DIVISIONE ELETTRONICA E SISTEMI

IBF4N

DIGITAL OVERCURRENT PROTECTION RELAY FOR BREAKER FAILURE FUNCTION

USER MANUAL

P500D820 **March 2018**

INDEX

1 GENERAL CHARACTERISTICS

The protection relay IBF4N performs functions as line overcurrent protection and it is designed to be used in GENERATOR BREAKER FAILURE protection schemes.

If the generator circuit breaker (52G) does not work properly when an open command is applied, the IBF4N protection relay identifies the fault condition and send the command to open the other circuit breaker in order to isolate the busbar.

The IBF4N protection relay identifies the fault condition of the circuit breaker sensing the position of the limit switches related to the circuit breaker poles (signal FC52) or by the measurement of a persisting current flowing through one or more poles of the circuit breaker after the OPEN command.

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 IBF4N relay manages one overcurrent threshold **I>** programmable **0.1 In ÷ 5.0 In** with resolution **0.1 In**.

TIME DELAYS
A programmable time delay **TI** (**time definite only**) is available for the threshold **I>**

Is it also available a time delay **TFC** which define the maximum operating time to open the circuit breaker; the time delay **TFC** is stopped by the acquisition of the LO (low) status of the digital input DIG1 - CIRCUIT BREAKER OPEN from the limit switches related to the circuit breaker poles.

The time delays are programmable **00.02 ÷ 99.99 s**, resolution **0.01 s**.

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

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

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.

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 IBF4N OPERATIONS

The protection relay IBF4N performs functions as line overcurrent protection and it is designed to be used in BREAKER FAILURE protection schemes.

If the generator circuit breaker (52G) does not work properly when an open command is applied, the IBF4N protection relay identifies the fault condition and send the open command to other circuit breakers in order to isolate the busbar.

The IBF4N protection relay identifies the fault condition of the circuit breaker sensing the position of the limit switches related to the circuit breaker poles (signal FC52) or by the measurement of a persisting current flowing through one or more poles (TRIP threshold I>) of a circuit breaker after the OPEN command.

Status and commands acquisition
The operations of the IBF4N protection relay are enabled (START condition) from the CIRCUIT BREAKER OPEN COMMAND acquisition; the open command issue is knowledge sensing the status of two digital inputs:

DIG2 **CAP** command Circuit breaker open command as consequence of a TRIP CONDITION of protective devices

DIG3 **CAN** command Circuit breaker open command as consequence of a MANUAL COMMAND

NOTE – the **CAP** command is master on the **CAN** command.

Another digital input is used for the acquisition of the limit switches related to the position of the circuit breaker poles (**FC52**).

DIG1 circuit breaker limit switches position **FC52** (HI status - circuit breaker NOT OPEN)

The digital input acquisition is valid when the voltage value stays in the range HI or LO for at least 40 ms. The active status of the digital inputs is defined (not programmable) HI.

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

Command and signaling relays
The IBF4N controls 4 output relays (named R1, R2, R3 and R4); these relays are programmed to be activated (normally OFF) on the following conditions:

- Relay R1 - START BF START condition of the IBF4N protection
- Relay R2 - FC52> repetition of the limit switches status
- Relay R3 - TRIP CAN TRIP on breaker failure detected condition following a manual open command
- Relay R4 - TRIP CAP TRIP on breaker failure detected condition following a protection open command

The START CONDITION of the breaker failure protection function is enabled when the **HI** status is detected by the digital input DIG2 (**CAP command**) or by the digital input DIG3 (**CAN command**) and AT LEAST one of the following condition is present:

- in the circuit breaker is flowing a current higher then the **I>** threshold value
- the limit switches status corresponds to NOT COMPLETELY OPEN circuit breaker condition (the **HI** status is detected by the digital input DIG1)

The **R2** output relay repeat the status detected by the digital input **DIG1**:

- relay **ON** detected status **HI** - circuit breaker **NOT COMPLETELY OPEN**
- relay **OFF** detected status **LO** - circuit breaker **OPEN**

The **R3** and **R4** relays are activated when one of the time delays will expires; the time delays are **TI** (related to threshold **I>**) and **TFC** (time delay of the opening operation of the circuit breaker) and they are active when the START CONDITIONS are still present, therefore:

- the measured current is still higher then the **I>** threshold value after **TI** seconds
- the digital input **DIG1** status is still **HI** (NOT COMPLETELY OPEN condition detected by the limit switches) after **TFC** seconds

Time delays stars from the acquisition of **CAN** or **CAP** commands:

- digital input DIG2 status **HI** command **CAP**
- digital input DIG3 status **HI** command **CAN**

There are available total and partial counters for the TRIP conditions related to each threshold (**I>** and **FC52** - circuit breaker NOT COMPLETELY OPEN condition)

OPEN COMMAND FROM PROTECTION RELAY TRIP (CAP signal)
The open command to the circuit breaker following a protection trip (digital input **DIG2** - status **HI**) activates the IBF4N protection relay to detect the current that is flowing through the circuit breaker poles and to detect the status of limit switches related to them (digital input **DIG1** - signal **FC52**).

If the flowing is current greater than the programmed threshold **I>** (poles still closed or presence of electric arc) or the non-open condition of the circuit breaker poles is detected,

the IBF4N will start the time delays **TFC** (related to limit switches) and **TI** (related to threshold **I>**)

If one of the two conditions is still present when ONE of the time delay expires (time delay **TI** for the condition of the measured flowing current greater than **I>** or time delay **TFC** for the condition of circuit breaker NOT COMPLETELY OPEN or undetected COMPLETELY OPEN condition) the IBF4N relay trips the final output relay **R4** to issue the open command to the busbar circuit breakers in order to isolate the faulty circuit breaker.

If before the end of the programmed time delay **TI** ALL the currents measured by the IBF4N relay become lower than the programmed threshold **I>** and before the end of the programmed time delay **TFC** the limit switches signal the fully open condition of the circuit breaker poles, the IBF4N relay will drops-off without command the **R4** output relay.

MANUAL OPEN COMMAND (CAN signal)
The manual open command to the circuit breaker (digital input **DIG3** - status **HI**) activates the IBF4N protection relay to detect the current that is flowing through the circuit breaker poles and to detect the status of limit switches related to them (digital input **DIG1** - signal **FC52**).

The IBF4N operates as for Open Command From Protection Relay Trip, but it trips the final output relay **R3** instead of **R4**; the **R3** output relay can be used to signal the breaker failure condition to the operator and the operator will decide the following actions (open command to bus-bars circuit breakers etc.).

REPETITION OF THE LIMIT SWITCHES STATUS (R2 relay)
The R2 relay repeat the status of the limit switches of the circuit breaker as following:

- DIG1 HI circuit breaker NOT OPEN R2 trip (ON)
- DIG1 LO circuit breaker OPEN R2 drop-off (OFF)

2 FRONT PANEL KEYS

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

right arrow

down arrow

programming session activation or parameter confirmation

change or increment of the selected parameter

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

VISUALIZATION OF PARAMETERS

- all visualizations are circular and they can be displayed using the two arrow push-buttons.
- the structure of the visualizations and their contents are showed in Figures 1, 2 and 3.
- when the sealable transparent front panel is installed only the arrow push-buttons and the RESET push-button are accessible to prevent unauthorized modification of the protection set-up.

MODIFICATION OF PARAMETERS

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

3 FRONT PANEL LED SIGNALING

POWER (green) ⊕ auxiliary supply available

FAIL (red) ⊕ fault condition detected by SELF-DIAGNOSIS software

REMOTE (red) ⊕ communication session active on RS485 port

TRIP I> (red) ⊕ trip condition on I> threshold (following command CAP or CAN)

TRIP CAP (red) ⊕ trip for breaker failure condition detected after CAP command

TRIP CAN (red) ⊕ trip for breaker failure condition detected after CAN command

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 and 3 at the following references:

B2 ÷ B6	relay address (RS485) and date/time
C1	relay insertion
D1 ÷ D3	nominal values, contrast etc
E1 ÷ E4	thresholds and time delays
R1 ÷ R4	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. H1) within 5 minutes depressing the push-buttons 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).

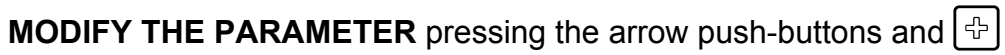
4.2 How to modify a visualized parameter

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 A) when the push-button [ENTER] is pressed for few seconds an error message will be displayed as:

```
Data
Error
```

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

4.3 Reset

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

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

4.4 Test of output relays

When the output relays test is selected (Fig. 2, ref. F3) 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 and 3; the references A1, B1, B2 etc. identify specific displayed messages in the figures.

5.1 Standard display

A1 - STANDARD DISPLAY

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

The displayed information is function of the protection relay status.

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
BF
```

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

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

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

```
FAIL
HARDWARE
```

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

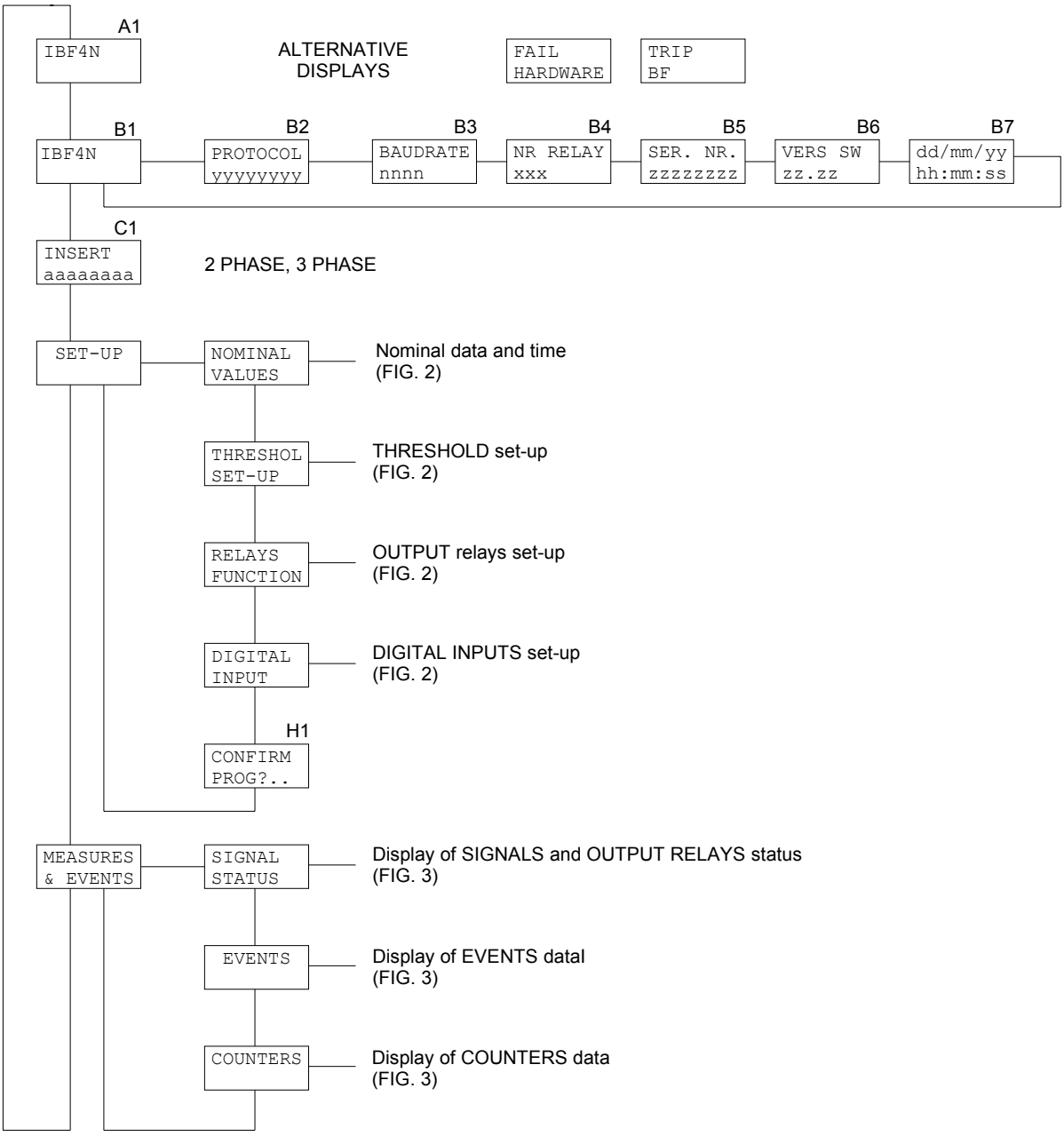


Figure 1

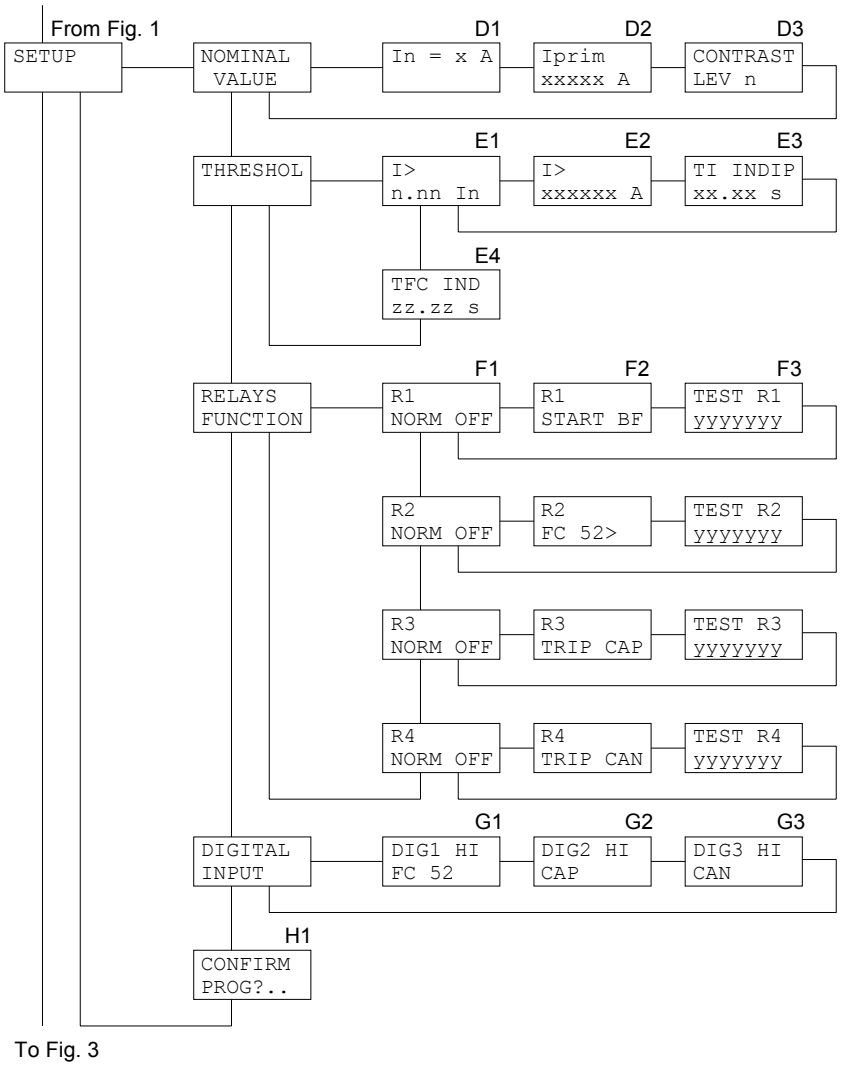

From Fig. 1
SETUP
NOMINAL VALUE
D1
In = x A
D2
Iprim xxxxx A
D3
CONTRAST LEV n
THRESHOL
E1
I> n.nn In
E2
I> xxxxxx A
E3
TI INDIP xx.xx s
E4
TFC IND zz.zz s
RELAYS FUNCTION
F1
R1 NORM OFF
F2
R1 START BF
F3
TEST R1 yyyyyyy
R2 NORM OFF
R2 FC 52>
TEST R2 yyyyyyy
R3 NORM OFF
R3 TRIP CAP
TEST R3 yyyyyyy
R4 NORM OFF
R4 TRIP CAN
TEST R4 yyyyyyy
DIGITAL INPUT
G1
DIG1 HI FC 52
G2
DIG2 HI CAP
G3
DIG3 HI CAN
H1
CONFIRM PROG?..
To Fig. 3

Figure 2

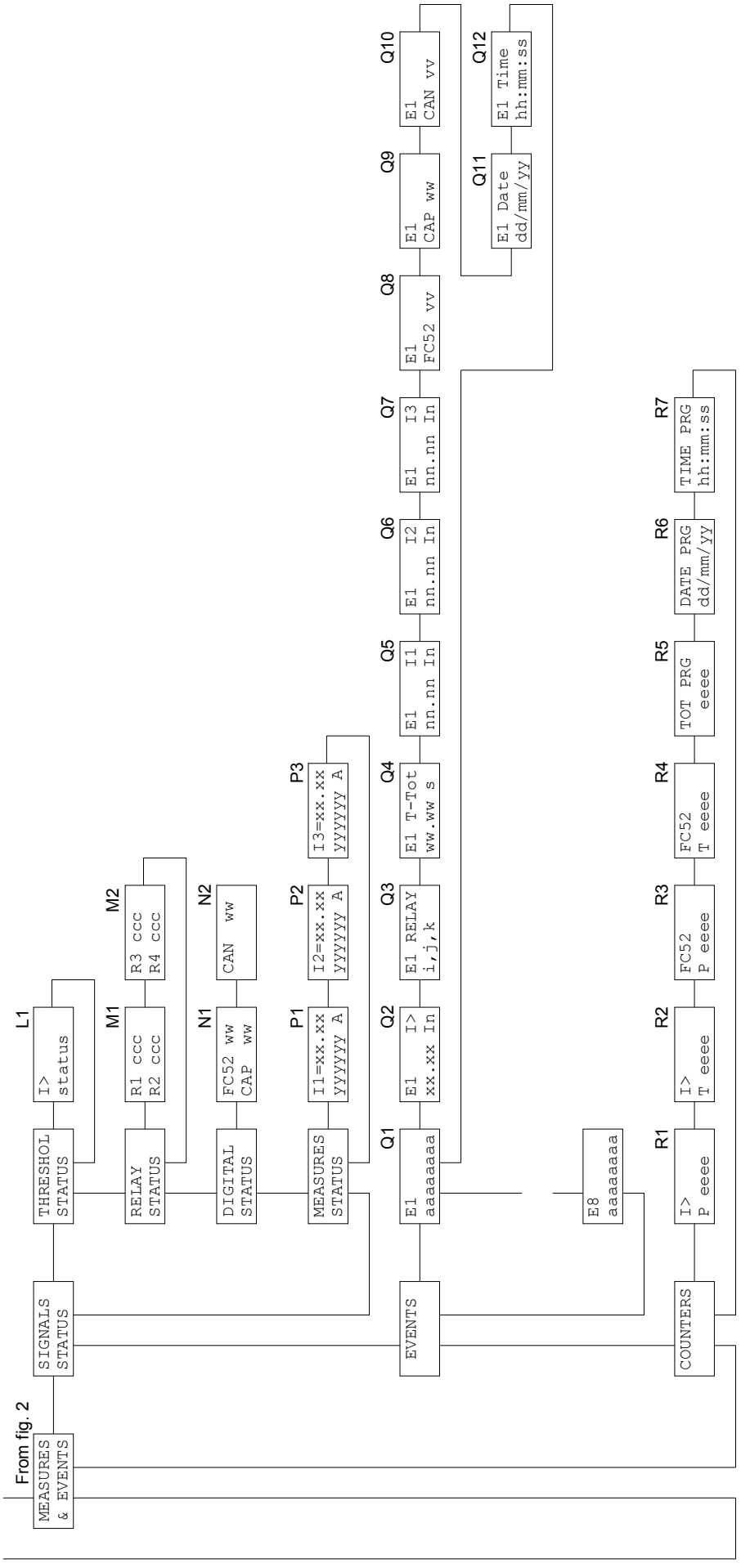

From fig. 2
MEASURES & EVENTS
SIGNALS STATUS
THRESHOL STATUS
L1
I> status
RELAY STATUS
M1
R1 ccc R2 ccc
M2
R3 ccc R4 ccc
DIGITAL STATUS
N1
FC52 ww CAP ww
N2
CAN ww
MEASURES STATUS
P1
I1=xx.xx yyyyyy A
P2
I2=xx.xx yyyyyy A
P3
I3=xx.xx yyyyyy A
EVENTS
Q1
E1 aaaaaaaa
Q2
E1 I> xx.xx In
Q3
E1 RELAY i,j,k
Q4
E1 T-Tot ww.ww s
Q5
E1 I1 nn.nn In
Q6
E1 I2 nn.nn In
Q7
E1 I3 nn.nn In
Q8
E1 FC52 vv
Q9
E1 CAP ww
Q10
E1 CAN vv
Q11
E1 Date dd/mm/yy
Q12
E1 Time hh:mm:ss
E8 aaaaaaaa
COUNTERS
R1
I> P eeee
R2
I> T eeee
R3
FC52 P eeee
R4
FC52 T eeee
R5
TOT PRG eeee
R6
DATE PRG dd/mm/yy
R7
TIME PRG hh:mm:ss

Figure 3

5.3 Address and time (fig. 1)

B1 - RELAY MODEL (not programmable)

```
IBF4N
```

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 Protection insertion selection (fig. 1)

C1 - INSERTION SELECTION (programmable)

```
INSERT
xxxxxxxx
```

The parameter xxxxxxxx is selectable between:

- **2 PHASE** 2 phase insertion (two currents measured)
- **3 PHASE** 3 phase insertion (three currents measured)

Examples:

```
INSERT
3 PHASE
```

```
INSERT
2 PHASE
```

5.5 Nominal values set-up (fig. 2)

D1 - NOMINAL CURRENT SELECTION (programmable)

```
In = jA
```

In nominal phase current programmable 1 or 5 A

D2 PRIMARY PHASE CURRENT (programmable)

```
In prim
xxxxx A
```

In prim primary current of the installed phase CT

The primary current values of the installed phase CT' s are programmable from 0001 to 18500 A.

D3 - DISPLAY CONTRAST LEVEL (programmable)

```
CONTRAST
LEV x
```

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

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

E1 - THRESHOLD LEVEL SET-UP (programmable)

```
I>
n.nn In
```

n.nn threshold level expressed in terms of relative values programmable **0.10 In** to **5.00 In**, resolution **0.01 In**

Examples:

```
I>
1.50 In
```

```
I>
0.80 In
```

E2 - THRESHOLD LEVEL IN PRIMARY VALUES (not programmable)

```
I>
xxxxx A
```

The programmed threshold (ref. E1) is shown in terms of primary current; the value depends on the programmed CT's primary values (ref. D2 – paragraph 5.5).

I> threshold identification
xxxxx: threshold level expressed in amperes (primary values)

E3 - THRESHOLD I>, 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.

The time delays is programmable from 0.02 s to 99.99 s, resolution 0.01 s.

E4 - CIRCUIT BREAKER OPENING TIME (programmable)

```
TFC IND
xx.xx s
```

Set-up of the time delay related to the opening time of the circuit breaker from the manual open command or from the protection trip open command.

The time delay is stopped when the digital input **DIG1** status is equal to LO (circuit breaker completely opened).

The time delays is programmable from **0.02 s** to **99.99 s**, resolution **0.01 s.**

5.7 Output relays functions (fig. 2)

NOTE- ALL output relays functions are pre-definite, NON PROGRAMMABLE.

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

F1 - OUTPUT RELAY R1 QUIESCENT STATUS (NON programmable)

```
R1
NORM OFF
```

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

F2 - OUTPUT RELAY FUNCTION (NON programmable)

```
R1
xxxxxxxx
```

It shows the trip condition on which the output relays will operate; the parameter xxxxxxxx will be:

- Relay R1 - START BF START condition of the IBF4N protection
- Relay R2 - FC52> repetition of the limit switches status
- Relay R3 - TRIP CAN TRIP on breaker failure detected condition following a manual open command
- Relay R4 - TRIP CAP TRIP on breaker failure detected condition following a protection open command

F3 - TEST OF OUTPUT RELAY R1

```
TEST R1
xxxxxxxx
```

See paragraph 4.4

5.8 Digital inputs functions (fig. 2)

NOTE- ALL digital inputs functions are pre-definite, NON PROGRAMMABLE.

DIG1 circuit breaker limit switches position sensing - signal **FC52** (**H**I status - circuit breaker NOT OPEN)

DIG2 functional activation of the **IBF4N** protection following a circuit breaker open command (**CAP** command) as consequence of a TRIP CONDITION of protective devices (HI status active)

DIG3 functional activation of the **IBF4N** protection following a circuit breaker open command (**CAN** command) as consequence of a MANUAL OPEN COMMAND (**HI** status active)

G1	G2	G3
DIG1 HI FC 52	DIG2 HI CAP	DIG3 HI CAN

5.9 Parameter values visualization (fig. 3)

L1 - THRESHOLD STATUS

The actual status of the I> threshold is displayed; the threshold status can show one of the following values:

ON	active threshold
OFF_DIG	threshold programmed active but momentary disabled by a digital input actual status (ref. DIG2 or DIG3 to paragraph 5.8).

Examples:

I> ON	I> OFF_DIG

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)

N1 - N2 - DIGITAL INPUT STATUS

The actual status of each digital input is displayed.

For each digital input the following information is presented:

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

N1	N2
FC52 HI CAP LO	CAN LO

P1 - P2 - P3 - MEASUREMENT DISPLAY

The actual value of the measured currents is displayed; only the measured currents (depending on FUNCTION SELECTION - ref. C1, paragraph 5.4) are displayed.

For each current the following information is displayed:

- current identification (I1, I2, I3)
- actual value expressed as In
- actual primary value expressed as amperes

Example:

P1	P2	P3
I1= 0.50 500 A	I2= 0.50 500 A	I3= 0.50 500 A

5.10 Events (fig. 3)

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

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

Q1 - EVENT NUMBER

```
E1
cccccccc
```

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

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

NONE	no event memorized
FC52	event on trip cause FC52
I>	event on trip threshold I>
POWER ON	switch-on of the protection relay (auxiliary power)

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

Q2 - TRIP THRESHOLD

```
E1 I>
x.xx In
```

It shows the threshold I> related to the TRIP condition of the protection relay and the value of the threshold (in relative terms). The information is not shown on STATUS or POWER ON events.

Q3 - ACTIVATED OUTPUT RELAYS

```
E1 RELAY
nnnnnnn
```

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

Examples:

```
E1 RELAY
3
```

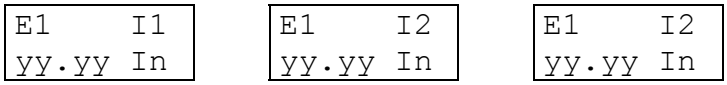
```
E3 RELAY
4
```

Q4 - TOTAL TIME DELAY ON TRIP

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

It is shown the total delay to the TRIP of the output relays from protection relay IBF4N start condition (see paragraph 1.1).

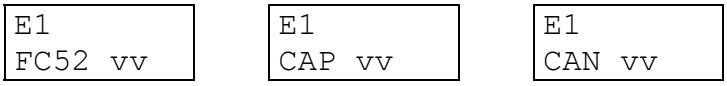
Q5 - Q6 - Q7 - MEMORIZED MEASURED CURRENTS ON EVENT



The values of the measured currents at the event are displayed; the values are expressed as **In** terms.

There are presented only the currents measured coherently with the selection on FUNCTION SELECTION set-up (ref. C1 – paragraph 5.4).

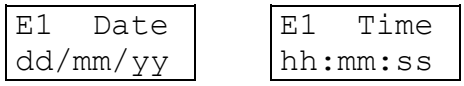
Q8 - Q9 - Q10 - DIGITAL INPUTS STATUS ON EVENT



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

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

Q11 - Q12 - DATE AND TIME OF THE EVENT



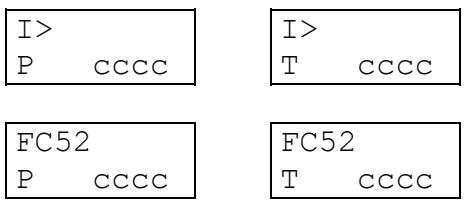
The date and time of the event are showed

5.11 Trip counters

In this section are displayed the total and partial counters of the output relay activation (on TRIP conditions) for the thresholds of the protection relay 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.

R1 ÷ R4 - TRIP COUNTERS



Display of the partial (P) and total (T) counters of the TRIP condition related to the **I>** threshold or **FC52** function.

The trip related to the **I>** threshold are the trips after the **TI** time delay (measured flowing current still higher than the threshold **I>** after the programmed **TI** time delay), whilst the trips related to the threshold **FC52** are the trips after the **TFC** time delay (circuit breaker not completely open after the programmed **TFC** time delay).

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

R5 ÷ R7 - TOTAL PROGRAMMING SESSIONS AND DATE/TIME OF THE LAST PROGRAMMING SESSION

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

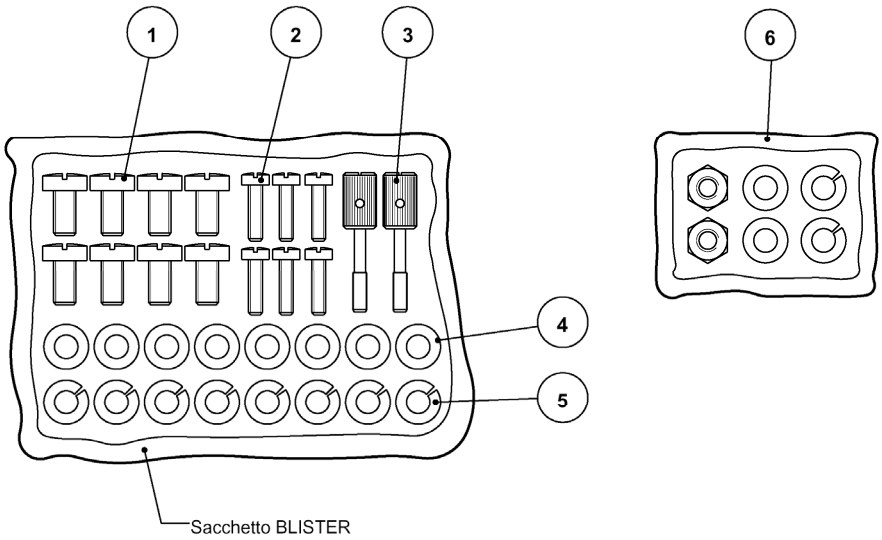
Display of the number of confirmed programming sessions (from the factory set-up) and the date and time of the last confirmed programming session.

6 INSTALLATION

6.1 Supplied kit

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

- protection relay module IBF4N with rear socket
- transparent front panel for rack installation
- 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 (or on the two brackets for flush mounting) n° 2 screws to fix (optionally) the protection relay on the front of the 19" rack
3) n° 2 knobs to fix the transparent front panel
4) n° 8 washers to be used to fix wire terminals (current)
5) n° 8 growers to be used to fix wire terminals (current)
6) small items to fix brackets on the cabinet (only CS version - not supplied)

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

Current circuits

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

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

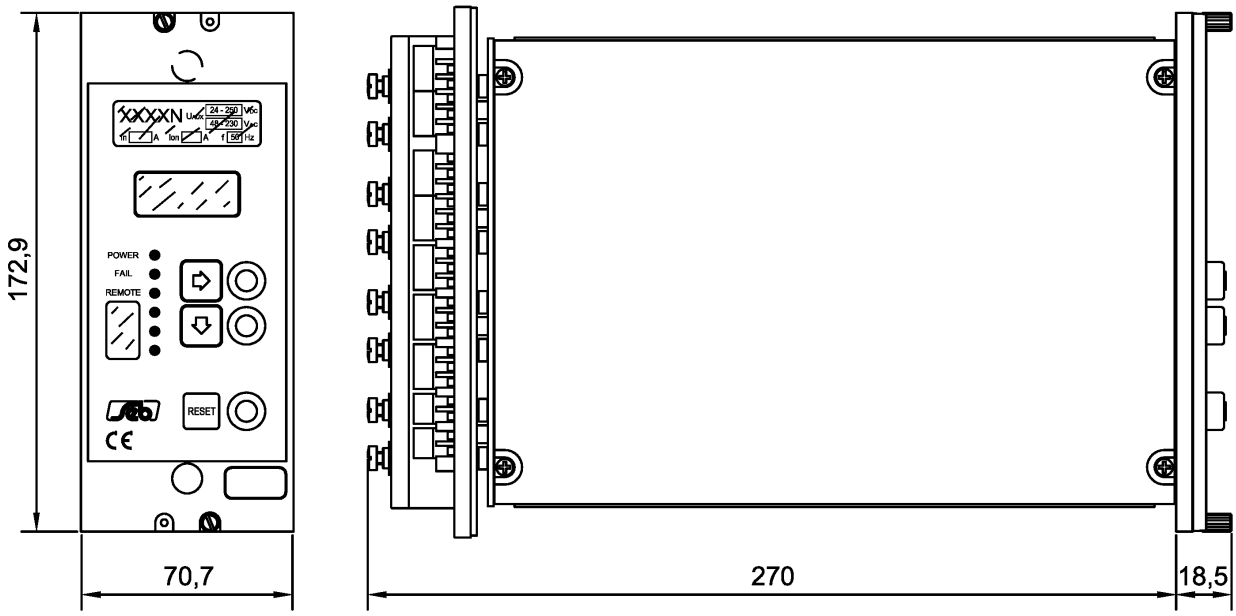
With reference to the insertion diagram in the next page, the currents measured by the protection relay have the following matching:

I1	terminals A1 - A2
I2	terminals B1 - B2
I3	terminals C1 - C2

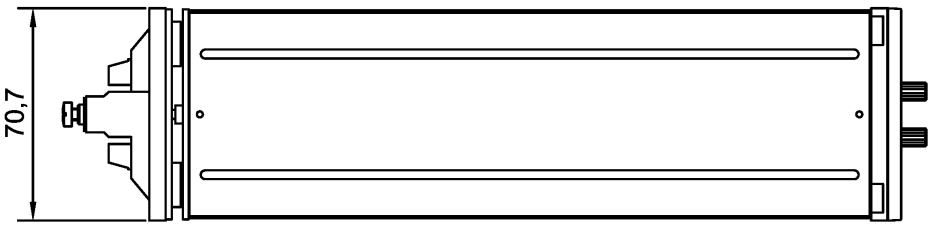
Other circuits (output relays etc.)

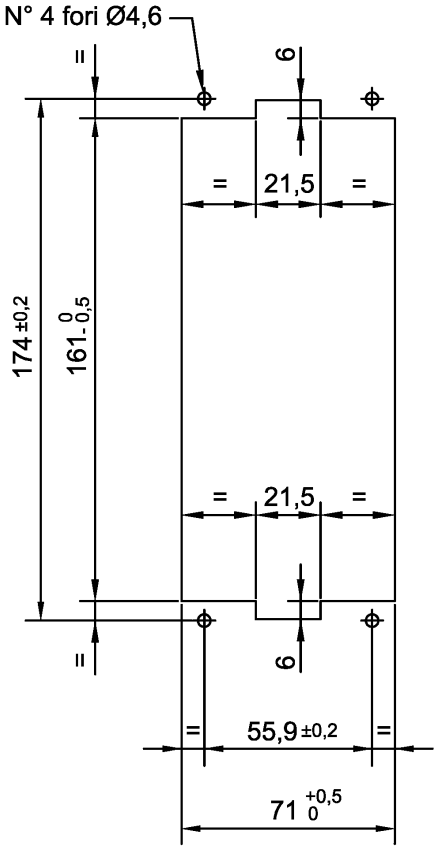
It is suggested to terminate the current wiring using plug terminals.

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



Dimensioni meccaniche
Case outlines





Dima montaggio da incasso
Flush mounting panel cut - out

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

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

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

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

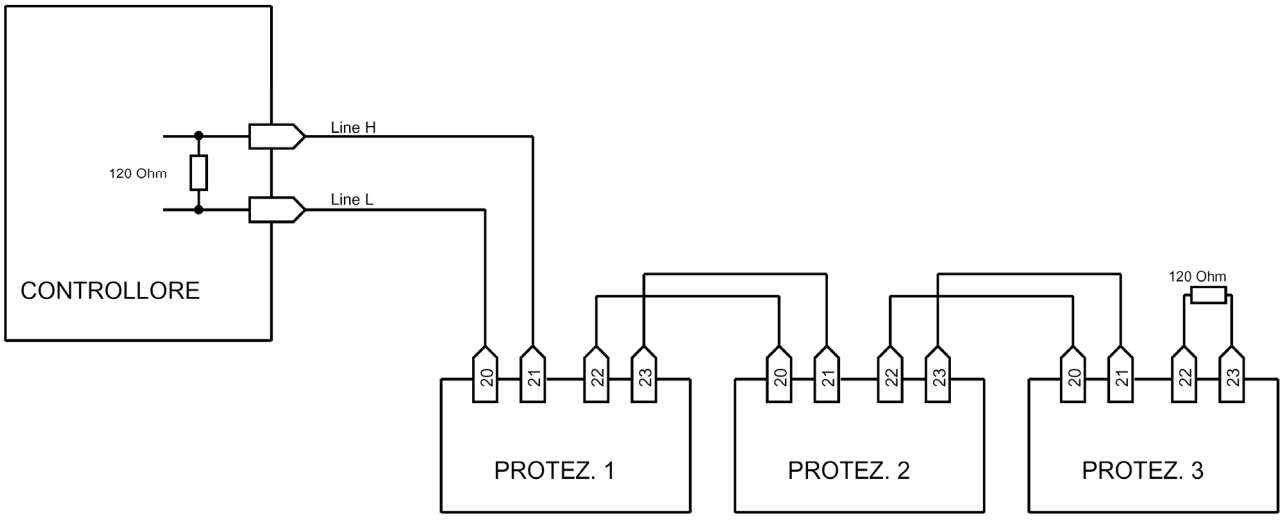
6.4 RS485 serial communication port

The digital protection relay IBF4N 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, par. 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	3
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	fibre optic module
Auxiliary supply	
Range	24 ÷ 320 Vdc ± 20% 48 ÷ 230 Vac ± 20%
Frequency (Vac)	47 ÷ 63 Hz
Burdens (min/max)	5 / 10 W
Environmental conditions	
Operation	- 10 / +60 °C
Transport and storage	- 25 / +80 °C
Relative humidity (without condensation)	< 95%
Protection degree for flush mounting (optional)	IP 52 (IP 54)
Weight	2.5 kg

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

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