ekorRPS
MULTIFUNCTIONAL PROTECTION UNIT
CONFIGURATION AND GENERAL CHARACTERISTICS

30.05.2014
CAUTION!

When MV equipment is operating, certain components are live, other parts may be in movement and some may reach high temperatures. Therefore, the use of this equipment poses electrical, mechanical and thermal risks.

In order to ensure an acceptable level of protection for people and property, and in compliance with applicable environmental recommendations, Ormazabal designs and manufactures its products according to the principle of integrated safety, based on the following criteria:

- Elimination of hazards wherever possible.
- Where elimination of hazards is neither technically nor economically feasible, appropriate protection functions are incorporated in the equipment.
- Communication about remaining risks to facilitate the design of operating procedures which prevent such risks, training for the personnel in charge of the equipment, and the use of suitable personal protective equipment.
- Use of recyclable materials and establishment of procedures for the disposal of equipment and components so that once the end of their service lives is reached, they are duly processed in accordance, as far as possible, with the environmental restrictions established by the competent authorities.

Consequently, the equipment to which the present manual refers complies with the requirements of section 11.2 of the forthcoming IEC standard 62271-1. It must therefore only be operated by appropriately qualified and supervised personnel, in accordance with the requirements of standard EN 50110-1 on the safety of electrical installations and standard EN 50110-2 on activities in or near electrical installations. Personnel must be fully familiar with the instructions and warnings contained in this manual and in other recommendations of a more general nature which are applicable to the situation according to current legislation.

The above must be carefully observed, as the correct and safe operation of this equipment depends not only on its design but also on general circumstances which are in general beyond the control and responsibility of the manufacturer. More specifically:

- The equipment must be handled and transported appropriately from the factory to the place of installation.
- All intermediate storage should occur in conditions which do not alter or damage the characteristics of the equipment or its essential components.
- Service conditions must be compatible with the equipment rating.
- The equipment must be operated strictly in accordance with the instructions given in the manual, and the applicable operating and safety principles must be clearly understood.
- Maintenance should be performed properly, taking into account the actual service and environmental conditions in the place of installation.

The manufacturer declines all liability for any significant indirect damages resulting from violation of the guarantee, under any jurisdiction, including loss of income, stoppages and costs resulting from repair or replacement of parts.

Guarantee

The manufacturer guarantees this product against any defect in materials and operation during the contractual period. In the event that defects are detected, the manufacturer may opt either to repair or replace the equipment. Improper handling of this equipment and its repair by the user shall constitute a violation of the guarantee.

Registered Trademarks and Copyrights

All registered trademarks cited in this document are the property of their respective owners. The intellectual property of this manual belongs to the manufacturer.

In view of the constant evolution in standards and design, the characteristics of the elements contained in this manual are subject to change without prior notification.

The validity of these characteristics, as well as the availability of components, are subject to confirmation by Ormazabal’s Technical - Commercial Department.
CONTENTS

1. GENERAL DESCRIPTION........................................................................................................ 4
   1.1. USER INTERFACE ......................................................................................................... 4
       1.1.1. Local .................................................................................................................. 4
       1.1.2. Remote .............................................................................................................. 5
   1.2. HARDWARE CONFIGURATION .................................................................................... 5
   1.3. ENVIRONMENTAL CONDITIONS ................................................................................. 7
   1.4. TESTS .......................................................................................................................... 7
       1.4.1. Electrical Tests .................................................................................................. 7
       1.4.2. Climatic Tests .................................................................................................. 7
       1.4.3. Mechanical Tests ............................................................................................. 7

2. HARDWARE ....................................................................................................................... 8
   2.1. CONSTRUCTIONAL CHARACTERISTICS ................................................................. 8
   2.2. REAR TERMINALS ..................................................................................................... 9
   2.3. REAR COMMUNICATION OUTPUT OPTIONS .......................................................... 10
       2.3.1. Single output .................................................................................................... 10
       2.3.2. Double output ................................................................................................. 10

3. TECHNICAL CHARACTERISTICS .................................................................................. 12
   3.1. AUXILIARY POWER SUPPLY VOLTAGE ................................................................. 12
   3.2. OUTPUT CONTACTS ................................................................................................. 12
   3.3. ANALOGUE OUTPUTS ............................................................................................... 13
   3.4. PHASE AND NEUTRAL CURRENT CIRCUITS (STANDARD RATING 1 A) ............. 13
   3.5. SENSITIVE NEUTRAL OR ISOLATED NEUTRAL CURRENT CIRCUITS 
       (STANDARD RATING 0.025 A) ...................................................................................... 13
   3.6. PHASE AND NEUTRAL CURRENT CIRCUITS (SPECIFIED RATING 1/5 A) ......... 13
   3.7. SENSITIVE NEUTRAL OR ISOLATED NEUTRAL CURRENT CIRCUITS 
       (SPECIFIED RATING 0.25 / 0.025 A) ........................................................................ 13
   3.8. VOLTAGE CIRCUITS ............................................................................................... 14
   3.9. ACCURACY OF MEASUREMENTS ........................................................................... 14
   3.10. OPERATING FREQUENCY ...................................................................................... 14
   3.11. PHASE ORDER ....................................................................................................... 14
1. GENERAL DESCRIPTION

ekorRPS units are multifunctional protection relays of numeric technology, and constitute the basic element of protection measurement and control for cogeneration installations or MV electric bays. They can be used as autonomous protection, control and measurement elements of electric bays, or incorporated into an integrated protection and control system.

Different models are available, each having a distinct aspect of hardware or functionality. A common aspect to all the models is the firmware; the functions available to the user of each model are defined in the circuit of a programmable logic device (PLD), which cannot be configured by the user.

1.1. USER INTERFACE

1.1.1. Local

The front board has:

1. 16-key keyboard
2. 4 signalled push-buttons
   - : Circuit-breaker closing
   - : Circuit-breaker opening
   - : Local / Remote
   - : Validates three other push-buttons in order to prevent unintended operations. It must be pressed at the same time as the other buttons to take effect.

   **NOTE:**
   - In order to consider these push-buttons active, they must be pressed for at least half a second.
   - In order for them to take effect, the "Enable push-buttons" configuration must be set to "Yes".

3. 2-row, 16-character display
4. 7 red LED lights and one green/red
5. RS-232 connector for direct connection to a PC via Procome Protocol.

Figure 1.1: Front mimic diagram
1.1.2. Remote

Depending on the model, there is a rear board consisting of 1 or 2-way glass optical fibre (ST type connector), plastic optical fibre, RS-232 or RS-485 for a PC, modem or substation control unit connection (in integrated systems). Protocol available is: Procome, DNP 3.0, MODBUS, IEC 870-5-101 or IEC 870-5-103.

Models with an Ethernet port (optical fibre or RJ-45) are available with TCP/IP Procome protocol.

1.2. HARDWARE CONFIGURATION

The different hardware possibilities that define a model are:

<table>
<thead>
<tr>
<th>Hardware Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box type</td>
</tr>
<tr>
<td>Horizontal</td>
</tr>
<tr>
<td>Terminal type</td>
</tr>
<tr>
<td>Pin-type termination</td>
</tr>
<tr>
<td>Eyelet termination</td>
</tr>
<tr>
<td>Unit power supply voltage</td>
</tr>
<tr>
<td>125 / 220 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>24 / 48 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>Voltage range of digital inputs</td>
</tr>
<tr>
<td>Extended (low)</td>
</tr>
<tr>
<td>18 to 160 V&lt;sub&gt;DC&lt;/sub&gt;(*)</td>
</tr>
<tr>
<td>Extended (high)</td>
</tr>
<tr>
<td>86 to 280 V&lt;sub&gt;DC&lt;/sub&gt;(*)</td>
</tr>
<tr>
<td>Restricted 24 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>18 to 34 V&lt;sub&gt;DC&lt;/sub&gt;(**)</td>
</tr>
<tr>
<td>Restricted 48 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>36 to 60 V&lt;sub&gt;DC&lt;/sub&gt;(**)</td>
</tr>
<tr>
<td>Restricted 125 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>85 to 150 V&lt;sub&gt;DC&lt;/sub&gt;(**)</td>
</tr>
<tr>
<td>Restricted 220 V&lt;sub&gt;DC&lt;/sub&gt;</td>
</tr>
<tr>
<td>165 to 264 V&lt;sub&gt;DC&lt;/sub&gt;(**)</td>
</tr>
</tbody>
</table>

(*) Single-directional inputs (with polarity)
(**) Two-way inputs (without polarity)
## Hardware Configuration

<table>
<thead>
<tr>
<th>Number of digital inputs/outputs</th>
<th>Standard</th>
<th>8 inputs (5 independent, 3 with a common point)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>7 outputs (4 independent, 3 with a common point)</td>
</tr>
<tr>
<td>Extended: adds to the standard</td>
<td></td>
<td>9 inputs (6 independent, 3 with a common point)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7 outputs (4 independent, 3 with a common point)</td>
</tr>
<tr>
<td>Extended (option 2): adds to the standard</td>
<td>5 independent inputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 outputs (4 independent, 2 with a common point)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 analogue outputs (0 to 5 mA)(^1)</td>
</tr>
</tbody>
</table>

### Rear communication\(^2\)

- Glass optical fibre (GOF)
- Plastic optical fibre (POF)
- RS-232
- RS-485
- GOF + GOF
- POF + POF
- RS-232 + RS-232
- RS-485 + RS-232
- GOF + RS-232
- GOF + Ethernet (RJ-45)
- GOF + Ethernet (OF)
- RS-232 + Ethernet (RJ-45)
- RS-485 + Ethernet (RJ-45)

### Analogue inputs\(^3\)

<table>
<thead>
<tr>
<th>Input number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>(I_A) phase current metering</td>
</tr>
<tr>
<td>2</td>
<td>(I_B) phase current metering</td>
</tr>
<tr>
<td>3</td>
<td>(I_C) phase current metering</td>
</tr>
<tr>
<td>4</td>
<td>(I_N) sensitive neutral current metering</td>
</tr>
<tr>
<td>5(^4)</td>
<td>Not available</td>
</tr>
<tr>
<td>6</td>
<td>(V_0) zero-sequence voltage metering</td>
</tr>
<tr>
<td>7</td>
<td>(V_A) phase voltage metering</td>
</tr>
<tr>
<td>8</td>
<td>(V_B) phase voltage metering</td>
</tr>
<tr>
<td>9(^4)</td>
<td>(V_C) phase voltage metering</td>
</tr>
</tbody>
</table>

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\(^1\) For other ranges, please consult the Ormazabal Technical - Commercial Department.

\(^2\) In the event of rear two-way ports, the one indicated in second place is in parallel with the front RS-232 (they occupy the same port).

\(^3\) The unit can have up to 9 analogue inputs (via a transformer).

\(^4\) Depending on the model, the input possibilities vary.
1.3. ENVIRONMENTAL CONDITIONS

- Operation temperature: -10 to +55 ºC
- Storage temperature: -40 to +85 ºC
- Relative humidity: up to 95% with no condensation

1.4. TESTS

1.4.1. Electrical Tests
- Dielectric rigidity: acc. to IEC 255-5, C series (2 kV, 1 min)
- Insulation resistance: acc. to IEC 255-5, > 10 GΩ at 500 V<sub>dc</sub>
- Pulse (lightning impulse): acc. to IEC 255-5, appendix E., class III
- HF disturbances: acc. to IEC 255-22-1, class III
- Fast transients (bursts): acc. to IEC 61000-4-4, class IV
- Electrostatic discharges: acc. to IEC 61000-4-2, class IV
- Overvoltage pulses (surge): acc. to IEC 61000-4-5, class IV
- Voltage dips: acc. to IEC 60870-2-1, 100 ms at 110 V<sub>dc</sub>
- Radiated electromagnetic interference: acc. to EN 61000-6-4
- Immunity to radiated fields: acc. to IEC 61000-4-3, class III
- Immunity to induced signals: acc. to IEC 61000-4-6, class III radiofrequency
- Immunity to magnetic fields: acc. to low frequency IEC 61000-4-8

1.4.2. Climatic Tests
- Cold: acc. to IEC 68-2-1 (-40ºC)
- Dry heat: acc. to IEC 68-2-2 (+85ºC)
- Humid heat: acc. to IEC 68-2-3 (+70ºC, 93% Relative humidity)
- Thermal shock: acc. to IEC 68-2-14 (-20º/70ºC. 2 4-hour cycles)
- Operating range: -10ºC to +55ºC

1.4.3. Mechanical Tests
- Vibration tests: acc. to IEC 255–21-1 class I
- Shock and bump tests: acc. to IEC 255-21-1 class I
2. HARDWARE

2.1. CONSTRUCTIONAL CHARACTERISTICS

Horizontal box (ekorRPS-H).

Figure 2.1: External dimensions of the unit [mm]

Figure 2.2: Panel cut-off [mm]
2.2. REAR TERMINALS

Figure 2.3: Standard (all for pin-type termination)

Figure 2.4: Eyelet-type termination terminal option for analogue inputs
2.3. REAR COMMUNICATION OUTPUT OPTIONS

2.3.1. Single output

Figure 2.5: OF (glass or plastic)
Figure 2.6: RS-485
Figure 2.7: RS-232

2.3.2. Double output

Figure 2.8: OF + OF
Figure 2.9: RS-485 + RS-232
Figure 2.10: RS-232 + RS232
Figure 2.11: OF + RS-232

Figure 2.12: Ethernet OF + OF

Figure 2.13: Ethernet RJ45 + OF

Figure 2.14: Ethernet RJ45 + RS-232

Figure 2.15: Ethernet RJ45 + RS-485
3. TECHNICAL CHARACTERISTICS

3.1. AUXILIARY POWER SUPPLY VOLTAGE

- 24 and 48 V\textsubscript{dc} models
  - Operating range: 18 to 60 V\textsubscript{dc}
- 125 and 220 V\textsubscript{dc} models
  - Operating range: 86 to 280 V\textsubscript{dc}
- Consumption: 8 W minimum
  
  18 W maximum

3.2. OUTPUT CONTACTS

- Relays 1 to 6 and 8 to 13
  
  Passage of current (permanent) + 5 A to + 25 °C
  Max. inrush current (0.5 s) 30 A
  Breaking capacity
  \begin{align*}
    220 \text{ V}_{dc} & : 0.4 \text{ A} \\
    125 \text{ V}_{dc} & : 1 \text{ A} \\
    48 \text{ V}_{dc} & : 3 \text{ A} \\
  \end{align*}
  Breaking capacity
  \begin{align*}
    220 \text{ V}_{dc} & : 0.2 \text{ A} \\
    125 \text{ V}_{dc} & : 0.3 \text{ A} \\
    48 \text{ V}_{dc} & : 0.5 \text{ A} \\
  \end{align*}

- Relays 7 and 14
  
  Passage of current (permanent) + 5 A to + 25 °C
  Max. inrush current (0.5 s) 30 A
  Breaking capacity
  \begin{align*}
    220 \text{ V}_{dc} & : 0.15 \text{ A} \\
    125 \text{ V}_{dc} & : 0.4 \text{ A} \\
    48 \text{ V}_{dc} & : 2 \text{ A} \\
  \end{align*}
  Breaking capacity
  \begin{align*}
    125 \text{ V}_{dc} & : 0.25 \text{ A} \\
    48 \text{ V}_{dc} & : 0.5 \text{ A} \\
  \end{align*}
3.3. ANALOGUE OUTPUTS

- Range: 0 to 5 mA
- Accuracy: ±1% of full scale
- Maximum load: 1200 Ω
- Insulation: 1 kV

3.4. PHASE AND NEUTRAL CURRENT CIRCUITS (standard rating 1 A)

- Phases full scale: 40 A
- Neutral full scale: 20 A
- Thermal Capacity
  - Continuous: 20 A
  - Short duration: 500 A (1 s)
- Consumption $I_r = 1$ A: < 0.02 VA

3.5. SENSITIVE NEUTRAL OR ISOLATED NEUTRAL CURRENT CIRCUITS (standard rating 0.025 A)

- Full scale: 1 A
- Thermal Capacity
  - Continuous: 3 A
  - Short duration: 60 A (1 s)
- Consumption $I_r = 0.025$ A: < 0.015 VA

3.6. PHASE AND NEUTRAL CURRENT CIRCUITS (specified rating 1/5 A)

- Thermal Capacity
  - Continuous: 20 A
  - Short duration: 500 A (1 s)
  - Very short duration: 1250 A (half cycle)
- Consumption $I_r = 5$ A: < 0.2 VA
- Consumption $I_r = 1$ A: 0.02 VA

3.7. SENSITIVE NEUTRAL OR ISOLATED NEUTRAL CURRENT CIRCUITS (specified rating 0.25 / 0.025 A)

- Thermal Capacity
  - Continuous: 20 A
  - Short duration: 500 A (1 s)
- Consumption $I_r = 0.025$ A: 0.015 VA
3.8. VOLTAGE CIRCUITS

- Thermal Capacity
  - Continuous \(2 \text{ } U_r\)
  - Short duration \(5 \text{ } U_r\) (1 s)
    \(3.5 \text{ } U_r\) (1 min)
  - Consumption 63.5 V \(0.015 \text{ } \text{VA}\)
  - Consumption 100 V \(< 0.03 \text{ } \text{VA}\)

3.9. ACCURACY OF MEASUREMENTS

- Current
  - Range \((0 \text{ to } 1.2*I_r)\)
    For \(I_r=1\): class 1 (1% of \(I_r\))
    For \(I_r=5\): class 0.5 (0.5% of \(I_r\))
  - Protection range \((0.1 \text{ to } 200 \text{ A})\)
    1% of the real value, for \(I>1 \text{ A}\)
    3% of the real value, for \(I>1 \text{ A}\)
    (in areas where the measurement range and the protection range overlap, the accuracy is the best one of both of them)

- Voltage
  - Accuracy 0.5% of rated voltage \(U_r\) to \(1.2*V_r\)

- Phase difference angles
  - Accuracy \(\pm 1^\circ\)

- Active power
  - Range \((0 \text{ to } 1.2*I_r*1.2*V_r)\)
    For \(I_r=1\): class 1 (1% of \(P_r\))
    For \(I_r=5\): class 0.5 (0.5% of \(P_r\))

3.10. OPERATING FREQUENCY

- Rated: 50 or 60 Hz (programmable)
- Operating range: \(f_r \pm 5 \text{ Hz}\)

3.11. PHASE ORDER

- ABC or CBA (programmable)