays can be configured as signaling or tripping relays

8 TABLE

Table B Settings

ANSI	THRESHOLDS		Setting	Resolution
87T	Id>	Insensibility threshold	0.10 ÷ 2.00 In	0.01 In
	P1	Slope of the first percentage branch	0 ÷ 50 %	1%
	P2	Slope of the second percentage branch	0 ÷ 100 %	1%
	DI	Base point of the second branch	0.00 ÷ 20.00 In	0.01 In
	Id>>	Second differential threshold	0.50 ÷ 30.00 In	0.01 In
	TH2>	2nd harmonic threshold	10 ÷ 80 %	1 %
	TH5>	5th harmonic threshold	10 ÷ 80 %	1 %
51	IH>	1st overcurrent threshold (primary side)	0.10 ÷ 10.00 In	0.01 In
	IH>>	2nd overcurrent threshold (primary side)	0.10 ÷ 40.00 In	0.01 In
	IH>>>	3rd overcurrent threshold (primary side)	0.10 ÷ 40.00 In	0.01 In
	IL>	1st overcurrent threshold (secondary side)	0.10 ÷ 10.00 In	0.01 In
	IL>>	2nd overcurrent threshold (secondary side)	0.10 ÷ 40.00 In	0.01 In
	IL>>>	3rd overcurrent threshold (secondary side)	0.10 ÷ 40.00 In	0.01 In
51N	IE>	1st residual overcurrent threshold	0.005 ÷ 1.0 Ion	0.001 Ion
	IE>>	2nd residual overcurrent threshold	0.01 ÷ 2.0 Ion	0.01 Ion
	IE>>>	3rd residual overcurrent threshold	0.01 ÷ 2.0 Ion	0.01 Ion
Delays			**Setting**	**Resolution**
All thresholds		Definite time	0.03 ÷ 999.99 s	0.01 s
All thresholds		Output relay minimum activation time	0.10 ÷ 99.99 s	0.01 s

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