ORION ITALIA

INSTRUCTION MANUAL

IPR96D

Ground protection relay

Software version 1.21

CE

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SAFETY STANDARDS AND GENERAL WARNINGS

	For a proper installation of the unit the technicians must read carefully and understand the instructions provided by the Constructor. All the installation operations must be carried out by suitably qualified technicians with adequate knowledge of the unit and of the content of this manual.

1. Check that the installation room (spaces, segregations and ambient) are suitable for the electrical and electronic apparatus and in particular that:
   - the room conditions are in compliance with the information contained in SPECIFICATION;
   - the rating of the unit (voltages, frequencies, and so on) are coherent with the features of the electric system.

2. Make sure that the Standard and Legal requirements are followed during installation, service and maintenance, in order to construct installations according to good technical and safety working practices.

	The unit must be used EXCLUSIVELY for the purposes described in the Chapter GENERAL INFORMATION.
	High-voltage live parts; disconnect the unit before carrying out any insulation tests on the installation.
	Do not carry out any installation/maintenance operations requiring the disassembling and the removal of the unit from the panel on which it is mounted when the unit is live: make sure it has been disconnected.

For any requests, please contact:
ORION ITALIA ASSISTANCE SERVICE

WEB: www.orionitalia.com

SYMBOLS IN THE TEXT AND THEIR MEANINGS

	It indicates an OBLIGATION, an operation that must be obligatory. Pay attention to the information signalled by this symbol, as it refers to situations which require CAUTION AND WARNING: any operations not in compliance with what is indicated could provoke damages to objects or people.
	Pay particular ATTENTION to the parts indicated by this symbol: they are live.
	It indicates a DANGER, a situation or operation requiring the MAXIMUM ATTENTION: any actions not in compliance with what is indicated could provoke really serious damages to objects and even mortal injuries to people.
	It indicates INFORMATION or REMARKS that must be read with particular attention.

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1. General Information

1.1 DESCRIPTION

Ground Protection Relay (IPR96D) has been designed to measure the ground RMS current under normal conditions or under disturbances.
The current signals are sensed throughout a current transformer (CT). This information is internally processed by the microprocessor in order to take the current protection actions defined under ANSI, IAC or IEC standard.

1.2 APPLICATIONS

- Primary and backup protection for utility feeder, power plants and industrial distribution systems

1.3 DIGITAL MEASUREMENT

- Ground RMS Currents

1.4 FEATURES

- CT rated primary selectable in 5 A steps (5 A to 5000 A)
- Ground RMS current measurement
- 1 trip relay and 2 programmable auxiliary relay
- Control power drop or internal fault relay
- Breaker operation & trip failure
- Digital input functions:
  - remote TRIP
  - remote RESET
  - remote Aux Relay activation
  - breaker Status

1.5 COMMUNICATION

- Communication port RS485
- Remote programming of the setpoints
- Communication Protocol: Modbus RTU

1.6 SIGNALLING AND PROGRAMMING

- LED and LCD display indication
- Ground current indication
- Indication and storage through a Pop-Up function, of fault conditions and their values
- Available leds:

Led	Description	Duty Cycle
Status (keep alive)	-It indicates that the device is switched on and the self-diagnosis has not encountered any problems. -When it blinks, it indicates an error in setpoint discrepancy, flash memory, RAM memory, ADC or Bluetooth BLE.	OFF = 3s ON = 0.1s OFF = 0.3s ON = 0.3s
Trip	-The protection function has activated the TRIP relay. -A breaker failure has occurred. A protection has activated the TRIP relay, but the breaker did not interrupt the circuit.	ON = fixed OFF = 0.3s ON = 0.3s
Reclose	*Optional. Available depending on model type.	

In case of setpoint discrepancy, check *[Troubleshooting]*.

1.7 PROTECTIONS AND FUNCTIONALITIES

- (50G/50N) Instantaneous ground overcurrent
- (51.1G/51.1N) Ground timed overcurrent
- (51.2G/51.2N) Ground timed overcurrent
- ANSI, IAC or IEC/BS142 curves included:
  - moderately inverse
  - normal inverse
  - very inverse
  - extremely inverse
  - definite time

1.8 SPECIFICATIONS

SUPPLY VOLTAGE
Options: *(See Section 1.9 Order Code)*
Model A: 120/230 Vac, -15%, +10%, 50/60 Hz
Model W: 85V (115V) ÷ 264V (300V) Vac (Vdc)
Model B: 24Vdc -15%, +10%,
Model C: 48Vdc -15%, +10%

TEMPERATURE
Operational: 0°C ÷ +50°C
Storage temperature: -20°C ÷ +70 °C

ELECTRICAL INSULATION CONSTRUCTION
OverVoltage category: III
Pollution degree: 2
Altitude: 2000m (AMSL)

GROUND CT INPUT
CT Rated Primary Current (I_{Pn}) 5A to 5000A, Steps: 5
CT Rated Secondary Current (I_{sn}) 1A and 5A
Sampling: True RMS, 32 sample/s
CT burden: 0.25 VA (5A input)
0.1 VA (1A input)
Continuous Current: 2xI_{sn}
Current withstand capac.: 30 times I_{sn} for 1 sec.
Accuracy: at <= I_{sn} → ±0.5% x I_{sn}
at > I_{sn} → ±0.5% of 20x I_{sn}

INSTANTANEOUS GROUND OVERCURRENT (50 N/G)
Pickup Level: 1% to 2000% of CT, Steps: 1% / 10%
Delay Time: 0 to 2000 ms, Steps: 10 ms
Accuracy Pickup: ±1% CT
Time +40 ms max

GROUND TIME OVERCURRENT (51.1 N/G)
Pickup Level: 1% to 300% of CT, Steps: 1%
Time Multiplier: 0.1 to 20.0 for each curve
Accuracy Pickup: ±1% CT
Time ±3% of trip time or 20 ms
Delay time: 0.5s → 600s,
Steps: 0.1s (from 0.5s to 10s); 1s (from 10s to 600s)

GROUND TIME OVERCURRENT (51.2 N/G)
Pickup Level: 1% to 300% of CT, Steps: 1%
Time Multiplier: 0.1 to 20.0 for each curve
Accuracy Pickup: ±1% CT
Time ±3% of trip time or 20 ms
Delay time: 0.5s → 600s,
Steps: 0.1s (from 0.5s to 10s); 1s (from 10s to 600s)

MAX. POWER CONSUMPTION
6 VA (4 W)

RELATIVE HUMIDITY
Max. 90% (non-condensing)

BURN IN
48 hours at 50 °C

DIELECTRIC WITHSTAND VOLTAGE
2 kVac, 60s from all circuits and enclosure
2 kVac, 60s between HLV and LV circuit

DIGITAL INPUT
(2) dry contacts
Max connection lengths: 3mt
Rated Voltage: 5 Vdc internally powered

OUTPUT CONTACT
(1) trip relay and (2) programmable auxiliary relays
Rated load: 8A@ 240Vac Resistive
8A@ 24Vdc Resistive (0,2 A @125 Vdc)
Max Switching Voltage: 250 Vac / 150 Vdc
Max Continuous Current: 5 A

MECHANICAL
Back connection, section 2,5 mm² or 14 AWG
Frame: Noryl auto-extinguish
IP40 Front (up to IP54 front, on request)
Dimension: 96 x 96 x 113 mm.
Front panel cutout: 92 x 92 mm
Weight: 500 gr.

COMMUNICATION
RS-485 serial port
Protocol: Modbus RTU-Slave
Insulation: 1,5 kVdc
Bluetooth: 4.2

STANDARDS
Low voltage directive: IEC 60255-27, IEC 60255-5
EMC directive: IEC 60255-26

FIRMWARE UPGRADE
via RS-485 Serial Port
OTA via Bluetooth (Future option)

*Depending on IPR96D version

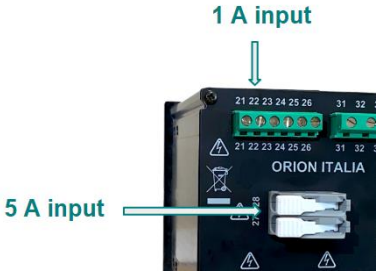
The term CT is intended as the abbreviation of CT Rated Current; meaning I_{Pn} for the primary CT or I_{Sn} for the secondary CT.

1.9 ORDER CODE

IPR96D X Y

Where X stands for MODEL:
1: Standard version (Secondary CT 1A/5A)
X: Special version

Where Y stands for POWER SUPPLY:
A: 120/230 Vac
W: 85÷240 Vac/dc
B: 24 Vdc
C: 48 Vdc



2. Installation

2.1 DESCRIPTION

The label of the relay details the following information:

ORION ITALIA
TEL: 0523 591161
FAX: 0523 593898
www.orionitalia.com
MADE IN ITALY
POWER SUPPLY
GROUND CURRENT INPUTS RATINGS
MODEL: IPR96D
SERIAL No.

2.2 UNPACKING

The shipping container includes:

- the IPR96D Relay
- this instruction manual
- the fixing elements
- the Test Report (if required)

Inspect the unit and inform ORION ITALIA of any damage.
If reshipment is required, the original container and packing should be used.

2.3 MOUNTING

The mounting should be carried out as follows:

1. Install the relay in a place where the humidity and temperature are those for which it has been designed *[General Information: 1.8 SPECIFICATIONS]* and away from high current conductors and sources of strong magnetic fields.
2. Put the relay on a panel so that the keypad is easily accessible, and the display is visible.
3. Make a cutout in the panelboard *[Figure 2.1]* and fix the relay by using the fixing elements provided.

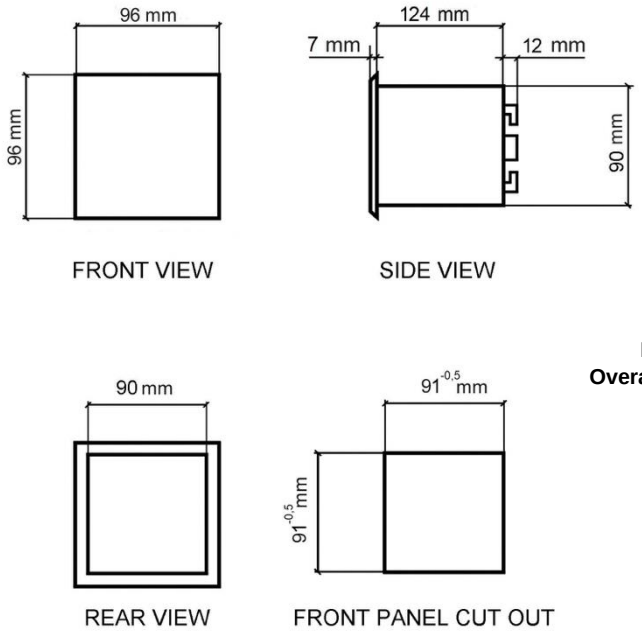


Figure 2.1
Overall dimensions

2.4 WIRING

The electrical connections are made by terminal blocks on the back side of the unit.

CONNECTIONS	TERMINALS No.
Power Supply	**1-2-3**
Relays: **AUX2** **AUX1** **TRIP**	 **10-11-12** **13-14** **15-16**
Digital Inputs: **Com** **DI_1** **DI_2**	 **41** **42** **43**
Current Inputs	**In= 1A: 21-22** **In= 5A: 27-28**
RS485 communication port	**90-91**

Figure 2.2

	Before carrying out the installation of the unit, it is necessary to read and understand the indications provided by the Constructor. All the installation operations must be carried out by qualified personnel with adequate knowledge of the functioning of the unit and of the content of this manual.
	The control power, current/voltage input and output contacts must be connected according to the supply voltage connection diagram included in the present manual. Ensure applied currents/voltages abide by the IPR96D ratings indicated on the relay label.
	Orion Italia suggests that the maximum length of the digital input connections must be under 3mt. Further information: → 1.8 Specifications

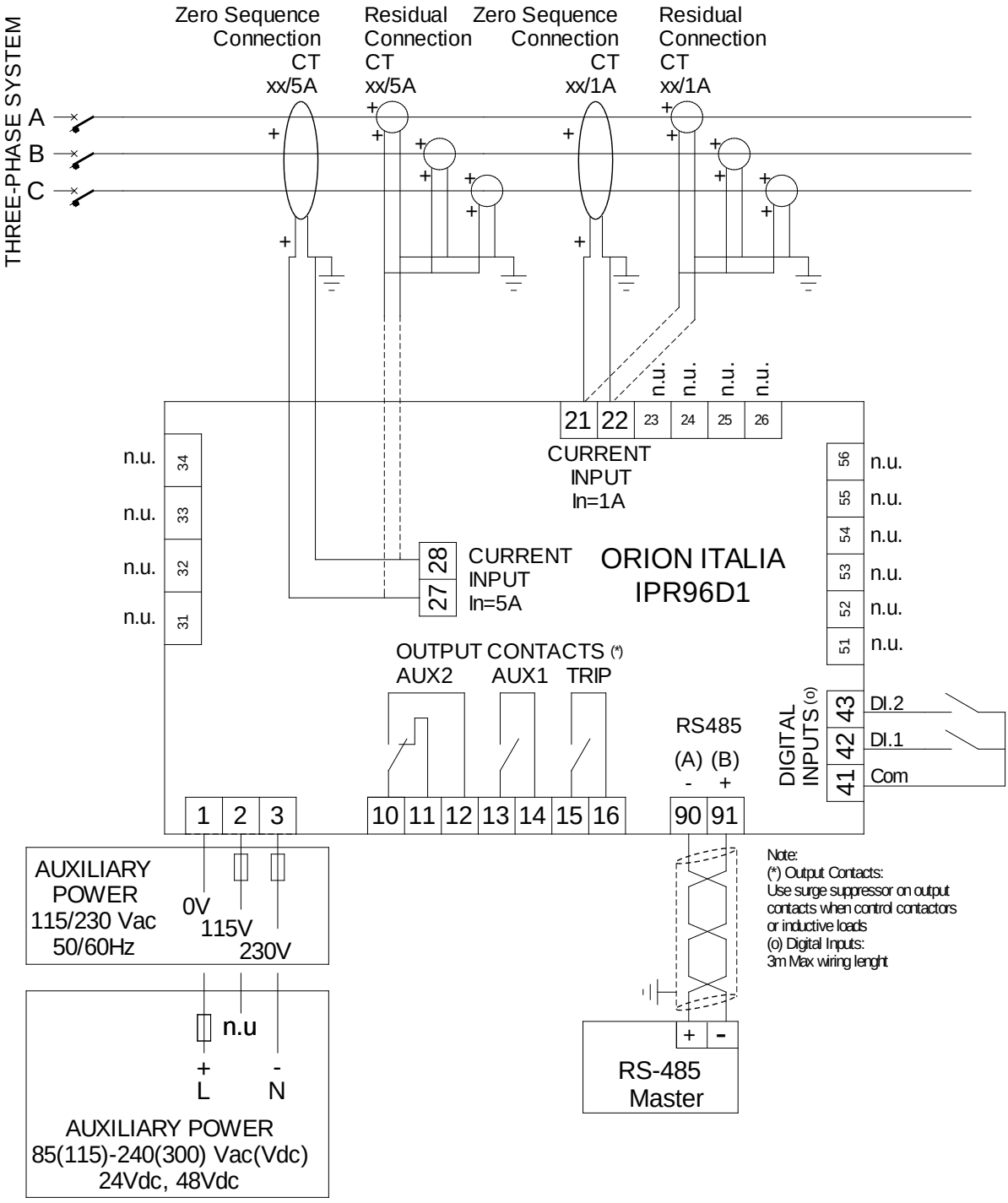


Figure 2.3 – **Wiring diagram**

2.5 COMMUNICATIONS

Thanks to the serial port the monitoring and control of the relay can be made by a SCADA system, a PC or PLC device.

The ports provided are:

1 two-wire RS-485 port → 1 twisted pair which transmits and receives alternatively is used for the data TX and RX

For the RS-485 port use shielded & twisted pair wire to minimize communication errors from noise.
A suitable type of wire is: **BELDEN#9841**, **AWG 24** which is shielded and with a characteristic impedance of **120 Ω**.

Ground the shield only at one point *[Figure 2.4]*
For the RS-485 port a maximum of 35 relays can be daisy chained together in parallel mode on a communication channel for a MAXIMUM DISTANCE OF 1000 METERS.
For larger systems, additional RS-485 channels must be added.

To increase the number of relays over 35 on single channel, consult the relay constructor.

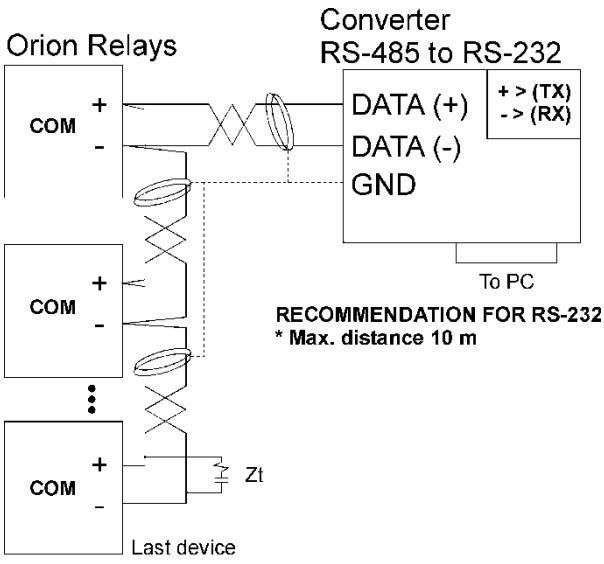


Figure 2.4 – **Communications**

RECOMMENDATION FOR RS-485
*** Use shielded twisted cable**
*** Use only one (1) point of ground**
*** Place a Zt in the last device**
(resistance 250 Ω, condensator 1 nF)
*** Max. distance 1000 m**

2.6 POWER SUPPLY

Voltage ranges for the relay → *[General Information: 1.8 SPECIFICATIONS]*
Power supply connection terminals → *[Installation: 2.3 WIRING]*

The relay has no internal fuses, external protection should be applied.
Orion Italia advices the use of 1 A timed external fuse.

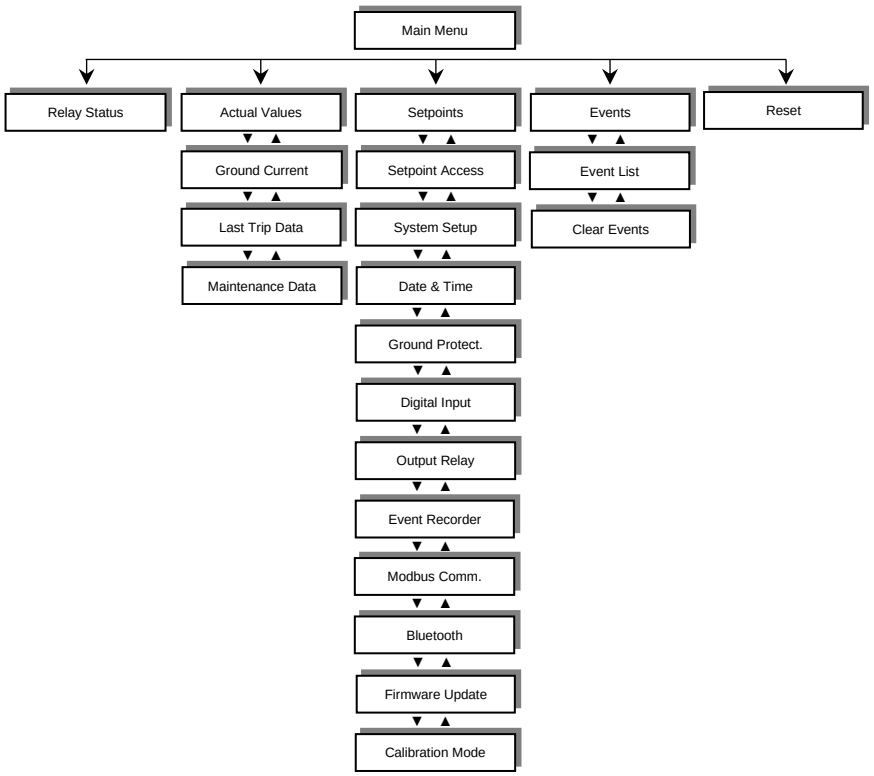
3. Main Menu, Autoscroll and Pop-Up Functions

3.1 MENU STRUCTURE

You can have access to the Main Menu by turning on the unit. The display shows the following options:

RELAY STATUS	→	status of the relay
ACTUAL VALUES	→	display of metering values
SETPOINTS	→	set up the general system and functions
EVENTS	→	visualize the last events stored and possibly clear them all
RESET	→	reset the IPR96D

Below, you can find the representation of the complete structure consisting of the Relay Main Menu and sub-menus.



3.2 AUTOSCROLL FUNCTION

When the user turns on the IPR96D, the unit will cyclically show the following screens:
Ground Current, Relay Status, Last Trip Data.

The Autoscroll mode will also be activated five (5) minutes after complete inactivity.
To exit, press any key on the IPR96D to return to the Main Menu.

3.3 POP-UP FUNCTION

Whenever there is a fault condition, the IPR96D display will immediately show a POP-UP screen with the cause of the last protection intervention and the corresponding time stamp. To exit, press ↶ **ESC**.

3.4 MENU SURFING

To surf the menus, use one of the following keys:

▲	**UP**	→	move through the previous options of each menu
▼	**DOWN**	→	move through the next options of each menu
↲	**ENTER**	→	access the selected option
↶	**ESC**	→	go back to the previous menu

3.5 PASSWORD MANAGEMENT

The IPR96D has three levels of password-granted authorizations:

FIRST LEVEL	→	view Actual Values and modify Setpoints. A First-Level password cannot navigate through some of the options in the Calibration Mode menu *[APPENDIX A].*

How to Set or Modify a First-Level password
DEFAULT FIRST-LEVEL PASSWORD: 1111

Setpoint Access ORION ITALIA IPR96DX F.V. X.XX	To modify the First-Level password, press **ENTER**.
Setpoint Access **ORION ITALIA** **IPR96DX F.V. X.XX** Enter Password - - - -	Insert the current First-Level password and press **ENTER**. To edit and store the password, *see [Main Menu, Autoscroll and Pop-Up Functions: 3.6 EDITING AND STORING KEYS]*. Password correct >> Setpoint Enabled. *This screen does not appear if the user has previously entered the correct password. It will no longer be requested until 5min have passed since the last press of any of the buttons (i.e. when it returns to Autoscroll mode).*
Setpoint Access **Press Enter to Modify the Password** Otherwise press ▲▼ or Esc	Press **ENTER** and insert a new First-Level password. Insert new password >> New Password Stored.

By changing the First-Level password, the Second-Level password will automatically change.

SECOND LEVEL	→	access every option on the First Level, some options on the Calibration Mode *[APPENDIX A].* This password is obtained by adding 1 *(to the first digit)*, 2 *(to the second digit)*, 3 *(to the third digit)* and 4 *(to the fourth digit)* of the First-Level password. No digit in the resulting password can equal zero (0). If the sum of the two digits is greater than ten (10), only the unit will be considered. If the sum equals ten (10), the digit will become one (1).

For example: PSW1 = 9896 (new user password)
PSW1 = 1111 (**factory default**)

PSW1	9	8	9	6
+	1	2	3	4
=	**10**	**10**	**12**	**10**
PSW2	**1**	**1**	**2**	**1**

DEFAULT PSW1	1	1	1	1
+	1	2	3	4
=	**2**	**3**	**4**	**5**
PSW2	**2**	**3**	**4**	**5**

THIRD LEVEL	→	in this case, the user must contact Orion Italia to obtain the code. It allows access to every option on the Second Level and the ability to alter the IPR96D calibration settings *[APPENDIX A].*

3.6 EDITING AND STORING KEYS

To edit and store data, use the following keys:

▲	**UP**	→	increase the value
▼	**DOWN**	→	decrease the value
↲	**ENTER**	→	highlight the option and press **ENTER** to modify. Change the value, press **ENTER** to store

For example:
How to Change Ground CT Rating
Scroll ▲ or ▼and highlight the desired option, as shown in the following representation.
On the Main Menu, the user must select *[6.2 Setpoints: SYSTEM SETUP*]

System Setup **Ground CT Primary** **50 A** Command RS485

To modify the Ground CT Primary value, press **ENTER**.
The IPR96D will ask the user to insert a password.

System Setup **Ground CT Primary** **50 A** Enter Password - - - -

Press ▲ or ▼ to select the first digit of the password, press **ENTER**.
Repeat for the second, third and fourth digit.
Password correct >> Setpoint Access Enabled
Password incorrect >> Setpoint Access Disabled

This screen does not appear if the user has previously inserted the correct password.
See [Main Menu, Autoscroll and Pop-Up Functions: 3.5 PASSWORD MANAGEMENT].

System Setup **Phase CT Rating** Value 50 A

Password correct >> when the value blinks, press ▲ or ▼ to modify.
Press **ENTER** to store the new setpoint >> Setpoint Stored.

3.7 FUNCTION KEY

F	→	On the Main Menu or in Autoscroll mode, press **F** and access the two available QR Codes by scanning them with a cell phone or tablet equipped with internet. Technical Support QR Code ▲ or ▼ Product Info QR Code.

3.8 SYMBOLS USED IN THE TEXT

This figure on the left represents the relay display.

[*Main Menu option: SECTION*]
If x = x

This screen only appears if the statement on the left is applied.

Symbol

;	→	Select among the elements on the list
÷	→	Select any value within the indicated parameters

For example:
RANGE: 2; 3; 6 → select **2**, or **3**, or **6**.
RANGE: 2 ÷ 6 → select **2**, or **3**, or **4**, or **5**, or **6**.

FRONT PANEL

4. Menu *RELAY STATUS*

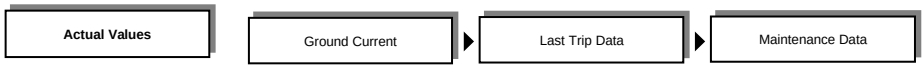
4.1 RELAY STATUS

Relay Status No Active Protection

This section provides information on the Relay Status.
For example, the display could indicate protection interventions, internal faults and/or setpoint discrepancies.
In the presence of more than four (4) alerts, navigate the list with the help of ▲ or ▼.
Normal conditions >> No Active Protection

[APPENDIX B] for all possible status.

5. Menu *ACTUAL VALUES*



5.1 Actual values: GROUND CURRENT

Ground Current Ig= 0.00 A

RMS Ground Current measured by residual connection or Zero Sequence CT.
See Wiring Diagram [Figure 2.3].

5.2 Actual values: LAST TRIP DATA

Last Trip Data No Trip Data

The variables of the latest trip will be immediately displayed on this screen, specifically showing date, time and cause of the last trip.

5.3 Actual values: MAINTENANCE DATA

Maintenance Data Trips Counter 33 Ground O/C Counter 30

▼

Counters Opening Counter 31 Maintenance Data Clear? No

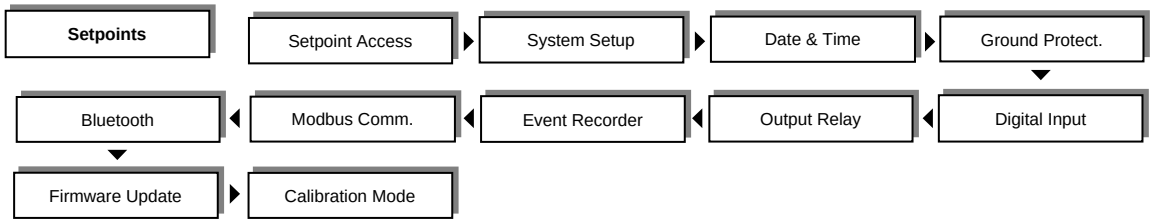
Trips Counter: it indicates the number of trips caused by protection interventions.
Ground O/C Trip: it counts the times the circuit breaker or disconnector controlled by IPR96D has tripped due to the intervention of ground overcurrent protection.

Opening Counter: it counts the breaker or disconnector openings.

If it is necessary to reset the Maintenance Data, press **ENTER,** insert the Second-Level password (PSW2), scroll ▲ ▼ and select YES.
This type of clearing requires at least the Second-Level password (PSW2).

6. Menu *SETPOINTS*

Before carrying out the programming of the unit, it is necessary to read and understand the indications provided by the Constructor. All the programming must be carried out by qualified personnel with adequate knowledge of the operation of the unit and of the content of this manual.



6.1 Setpoints: SETPOINT ACCESS

Setpoint Access ORION ITALIA IPR96DX F.V. X.XX

IPR96D model and the firmware version.
Press **ENTER**, insert and/or modify the First-Level password (PSW1).
See [Main Menu, Autoscroll and Pop-Up Functions: 3.5 PASSWORD MANAGEMENT].

6.2 Setpoints: SYSTEM SETUP

This section indicates the parameters for system setup.

System Setup **System Frequency** Value 50 Hz

RANGE: 50; 60 Hz
Enter the nominal power system frequency. This value will set the optimal digital sampling rate.

System Setup **Ground CT Primary** Value 50 A

RANGE: 5 ÷ 5000
STEPS: 5
Enter the primary current rating of the ground CT being used.

System Setup **Command** Value RS485

RANGE: RS485, LOCAL, RS485+BLE, BLE
Choose the enabled command source and with this, disable all commands sent by any other available communication methods or options.
The local HMI always remains enabled.

System Setup **Out of Service Relay** Value None

RANGE: None, Aux2
Select AUX2 to perform the SERVICE function
Once the power is applied, the relay will make AUX2 react and the related contact will be opened. In case of fault of the relay (STATUS led “On”) or of loss of power supply, AUX2 will pass to safe state position and exchange its contacts.
If the fault disappears, the IPR96D will get back to normal operation; the Out of Service relay will remain latched in safe state position (local HMI reset required).
See Wiring Diagram [Figure 2.3].

System Setup
Max Switching Current
Value
ENABLED

RANGE: ENABLED; DISABLED
Indicate whether you want to enable or disable a current limit beyond which the relay must not activate the TRIP output to avoid damaging the switching device (useful when there is a switch/disconnector instead of a Circuit Breaker). In case of Circuit Breaker, make sure to select DISABLED.

System Setup
Max Switching Current
Value
400 A

[6.2 Setpoints: SYSTEM SETUP]
If Max Switching Current = ENABLED

RANGE: 50 ÷ 5000
STEPS: 10
The selected value indicates the current limit described in the screen above.

System Setup
Breaker Failure Relay
Value
- - -

It allows selecting the output signaling the discrepancy between the trip command sent by the protection relay and the signal received at the BREAKER STATUS input from the circuit breaker or disconnector auxiliary contact.
This error information signals that the trip command has not provoked the opening or that the auxiliary contact (52a) does not operate properly.
Disable this function in case of no connection between 52a auxiliary contact and BREAKER STATUS input.
To disable the function, select "- - - ".

Following the intervention of the Breaker Failure function, once the circuit breaker has been repaired, it will be necessary to reset the IPR96D (if still in *Tripped* state) before proceeding to close the circuit breaker.

System Setup
Breaker Failure Delay
Value
1000 ms

[6.2 Setpoints: SYSTEM SETUP]
If Breaker Failure Relay ≠ - - -

RANGE: 10 ÷ 2500
STEPS: 10
Delay for the circuit breaker auxiliary contacts to signal the opening. If a correct reply is not obtained in this delay, an event for circuit breaker failure will be displayed and the selected contact will activate.

System Setup
Mech. Operations Relay
Value
- - -

Select the relays to be activated when reaching the max. number of mechanical operations set in the next Line.

System Setup
Mech. Operations Max
Value
3000

[6.2 Setpoints: SYSTEM SETUP]
If Mech. Operations Relay ≠ - - -

RANGE: 5 ÷ 9995
STEPS: 5
This value represents the granted quantity of mechanical operations carried out by the circuit breaker and the event indicates that maintenance is required.

6.3 Setpoints: DATE & TIME

Date & Time
2018. Jan. 9
16:54:02:00

Press **ENTER** to modify.

Date & Time 2018. Jan. 9 16:54:02:00 Enter Password - - - -

Insert the First-Level password (PSW1) to set or modify Date and Time.
To store new Date and Time:

1. Insert the correct password, if required, using ▲ and ▼
2. If the password is correct, the year will blink.

Date & Time **2018. Jan. 9** **16:54:02:00** Value 2018. Jan. 9 16:54:02:00

3. Select the year using ▲ and ▼ and press **ENTER**.
4. Repeat steps 2 and 3 for month, day, hour, minutes, and seconds.
5. Press **ENTER** to store the new date and time.
   Note: press **ENTER**, the decimals of the seconds will begin from zero (0).

6.4 Setpoints: GROUND PROTECTION

Ground Protect. **Ground Timed1 O/C** **Relay** Value - - -

RANGE: NONE; ANY COMBINATION OF TRIP, AUX1 OR AUX2.

Select the outputs to be activated by the ground timed 1 overcurrent protection (ANSI 51.1 N/G).

Ground Protect. **Ground Timed1 O/C** **Pickup** Value 12 %CT

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed1 O/C Relay ≠ - - -

RANGE: 1 ÷ 300
STEPS: 1
Enter the ground overcurrent pickup level. This level determines the current level at which the relay will start counting the circuit breaker/disconnector trip time according to the protection curve selected in the following line: **GROUND O/C CURVE**.

Ground Protect. **Ground O/C Curve** Value ANSI MOD INV

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed1 O/C Relay ≠ - - -

RANGE: ANSI EXTREME INV; ANSI VERY INV; ANSI NORMAL INV; ANSI MOD INV; DEFINITE TIME; IEC-C EXTREME INV; IEC-B VERY INV; IEC-A NORMAL INV; IEC SHORT TIME; IAC EXTREME INV; IAC VERY INV; IAC NORMAL INV; IAC MODERATE INV
Enter the ground 1 overcurrent protection curve shape required.

Ground Protect. **Ground Timed1 O/C** **Delay** Value 1.00 s

[6.4 Setpoints: GROUND PROTECT.]
If Ground O/C Curve = DEFINITE TIME and ≠ - - -

RANGE: 0.01 ÷ 600
STEPS: 0.01, 0.1, 1
Enter the ground timed 1 overcurrent delay. The related output will activate if the current rating is superior to “GROUND TIMED O/C PICKUP” for a longer time than the set one.

Ground Protect. **Ground Timed1 O/C** **Mult.** Value 1.0

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed1 O/C Relay ≠ DEFINITE TIME or - - -

RANGE: 0.1 ÷ 20.0
STEPS: 0.1
Set the ground overcurrent multiplier for the selected curve.

Ground Protect. **Ground Timed2 O/C** **Relay** Value - - -

RANGE: NONE; ANY COMBINATION OF TRIP, AUX1 OR AUX2.

Select the outputs to be activated by the ground timed 2 overcurrent protection (ANSI 51.2 N/G).

Ground Protect.
Ground Timed2 O/C
Pickup
Value
12 %CT

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed2 O/C Relay ≠ - - -

RANGE: 1 ÷ 300
STEPS: 1
Enter the ground overcurrent pickup level. This level determines the current level at which the relay will start counting the circuit breaker/disconnector trip time according to the protection curve selected in the following line: **GROUND O/C CURVE**.

Ground Protect.
Ground O/C Curve
Value
ANSI MOD INV

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed2 O/C Relay ≠ - - -

RANGE: ANSI EXTREME INV; ANSI VERY INV; ANSI NORMAL INV; ANSI MOD INV; DEFINITE TIME; IEC-C EXTREME INV; IEC-B VERY INV; IEC-A NORMAL INV; IEC SHORT TIME; IAC EXTREME INV; IAC VERY INV; IAC NORMAL INV; IAC MODERATE INV
Enter the ground 2 overcurrent protection curve shape required.

Ground Protect.
Ground Timed2 O/C
Delay
Value
1.00 s

[6.4 Setpoints: GROUND PROTECT.]
If Ground O/C Curve = DEFINITE TIME
and ≠ - - -

RANGE: 0.01 ÷ 600
STEPS: 0.01, 0.1, 1
Enter the ground timed 2 overcurrent delay. The related output will activate if the current rating is superior to “GROUND TIMED O/C PICKUP” for a longer time than the set one.

Ground Protect.
Ground Timed2 O/C
Mult.
Value
1.0

[6.4 Setpoints: GROUND PROTECT.]
If Ground Timed2 O/C Relay ≠ - - -

RANGE: 0.1 ÷ 20.0
STEPS: 0.1
Set the ground overcurrent multiplier for the selected curve.

Ground Protect.
Ground Inst. O/C
Relay
Value
- - -

RANGE: NONE; ANY COMBINATION OF TRIP, AUX1 OR AUX2.

Select the outputs to be activated by the ground instantaneous overcurrent protection (ANSI 50N).

Ground Protect.
Ground Inst. O/C
Pickup
Value
120 %CT

[6.4 Setpoints: GROUND PROTECT.]
If Ground Inst. O/C Relay ≠ - - -

RANGE: 1 ÷ 2000
STEPS: 1, 10
Enter the instantaneous overcurrent pickup level. This level determines the current level at which the relay will start counting the time for the activation of the related output.

Ground Protect.
Ground Inst. O/C
Delay
Value
0 ms

[6.4 Setpoints: GROUND PROTECT.]
If Ground Inst. O/C Relay ≠ - - -

RANGE: 0 ÷ 2000
STEPS: 10
Enter the intervention delay for ground instantaneous overcurrent protection.
If: the ground current increases above the value entered in “GROUND INST. O/C PICKUP” for a time > delay time selected, the output will activate.

6.5 Setpoints: DIGITAL INPUT

Digital Input
Input 1 Function
Value
NONE

RANGE: ACTIVATE AUX2; ACTIVATE AUX1; EXTERNAL RESET; BREAKER STATUS; NONE
Select the function to be associated with INPUT 1.

Digital Input **Input 2 Function** Value NONE	RANGE: ACTIVATE AUX2; ACTIVATE AUX1; EXTERNAL RESET; BREAKER STATUS; NONE Select the function to be associated with INPUT 2.

Note: Whenever the digital input is activated, the associated function will run. If the operator resets from HMI, the function will also be reset in any case (even though the digital input remains closed).

6.6 Setpoints: OUTPUT RELAY

In case of fault condition, the output relay associated to the active protection function will act (it will go from a Non-Operating State to an Operating State). If the output relay is configured as a Trip Relay [6.2 *Setpoints: SYSTEM SETUP: Trip Relay*], the protection intervention will cause the Trip led to turn ON.

Output Relay **Trip Output Relay** Value LATCHED	RANGE: LATCHED; PULSED *PULSED:* in case of fault condition due to which the related output must activate, this output will be energized for a time as the one set in **TRIP RELAY PULSE TIME**; after this time the output relay will de-energize and the contact will return to the stand-by condition. The output will repeat this operation every 3 seconds in case the fault condition is still present. *LATCHED:* in case of fault condition due to which the related output must activate, this output will be energized for an indefinite time. The output relay will de-energize only when the fault condition is no more present and the unit is RESET.

Output Relay **Trip Pulse** **Time** Value 200 ms	RANGE: 100 ÷ 2000 STEPS: 100 Enter the delay for the trip relay de-energizing.

[6.6 Setpoints: OUTPUT RELAY]
If Trip Output Relay = PULSED

Output Relay **Aux1 Output Relay** Value LATCHED	RANGE: LATCHED; PULSED *PULSED:* in case of fault condition due to which the related output must activate, this output will be energized for a time as the one set in **AUX1 RELAY PULSE TIME**; after this time the output relay will de-energize and the contact will return to the stand-by condition. *LATCHED:* in case of fault condition due to which the related output must activate, this output will be energized for an indefinite time. The output relay will de-energize only when the fault condition is no more present and the unit is RESET.

Output Relay **Aux1 Pulse** **Time** Value 200 ms.	RANGE: 100 ÷ 2000 STEPS: 100 Enter the delay for the AUX1 relay de-energizing.

[6.6 Setpoints: OUTPUT RELAY]
If AUX1 Output Relay = PULSED

Output Relay **Aux2 Output Relay** Value LATCHED.	RANGE: LATCHED; PULSED *PULSED:* in case of fault condition due to which the related output must activate, this output will be energized for a time as the one set in **AUX2 RELAY PULSE TIME**; after this time the output relay will de-energize and the contact will return to the stand-by condition. *LATCHED:* in case of fault condition due to which the related output must activate, this output will be energized for an indefinite time. The output relay will de-energize only when the fault condition is no more present and the unit is RESET.

Output Relay **Aux2 Pulse** **Time** Value 200 ms	RANGE: 100 ÷ 2000 STEPS: 100 Enter the delay for the AUX2 relay de-energizing.

[6.6 Setpoints: OUTPUT RELAY]
If AUX2 Output Relay = PULSED

6.7 Setpoints: EVENT RECORDER

You can enable/disable the recording of each type of event. All events, up to 100 maximum, will be stored in a memory buffer operating in FIFO (First-In, First-Out) mode. Once 100 events are stored, the new event will push out the oldest one from the Event List.

Event Recorder **System Events** Value ENABLED	RANGE: ENABLED; DISABLED

Event Recorder **Output Relays** **Events** Value DISABLED	RANGE: ENABLED; DISABLED

Event Recorder **Digital Input.** **Events** Value DISABLED	RANGE: ENABLED; DISABLED Note: If enabled, these events will be stored during digital inputs normal operation and in the following cases: • After the IPR96D is powered on • When Digital Input function is modified *[6.5 Setpoints: DIGITAL INPUT*].

Event Recorder **Gnd Current Protect.** **Events** Value ENABLED	RANGE: ENABLED; DISABLED

6.8 Setpoints: MODBUS COMMUNICATION

This section contains the settings that allow the IPR96D communication with other devices.

Modbus Comm. **Modbus** **Address 1** Value 1	RANGE: 1 ÷ 247 STEPS: 1 Modify the Modbus ID.

Modbus Comm. **RS-485** **Baudrate** Value 9600	RANGE: 9600; 19200; 38400; 57600; 115200 Select the Baud rate.

Modbus Comm. **RS-485** **Config.** Value 8N1	RANGE: 8N1; 8N2; 8E1; 8E2; 8O1; 8O2 Specify the parity and the Stop-bit.

For further information, download *Modbus Memory Map* from the Orion Italia website.

6.9 Setpoints: BLUETOOTH

This section contains information regarding the IPR96D Bluetooth connectivity.

Bluetooth **Device Name** Value IPR96D1–XXXXXX	Modify the Bluetooth ID. If an external device carries out a Bluetooth scan, the IPR96D will appear with the Device Name specified on the screen.

6.10 Setpoints: FIRMWARE UPDATE

Before proceeding with the upgrade, the user must make sure to not have any issues regarding the power supply.
DO NOT DISCONNECT POWER SUPPLY during the firmware upgrade, the device could remain unusable.
Orion Italia cannot be held responsible for any damage that may incur following the incorrect firmware upgrade procedure.

The IPR96D firmware can be updated by Bluetooth or by serial RS-485 port.

Firmware Update **RS485 Update** BLE Update	To initialize the upgrade, select the method and press **ENTER**.

Firmware Update Ready to be Updated	The IPR96D is waiting to receive the update. Once the upgrade has been successfully installed, verify the firmware version in *[6.1 Setpoints: SETPOINT ACCESS].*

6.11 Setpoints: CALIBRATION MODE

When the user is operating the setpoints on this menu, the IPR96D does not guarantee the correct performance of the protection and storage of Events, as well as the correct execution of the measuring functions.

For security purposes, it is therefore highly suggested that the user take the necessary precautions before operating in this section.

Calibration Mode **Display Brightness** Value 5	RANGE: 0 ÷ 10 Choose the Display Brightness to be applied when the IPR96D is not in Autoscroll mode.

Calibration Mode **Display Contrast** Value 5	RANGE: 1 ÷ 10 Choose the Display Contrast.

Calibration Mode **Test HMI** Value No	RANGE: Yes; No Choose YES and press **ENTER**, to carry out a test of the display and the leds. The display will show only dots and the leds will turn on for a couple of seconds.

Calibration Mode **Test BLE** Value No	RANGE: Yes; No Choose YES and press **ENTER**, to carry out a test.

Calibration Mode **Digital Input1** Value DEACTIVATED	This screen shows the status of the Digital Input 1 (activated or deactivated).

Calibration Mode **Digital Input2** Value DEACTIVATED	This screen shows the status of the Digital Input 2 (activated or deactivated).

Calibration Mode **Test Relays** Value None	RANGE: NONE; TRIP; AUX1; AUX2; ALL Energize one or more output relays. During the test, the chosen relay(s) will remain energized for five (5) seconds and the navigation will be disabled throughout this time.

Calibration Mode **Device ID** Value 63aDedRt2f4=	A code like the example on the screen uniquely identifies the IPR96D. It is useful in case the password gets lost or in case Orion Italia requires it for technical support.

The following screens will only be visible if the system is accessed with the Second-Level Password (PSW2):
See [APPENDIX A]

Any modification applied to the following settings, can affect metering and protection functions.

Calibration Mode **K Time** Value 0	RANGE: -116 ÷ 116 STEPS: 1 It allows the application of a corrective K to the relay clock to correct the time drift. Consult Orion Italia for further information.

7. Menu *EVENTS*

7.1 EVENT LIST

The IPR96D is capable of storing up to one hundred (100) events.
Certain types of Events could be registered or not, depending on the settings stored in the section *[6.10 Setpoints: EVENT RECORDER].*

Event List Event *X* *Type of event* DD-MM-YY hh:mm:ss

- Event ID
- Event description
- Time stamp

Press **ENTER** to view the electrical values at the time of the Event.

7.2 CLEAR EVENTS

Events Clear All Events? No

Select the desired option and press **ENTER**.
Insert the First-Level (PSW1) or Second-Level password (PSW2) - unless there has been a previous log in.
Press **ENTER** to Clear All Events or press ↶ **ESC** to abort.
The unit will confirm the clearing by showing Events Data Cleared.

8. Menu *RESET*

All the programming must be carried out by qualified personnel with adequate knowledge of the operation of the unit and of the content of this manual.

8.1 RESET

This Main Menu option allows the user to execute a RESET of the IPR96D.
The Reset command does not cancel any acquired data (Events, Counters…), instead, it resets a fault condition (including Trip) if it is no longer present; and/or eliminates the notification of a previously stored fault condition.

Reset
Reset Relays?
No

RANGE: NO; YES
Scroll ▲ ▼ to select YES and press **ENTER** to proceed >> Reset Sent.
To abort, press ↶ **ESC**.

This Menu can be accessed by a Shortcut:
Press down ENT and ESC contemporarily for more than two seconds.

Another way to proceed with the RESET is through Modbus RS485, only if [6.2 *Setpoints: SYSTEM SETUP:* Command] REMOTE 485 or REMOTE BLE+485.

9. Troubleshooting

RELAY CANNOT TURN ON

- Check the connections and the control power fuses.

CURRENTS ARE NOT DISPLAYED

- Check the CTs wiring.
- Check the terminal for short-circuiting.

OUTPUT RELAYS (TERMINALS N. 10 to 16) MALFUNCTIONING

- Check for proper operating following *[6.14 Setpoints: CALIBRATION MODE]* instructions.
- Check for proper wiring connection.

SETPOINT DISCREPANCY (led STATUS blinking 0.3s ON – 0.3s OFF)

- Check that all setpoints **are not** out of range with respect to the memory map.
- Only if *[6.2 Setpoints: SYSTEM SETUP*: Out of Service Relay = AUX2]; check that no protection is enabled on Out of Service Relay.
- If Breaker Failure protection is enabled on Trip Relay.
- If Breaker Failure protection is enabled, and none of the Digital Inputs are set as *Breaker Status*.
- If both Digital Inputs are set as *Breaker Status*.

APPENDIX A

Function/Level PSW	No PSW	First Level (PSW1)	Second Level (PSW2)	Third Level (PSW3) *Contact Orion Italia*	Notes
Reset Relay	X	X	X	X	
Clear Events		X	X	X	
Reset Counters			X	X	
Factory Default				X	K-Calibration, Events and Counters will remain the same.
Auto-Calibration				X	
K-Calibration (relay)				X	
Upgrade Firmware			X	X	
Update BLE Stack				X	
Info Stack BLE			X	X	
Device ID			X	X	
BLE Name		X	X	X	

See [Main Menu, Autoscroll and Pop-Up Functions: 3.5 PASSWORD MANAGEMENT].

APPENDIX B

Status	Description
No Active Protection	Normal status, no faulty conditions present.
Ground Timed 1 O/C	Active protection for ground timed 1 overcurrent threshold reached.
Ground Timed 2 O/C	Active protection for ground timed 2 overcurrent threshold reached.
Ground Inst. O/C	Active protection for ground instantaneous overcurrent threshold reached.
Setpoint Discrepancy	A discrepancy was found in the stored setpoints.
Flash Busy	The internal flash memory is not available during the reading/writing operations.
ADC Failure	Analog to digital converter internal failure.
BLE Failure	Bluetooth low energy internal failure.
RAM Failure	Ram internal failure.
Check Events	A protection occurred. For details, see *[Events: 7.1 EVENT LIST].*
Out Of Service	IPR96D is *out of service*. IPR96D functions are not guaranteed.
Breaker Failure	A trip command was issued but the switch did not open.
Mech. Op. Prot.	Active protection for number of mechanical operations reached.
Max Sw. Curr. Reached	Max switching current threshold reached.

APPENDIX C

Event	Description
No Events	
Clear Events	It indicates events were cleared.
Ground Timed 1 O/C	Ground timed 1 overcurrent protection occurred.
Ground Timed 2 O/C	Ground timed 2 overcurrent protection occurred.
Ground Inst. O/C	Ground instantaneous overcurrent protection occurred.
Aux1 De-Energized	The output Aux1 status was changed from energized to de-energized.
Aux2 De-Energized	The output Aux2 status was changed from energized to de-energized.
TRIP De-Energized	The output TRIP status was changed from energized to de-energized.
Aux1 Energized	The output Aux1 status was changed from de-energized to energized.
Aux2 Energized	The output Aux2 status was changed from de-energized to energized.
TRIP Energized	The output TRIP status was changed from de-energized to energized.
Aux1 Remote De-Energ.	The output Aux1 status was changed from energized to de-energized through a remote command.
Aux2 Remote De-Energ.	The output Aux2 status was changed from energized to de-energized through a remote command.
TRIP Remote De-Energ.	The output TRIP status was changed from energized to de-energized through a remote command.
Aux1 Remote Energ.	The output Aux1 status was changed from de-energized to energized through a remote command.
Aux2 Remote Energ.	The output Aux2 status was changed from de-energized to energized through a remote command.
TRIP Remote Energ.	The output TRIP status was changed from de-energized to energized through a remote command.
Default Sp. Loaded	In case of internal fault, the IPR96D has been reset back to default setpoint values.
Setpoint Stored	A setpoint modification took place. Consecutive changes in the Setpoint section are stored under the same event. Following a minute after the last modification, a new event will be generated.
Setpoint Discrepancy	The values set by the user in the Setpoint section, generated a discrepancy (e.g.: verify the values of Threshold and Reset that could generate a protection malfunction). **See *[Troubleshooting]***
BLE Failure	Internal fault occurred in the Bluetooth module.
BLE Module Tested	The BLE test was executed by the user.
Password Changed	The user changed the password.
Model Changed	The version model of the IPR96D was upgraded.
Calibration Data Lost	The IPR96D has lost the Calibration data values.
Memory Status Lost	Following a restart of the IPR96D, the unit is not capable of reaching the same status present before it was restarted.
Aux Power Lost	The IPR96D was powered off.
Aux Power Restored	The IPR96D was powered on.
ADC Failure	Internal fault occurred in the digital analogic converter.
Flash Busy	The internal flash memory was not available during the reading/writing operations.
Out Of Service	Out of service conditions occurred.
Breaker Failure	Breaker failure conditions occurred.
Mechanical Op.	Mechanical operation protection occurred.
Max Sw. Curr. Reached	Max switching current threshold reached.

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