CAUTION!

When medium-voltage 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 Standard IEC 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. This 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.[1]

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.

**Warranty**

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 warranty.

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[1] For example, in Spain the “Regulation on technical conditions and guarantees for safety in high-voltage electrical installations” – Royal Decree 337/2014 is obligatory.
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1. General description

Ormazabal’s ekor.gid Smart Distribution Management Unit combines Telemanagement, Monitoring of Low Voltage and Medium Voltage networks and Automation, along with its associated communications, in the Transformer and/or Switching Substations.

ekor.gid has the following advantages:

1. It represents a standard solution with components assembled and tested at the factory. This way, the quality of the equipment is guaranteed at the factory, which results in fewer errors on site.

2. Scalability of the investment. The items required for Telemanagement can be installed at an initial phase. Subsequently it is possible to add the rest of components required for greater control of the Transformer or Switching Substation either by the Monitoring of the Low or Medium Voltage network or via their Automation.

3. Maintains the installation’s safety levels for personnel as well as for the equipment. Does not decrease insulation levels and protects the connections.

4. Maintains the operational clearance and does not use up space for future expansion with new lines.

5. Reduces the ergonomic hazards of the work station and provides good accessibility to the equipment.

Figure 1.1. General view of ekor.gid
1.1. General operating features

**Ormazabal's ekor.gid Smart Distribution Management Unit** contains the components required for carrying out the following functions:

1. **Telemanagement**
   Collects and processes information from the Low Voltage customer meters. Sends the information collected and processed to the Telemanagement System by way of STG connection.

2. **Monitoring of the Low Voltage network**
   Measures and processes the electrical characteristics of Low Voltage consumption.

3. **Monitoring of the Medium Voltage network**
   Measures and processes the electrical characteristics of Medium Voltage consumption, alarms from the Transformer Substation and faults.

4. **Automation of the Medium Voltage network**

5. **Communications**
   This acts as a communication link between the Dispatching centre and the corresponding elements for the Monitoring and Automation functions.

<p>| | |</p>
<table>
<thead>
<tr>
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</table>
| 1 | Medium Voltage monitoring  
- Fault indication  
- Measurements: V, I, P, Q  
- Alarms |
| 2 | Ethernet IEC 60870-5-104 |
| 3 | Communications  
- GPRS  
- PLC-MV  
- O.F  
- Radio |
| 4 | PLC - LV; Prime protocol |
| 5 | Low Voltage monitoring  
- TS complete measurements  
- LV line measurements  
- LV blown fuse  
- Customer connectivity |
| 6 | Telemanagement  
- Customer meterings.  
- Quality parameters  
- Breaking and restarting  
- Manufacturer compatibility |
| 7 | Automation  
- Remote control  
- Automations  
- WEB server  
- Maintenance (fault detection, V, I, P, Q, alarms). |

**Figure 1.2. ekor.gid functions**
2. Applications

2.1. Telemanagement

The Transformer or Switching Substations with Basic Telemanagement include the equipment and technology required for remote management of the Low Voltage meters. To accomplish this, the following components are included inside the ekor.gid unit:

1. Communication components
2. PLC concentrator
3. Low Voltage Monitor(s)
4. Ethernet gateway
5. Power supply equipment

![Figure 2.1. Detail of ekor.gid in the pfu.7 transformer substation](image)

The ekor.gid unit includes the structure required so that the Medium Voltage Monitoring or even the Automation of the Transformer or Switching Substation can be added in the future. This is especially the case using the Ethernet communication ports that are available in the communication components of the ekor.gid unit.

2.2. Monitoring of the Low Voltage network

2.2.1. Basic monitoring of the Low Voltage network

The Basic Monitoring of the Low Voltage network is included by default in any of the three applications: Substation with Basic Telemanagement, Monitored Substation or Remote Controlled Substation.

The Basic Monitoring includes the following functions:

- Metering of the instant voltage values per phase, current per phase, power factor per phase and active, reactive and apparent three-phase power per each Low Voltage board.
- Calculation of the total powers per each Low Voltage board: active and reactive energy.

This basic functionality is implemented through the ekor.gid unit Low Voltage Monitor(s).

![Figure 2.2. ekor.gid communication with Low Voltage Board](image)
2.2.2. **Advanced monitoring of the Low Voltage network**

The Advanced Monitoring of Low Voltage is a functionality that can be included in any of the three applications: Substation with Basic Telemanagement, Monitored Substation or Remote Controlled Substation.

In addition to the functions previously described in the Basic Low Voltage Monitoring, the Advanced Monitoring of the Low Voltage network allows the following functions:

- Current metering per each one of the Low Voltage board (or fuse) outputs.
- Blown fuse detection in each Low Voltage line.
- Possibility of developing algorithms for identifying the Low Voltage connectivity.
- Possibility of fuse temperature detection.

The Advanced Monitoring of the Low Voltage network is implemented using sensors in the Low Voltage fuses of the board available in the Substation. These sensors are self-powered by a 10 A current through the fuse.

Additionally, these sensors have a radio transmitter to report the information collected in the fuse to the **ekor.gid** unit.

In order to receive this information from the fuse, the **ekor.gid** unit includes a component called the Ethernet Gateway that functions as a radio receiver, 10 kV insulator and MODBUS master.

In its Modbus master function, this Ethernet gateway also collects the data originating from the Low Voltage network Monitor(s) (Basic Monitoring data) and makes them available along with the Advanced Monitoring data, to send them to the Customer Management Centre via communications.

![Fuse detail in Low Voltage board](image)
2.3. Monitoring of the Medium Voltage network

The Monitored Transformer or Switching Substations include the equipment and technology required for carrying out the remote reading of meters as well as the Monitoring of the Medium Voltage network. To accomplish this, the Transformer or Switching Substation will include the following components:

Equipment for the monitoring of the Medium Voltage network installed in the Medium Voltage switchgear of the Transformer or Switching Substation.

An ekor.gid unit which includes:

1. Communication components
2. PLC concentrator
3. Low Voltage network monitor(s)
4. Ethernet gateway
5. Power supply equipment: this power supply equipment is also responsible for powering the equipment for Monitoring the Medium Voltage network.

In cases where the Substation is monitored, in addition to having an ekor.gid unit, there is at least one cubicle with an ekor.rci unit, whose primary purpose is the Monitoring of the Medium Voltage network.

Monitoring of the Medium Voltage network corresponds to the ekor.rci Integrated Control unit, which has the following functions implemented:

- Directional fault indication. This functionality facilitates the location of failures inside the Electrical network.
- Metering of the Medium Voltage electrical parameters: voltage, current, active power and reactive power. These meterings are meant to optimise the energy flows.
- Detection of substation alarms coming from different sensors:
  - Water or level sensor
  - Fire or smoke sensor
  - Presence of personnel at the Substation sensor or intruder alarm
  - Transformer temperature sensor
  - Others…
- Communications protocol IEC 60870-5-104 for communicating with the Operation dispatching Centre through communication components of the ekor.gid unit.
- Web server included with the Integrated Control unit for consulting all the functions available in the ekor.rci unit as well as modifying settings and updating functionality.
2.4. Automation

The Automated Transformer and Switching Substations include the equipment and technology necessary for carrying out the Remote Control and Automation of the network, as well as the remote reading of the meters. To accomplish this, the Transformer and/or Switching Substation includes the following components:

Equipment for automation of the network installed in the Medium Voltage switchgear of the Transformer and/or Switching Substation.

An ekor.gid unit which includes:

1. Communication components
2. PLC concentrator
3. Low Voltage network Monitor(s).
4. Ethernet gateway

In cases in which the Substation is automated, in addition to having an ekor.gid unit, the Substation includes at least one ekor.uct unit or a cgmcosmos-2lpt Compact Cubicle with Integrated Remote Control Equipment, through which the automation and remote control of the entire Substation is carried out.

The Automation of the Medium Voltage network is an ekor.uct Compact Remote Control Unit or a cgmcosmos-2lpt Compact Cubicle with Integrated Remote Control Unit, which has the following functionalities implemented:

1. Operation and status of the Medium Voltage switchgear.
2. Directional fault indication. This functionality facilitates the location of damages inside the Electrical network.
3. Metering of the Medium Voltage electrical parameters: voltage, current, active power and reactive power. These measurements are meant to optimise the energy flows.
4. Enable alarms using different sensors:
   - Water or level sensor
   - Fire or smoke sensor
   - Presence of personnel at the Substation sensor or intruder alarm
   - Transformer temperature sensor
   - etc.
5. Medium Voltage transformer position trip with presence of any alarm (fire, water, etc.).
6. Communications protocol IEC 60870-5-104 implemented in the ekor.ccp unit for communicating with the Operation Control Centre through the ekor.gid.
7. Web server included with the ekor.ccp Programmable Cubicle Controller for consulting all the functions available in the ekor.ccp unit as well as modifying settings and updating functionality.
8. Possibility of programming restore-service automations.
9. Power supply equipment:
   There is a direct current power supply that is connected to the Substation’s Low Voltage Board. This power supply equipment adapts the direct voltage level to the power supply both for internal components and all the equipment available in the ekor.gid unit. It also charges the batteries included with the ekor.uct unit, which allows feeding these components in the absence of voltage.

2.5. Communications

The ekor.gid Smart Distribution Management Unit provides the Substation with the possibility of integrating different means for establishing communication with the Customer Management Centre or the dispatching Centre:

1. GPRS
2. PLC-Medium Voltage
3. Optical Fibre
4. Radio

Isolated communication of the Low Voltage network is possible thanks to the operating time provided by the batteries integrated in the ekor.gid unit, which provide power to these components in the absence of voltage.

The option is available for adding a PLC-Medium Voltage router for grouping several Transformer Substations, etc.
3. Main components of ekor.gid

The components of the wall-mounted version of the ekor.gid Smart Distribution Management Unit are shown below.

![Diagram of ekor.gid components]

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Communications Compartment</td>
</tr>
<tr>
<td>2</td>
<td>Low Voltage connections compartment</td>
</tr>
<tr>
<td>3</td>
<td>Interior enclosure interlock system. Low Voltage Access</td>
</tr>
<tr>
<td>4</td>
<td>Connection, protection and power supply components</td>
</tr>
<tr>
<td>5</td>
<td>Communication components</td>
</tr>
<tr>
<td>6</td>
<td>Batteries</td>
</tr>
<tr>
<td>7</td>
<td>PLC concentrator</td>
</tr>
<tr>
<td>8</td>
<td>Ethernet gateway</td>
</tr>
<tr>
<td>9</td>
<td>Low Voltage Monitor</td>
</tr>
<tr>
<td>10</td>
<td>Connection and protection components</td>
</tr>
<tr>
<td>11</td>
<td>Power supply equipment</td>
</tr>
</tbody>
</table>

Figure 3.1. Main components of wall-mounted ekor.gid
The cubicle-mounted integrated solution has the following layout of elements of the *ekor* gid Smart Distribution Management Unit:

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Auxiliary terminals</td>
</tr>
<tr>
<td>2</td>
<td>Low Voltage Monitor</td>
</tr>
<tr>
<td>3</td>
<td>Concentrator</td>
</tr>
<tr>
<td>4</td>
<td>ED Module</td>
</tr>
<tr>
<td>5</td>
<td>ED Terminals</td>
</tr>
<tr>
<td>6</td>
<td>GPRS Modem</td>
</tr>
<tr>
<td>7</td>
<td>GPRS Antenna</td>
</tr>
<tr>
<td>8</td>
<td>Low Voltage Indicator</td>
</tr>
<tr>
<td>9</td>
<td>Isolation transformer</td>
</tr>
<tr>
<td>10</td>
<td>Voltage Terminals</td>
</tr>
<tr>
<td>11</td>
<td>Test block</td>
</tr>
</tbody>
</table>

*Figure 3.1. Main components of cubicle-mounted *ekor* gid-s*
3.1. Enclosure

3.1.1. Wall-mounted

The exterior enclosure of the ekor.gid unit is made of metal in order to achieve an improved mechanical protection and greater rigidity. This ensures a greater protection of its internal components against handling accidents such as dropping the unit and external impacts, or accidents once the unit is installed at its final location. Also, internal components, whose weight require them to be securely fastened to the structure, can be installed at the factory.

In accordance with current regulations, the ekor.gid Smart Distribution Management Unit has reduced depth dimensions so it can be installed without obstructing the operational clearance of the Transformer or Switching Substations.

It has two independent and removable doors to allow proper access to its interior in areas with reduced space. This allows for optimum operation of its components under any circumstance.

Its interior is divided into two clearly differentiated areas or compartments, which are accessed via each of the doors:

- The top area, Communications Compartment, houses the communication components and the batteries. All the components are connected to a protective earth and therefore they can be directly accessed for maintenance, configuration, etc.
- The lower area, Low Voltage Compartment, houses the Low Voltage components like the power supply equipment, PLC concentrator, Low Voltage Monitor(s), Ethernet gateway and each of their different connection/protection components. These components are referenced to the Low Voltage neutral potential and are integrated inside polycarbonate, providing a 10 kV insulation that does not allow accessing them if they have not been previously disconnected, in order to ensure the safety of the operators.

The cabinet incorporates non-forced ventilation by means of side grilles for proper circulation of the air and the heat generated by the different components.

Since this is a cabinet with a metallic structure, the fire load is minimal.

3.1.2. Cubicle-mounted

The exterior enclosure of the ekor.gid-s unit is metal, using the same fastening and support elements as those designed for other cabinets installed on cubicles. Mechanical protection is therefore maintained, along with improved rigidity. This ensures a greater protection of its internal components against handling accidents such as dropping the unit and external impacts, or accidents once the unit is installed at its final location. Also, internal components, whose weight require them to be securely fastened to the structure, can be installed at the factory.

The ekor.gid-s cubicle-mounted Smart Distribution Management Unit uses the space on the cubicle to integrate the telemanagement and communications solutions without having to occupy the operating clearance in Transformation or Switching Substations, in accordance with current regulations.

The interior is defined in two zones or compartments which are accessed from the front of the cubicles, straightforwardly and close to the door:

- The exterior zone, namely the Communications Compartment, houses the communication elements on the door. A volume has been defined which allows the installation of different communication solutions, as well as the communications antenna. All the components are connected to a protective earth and therefore they can be directly accessed for maintenance, configuration, etc.
- The interior, Low Voltage Compartment, houses the Low Voltage Remote Management components like the PLC concentrator, Low Voltage Monitor(s), Ethernet gateway and each of their different connection/protection components. These components are referenced to the Low Voltage neutral potential and are integrated inside polycarbonate, providing a 10 kV insulation that does not allow access if they have not been previously disconnected, in order to ensure the safety of operators.

The cabinet incorporates non-forced ventilation by means of rear grilles for proper circulation of the air and the heat generated by the different components.

Since this is a cabinet with a metallic structure, the fire load is minimal.
3.2. Communications Compartment

3.2.1. Wall-mounted

The Communications Compartment is located in the upper part of the ekor.gid unit and is where the communication components are housed; their primary purpose is to transmit the readings taken by the customer's low voltage meters to the Customer Management Centre.

The type of communications that can be established between the ekor.gid unit and the Customer Management Centre or the Control Centre are: GPRS, PLC-Medium Voltage, optical fibre and radio.

The following communication equipment can be installed in the ekor.gid unit:

1. PLC - Medium Voltage Modem
2. GPRS Router - modem
3. Switch
4. ADSL modem: GPRS Router - modem

All the components are connected to a protective earth and therefore they can be directly accessed for maintenance, configuration, etc.

3.2.2. Cubicle-mounted

The Communications Compartment reserved in the ekor.gid-s corresponds to the volume on the inside of the door. This location houses the communication elements, the main aim of which is to transmit the readings made by the low voltage meters of the consumers to the Customer Management Centre.

The volume for the communication equipment between the telemanagement elements of the ekor.gid-s unit and the Customer Management Centre or Control Centre may contain:

1. PLC - Medium Voltage Modem
2. GPRS Router - modem
3. Switch
4. ADSL modem: GPRS Router - modem
5. ...

The communication components already available in the ekor.gid unit in the Transformer and/or Switching Substation can be used for carrying out other additional functions such as the ones listed below:

- Monitoring of the network. To accomplish this, the ekor.rci integrated control unit monitors the Medium Voltage network and communicates with the Operation Control Centre by means of the ekor.gid unit's communications components.

- The automation of the Transformer and/or Switching Substation. In this case, the Substation includes an ekor.uct Remote Control Compact Unit, or a cgmcosmos-2lpt Compact Cubicle with Integrated Remote Control Equipment that allows carrying out the functions associated with the Automation and Remote Control of the Substation (e.g.: the operation of the switchgear, the displaying of the Substation's status, etc.). The available ekor ccp unit communicates with the Operation Control Centre by means of the ekor.gid unit's communications components.

All the components are connected to a protective earth and therefore they can be directly accessed for maintenance, configuration, etc.

The versatility of the installation of the communication elements thanks to their cubicle-mounted location, close to the Low Voltage board and the automation devices, means these communication systems can be used to generate other communications architectures of other systems in the Substation (Low Voltage Advanced Monitoring, Monitoring of the Medium Voltage network, etc.).
3.3. Batteries

3.3.1. Wall-mounted

The batteries available in the ekor.gid unit are sealed and made of pure lead. The batteries have the following characteristics:

1. Adjustable / resealable valve technology
2. 8 batteries with an operating life time of 2.5 Ah and 6 V
3. Duration: an average life of 15 years
4. Maintenance-free

3.3.2. Cubicle-mounted

The ekor.gid-s model is designed to accompany the automation devices, since it has a charger and power batteries. Combining the ekor.gid-s unit with a Telemanagement unit with charger and batteries means the Telemanagement and communications equipment with multi-range voltage (Vac and Vdc) can supply direct voltage, bringing the benefit of uninterrupted power.

3.4. Low Voltage Compartment

3.4.1. Wall-mounted

The Low Voltage cabinet area is designed as a high safety area as it includes a second enclosure made of plastic (polycarbonate) that allows the electrical and physical isolation of all the components that are housed inside. The main characteristics of the polycarbonate are:

1. Self-extinguishing material.
2. Shock resistant. Withstands impact tests with a 4.11 kg steel ball (DIN 52290).
3. High degree of light transmission. Up to 88-90% for a 3 mm thick sheet.
4. Very light weight, with a density of 1.2-3.6 kg/m2. Half of that of glass.
5. Temperature performance limit: 80 ºC without deformation.

This polycarbonate enclosure guarantees complete isolation between the components housed inside and the rest of the cabinet. Also, it includes an interlock system that prevents its opening if it has not been previously disconnected from the Low Voltage power going to the assembly. This way, the protection of the operators is guaranteed if they need to handle the interior components.

A small-sized removable auxiliary window that allows access to the protection miniature circuit-breakers that are housed inside, without interrupting the service. This window is identified and includes the required instructions in accordance with all the safety criteria.

The Low Voltage Compartment is the place where all the components that allow carrying out the Telemanagement of the Transformer and/or Switching Substation are housed. These components are referenced to the Low Voltage neutral potential. Since the enclosure of the ekor.gid unit is at protective earth potential, all the components are integrated inside polycarbonate to prevent insulation problems. This polycarbonate enclosure, in addition to providing the necessary insulation between the Low Voltage and Medium Voltage, includes an interlock system that prevents accessing the Low Voltage Compartment until the voltage inputs coming from the Low Voltage Board have been disconnected.
The components available in the ekor.gid unit Low Voltage compartment are the following:
1. PLC concentrator
2. Low Voltage network monitor(s)
3. Power supply equipment
4. Ethernet gateway
5. Connection and protection components: terminals and miniature circuit-breakers

3.4.2. Cubicle-mounted

The cabinet area corresponding to Low Voltage is designed as a highly safe area since it has a second plastic (polycarbonate) enclosure which electrically isolates all the elements housed inside from the metal enclosure in contact with the cubicle. The main characteristics of the polycarbonate are:
1. Self-extinguishing material.
2. Shock resistant. Withstands impact tests with a 4.11 kg steel ball (DIN 52290).
3. High degree of light transmission. Up to 88-90% for a 3 mm thick sheet.
4. Very lightweight, with a density of 1.2-3.6 kg/m2. Half of that of glass.
5. Temperature performance limit: 80 ºC without deformation.

This polycarbonate enclosure guarantees isolation between the components housed inside and the rest of the cabinet. All the cables and elements are isolated from the metal enclosure, which will be at the potential of the cubicle where it is installed.

3.4.3. PLC concentrator

The primary function of the Concentrator that is integrated inside the Smart Distribution Management Unit is the communication of the latter via Power Line Communications or Low Voltage PLC communications, with the digital meters used for the electricity supply for domestic customers. At the same time, this Concentrator is connected to all the ekor.gid Communications components, with the purpose of transmitting the readings to the Customer Management Centre.

The PLC Concentrator, as with the Low Voltage meters, is programmed with the PRIME communications protocol and this protocol is used for communications between the Concentrator and the Low Voltage meters.

Additionally, the PLC Concentrator includes a platform or Server for Web applications.

The PLC signal entering the Concentrator from the Substation’s Low Voltage board is protected or insulated against short-circuits.

The Ethernet output of the PLC Concentrator that is connected to the Communication components available at the upper part of the ekor.gid unit is connected to a 10 kV Ethernet insulator.

This component provides the insulation of the communications components (which are at protective earth potential) with respect to the equipment housed in the ekor.gid unit’s Low Voltage area up to a 10 kV voltage level.
The main characteristics of the insulator are as follows:

1. 10 kV passive insulator. Shock resistant thanks to its polystyrene construction. It does not have any accessible metallic components.

2. Individual insulation tests for each insulation unit. Suitable for use in an IEC 601-1-1 (class 3 safety) system environment.

3. Suitable for 10BASE-T Ethernet (IEEE 802.3) and 100BASE-TX phase Ethernet (IEEE 802.3u) connections.

4. Dimensions 102 x 53.5 x 32 mm

5. Maximum continuous voltage difference between ports 2 kV DC/ 2.5 kV AC (50 Hz)

6. Coupling capacity ≤ 15 pF

7. Leakage current at 10 kV (10 s) ≤ 5 uA

3.4.4. Low Voltage Monitor(s)

The Low Voltage Monitor is the component in charge of measuring the instant current and voltage per phase and calculating the instant power factor per phase as well as the active, reactive and apparent three-phase power and the active and reactive energies.

These electrical parameter meterings and calculations are carried out by each Low Voltage board; therefore, the ekor.gid unit includes two Medium Voltage Monitors for cases in which the Substation includes two Medium / Low Voltage transformers.

The monitors of the ekor.gid unit’s Low Voltage network communicate via RS-485 with the Ethernet Gateway, which is connected to the communication components, and they send the information from these to the Customer Management Centre.

3.4.5. Power Supply Equipment (depending on the model)

The power supply unit is a component connected to the Substation’s Low Voltage Board and from this voltage provides 230 VAC.

The power supply unit carries out the power supply and battery charging functions. This unit is linked with the batteries that are housed in the communications compartment, which are responsible for providing power to the ekor.gid unit in the absence of Low Voltage.

This component guarantees power to all the units that are located inside the ekor.gid unit, whether it is the Low Voltage equipment or the Communications equipment.

Additionally, this system provides power to the equipment external to the ekor.gid unit when the Transformer and/or Switching Substation includes a Medium Voltage Monitor.

For cases in which the Substation is Automated / Remote controlled, power for the different components of the ekor.gid unit (including the Low Voltage components as well as the communications components) is provided by the power supply system and the batteries available inside the ekor.uct unit or the Substation’s cgmcosmos–2lpt cubicle.

The main features are as follows:

1. Power supply input: the power supply receives a single-phase voltage of 230 Vac (P+N), although it is possible to feed it with three-phase voltage (3P+N), which provides a more reliable service in the case that one of the phases is lost.

Operating voltage range 110 Vac (-20%) at 230 Vac (+20%)

2. The power unit also includes the battery charger part up to 50 W. For this purpose, there is a 48 Vdc output which ensures the batteries available in the ekor.gid unit are charged. The charge is in C10.

3. Power supply outputs:
   a. 48 Vdc at protective earth potential: Power supply for the communication components of the ekor.gid unit as well as the Monitoring components in the case of a network Monitoring Substation.
   b. 48 Vdc at the Low Voltage neutral potential: Power supply of the Low Voltage components, which are required for carrying out the Telemangement (PLC Concentrator, Low Voltage monitor(s), etc.).
c. 48 V<sub>DC</sub> output at protective earth potential for charging the batteries. (The batteries are housed in the Communications compartment).

4. Input / output insulation (in the power supply): The insulation must be 10 kV / 50 Hz / 60 s between the power supply parts that are at Low Voltage potential (48 V<sub>DC</sub> input and output in Low Voltage) and the components at protective earth potential.

5. Short-circuitable output by means of a resettable fuse.

6. Operating temperature range: -10 to +60 ºC in accordance with standard NI 70.02.01

7. Ventilation by natural convection without mechanical components.

8. Alarms:
   a. Alarms for incorrect operation of the equipment and the batteries.
   b. Alarm for Loss of Alternating Voltage.

**Required functionality:**

1. Upon loss of Low Voltage, there cannot be zero voltage; instead, it should switch to being supplied directly from the batteries.

2. Batteries test.

The 10 kV of insulation at the power source prevents having to install an additional insulation transformer to protect the units housed inside the Communications Compartment, which affects the reliability of the assembly.

### 3.4.6. Ethernet

The Ethernet gateway is a component integrated inside the ekor.gid Low Voltage Compartment and implements the following functions:

1. Radio Receiver for Advanced Monitoring of the Low Voltage network
2. MODBUS master
3. 10 kV insulation

**Advanced monitoring of the Low Voltage network**

1. Radio Receivers
   - The radio receivers implement the following functionality:
     - Current metering per each one of the Low Voltage board (or fuse) outputs.
     - Blown fuse detection in each Low Voltage line.
     - Possibility of developing algorithms for identifying the Low Voltage connectivity.
     - Possibility of fuse temperature detection.
   
   Two radio receivers are installed inside the ekor.gid unit: one for each Low Voltage board that may be monitored.

   Each Radio Receiver can monitor up to 36 radio transmitter positions or Low Voltage fuses.

   Additionally, the Radio Receiver stores information of the transmitter / receiver configuration. This information corresponds to:
   1. Identifier of each one of the sensors (transmitter) that are added in Low Voltage (from 1 to 36).
   2. Version of the firmware available in the sensor.

**MODBUS master**

The Ethernet Gateway also carries out the functions corresponding to a master in a Modbus communications bus.

This component is in charge of managing the communications with the Radio Receiver and the Low Voltage Monitor, and facilitating all the information of this bus to the communication components via Ethernet.

**10 kV insulation**

The Ethernet Gateway, which is at Low Voltage potential, is connected directly to the communication components, which are at protective earth potential. Therefore, this component includes an additional 10 kV / 50 Hz / 60 s insulation.
3.4.7. Connection and Protection Components

The ekor.gid Smart Distribution Management Unit includes miniature circuit-breakers for protecting the different electrical components installed inside it. This ensures the integrity of the system against overvoltage problems and prevents unnecessary maintenance operations to replace defective components or components that are not operating properly as a consequence of these overvoltages.

The available protection components are one independent four-pole miniature circuit-breaker (3 phases and neutral) for each one of the Low Voltage boards that are monitored via the ekor.gid unit.

The characteristics of the four-pole miniature circuit-breakers are the following:

4. $I_n = 1$ A
1. $I_{cu} = 25$ kA
2. $I_{ca} = 75\% I_{cu}$
3. D type curve

As connection components, the ekor.gid unit includes short-circuitable and disconnectable terminals with 6 currents per each Low Voltage board to be monitored.

3.5. ekor.gid unit interconnections

3.5.1. Telemanned Substation/Low Voltage network Monitor

Wall-mounted

The wiring corresponding to the currents and voltages required for carrying out the functions for telereading of meters enters the ekor.gid unit through the base of the Low Voltage Compartment, which is protected by the polycarbonate enclosure.

This input wiring is divided into Voltage and Current signals. There are 4 voltage outputs (3P+N) and 6 current outputs (Ia1-Ia2, Ib1-Ib2, Ic1-Ic2) for each Low Voltage board to be monitored. The voltage signals are wired to miniature circuit-breakers and, in the case of current signals, to test blocks or disconnectable and short-circuitable terminal blocks.

These cable feeds to the ekor.gid unit are carried out using packing glands without requiring external connectors.

The cables corresponding to Low Voltage signals are wired to different connectors that carry out the function of blocking the opening or interlocking of the cover used for accessing the entire Low Voltage Compartment. These components must be disconnected in order to access the inside.

The Low Voltage current signals are inserted into the protected area using feedthroughs.

All the components are supported by an insulated DIN rail made of plastic. The wiring is routed using plastic ducts. Both the wires and the ducts are halogen free.

Cubicle-mounted

The cable corresponding to the currents and voltages necessary to carry out the telereading functions of the meters enters the ekor.gid-s unit through the back of the cabinet, via the access fitted for this purpose.

This input wiring is divided into Voltage and Current signals. There are 4 voltage outputs (3P+N) and 6 current outputs (la1-la2, lb1-lb2, lc1-lc2) for each Low Voltage board to be monitored. The voltage signals are wired to the double-level terminals and, in the case of current signals, to test blocks or disconnectable and short-circuitable terminal blocks. There is a Low Voltage indicator which warns of the presence of Voltage in the access terminals.
These cable feeds to the ekor.gid unit are carried out using packing glands without requiring external connectors.

Figure 3.3. Low Voltage wiring in ekor.gid-s

3.5.2. Monitored Substation with wall-mounted ekor.gid

The monitored Transformer or Switching Substations have at least one cubicle with an ekor.rci Integrated Control unit used for the Medium Voltage Monitoring. This ekor.rci unit is powered directly from the ekor.gid unit.

For this purpose, the power supply voltage comes directly from the ekor.gid unit, using packing glands without requiring an external connector. This power supply output, like the communications wiring, is carried out through the top part of the ekor.gid (wall unit).

To simplify the connection between the ekor.gid and the cubicle with ekor.rci for the operator, a connection device is installed with two terminals for the power and a hub for the Ethernet connector. This component, which is housed in the Communications compartment of the ekor.gid unit, separates and isolates the communications of the power supply and distributes them inside the ekor.gid unit. The Ethernet hub connector includes an 8-wire connection.

This way, the installer only needs to install one prefabricated Ethernet cable and the power supply wires between the cubicles and the ekor.gid unit.

3.5.3. Automated Substation with wall-mounted ekor.gid

If the Transformer or Switching Substation is Automated and therefore includes an ekor.uct or cgmos-2lpt, the feeding of wires into the ekor.gid unit is carried out directly using packing glands without needing an external connector.

This power supply input, like the communications wiring, is carried out through the top part of the ekor.gid unit.

To simplify the connection between the ekor.gid and ekor.uct or cgmos-2lpt for the operator, a connection device is installed with two terminals for the power and a hub for the Ethernet connector. This component separates and isolates the power supply communications and distributes them inside the ekor.gid.

This connection device is housed inside the communications compartment of the ekor.gid unit. The Ethernet hub connector includes an 8-wire connection.

This way, the installer nature needs to install one prefabricated Ethernet cable and the power supply wires between the cubicles and the ekor.gid unit.
3.6. Other Components

There is another series of components that are external to the ekor.gid unit and are associated with it.

3.6.1. Low Voltage Sensors

The Low Voltage Sensors are housed in the fuse holders of the Low Voltage board and almost completely cover the fuses.

These sensors are responsible for carrying out the meterings required for the Advanced Monitoring of the Low Voltage network.

The main characteristics of these Low Voltage sensors are the following:

1. The installation of the sensors can be carried out on the existing Low Voltage network (they can be installed on the standard fuses).
2. The sensors do not require wired connections for each outgoing line because they have wireless radio links (free frequency of 433 MHz).
3. The sensors are self-powered.
4. Allows the possibility of only installing sensors on the most interesting Low Voltage lines and over which you want to implement the Advanced Monitoring.
5. The Low Voltage Monitor(s) that is used to carry out the Advanced Monitoring functions is independent of the number of Low Voltage lines to be monitored (up to 36 sensors).

Figure 3.4. Fuse with Low Voltage sensor
4. **ekor.gid models**

4.1. **Basic interior wall-mounted ekor.gid**

The Basic Interior ekor.gid Wall-Mounted Smart Distribution Management Unit includes the following main functions:

1. Telemanagement
2. Monitoring of the Low Voltage network
3. Interconnection with Automation of the Medium Voltage network
4. Communications

The Basic Interior Wall-Mounted Distribution Management Unit does not include a power supply unit since it is oriented towards Automated Substations, where the power is provided by the ekor.uct unit or the cgmcosmos-2lpt cubicle that is present at the Substation.

Additionally, this Basic ekor.gid unit can carry out the Advanced Monitoring of the Low Voltage network when it is associated with Low Voltage sensors in charge of carrying out the meterings required in the Low Voltage Board in order to implement these functions.

In the event that the Low Voltage Board does not include sensors, the Basic Monitoring of the low Voltage network is carried out.
4.2. Standard interior wall-mounted ekor.gid

The Standard Interior ekor.gid Wall-Mounted Smart Distribution Management Unit includes the following main functions:

1. Telemanagement
2. Monitoring of the Low Voltage network
3. Interconnection with Monitoring of the Medium Voltage network
4. Communications

The Standard Interior ekor.gid Smart Distribution Management Unit includes a power supply unit and is installed in Substations used for Remote Meter readings or even Substations that are to be monitored (in these cases, power for the component that monitors the Medium Voltage is provided by the ekor.gid).

Additionally, the Standard Interior ekor.gid unit can carry out the Advanced Monitoring of the Low Voltage network when it is associated with Low Voltage sensors, which are in charge of carrying out the meterings required in the Low Voltage Board in order to implement these functions.

In the event that the Low Voltage Board does not include sensors, the Basic Monitoring of the Low Voltage is carried out.

![Standard Interior ekor.gid](image)

Figure 4.2. Standard interior ekor.gid

4.3. Interior cubicle-mounted ekor.gid-s

The ekor.gid-s interior cubicle-mounted Smart Distribution Management Unit has the following main functions:

1. Telemanagement
2. Monitoring of the Low Voltage network
3. Interconnection with Monitoring of the Medium Voltage network
4. Collection of signals from the Substation (Flood, Fire, Intruder, etc.).
5. Communications

The ekor.gid-s cubicle-mounted Smart Distribution Management Unit does not have a power unit, but can be operated simply using the safe power of the charger with batteries, benefiting from its layout close to the cubicle-mounted automation.

Additionally, this Basic ekor.gid unit can carry out the Advanced Monitoring of the Low Voltage network when it is associated with Low Voltage sensors in charge of carrying out the meterings required in the Low Voltage Board in order to implement these functions.

In the event that the Low Voltage Board does not include sensors, the Basic Monitoring of the low Voltage network is carried out.

The ekor.gid-s can be used to collect activation signals from the sensors of the Substation. It is configured to transmit the signal from the limit switch to be installed in a door in order to detect intruders, or the buoy or smoke detector.

![Cubicle-mounted ekor.gid-s](image)

Figure 4.3. Cubicle-mounted ekor.gid-s
### 4.4. Cubicle-mounted ekor.gid-s integrated in the automation

The cubicle-mounted ekor.gid-s Smart Distribution Management Unit integrated in the automation has the following main functions:

1. Telemanagement
2. Monitoring of the Low Voltage network
3. Interconnection with Monitoring of the Medium Voltage network
4. Collection of signals from the Substation (Flood, Fire, Intruder, etc.).
5. Communications

The integrated cubicle-mounted ekor.gid-s Smart Distribution Management Unit uses the safe power of the charger with batteries, benefiting from its layout close to the cubicle-mounted automation.

Additionally, this Basic ekor.gid unit can carry out the Advanced Monitoring of the Low Voltage network when it is associated with Low Voltage sensors in charge of carrying out the meterings required in the Low Voltage Board in order to implement these functions.

In the event that the Low Voltage Board does not include sensors, the Basic Monitoring of the Low Voltage network is carried out.

The ekor.gid-s can be used to collect activation signals from the sensors of the Substation. It is configured to transmit the signal from the limit switch to be installed in a door in order to detect intruders, or the buoy or smoke detector.
5. Technical characteristics

5.1. Rated values

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<tr>
<th>Parameter</th>
<th>Unit</th>
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<td>Frequency</td>
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5.2. Mechanical design

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<thead>
<tr>
<th>Maximum Dimensions</th>
<th>Height</th>
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<tr>
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<table>
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<th>Width</th>
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</table>

(*) ekor.gid unit, standard interior wall-mounted model
(**) ekor.gid-s unit, standard model with GPRS communications.

Table 5.1. Mechanical design

ekor.gid exterior connections:

1. Power from Low Voltage board in ekor.gid-i-L-A-x-x
2. Connection to the monitoring cubicle (power supply + communications)
3. Connection to cgmcosmos-2lpt or ekor.uct (power supply + communications)
4. Connections to the sensors of the Substation or to the digital signals box of the Substation
6. Installation and connections

6.1. ekor.gid installation

6.1.1. Wall-mounted

The ekor.gid Smart Distribution Management Unit can be installed on any of the Substation’s free walls, regardless of the number of cubicles it contains.

The following steps must be followed for installing the ekor.gid on the wall:

1. Depending on the limitations of the Substation, install the lugs on the ekor.gid unit protruding to the left / right or protruding upwards / downwards.
2. Drill the holes corresponding to the lugs, using as the lower reference point a height of 1000 mm from the Substation floor.
3. Use a punch to mark the points where the holes are to be drilled.
4. Use an M8 bit to drill the two holes where the top part of the ekor.gid unit will be attached.
5. Fit M8 wallplugs in each of the holes.
6. Insert M8 screws in each of the wallplugs. Take care not to tighten the screws fully so that the ekor.gid unit can be supported on the two screws.
7. Hang the cabinet using proper mechanical means and finish screwing each one of the screws.
8. Once the ekor.gid unit is installed, drill its lower holes.
9. Fit an M8 wallplug in each of the holes and screw tightly into each of them.

This way the ekor.gid unit is installed at a height of about one metre from the floor, fixed with four screws.
6.1.2. **Cubicle-mounted**

The ekor.gid-s Smart Distribution Management Unit can be installed on any of the Substation's free walls, regardless of the number of cubicles it contains.

![Figure 6.2. Detail of installed cubicle-mounted ekor.gid](image)

The ekor.gid-s unit is ready for cubicle-mounted installation, through a system of supports which can be easily installed and coupled to the cubicle, even in compact spaces.

The following steps must be followed for installing the cubicle-mounted ekor.gid-s:

1. Place the supports on the cubicle, leaving them horizontally balanced. The supports have a pair of screws for height adjustment.
2. Bolt the supports to the side lugs of the cubicle.
3. Remove the cover from the cubicle's control.
4. Place the cabinet on the cubicle, using the cubicle lugs on the control. Doing this will leave the ekor.gid-s on the supports.
5. The right side of the ekor.gid-s has a window with 3 easily removable screws, to access the cabinet's attachment point with the support.
6. The other point to bolt the ekor.gid-s is on the bottom of the cubicle lugs, located above the motor control. It is bolted to the cages located in the cabinet.
7. The next step is to cover the motorised control, along with the cabinet's side cover.
8. Finally, the decorative covers should be placed on the other cubicles.

The ekor.gid-s is therefore installed cubicle-mounted in any position in the substation, secured at at least four points.
6.2. **ekor.gid connections**

### 6.2.1. **Wall-mounted**

Once the ekor.gid unit has been installed on the wall, the general connections are carried out, which are required to carry out the remote reading of the Low Voltage meters. These connections are the following:

1. **4 voltage signals (3P+N) per each Low Voltage board to be monitored (and therefore, per Medium / Low Voltage transformer in the Substation), with a maximum of 2 boards in the ekor.gid unit.** This wiring comes from the Low Voltage board and is connected to each of the two voltage connectors available on the ekor.gid unit, where preferably the left connector is used for transformer 1 and the right one for transformer 2.

2. **6 voltage signals (Ia1-Ia2, Ib1-Ib2, Ic1-Ic2) per each Low Voltage board to be monitored (and therefore, per Medium / Low Voltage transformer in the Substation), with a maximum of 2 boards in the ekor.gid.** This wiring comes from the Low Voltage board and is fed through the packing gland located in the lower part of the cabinet, to the disconnectable and short-circuitable terminals of the ekor.gid unit.

### Connections for the Monitoring of the Medium Voltage network

In the event that the Substation is Monitored, in addition to the general connections, the following connections between the ekor.gid unit and the corresponding Monitoring cubicle must be carried out:

1. **Two power supply wires (+48 V\textsubscript{dc} / 0 V) to feed the Medium Voltage network relays, which come out of a packing gland in the Communications Compartment of the ekor.gid unit and go to the Monitoring cubicle.** This circuit is protected by a miniature circuit-breaker.

2. **Two wires (+48 V\textsubscript{dc} / 0 V\textsubscript{dc}) that come out of a packing gland in the Communications Compartment of the ekor.gid unit and supply the protection cubicle trip circuit.** This circuit is protected by a miniature circuit-breaker.

3. **An Ethernet cable sheath with 8 wires, prefabricated and ending on both sides with an RJ-45 connector, which on one side is connected to the ekor.rci unit of the Monitoring cubicle and on the other side to a hub located inside the Communications Compartment of the ekor.gid unit. The cables are also fed in through the packing gland located at the top part.**

4. **Two wires (+48 V\textsubscript{dc} / 0 V\textsubscript{dc}) for the battery charger alarms that come out of a packing gland in the Communications Compartment of the ekor.gid unit and go to the Monitoring cubicle.**

### Connections for Automation

In the event that the Substation is Automated, in addition to the general connections, the following connections between the ekor.gid unit and the ekor.uct unit or the corresponding cgmcosmos-2lpt cubicle must be carried out:

1. **Two power supply wires (+48 V\textsubscript{dc} / 0 V) that come out of a packing gland in the Communications Compartment of the ekor.uct unit or cgmcosmos-2lpt unit and go to the ekor.gid unit, also entering through the packing gland in the Communications Compartment of the ekor.gid unit.**

2. **An Ethernet cable sheath with 8 wires, prefabricated and ending on both sides with an RJ-45 connector, which on one side is connected to the ekor.cpp unit of the ekor.uct unit or the cgmcosmos-2lpt cubicle and the other side to a hub located inside the Communications Compartment of the ekor.gid unit. The cables are also fed in through the packing gland located at the top part.**
6.2.2. Cubicle-mounted

Once the ekor.gid-s unit has been installed on the corresponding cubicle (the one closest to the Low Voltage board being recommended), the general connections are made, which are essential for telereading of the Low Voltage meters. These connections are the following:

1. 4 voltage outputs (3P+N) of the Low Voltage board to be monitored (and, therefore, for each Medium/Low Voltage transformer available in the Substation). This cable comes from the Low Voltage board and is introduced through the packing gland at the back of the cabinet, and connects wire-by-wire to the double-level voltage terminals in the ekor.gid-s unit; connecting to the bottom level of the terminal, which has been purposely left without any connections, is recommended.

2. 6 current outputs (Ia1-Ia2, Ib1-Ib2, Ic1-Ic2) of each Low Voltage board to be monitored (and, therefore, for each Medium/Low Voltage transformer available in the Substation). This wiring comes from the Low Voltage board and is fed through the packing gland located in the lower part of the cabinet, to the disconnectable and short-circuitable terminals of the ekor.gid-s unit.

3. Up to 4 digital signals (ED1, Ed2, Ed3, Ed4 and 2 common) of the Substation to be monitored. This cable comes from the sensors themselves or from a signal hub box of the Substation. It is introduced through the packing gland at the back of the cabinet, to the red terminals (digital inputs) and black terminals (common) of the ekor.gid-s unit.

4. When using safe power, the ekor.gid-s has two backup terminals to distribute the power which the safe power can be connected to. This twin-wire cable (+48 VDC / 0 V) comes from inside the cabinet through the bottom side input.
7. Additional information

7.1. Configurator

Not all combinations resulting from this configurator are possible. For the availability of other models, please consult Ormazabal's Technical - Commercial Department.

The following configurator is available for selecting the ekor.gid Smart Distribution Management Unit required for each installation:

Cabinet type:
- i – Interior wall cabinet
- s – Cubicle-mounted cabinet

Cabinet size:
- S – Basic size: never has power unit
  Automated Substation
- L – Standard size: always has power unit
  Telemanced or Monitored Substation
- ∅ – Cubicle-mounted model

Power supply:
- ∅ – No power supply: the power comes from the ekor.uct or cgmos-2lpt (cubicle-mounted model)
- A – With power supply equipment and batteries.

Low Voltage Monitors:
- 1 Low Voltage – Monitoring of the Low Voltage network
  (a single Medium/Low Voltage transformer in the Substation)
- 2 Low Voltage – Two Low Voltage network monitors
  (two Medium/Low Voltage transformers in the Substation)
  (second transformer monitoring in the case of cubicle-mounted)

Medium Voltage Monitors:
- ∅ – Without monitoring of the Medium Voltage network
- MT – With monitoring of the Medium Voltage network

7.2. CE CONFORMITY

This product complies with the European Union directive 2014/30/EU on electromagnetic compatibility, and with the IEC 60255 international regulations. The unit has been designed and manufactured for use in industrial areas, in accordance with EMC standards. This conformity is a result of the test carried out in accordance with article 7 of the Directive.