DIVISIONE ELETTRONICA E SISTEMI

IDT8N

DIGITAL PERCENTAGE BIASED TRANSFORMER DIFFERENTIAL PROTECTION RELAY

USER MANUAL

P501D808 **September 2004**

INDEX

1 GENERAL CHARACTERISTICS

The protection relay IDT8N 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	50 - 51

The stand alone **IDT8N** relay performs the function as three-poles percentage biased transformer differential protection relay for 2-winding transformers; when installed with the **AMF3N** module it performs the function as three-poles percentage biased transformer differential protection relay for 3- winding transformers or 2-winding transformer in 3-ended schemes.

For 3-winding transformer and 2-winding transformer in 3-ended scheme, the protected transformer must have **at least one of the windings STAR configured**.

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

THRESHOLDS - the following thresholds are available:

- 1 differential percentage biased threshold (two branches)
- 1 absolute value differential threshold
- 1 overcurrent threshold for the stabilizing current
- 2 overcurrent thresholds (one for each winding of the transformer)

The tripping characteristic for the differential thresholds is presented in figure A.

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

TRIP DELAYS - All the thresholds are time definite and each threshold time delay TI can be combined with an additional time delay (TA); the additional time delay is added to time delay TI. The additional time delay activation is controlled by the digital inputs.

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

OUTPUT RELAYS - the IDT8N 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 6 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 (only digital input DIG2)

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 STATUS) 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 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 Operation of the differential thresholds

The IDT8N relay performs functions as percentage biased differential protection relay; 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 (0.02 ÷ 99.99 s) and each of them can be combined with an additional timer controlled by the digital inputs.

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

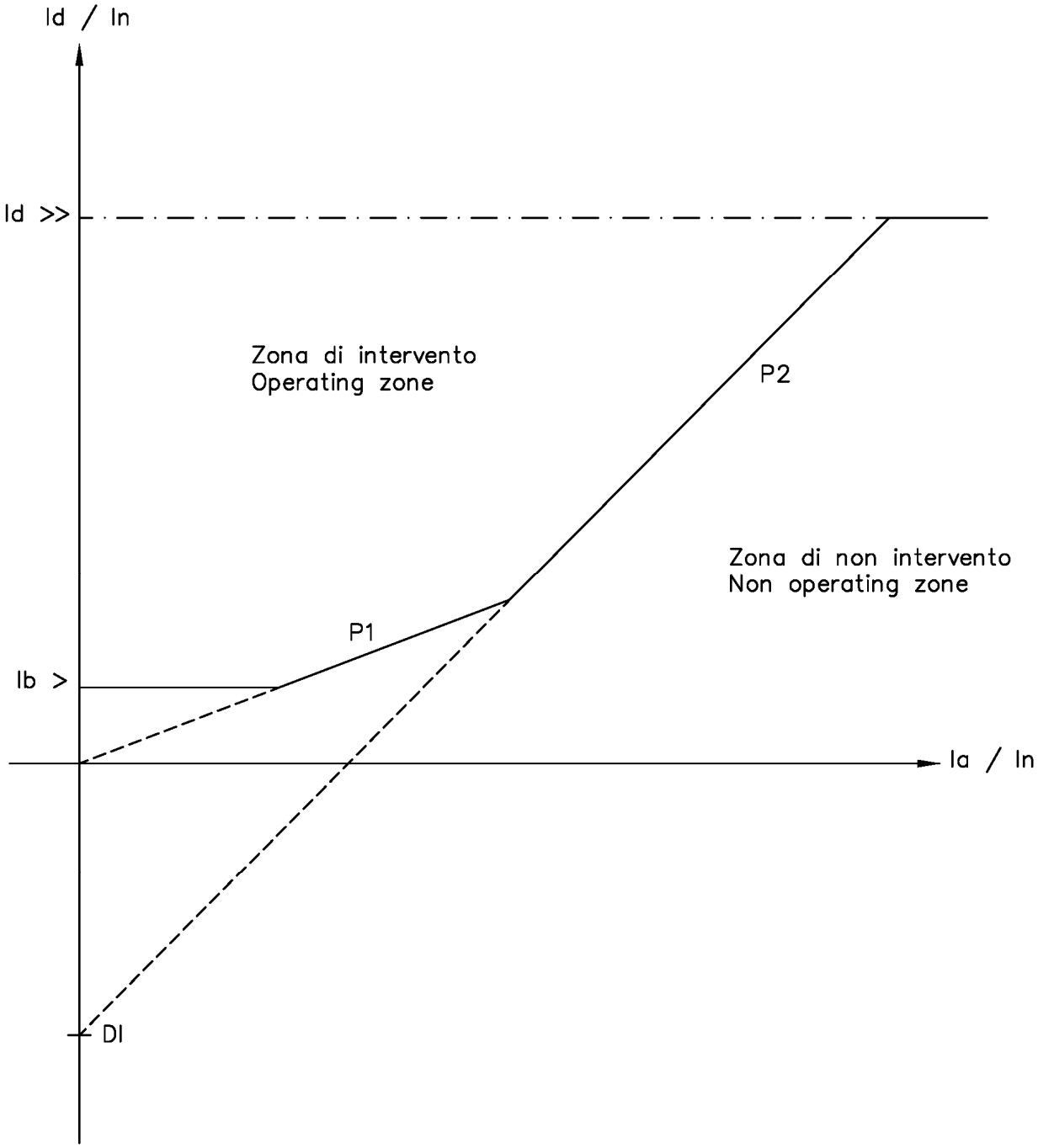
The differential thresholds **Id>** and **Id>>** and the overcurrent threshold **Ip>** related to the stabilizing current (see par. 1.3) are referred to the rated current of the protected transformer normalized with the ratio of the installed CT's in order that the value of measured currents on the primary and secondary windings can be directly compared.

$$In = \frac{\frac{An}{Un * \sqrt{3}}}{I_{TAP}}$$

An transformer rated apparent power

Un transformer rated voltage

I_{TAP} rated primary current of the CT's installed on the winding side Un



Operating characteristic - figure A

1.2 Transformer differential protection (ANSI 87T)

The protection relay IDT8N has been designed to provide three-poles percentage biased differential protection function to transformer and generator-transformer units.

2-WINDING TRANSFORMER

For this installation a stand alone **IDT8N** relay is available; in table A (see ref. D2) there are the vectorial groups of the transformers which can be protected by the **IDT8N** stand alone 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.

3-WINDING TRANSFORMER
For this installation is required a **IDT8N** relay and a **AMF3N** module; in table B (see ref. D2) there are the vectorial groups of the transformers which can be protected by the **IDT8N+AMF3N** system.

For protected transformer must have at least one of the windings STAR configured.

An example of the insertion of the protection relay is presented in figure 7. For insertion scheme related to different vectorial group, please contact SEB technical department.

2-WINDING TRANSFORMER in 3-ended scheme
For this installation is required a **IDT8N** relay and a **AMF3N** module; in table C (see ref. D2) there are the vectorial groups of the transformers which can be protected by the **IDT8N+AMF3N** system.

For protected transformer must have at least one of the windings STAR configured.

An example of the insertion of the protection relay is presented in figure 8. For insertion scheme related to different vectorial group, please contact SEB technical department.

The differential relay **IDT8N** 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:

- power transformer nominal data
- power transformer vector group
- installed CT's characteristics

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 **IDT8N** 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 50 - 51)

Two overcurrent thresholds are available and actionable 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.

- **Ia>** - primary winding overcurrent threshold (side "**a**")
- **Ib>** - secondary winding overcurrent threshold (side "**b**")

Both thresholds are definite time; each threshold delay can be combined with an additional timer controlled by the digital inputs.

It is also available an additional overcurrent threshold (**Ip>**) related to the stabilizing current to give an additional protection to the transformer if the fault condition has not been eliminated by other protection relays.

The overcurrent thresholds **Ia>** and **Ib>** are referred in terms of the rated current **In** of the corresponding installed CT's.

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 or by PILOT WIRE FAULT MONITORING function
REMOTE (red)	⊕	communication session active on RS485 port
Id> (red)	⊕	trip condition on **Id>** threshold (ANSI 87T)
Id>> (red)	⊕	trip condition on **Id>>** threshold (ANSI 87T)
I> (red)	⊕	trip condition on overcurrent thresholds **Ip>**, **Ia>** and **Ib>** (ANSI 50-51)

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 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 ÷ C3	display and drop-off time
D1 ÷ D12	nominal values of the protected transformer
E1D ÷ E8D	threshold set-up and time delays Id>
E1P ÷ E5P	threshold set-up and time delays Id>>
E1S - E1T	harmonic thresholds
F1P ÷ F5P	threshold set-up and time delays Ip>
F1A ÷ F6A	threshold set-up and time delays Ia>, Ib>
G1 ÷ G6	output relays functions
H1 ÷ H6	digital input functions
S1 ÷ S10	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? (Fig. 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:

```
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 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 (Fig. 1, ref. A1 - par. 5.1)

4.4 Test of output relays

When the output relays test is selected (Fig. 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 - 50).

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>	TRIP Id>>	TRIP Ido>	TRIP Ido>>

The information of the trip, as well the glowing of the related LEDs, 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

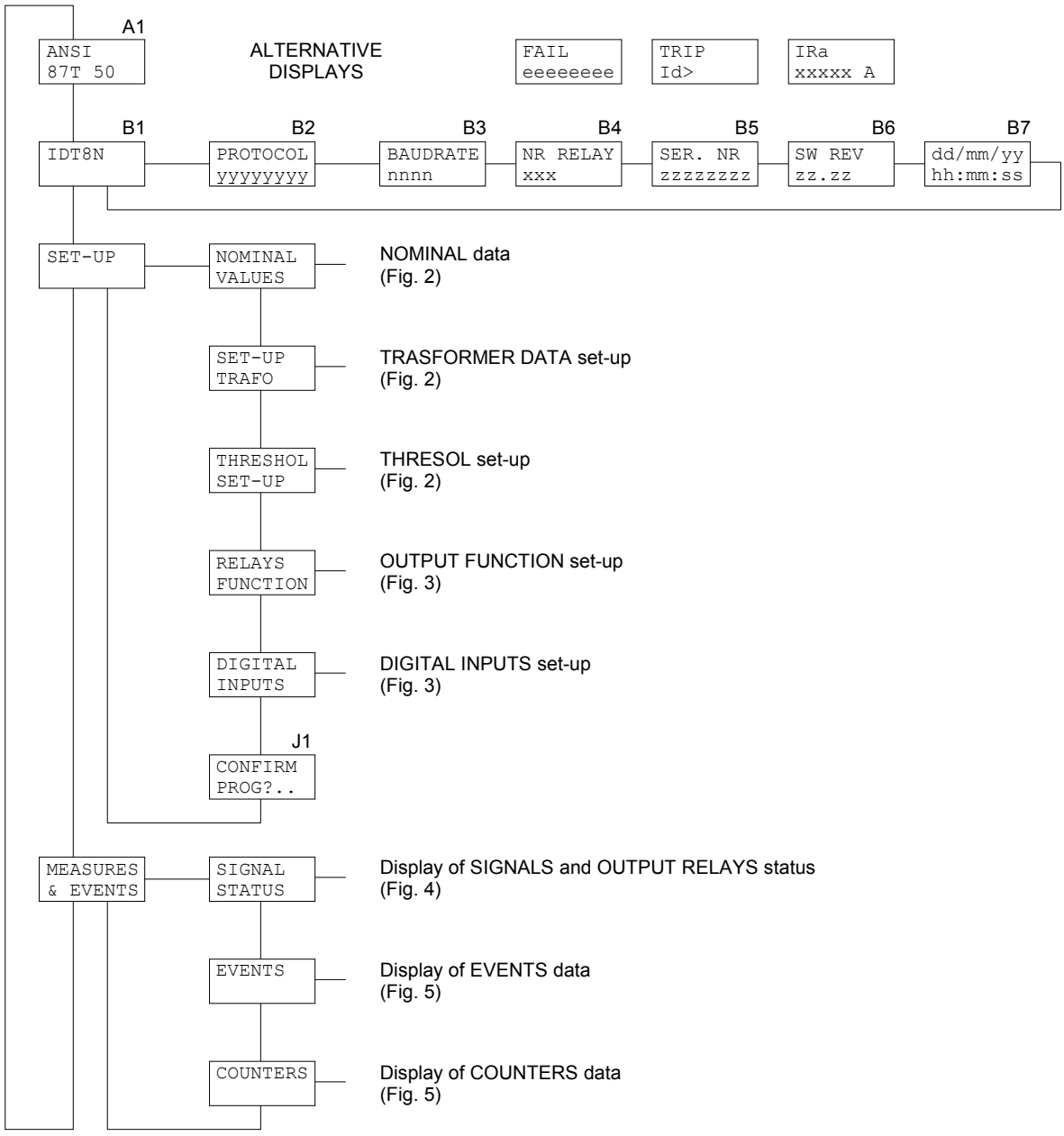


Figure 1

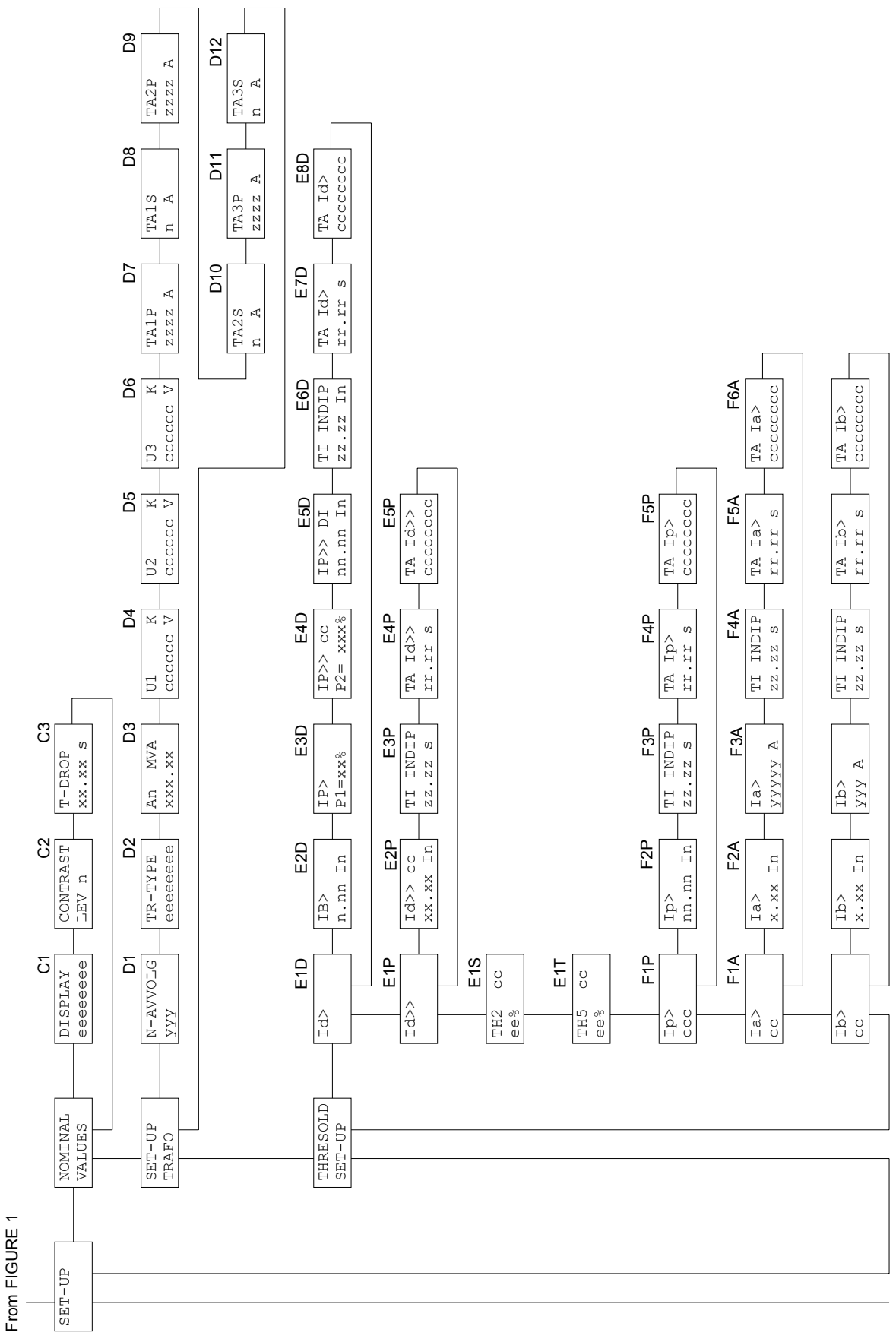

From FIGURE 1
SET-UP
NOMINAL VALUES
SET-UP TRAFO
THRESOLD SET-UP
C1
DISPLAY eeeeeeee
C2
CONTRAST LEV n
C3
T-DROP xx.xx s
D1
N-AVVOLG yyy
D2
TR-TYPE eeeeeeee
D3
An MVA xxx.xx
D4
U1 K ccccc V
D5
U2 K ccccc V
D6
U3 K ccccc V
D7
TA1P zzzz A
D8
TA1S n A
D9
TA2P zzzz A
D10
TA2S n A
D11
TA3P zzzz A
D12
TA3S n A
E1D
Id>
E1P
Id>>
E1S
TH2 cc ee%
E1T
TH5 cc ee%
E2D
IB> n.nn In
E2P
Id>> cc xx.xx In
E3D
IP> P1=xx%
E3P
TI INDIP zz.zz s
E4D
IP>> cc P2= xxx%
E4P
TA Id>> rr.rr s
E5D
IP>> DI nn.nn In
E5P
TA Id>> ccccccccc
E6D
TI INDIP zz.zz In
E7D
TA Id> rr.rr s
E8D
TA Id> ccccccccc
F1P
Ip> ccc
F1A
Ia> cc
F2P
Ip> nn.nn In
F2A
Ia> x.xx In
F3P
TI INDIP zz.zz s
F3A
Ia> yyyyy A
F4P
TA Ip> rr.rr s
F4A
TI INDIP zz.zz s
F5P
TA Ip> ccccccccc
F5A
TA Ia> rr.rr s
F6A
TA Ia> ccccccccc
Ib> cc
Ib> x.xx In
Ib> yyy A
TA Ib> rr.rr s
TA Ib> ccccccccc
To FIGURE 3

Figure 2

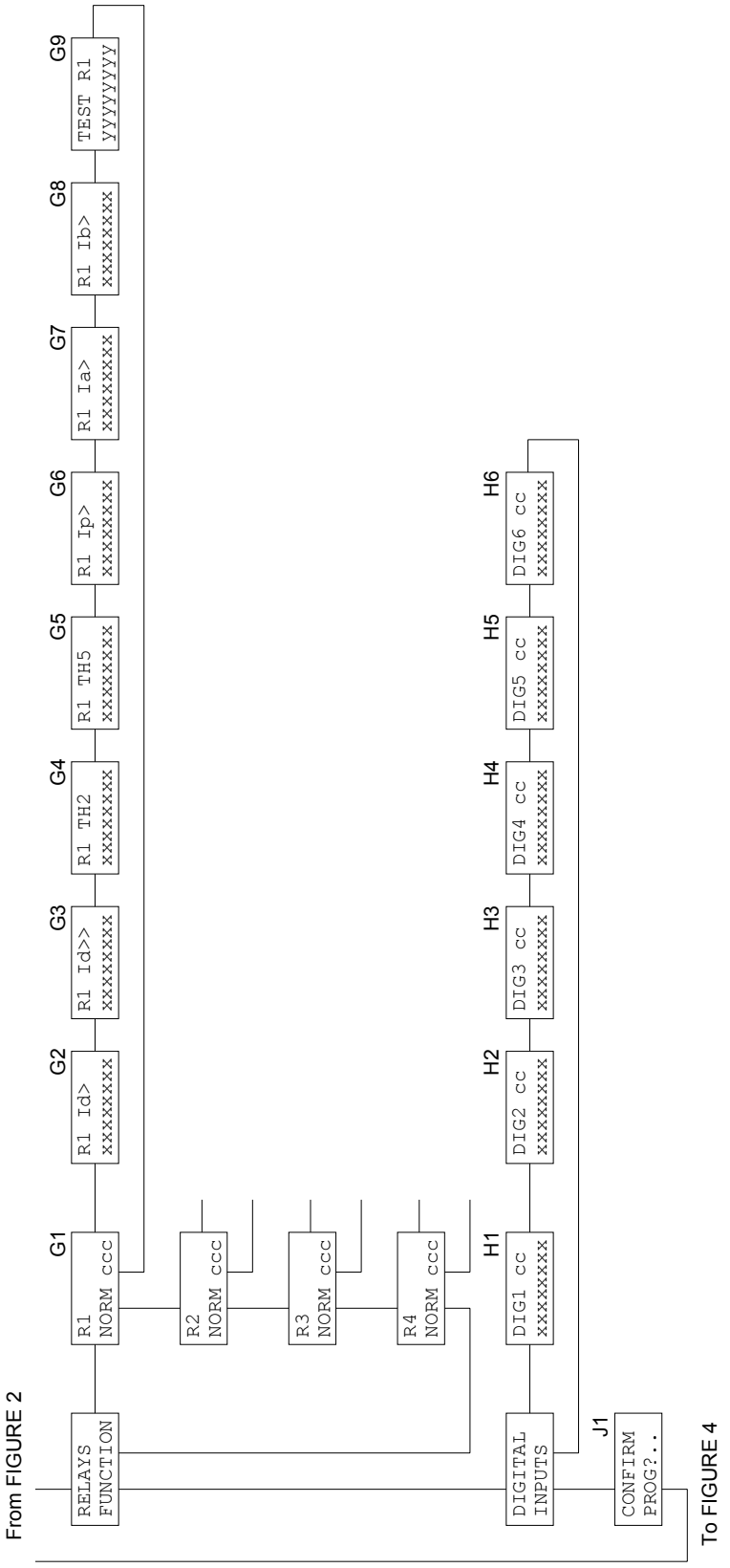

From FIGURE 2
RELAYS FUNCTION
G1
R1 NORM ccc
R2 NORM ccc
R3 NORM ccc
R4 NORM ccc
G2
R1 Id> xxxxxxxxx
G3
R1 Id>> xxxxxxxxx
G4
R1 TH2 xxxxxxxxx
G5
R1 TH5 xxxxxxxxx
G6
R1 Ip> xxxxxxxxx
G7
R1 Ia> xxxxxxxxx
G8
R1 Ib> xxxxxxxxx
G9
TEST R1 yyyyyyyy
DIGITAL INPUTS
H1
DIG1 cc xxxxxxxxx
H2
DIG2 cc xxxxxxxxx
H3
DIG3 cc xxxxxxxxx
H4
DIG4 cc xxxxxxxxx
H5
DIG5 cc xxxxxxxxx
H6
DIG6 cc xxxxxxxxx
J1
CONFIRM PROG?..
To FIGURE 4

Figure 3

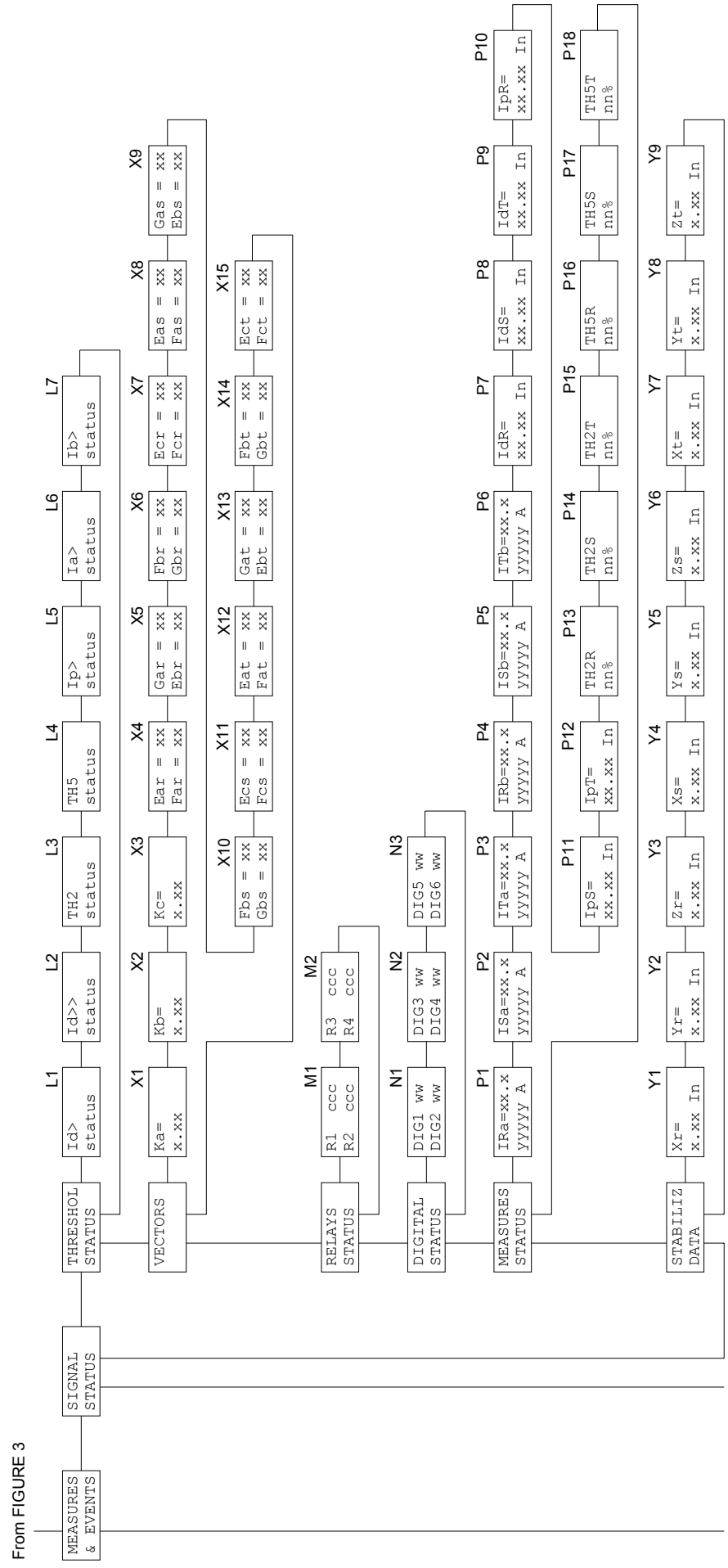

From FIGURE 3
MEASURES & EVENTS
SIGNAL STATUS
THRESHOL STATUS
VECTORS
RELAYS STATUS
DIGITAL STATUS
MEASURES STATUS
STABILIZ DATA
To FIGURE 5
L1 Id> status
L2 Id>> status
L3 TH2 status
L4 TH5 status
L5 Ip> status
L6 Ia> status
L7 Ib> status
X1 Ka= x.xx
X2 Kb= x.xx
X3 Kc= x.xx
X4 Ear = xx Far = xx
X5 Gar = xx Ebr = xx
X6 Fbr = xx Gbr = xx
X7 Ecr = xx Fcr = xx
X8 Eas = xx Fas = xx
X9 Gas = xx Ebs = xx
X10 Fbs = xx Gbs = xx
X11 Ecs = xx Fcs = xx
X12 Eat = xx Fat = xx
X13 Gat = xx Ebt = xx
X14 Fbt = xx Gbt = xx
X15 Ect = xx Fct = xx
M1 R1 ccc R2 ccc
M2 R3 ccc R4 ccc
N1 DIG1 ww DIG2 ww
N2 DIG3 ww DIG4 ww
N3 DIG5 ww DIG6 ww
P1 IRa=xx.x yyyyy A
P2 ISa=xx.x yyyyy A
P3 ITa=xx.x yyyyy A
P4 IRb=xx.x yyyyy A
P5 ISb=xx.x yyyyy A
P6 ITb=xx.x yyyyy A
P7 IdR= xx.xx In
P8 IdS= xx.xx In
P9 IdT= xx.xx In
P10 IpR= xx.xx In
P11 IpS= xx.xx In
P12 IpT= xx.xx In
P13 TH2R nn%
P14 TH2S nn%
P15 TH2T nn%
P16 TH5R nn%
P17 TH5S nn%
P18 TH5T nn%
Y1 Xr= x.xx In
Y2 Yr= x.xx In
Y3 Zr= x.xx In
Y4 Xs= x.xx In
Y5 Ys= x.xx In
Y6 Zs= x.xx In
Y7 Xt= x.xx In
Y8 Yt= x.xx In
Y9 Zt= x.xx In

Figure 4

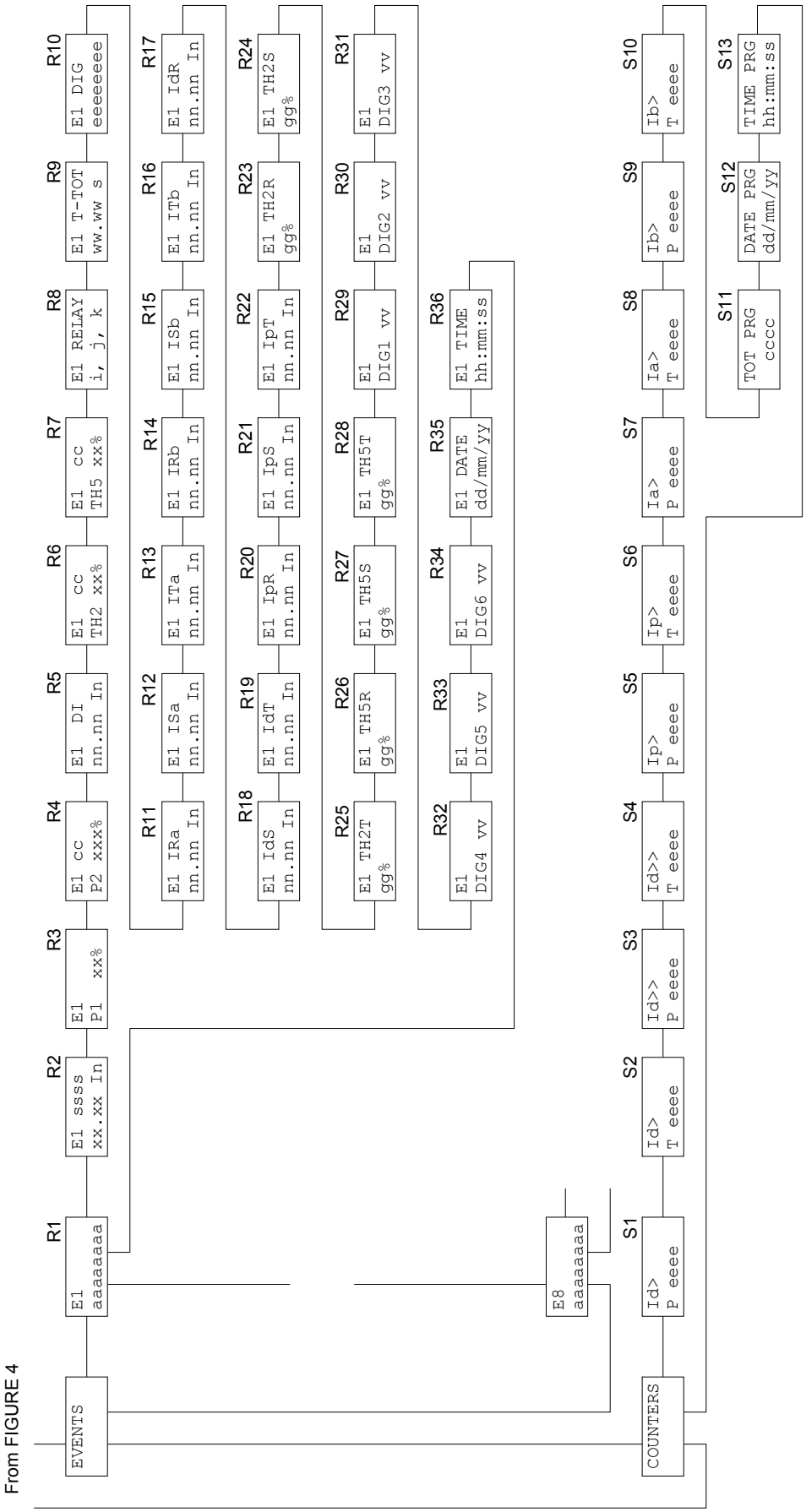

From FIGURE 4
EVENTS
COUNTERS
R1
E1
aaaaaaaa
R2
E1 ssss
xx.xx In
R3
E1
P1 xx%
R4
E1 cc
P2 xxx%
R5
E1 DI
nn.nn In
R6
E1 cc
TH2 xx%
R7
E1 cc
TH5 xx%
R8
E1 RELAY
i, j, k
R9
E1 T-TOT
ww.ww s
R10
E1 DIG
eeeeeeee
R11
E1 IRa
nn.nn In
R12
E1 ISa
nn.nn In
R13
E1 ITa
nn.nn In
R14
E1 IRb
nn.nn In
R15
E1 ISb
nn.nn In
R16
E1 ITb
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 TH2R
gg%
R24
E1 TH2S
gg%
R25
E1 TH2T
gg%
R26
E1 TH5R
gg%
R27
E1 TH5S
gg%
R28
E1 TH5T
gg%
R29
E1
DIG1 vv
R30
E1
DIG2 vv
R31
E1
DIG3 vv
R32
E1
DIG4 vv
R33
E1
DIG5 vv
R34
E1
DIG6 vv
R35
E1 DATE
dd/mm/yy
R36
E1 TIME
hh:mm:ss
E8
aaaaaaaa
S1
Id>
P eeee
S2
Id>
T eeee
S3
Id>>
P eeee
S4
Id>>
T eeee
S5
Ip>
P eeee
S6
Ip>
T eeee
S7
Ia>
P eeee
S8
Ia>
T eeee
S9
Ib>
P eeee
S10
Ib>
T eeee
S11
TOT PRG
cccc
S12
DATE PRG
dd/mm/yy
S13
TIME PRG
hh:mm:ss

Figure 5

5.3 Address and time (fig. 1)

B1 - RELAY MODEL (not programmable)

```
IDT8N
```

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 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:

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
Ia	displays current winding “a” (the maximum of the 3 measured values)
Ib	displays current winding “b” (the maximum of the 3 measured values)

The current is displayed in primary values.

Selection examples:

```
DISPLAY
ANSI
```

```
DISPLAY
IdR
```

```
DISPLAY
Ia
```

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- button 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
```

5.5 Nominal values of the protected transformer (fig. 2)

D1 - NUMBER OF WINDINGS (programmable)

```
N-AVVOLG
yyy
```

Number of windings of the protected transformer; the available selection are the followings:

2	2-winding transformers
3	3-winding transformers
2 + S	2-winding transformers in 3-ended installation

D2 - TRANSFORMER VECTOR GROUP (programmable)

```
TR TYPE
e eeee
```

Programming of the vector group of the protected transformer.

2- windings 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.

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

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 Y d11	TR TYPE Y d1	TR TYPE D y5

2- windings transformer in 3-ended installation:
The first character represents the connection of the primary winding (side "**1**" in the insertion drawing), whilst the other characters represent the connection of the secondary winding (side "**2**" in the insertion drawing) and the vector group.

The allowable selections are the following:

Table B

Primary (side 1)	Secondary (side 2)
Y	y0, y6, d1, d5, d7, d11 z5, z11
D	y1, y5, y7, y11

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

3-winding transformer:
The first character represents the connection of the primary winding (side "**1**" in the insertion drawing), the second field represents the connection of the secondary winding (side "**2**" in the insertion drawing) and the related vector group, whilst the third field represents the connection of the secondary winding (side "**3**" in the insertion drawing) and related the vector group.

Table C

Primary (side 1)	Secondary (side 2)	3rd winding (side 3)
Y	y0, y6	y0, y6, d1, d5, d7, d11 z1, z5, z7, z11
Y	d1, d7, z1, z7	y0, y6, d1, d7, z1, z7
Y	d5, d11, z5, z11	y0, y6, d11, d5, z5, z11
D	y1, y5, y7, y11	y1, y5, y7, y11, d0, d6, z0, z6
D	d0, d6, z0, z6	y1, y5, y7, y11

Examples:

TR TYPE Y y0 y0	TR TYPE Y d1 d1	TR TYPE D y1 y1

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

D3 - RATED POWER OF THE TRANSFORMER (programmable)

```
An MVA
xxx.x
```

Value of the rated power of the protected transformer; the value is programmable from 0.1 to 999.9 MVA.

D4 - PRIMARY RATED VOLTAGE OF THE TRANSFORMER (programmable)

```
U1   a
cccccc V
```

Primary voltage rated value of the protected transformer; the value is programmable from 100 to 400000 V.

a winding side indication

Winding-**a**: input transducers I1, I2, I3 (see figure 6, 7, 8)
Winding-**b**: input transducers I4, I5, I6 (see figure 6, 7, 8)
Winding-**c**: input transducers AMF3N, I7, I8 (see figure 6, 7, 8)

Example:

```
U1   a
132000 V
```

D5 - SECONDARY RATED VOLTAGE OF THE TRANSFORMER (programmable)

```
U2   b
cccccc V
```

Secondary voltage rated value of the protected transformer the value is programmable from 100 to 400000 V.

b winding side indication (see ref. D4)

Example:

```
U1   b
 15000 V
```

NOTE in the case of generator-transformer unit must be programmed the secondary rated voltage of the transformer.

D6 - THIRD WINDING RATED VOLTAGE OF THE TRANSFORMER (programmable)

```
U3   c
cccccc V
```

Secondary voltage rated value of the protected transformer; the value is programmable from 100 to 400000 V.

c winding side indication (see ref. D4)

Example:

```
U3   c
15000 V
```

NOTE in the case of 2-winding transformer in 3-ended installation, the voltage must be programmed as the secondary rated voltage (U2) of the transformer.

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

```
TA1P
zzzzz 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.

D8 - 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.

D9 - RATED PRIMARY CURRENT OF THE "CT" ON SECONDARY SIDE OF THE TRANSFORMER (programmable)

```
TA2P
zzzzz 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.

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

```
TA2S
n A
```

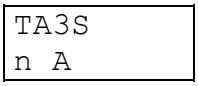
Value of the rated secondary current of the CT's installed in the plant on the secondary side of the transformer; the value is programmable 1 A or 5 A.

D11 - RATED PRIMARY CURRENT OF THE "CT" ON THIRD WINDING SIDE OF THE TRANSFORMER (programmable)

```
TA3P
zzzzz 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.

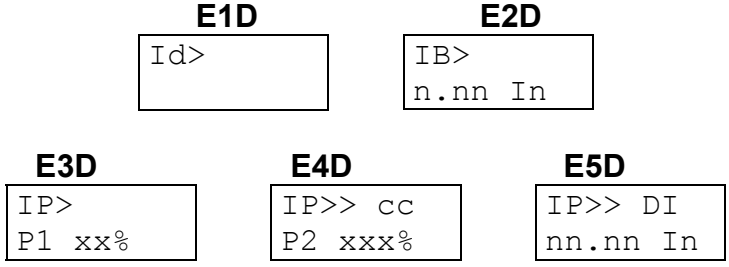
D12 - RATED SECONDARY CURRENT OF THE "CT" ON THIRD WINDING SIDE OF THE TRANSFORMER (programmable)



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.

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

5.6.1 Percentage biased differential thresholds (fig. 2)



E1D - THRESHOLD IDENTIFICATION (non programmable)

E2D - INSENSIBILITY THRESHOLD SET-UP (programmable)

n.nn value of the threshold programmable from 0.15 to 2.00 **In**
For the value of **In** please refer to paragraph 1.1.

E3D - 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 %)

E4D - ON/OFF and SET-UP SECOND PERCENTAGE BRANCH (programmable)

cc ON - enabled branch
OF - disabled branch

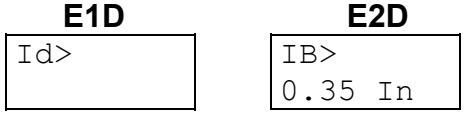
xxx slope value of the second percentage branch (0 ÷ 100 %)

E5D - 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:



E3D

```
IP>
P1 20%
```

E4D

```
IP>> ON
P2 55%
```

E5D

```
IP>> DI
 3.50 In
```

E6D - TIME DELAY SET-UP (programmable)

E6D

```
TI eeeee
zz.zz s
```

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

zz.zz time delay programmable from 00.02 to 99.99 s

Example:

```
TI INDIP
00.04 s
```

E7D - E8D - ADDITIONAL TIME DELAY SET-UP (E7D - programmable, E8D - non programmable)

E7D

```
TA Id>
xx.xx  s
```

E8D

```
TA Id>
cccccccc
```

The selection allows to program an additional time delay TA 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. H1 ÷ H6 - paragraph 5.8).

The additional time delay TA is added to the time delay TI to obtain the output relay trip when the TI+TA time expires.

The display E8D shows the digital input programmed to activate the additional time delay TA on the displayed threshold.

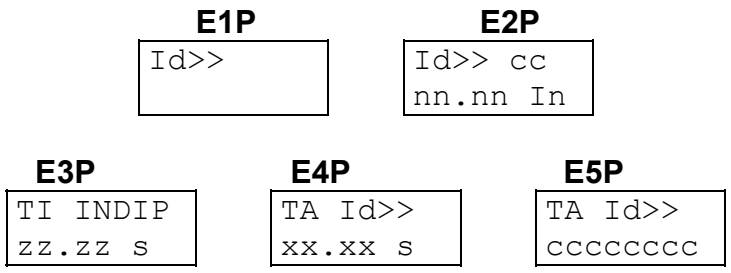
The parameter eeeeeeee can show one of the following values:

DISABLED	none of the digital inputs has been programmed to activate an additional time delay related to threshold Id>
DIG1	digital input DIG1 activates the TA delay on threshold Id>
DIG2	digital input DIG2 activates the TA delay on threshold Id>
DIG3	digital input DIG3 activates the TA delay on threshold Id>
DIG4	digital input DIG4 activates the TA delay on threshold Id>
DIG5	digital input DIG5 activates the TA delay on threshold Id>
DIG6	digital input DIG6 activates the TA delay on threshold Id>

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

NOTE the additional delay TA will be added only if the TI time delay is at least 50 ms (0.05 s at reference E6D) as for safety reason (to guarantee proper operation) the digital input is filtered at 40 ms.

5.6.2 Second differential thresholds (Id>> - fig. 2)



E1P - THRESHOLD IDENTIFICATION (non programmable)

E2P - ON/OFF and SET-UP SECOND DIFFERENTIAL THRESHOLD (programmable)

cc ON - enabled threshold
OF - disabled threshold

nn.nn **d>>** threshold value programmable from 0.50 to 20.00 In

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

E3P - 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.

zz.zz time delay programmable from 00.02 to 99.99 s

E4P - E5P - ADDITIONAL TIME DELAY SET-UP (E4P - programmable, E5P - non programmable)

The selection allows to program an additional time delay TA 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. H1 ÷ H6 - paragraph 5.8).

The additional time delay TA is added to the time delay TI to obtain the output relay trip when the TI+TA time expires.

The display **E5P** 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 Id>
DIG1	digital input DIG1 activates the TA delay on threshold Id>>
DIG2	digital input DIG2 activates the TA delay on threshold Id>>
DIG3	digital input DIG3 activates the TA delay on threshold Id>>
DIG4	digital input DIG4 activates the TA delay on threshold Id>>
DIG5	digital input DIG5 activates the TA delay on threshold Id>>
DIG6	digital input DIG6 activates the TA delay on threshold Id>>

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

Example:

E1P

```
Id>>
```

E2P

```
Id>> ON
 0.90 In
```

E3P

```
TI INDIP
00.02 s
```

E4P

```
TA Id>>
00.00 s
```

E5P

```
TA Id>>
DISABIL
```

5.6.3 Harmonic restrain thresholds (TH2, TH5 - fig. 2)

E1S

```
TH2 cc
ee %
```

E2T

```
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%

5.6.4 Overcurrent threshold - stabilizing current (Ip> - fig. 2)

F1P - ON / OFF PHASE OVERCURRENT THRESHOLD (programmable)

```
Ip>
cc
```

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

F2P - THRESHOLD LEVEL SET-UP (programmable)

```
Ip>
xx.xx In
```

nn.nn hreshold level Ip> expressed in terms of In

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

Examples:

Ip> 06.50 In	Ip> 12.00 In

F3P - 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 current exceeds the threshold level.

zz.zz time delay programmable from 00.02 to 99.99 s

F4P - F5P - ADDITIONAL TIME DELAY SET-UP (programmable) (F4P - programmable, F5P - non programmable)

F4P	**F5P**
TA Ip> xx.xx s	TAIp> cccccccc

The selection allows to program an additional time delay TA 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. H1 ÷ H6 - paragraph 5.8).

The additional time delay TA is added to the time delay TI to obtain the output relay trip when the TI+TA time expires.

The display **F5P** 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 Id>
DIG1	digital input DIG1 activates the TA delay on threshold Ip>
DIG2	digital input DIG2 activates the TA delay on threshold Ip>
DIG3	digital input DIG3 activates the TA delay on threshold Ip>
DIG4	digital input DIG4 activates the TA delay on threshold Ip>
DIG5	digital input DIG5 activates the TA delay on threshold Ip>
DIG6	digital input DIG6 activates the TA delay on threshold Ip>

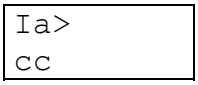
More than one digital input can activate the same additional time delay (e.g. DIG 1,3).

5.6.5 Overcurrent thresholds - line currents (Ia>, Ib> - fig. 2)

The **Ia>** threshold refers to primary winding ("**a**") of the protected transformer, whilst the **Ib>** threshold refers to secondary winding ("**b**") of the protected transformer.

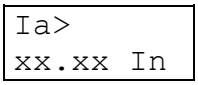
The information and set-ups related to threshold **Ia>** in the following points are effective for the threshold **Ib>** just taking into consideration the change of the threshold identification.

F1A - ON / OFF PHASE OVERCURRENT THRESHOLD (programmable)



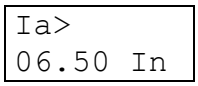
cc ON - enabled threshold
OF - disabled threshold (available but not active)

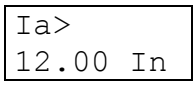
F2A - THRESHOLD LEVEL SET-UP (programmable)



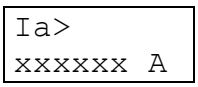
nn.nn threshold level **Ia>** expressed in terms of In of the CT's installed on the "**a**" side winding of the protected transformer

Examples:



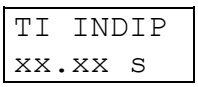


F3A - THRESHOLD LEVEL IN PRIMARY VALUE (non programmable)



xxxxxx threshold level expressed in Amperes (primary values)
NON PROGRAMMABLE as function of the primary rated current of the installed CT's (ref. D6 or D8 for **Ia>** or **Ib>**)

F4A - TIME DELAY SET-UP (programmable)

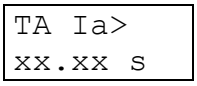


Set-up of time-delay to the activation (TRIP) of the programmed output relays when the measured current exceeds the threshold level.

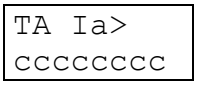
zz.zz time delay programmable from 00.02 to 99.99 s

F5A - F6A - ADDITIONAL TIME DELAY SET-UP (programmable) (F5A - programmable, F6A - non programmable)

F5A



F6A



The selection allows to program an additional time delay TA 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. H1 ÷ H6 - paragraph 5.8).

The additional time delay TA is added to the time delay TI to obtain the output relay trip when the TI+TA time expires.

The display F6A 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 Id>
DIG1	digital input DIG1 activates the TA delay on threshold Ia>
DIG2	digital input DIG2 activates the TA delay on threshold Ia>
DIG3	digital input DIG3 activates the TA delay on threshold Ia>
DIG4	digital input DIG4 activates the TA delay on threshold Ia>
DIG5	digital input DIG5 activates the TA delay on threshold Ia>
DIG6	digital input DIG6 activates the TA delay on threshold Ia>

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

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 (paragraph 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 ÷ G8 - OUTPUT RELAY ACTIVATION ON THRESHOLDS Id>, Id>>, TH2, TH5, Ip>, Ia> and Ib> (programmable)

G2

```
R1 Id>
xxxxxxxx
```

G3

```
R1 Id>>
xxxxxxxx
```

G4

```
R1 TH2
xxxxxxxx
```

G5

```
R1 TH5
xxxxxxxx
```

G6

```
R1 Ip>
xxxxxxxx
```

G7

```
R1 Ia>
xxxxxxxx
```

G8

```
R1 Ib>
xxxxxxxx
```

Programming of the R1 output relay activation (TRIP) on the Id>, Id>>, Ip>, Ia> and Ib> thresholds or on the harmonic restrain thresholds.

The parameter xxxxxxxx is selectable as the following:

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

Examples (related to several relays):

G2

```
R1 Id>
START
```

G3

```
R2 Id>>
TRIP
```

G4

```
R1 TH2
START
```

G6

```
R4 Ip>
NO AZION
```

G9 - TEST OF OUTPUT RELAY R1

```
TEST R1
xxxxxxxx
```

See paragraph 4.4

5.8 Digital inputs function programming (fig. 3)

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)

When function a) is programmed, a message is displayed at ref. E8D, E5P, F5P and F6A.

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.

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 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 Id>	additional time delay on the threshold Id>
TA Id>>	additional time delay on the threshold Id>>
TA Ip>	additional time delay on the threshold Ip>
TA Ia>	additional time delay on the threshold Ia>
TA Ib>	additional time delay on the threshold Ib>
TA ALL	additional time delay on all thresholds
OF Id	thresholds Id> and Id>> disabled
OF Id>	threshold Id> disabled
OF Id>>	threshold Id>> disabled
OF IP>>	second percentage slope disabled - threshold Id>
OF TH2	2nd harmonic restrain threshold disabled
OF TH5	5th harmonic restrain threshold disabled
OF I>	thresholds Ip>, Ia> and Ib> disabled
OF Ip>	threshold Ip> disabled
OF Ia>	threshold Ia> disabled
OF Ib>	threshold Ib> disabled
OF ALL	all thresholds disabled
STATUS	activation of status function (see paragraph 1.)

H2 - 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. H1) plus the following:

MONITOR	activation of pilot wire monitor function.

H3 ÷ H6 - DIGITAL INPUT DIG3-DIG6 SET-UP (programmable)

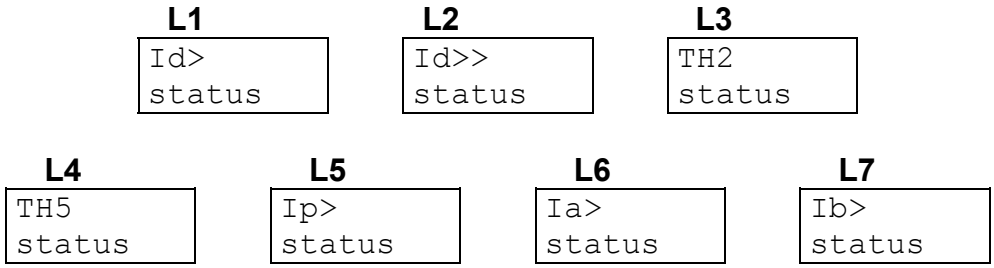
H3

```
DIG3 cc
xxxxxxxx
```

Programming of the function related to digital input channel from 3 (DIG3) to 6 (DIG6); the selections available are the same as presented for DIG1 (ref. H1).

5.9 Parameter values visualization (fig. 4)

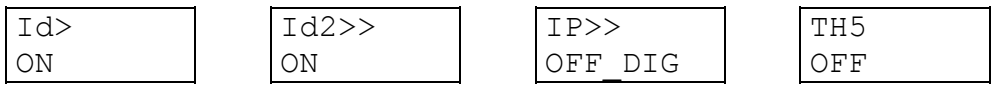
L1 - L2 - L3 - L4 - L5 - L6 - L7 - THRESHOLDS STATUS



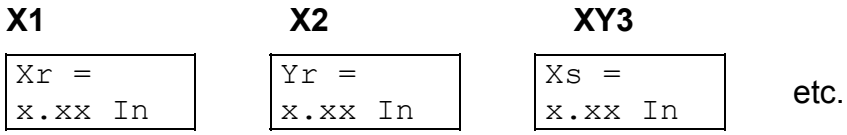
The actual status of each threshold is displayed. For each threshold are displayed the threshold identification (Id>, Id>> etc.) and the threshold status; the status can show one of the following values:

ON	active threshold
OFF	disabled threshold (programmed OFF at ref. E1, E5, F1)
OFF_DIG	threshold programmed active but momentary disabled by a digital input actual status (ref. H1 ÷ H6 - paragraph 5.8).

Examples:



X1 - X2 - X3 ÷ X15 - VECTORIAL COMPENSATION PARAMETERS



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).

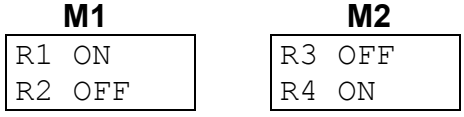
M1 - M2 - OUTPUT RELAY STATUS

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:



N1 - N2 - N3 - 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)

Example:

N1	**N2**	**N3**
DIG1 LO DIG2 HI	DIG3 LO DIG4 HI	DIG5 LO DIG6 LO

P1 ÷ P18 - MEASUREMENT DISPLAY

The actual values of the measured currents, differential currents and stabilizing currents are displayed; the currents related to disabled thresholds are not displayed.

For each current the following information is displayed:

- current or parameter identification
- actual values of the currents expressed as **In** and primary values (Amperes)
- actual **%** value of the harmonic content of the differential currents

P1	**P2**	**P3**
IRa=xx.x yyyyy A	ISa=xx.x yyyyy A	ITa=xx.x yyyyy A

P4	**P5**	**P6**
IRb=xx.x yyyyy A	ISb=xx.x yyyyy A	ITb=xx.x yyyyy A

IRa, ISa, ITa: currents R, S, T primary winding (side “a”)

IRb, ISb, ITb: currents R, S, T secondary winding (side “b”)

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

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

P7	**P8**	**P9**
IdR xx.xx In	IdS xx.xx In	IdT xx.xx In

P10	**P11**	**P12**
IpR xx.xx In	IpS xx.xx In	IpT xx.xx In

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

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

xx.x current values expressed as In (see paragraph 1.1)

P13	P14	P15
TH2R nn %	TH2S nn %	TH2T nn %

P16	P17	P18
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 %

Y1 - Y2 - Y3 ÷ Y9 - STABILIZING PARAMETERS

Y1	Y2	Y3	
Xr = x.xx In	Yr = x.xx In	Xs = x.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).

5.10 Events (fig. 5)

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.

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:

NONE	no event memorized
Id>	event on trip threshold Id>
Id>>	event on trip threshold Id>>
Ip>	event on trip threshold Ip>

Ia>	event on trip threshold Ia>
Ib>	event on trip threshold Ib>
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.

R2 - TRIP THRESHOLD

R2

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

It shows the threshold related to the TRIP condition (Id>, Id>>, Ip>, Ia> or Ib>) of the protection relay and the value of the threshold (in relative terms). The information is not shown on STATUS 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
```

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 STATUS 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 RELAY
nnnnnnn
```

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

Examples:

```
E1 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
```

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 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
```

R10 - 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 - ref. par. 5.8).

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

R11 ÷ R22 - 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  IRa
nn.nn In
```

R12

```
E1  ISa
nn.nn In
```

R13

```
E1  ITa
nn.nn In
```

R14	R15	R16
E1 IRb nn.nn In	E1 ISb nn.nn In	E1 ITb nn.nn In

R17	R18	R19
E1 IdR nn.nn In	E1 IdS nn.nn In	E1 IdT nn.nn In

R20	R21	R22
E1 IpR nn.nn In	E1 IpS nn.nn In	E1 IpT nn.nn In

IRa, ISa, ITa: measured primary winding currents R, S, T (side “a”)

IRb, ISb, ITb: measured secondary winding currents R, S, T (side “b”)

Note: the currents related to winding “c” are not displayed

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

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

R23 ÷ R28 - 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.

R23	R24	R25
E1 TH2R gg %	E1 TH2S gg %	E1 TH2T gg %

R26	R27	R28
E1 TH5R gg %	E1 TH5S gg %	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

R29 - R34 - 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 are displayed. The parameter vv can assume the value HI or LO.

R35 - R36 - 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 (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 resetted without the need of the programming confirmation).

S1 ÷ S10 - TRIP COUNTERS

S1	S2
Id> P cccc	Id> 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 (Id>, Id>>, Ip>, Ia> and Ib>); 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).

S11 ÷ S13 - TOTAL PROGRAMMING SESSIONS AND DATE/TIME OF THE LAST PROGRAMMING SESSION

TOT PRG eeee	DATE PRG dd/mm/yy	TIME 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

The MR version (with minirack) is suggested for 2-windings transformer protection only (without installation of AMF3N module). For all other installations the RK version must be preferred to allow an easy installation of the AMF3N module.

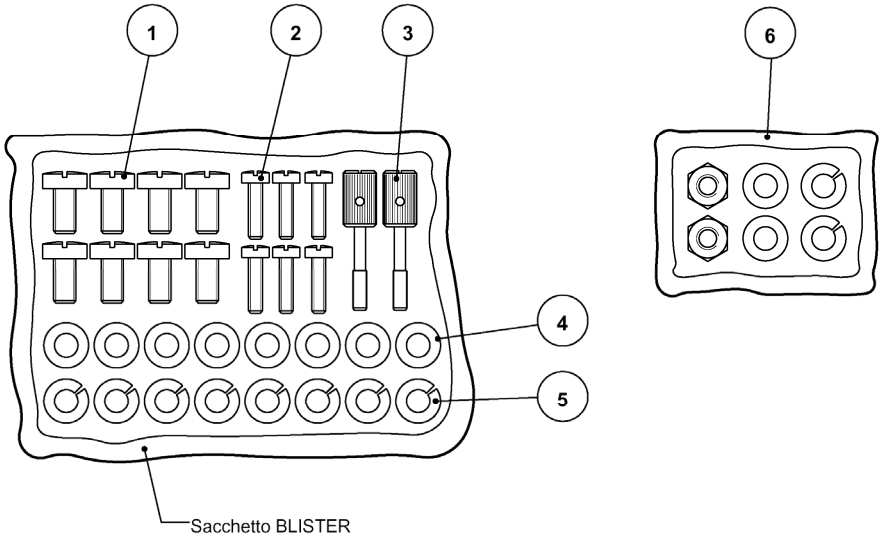
IDT8N protection relay

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

- protection relay module IDT8N with 2 rear sockets
- transparent front panel with push-buttons
- transparent front panel without push-buttons
- blister with items 1-2-3-4-5

MR VERSION - mini-rack installation

- mini-rack
- protection relay module IDT8N 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.

AMF3N module

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

- AMF3N module with 1 rear socket
- transparent front panel without push-buttons
- blister with items 1-2-3-4-5

6.2 Cabling

For the protection relay insertion please refer to figures 6, 7, and 8.

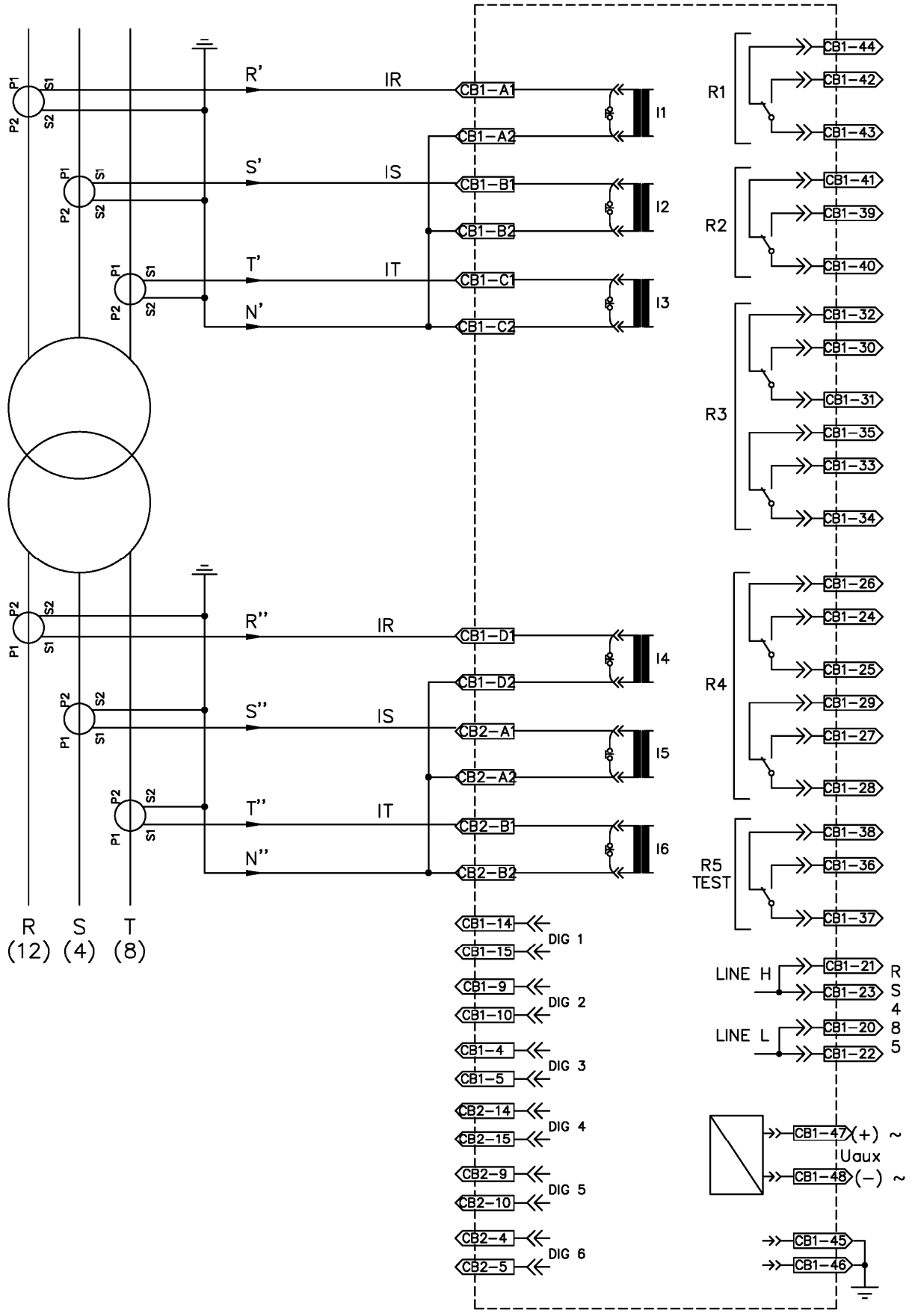
For insertion scheme related to different vectorial group, please contact SEB technical department.

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

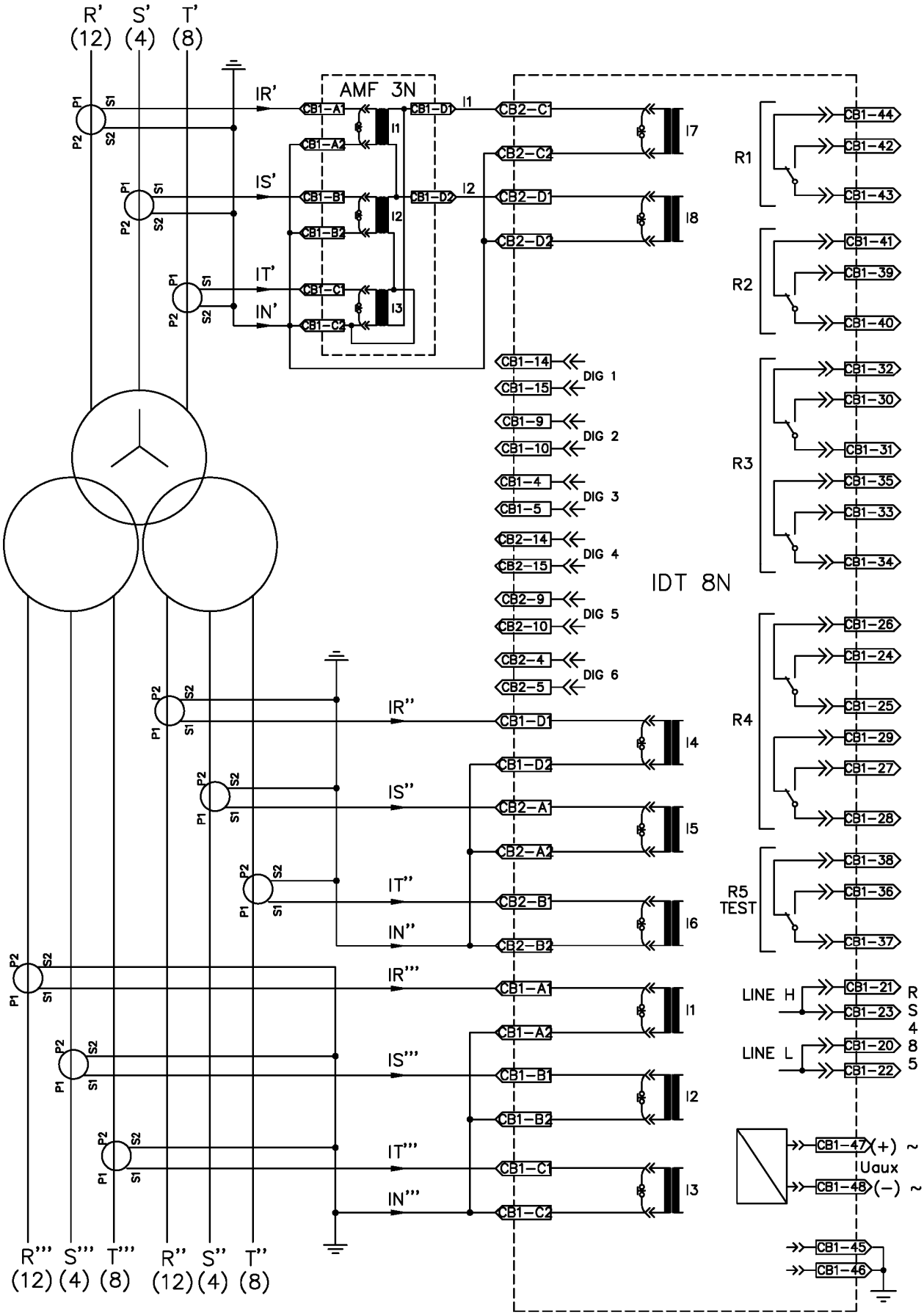
Minimum suggested wire cross section: 2,5 mm^2

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

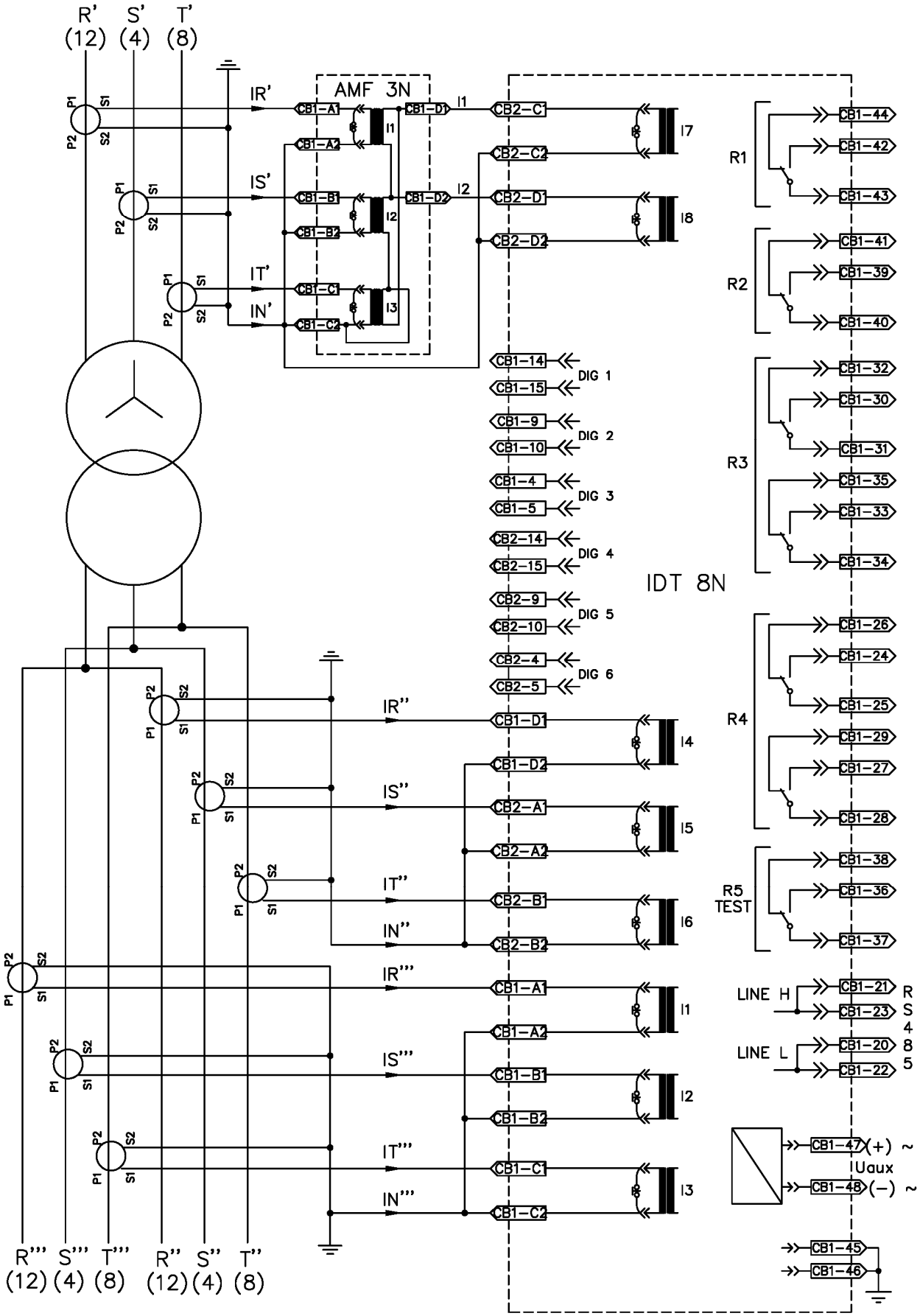
Minimum suggested wire cross section: 1,5 mm^2



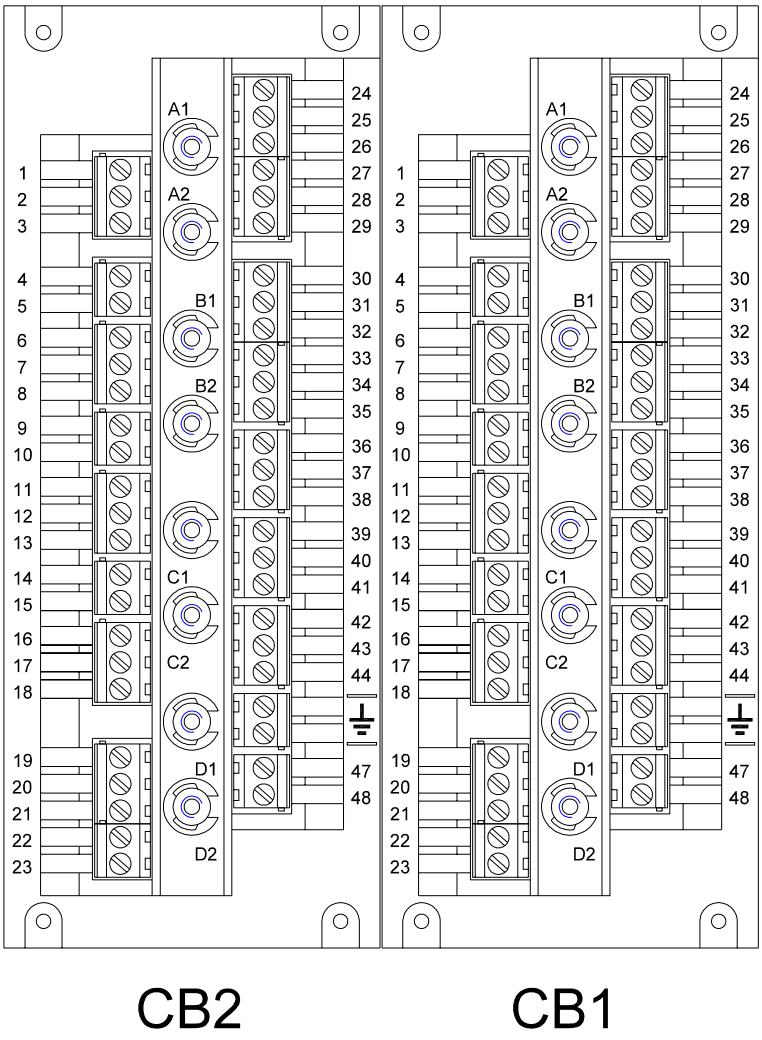
Insertion ANSI 87T - 2-WINDING TRANSFORMER - fig. 6



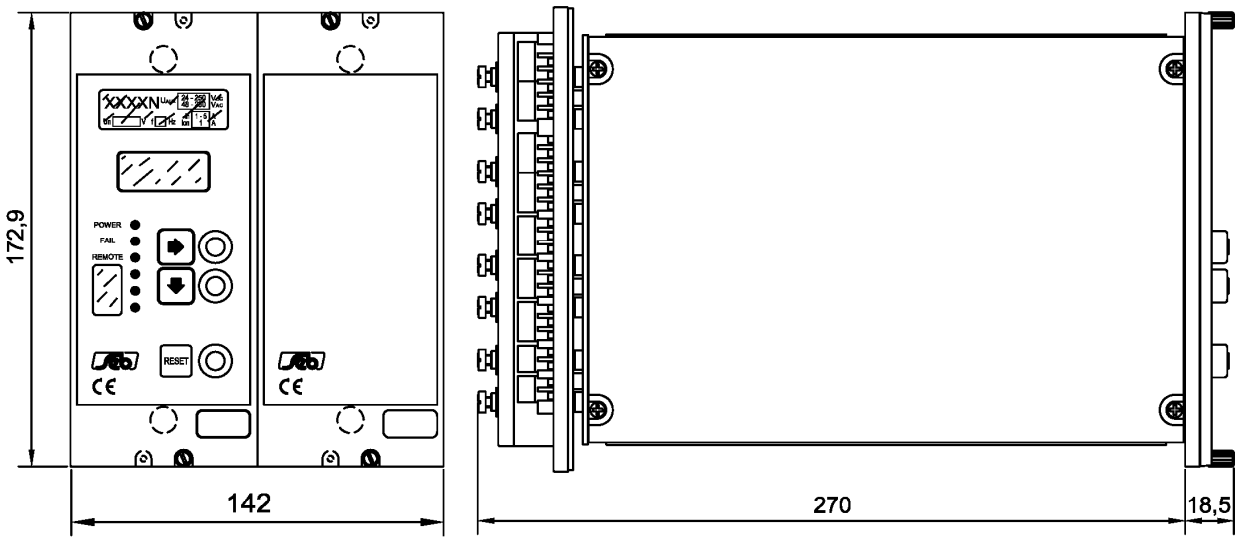
Insertion ANSI 87T - 3-WINDING TRANSFORMER - fig. 7

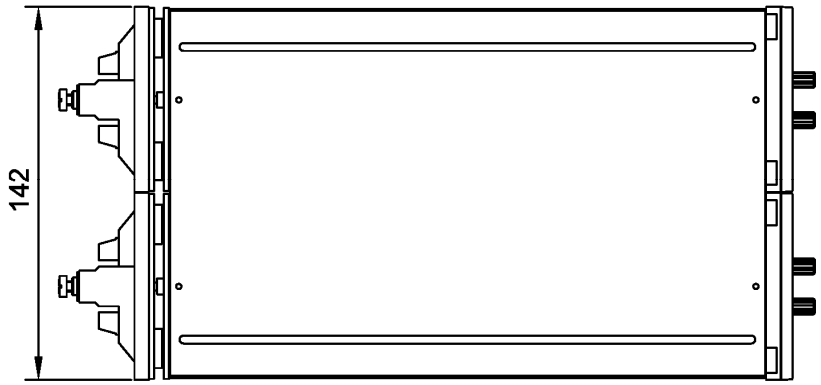


ANSI 87T - 2-WINDING TRANSFORMER 3-ENDED INSTALLATION - fig. 8

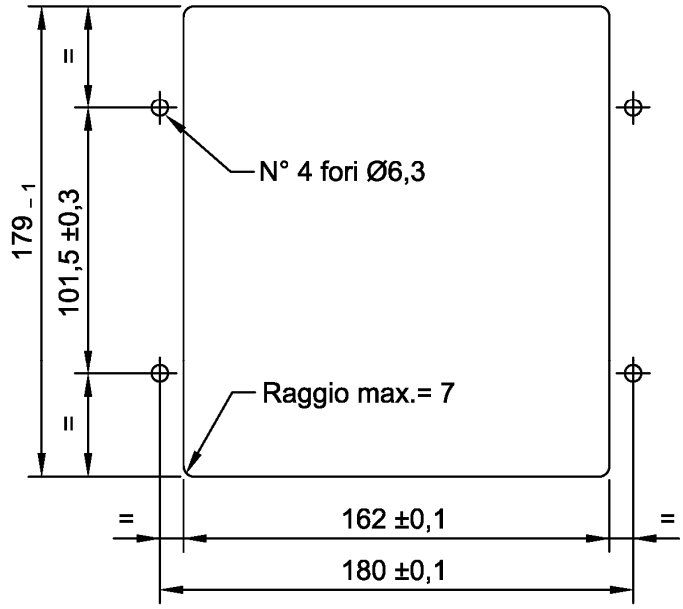


REAR VIEW - Figure 9





Dimensioni
meccaniche
Case outlines



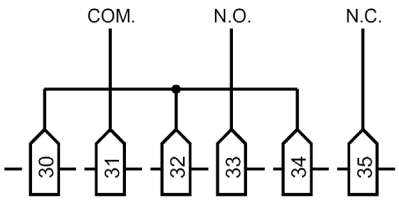
Dima montaggio da incasso
Flush mounting panel cut - out

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

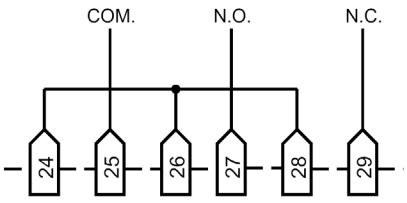
6.3 Relays R3 and R4 - Signaling / Command set-up

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

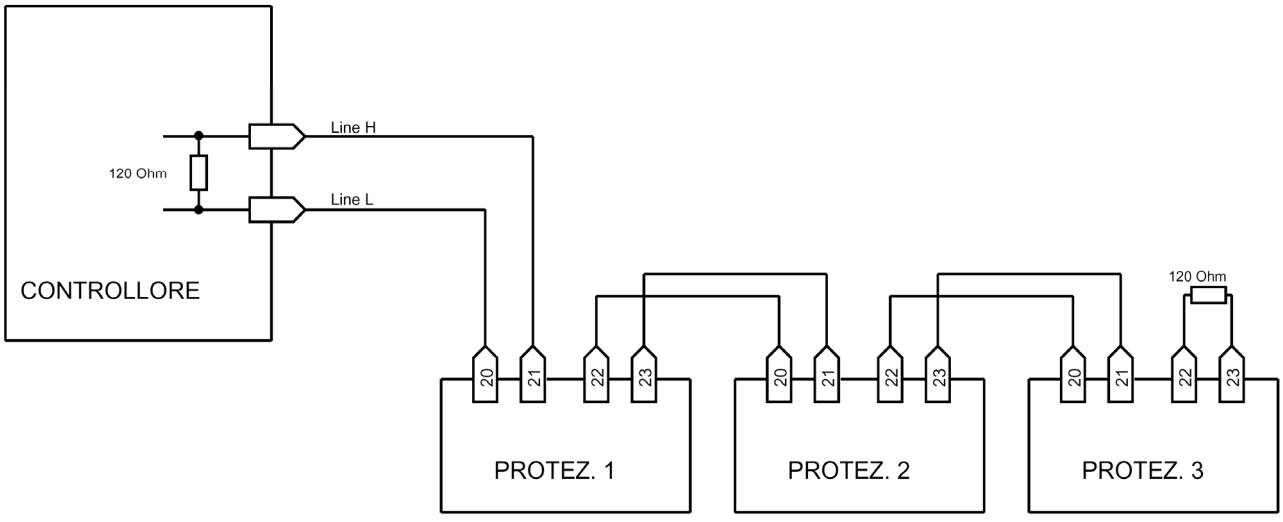
6.4 RS485 serial communication port

The digital protection relay IDG8N 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 resistance 120 Ω, 1/4 W.

7 TECHNICAL DATA

Measuring inputs

Rated phase current (In)	1 A / 5 A programmable
Thermal withstand continuously	4 In
Thermal withstand for 1 s	100 In
Rated frequency	50 / 60 Hz
Primary CT's current	1 - 18500 A

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	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
Optional	fiber 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 (mini rack)	IP 31
Weight	3.5 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 TABLE

Table D Settings

ANSI	THRESHOLDS		Setting	Resolution
87T	Ib>	Insensibility threshold	0.15 ÷ 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 ÷ 20.00 In	0.01 In
	TH2>	2nd harmonic threshold	10 ÷ 80 %	1 %
	TH5>	5th harmonic threshold	10 ÷ 80 %	1 %
50 - 51	Ia>	Overcurrent threshold - primary winding	0.10 ÷ 40.00 In	0.01 In
	Ib>	Overcurrent threshold - secondary winding	0.10 ÷ 40.00 In	0.01 In
	Ip>	Stabilizing overcurrent	0.10 ÷ 40.00 In	0.01 In
Delays			**Setting**	**Resolution**
Definite time		All thresholds 87T - 50/51	0.02 ÷ 99.99 s	0.01 s
All thresholds		Additional delay	0.00 ÷ 99.99 s	0.01 s
All thresholds		Output relay minimum activation time	0.10 ÷ 99.99 s	0.01 s

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