FGI Frequency Protection Terminal
Protection, Metering and Communications

Compatible Versys®
Description

The FGI is a powerful, microprocessor-based relay designed with state of the art digital technology. Incorporated into the unit are overfrequency, underfrequency, overvoltage, and undervoltage protection elements, complemented by metering and communication functions.

Each terminal unit can be used either individually or integrated into larger systems with other protective devices (CPI, MXI, TPI, etc.). Local and remote communication ports facilitate either type of application.

When the FGI is part of an integrated substation protection and control system, it is linked to a substation Central Unit using the remote communication port. The Central Unit is responsible for external communication and, if necessary, will emulate specified communications protocols.

Features

The following are standard features incorporated into FGI terminal units:

- 8 LED targets (7 programmable)
- Trip output
- Close output (FGI-B only)
- 2 configurable digital inputs
- 3 auxiliary outputs (2 programmable)
- Local and remote communication interface
- Metering: frequency and voltage
- Sequence of events recording

Application

Frequency is one of the defining parameters for “Power Quality” in electrical networks. During normal system operation (balanced generation and load) the power system frequency remains stable and usually very close to its rated value.

When fault conditions are present or in situations where the generation-load balance is disturbed, the frequency value changes upsetting the system stability. The FGI provides the system with a sensitive, fast and reliable protection against these abnormal situations.

FGI-B models automatically restore service to those circuits that have been cleared due to a load shedding initiated by the relay.

Overfrequency and underfrequency protection are also required at generator interconnection points, complemented with undervoltage, overvoltage and zero sequence voltage protection. FGI-C models include these functions.

Out-of-step protection is also required for interconnection systems. The out-of-step conditions may cause severe damage to the generator in cases where the interconnection circuit is provided with recloser. Therefore the protective relay should detect an out-of-step situation within 30 ms and trip the tie breaker. This protection is also included in FGI-C models.

Overfrequency and underfrequency protection are required in every substation, regardless of the voltage level.
Human-Machine Interface

FGI units can be accessed in two different ways:

- **Local Access:**
  1. **Keypad.** The FGI lets the user to access and change almost every function in the relay by scrolling through menus via the keypad (3 keys). This feature allows changes without the use of a computer.
  2. **Push Button.** The relays can be furnished with a sealable protective cover to restrict access to the keypad. With the cover installed, access to primary FGI information and functions is still available through the cover push button. Pressing the push button cycles through various information screens, displaying information and allowing operations such as:
     - Last trip data
     - Primary metering values
     - LED's and last trip data reset
  3. **Display.** Four (4) character LED type
  4. **Local PC.** FGI relays are provided with an RS-232 front port to allow local communication to a PC via a null modem cable. The relay can be accessed with the user-friendly software package.

- **Remote Access**

FGI units are provided with a rear communications port. This connection permits remote access via modem, or it can be used to include the FGI in an existing system (via RTU, Substation Central Computer or SCADA).
Communications

The [atcom] communications software program communicates directly with all types of [atcom] terminal units, either locally (via RS-232 front port), or remotely (via rear port).

[atcom] provides the user access to settings, local operations, input and output programming and data records. The program is password protected and can designate various levels of access to individual users.

[atcom] is an intuitive, Windows™ based program. The structure of the software consists of menus and graphical user interface dialog boxes. Each sub-menu prompts the user to enter data or make a selection among the available options.

[atcom] enables the user to program settings off-line. The information can be easily stored in the software database to be uploaded to the relays in the future.

Enclosure

3FGI unit dimensions are 1/7 of a 19" rack wide and 6 standard units high. This relay can be supplied in a 19" wide rack and 6 standard units high enclosure, as part of a system with other protective relays, all of them factory interconnected. 8FGI units are horizontally mounted and can be supplied with an adaptor to fit into a 2 standard units high 19" rack.
## Protection Settings

### General Settings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT Ratio</td>
<td>1 - 4000</td>
</tr>
<tr>
<td>Event Mask</td>
<td>YES/NO (*)</td>
</tr>
</tbody>
</table>

### Frequency Protection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Enable</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Unit Type</td>
<td>Overfrequency / Underfrequency</td>
</tr>
<tr>
<td>Pick-up</td>
<td>40.00 Hz - 70.00 Hz</td>
</tr>
<tr>
<td>Time delay</td>
<td>0.00 s - 20.00 s</td>
</tr>
<tr>
<td>Undervoltage block</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Undervoltage level</td>
<td>40 V - 120 V</td>
</tr>
</tbody>
</table>

### Voltage Protection

<table>
<thead>
<tr>
<th>Phase Units (3 x 27/59)</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Type</td>
<td>Overvoltage / Undervoltage</td>
</tr>
<tr>
<td>Time Delay Unit</td>
<td></td>
</tr>
<tr>
<td>Unit Enable</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Voltage - Time Characteristic</td>
<td>Inverse Curve / Definite Time</td>
</tr>
<tr>
<td>Definite Time Pick-up</td>
<td>20 V - 140 V</td>
</tr>
<tr>
<td>Definite Time Delay</td>
<td>0 s - 99.9 s</td>
</tr>
<tr>
<td>Curve time dial</td>
<td>0.05 - 1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Instantaneous Unit</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Enable</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Pick-up</td>
<td>20 V - 220 V</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0 s - 99.9 s</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neutral Unit (1 x 59N)</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Enable</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Pick-up</td>
<td>4 V - 60 V</td>
</tr>
<tr>
<td>Time Delay</td>
<td>0 s - 99.9 s</td>
</tr>
</tbody>
</table>

### Out-of-Step Protection

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Enable</td>
<td>YES/NO (*)</td>
</tr>
<tr>
<td>Pick-up</td>
<td>1º - 25º</td>
</tr>
<tr>
<td>Time delay</td>
<td>0.05 s - 20.00 s</td>
</tr>
<tr>
<td>Trip Latching Time</td>
<td>0.00 s - 20.00 s</td>
</tr>
</tbody>
</table>

(*) Unit disabling via HMI is done by setting the pickup value to zero.
Technical Characteristics

Power Supply Voltage*  
- 24-48 V dc (± 20 %)  
- 110-125 V dc (± 20 %)  
- 220-250 V dc (± 20 %)  
Rated Power Consumption: 7 W at 125 V dc

Analog Voltage Inputs  
- Rated voltage (Vn)  
  - 110 Vac, 50Hz  
  - 120 Vac, 60Hz  
- Thermal Withstand Capability  
  - 2 Vn (continuous)  
  - < 0.5 VA (Vn = 110 V)  
- Burden  
  - < 5 mA

Digital Inputs  
- Input Voltage Range*  
  - 24-125 Vdc (± 20 %)  
  - 48-250 Vdc (± 20 %)  
- Burden  
  - < 5 mA

Auxiliary Outputs  
- Connection Capability 2000 W  
- Breaking Capability 75 W (48Vdc)  
- 40 W (100 Vdc)  
- 1000 VA  
- Switching Voltage 250 Vdc  
- Continuous Current 3 A  
- Make and Carry 5 A (30 sec)

Trip & Close Contacts  
- Connection Capability 2500 W  
- Breaking Capability 150 W (48Vdc)  
- 55 W (100 Vdc)  
- 1250 VA  
- Switching Voltage 250 Vdc  
- Continuous Current 8 A  
- Make and Carry 30 A (1 sec)

Voltage Metering Accuracy  
- Rated frequency +/-3 Hz  
  - <5%  
- Display  
  - <5% +/- 1V

* Model selectable
Model Selection

Model selection is determined using the following figure, according to the characteristics required:

**Enclosure**
- Vertical Mount: 3
- Horizontal Mount: 8

**Functions**
- 81 Over/Under: A
- 81 O/U for load shedding: B
- 81 O/U + 2x(3x27/59) + 78 + 59N: C

**Power Supply**
- 24-48 Vdc (*): 1
- 110-125 Vdc (*): 2
- 220-250 Vdc (*): 3

(*) +/- 20%

**Frequency / Rated Voltage / Language**
- 50 Hz / 110 / 110 VAc / Spanish: 1
- 60 Hz / 120 / 120 VAc / English: 3
- 50 Hz / 110 / 110 VAc / English: B
- 60 Hz / 120 / 120 VAc / Spanish: D
- 60 Hz / 120 / 120 VAc / Portuguese: F

**Communications**
- RS232 Front: 1
- RS232 Front + Plastic Fiber (1mm) Rear: 2
- RS232 Front / Glass Fiber (SMA) Rear: 3
- RS232 Front / Glass Fiber (ST) Rear: 4

**Enclosure Type**
- 6U x 1/7 of 19" rack: D
- 1U x 19" rack mount: V

*8FGI models are designed to be mounted on 1 rack wide x 2U high adapter element.*