Over/under Voltage Protection
Protection, Metering and Communications
**Description**

TPI relay family, using digital technology of the last generation, incorporates over and under voltage protection functions as well as metering and communications. The following versions are available:

- **Single-phase over/under voltage (127/159) (selectable)**
- **Three-phase over/under voltage (3x27/3x59) (selectable)**
- **Single-phase residual voltage protection (1x59N)**

* 3rd harmonic filter included

Each relay can be used either individually or integrated in a system with other types of protections (CPI, FGI, FGI or others). Local and remote communications are available in each case.

When the relays are part of an integrated protection and control system, the connection to the remote center is made through the communications subsystem of each terminal. This subsystem is responsible for the external coupling functions.

**Application**

Voltage is one of the main electrical quantities for defining a Power System. The power equipment installed in a system, has been designed to operate at a given voltage level, however, small over voltages in the network have little effect on it.

Generators, transformers, capacitor banks, etc. are electrical machines very sensitive to over voltages. On the other hand, there are other components such as motors, regulators, etc. which should not operate under the rated voltage level.

Overvoltage and undervoltage protections are usually inverse or definite time type, with tripping times between 0.2 and 20 s. Instantaneous trip is required in those cases where the magnitude of the overvoltages is considerable.

TPI protective relays, are applicable in those installations requiring a reliable detection of voltage fluctuations.

**Functions**

In addition to the protection functions above described, they incorporate, as standard, the following ones:

- **Optical alarm indication**: 7 LED’s (6 configurable)
- **Tripping outputs**: (1 switched contact plus another configurable one a/b)
- **2 configurable digital inputs**
- **Programmable logic of auxiliary outputs**: (3 switched contacts)
- **Functions selection**:
  - 2 overvoltage levels
  - 2 undervoltage levels
  - 1 over and 1 undervoltage levels
- **Local and remote communications interface**
- **Measuring of voltage**
- **Event recording and Fault Reporting**

* Optional
Man-machine interface

Man-machine communication can be done in two different modes:
- **LOCALLY**, through:

  1. **Push button.** When the equipment has its cover on, access to it can be made through one push button. Pressing it, the information is displayed in a circular motion, showing the following features:
     - Last trip data
     - Measurements (referred to the primary side)
     - Last trip information and LED’s reset

  2. **Keyboard.** Removing the cover, user has access to the entire keyboard, 3 keys (↑, ↓ and Enter). Through the ↑, ↓ keys, access is allowed to the corresponding submenus, for example:

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Settings</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications</td>
<td>General</td>
<td>Measurements</td>
</tr>
<tr>
<td>Inputs and outputs</td>
<td>Protection</td>
<td>Last trip data</td>
</tr>
</tbody>
</table>

3. **Display.** LCD type with one row of 4 characters.

4. **PC.** Connected to a serial communications port, placed in the front of the equipment.

- **REMOTELY (optional),** through a serial communications port in the rear of the equipment. RS232 or Optical Fiber (glass or plastic) are the two available options.
Communications

The communications program enables the dialogue with TPI relays, and other equipment, either locally (via front port) or remotely (via serial port). This program covers every user need regarding programming, setting, operations, event recording, reporting, measuring data, etc.. The program is protected against unauthorized users by means of passwords, which runs in Windows™, is user friendly and requires buttons or keys to open the various submenus.

Each submenu contains one or several dialog windows which, in each case, ask user to either introduce data or select certain predetermined values.

The communication through the local port implies necessarily an automatic switch to local mode. Thus, remote access is inhibited. Configuration of the remote serial port and the programmable I/O, can only be carried out in local mode.

Modularity

The TPI protective relays are mounted in standard 1/7 19"rack metallic housing, (horizontal construction is also available) all are 6 RU high and painted in graphite color. They are designed for panel installation. Additionally, TPI equipment can be part of a system with other type of protections (CPI, MXI and/or FGI). In this case, housings would be 1/2 or 1 full 19"-rack. All equipment is protected with a transparent sealable cover.

Terminal blocks are placed in the rear of the equipment and admit wires of a cross section up to 4 mm² (11 AWG) for voltage circuits and 2.5 mm² (13 AWG) for the rest of the circuits.

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### Protection setting ranges

<table>
<thead>
<tr>
<th>General setting ranges</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Transformer ratio VT</td>
<td>1 - 4000</td>
</tr>
<tr>
<td>Over voltage Function</td>
<td>YES/NO</td>
</tr>
<tr>
<td>Under voltage Function</td>
<td>YES/NO</td>
</tr>
<tr>
<td>Over and Under voltage</td>
<td>YES/NO</td>
</tr>
</tbody>
</table>

#### Single-phase over/under voltage unit (1 × 27) / (1 × 59)

- **Pick-up unit, U< / U>**: $0 - (0.1 - 1.5) U_n$
- **Instantaneous U>, V**: $0 - (1 - 2.5) U_n$
- **Definite time t< / t>**: $(0 - 100) s$
- **Unit curve U<**: V/t
- **Unit curve U>**: V/t

#### Single-phase over / under voltage unit (3 × 27) / (3 × 59)

- **Pick-up unit, U< / U>**: $(0.1 - 1.5) U_n$
- **Instantaneous U>, T**: $(1 - 2.5) U_n$
- **Definite time t< / t>**: $(0 - 100) s$
- **Unit curve U<**: V/t
- **Unit curve U>**: V/t

#### Residual voltage unit (1 × 59N)

- **Pick-up unit U>**: $(0.2 - 0.5) U_n$
- **Definite time t>**: $(0 - 100) s$
**Technical characteristics**

**Auxiliary voltage (U_{aux})**
- 24-48 V dc (± 20 %)
- 110-125 V dc (± 20 %)
- 220-250 V dc (± 20 %)
- 230 V ac (± 20 %)

Power drain: 7 W

* Selectable according to models

**Voltage inputs**

- Rated values (U_{n})
  - 110 V, 50 Hz
  - 120 V, 60 Hz

- Thermal capability (continuous) 2xU_{n} (Phases)
- Thermal capability (for 10 s) 3.6xU_{n} (zero sequence)

**Digital inputs**

- Input voltage range
  - 24–250 ±20% V dc
  - 110 ±20% V dc/ac
  - 230 V ac

- Current Drain < 10 mA

**Tripping outputs**

- Switching capability 2500 W
- Breaking capability 250 W/1250 VA
- Switching voltage 250 Vcc
- I continuous 5 A
- I short duration 10 A during 0.5 s

**Auxiliary outputs**

- Switching capability 2000 W
- Breaking capability 200 W/1000 VA
- Switching voltage 250 Vcc
- I continuous 3 A
- I short duration 8 A during 4 s

* With a resistive load

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**Dimensions**

Enclosure Type "D"

Holes 5 mm Ø

Measurements in mm

NOTE: These dimensions are valid for both vertical and horizontal construction
Common mode 2.5 kV
Differential mode 1 kV

Standards and type tests

This equipment satisfies and exceeds the requirements of IEC-255 in its maximum class for all the values indicated below:

**Insulation test (IEC-255-5)**
- Between circuits and earth: 2 kV, 50 Hz, 1 min
- Between independent circuits: 2 kV, 50 Hz, 1 min

*Selectable according to models

**Impulse test**
- CEI 255-5: 5 kV, 1.2/50 µs, 0.5 J

**1 MHz disturbances**
- IEC 255-22-4 Class III: Common mode 2.5 kV
- Differential mode 1 kV

**Fast transients**
- IEC 255-22-1 Class IV: 4 kV ± 10%
- IEC 255-22-2 Class III: 8 kV ± 10%

**Electrostatic discharges**
- IEC-41B (5): 80

**Temperature (IEC-255-6)**
- Operating range: -10°C to +55°C
- Storage range: -25°C to +70°C
- Humidity: 95% (non-condensing)

**Alternating component (ripple)**
- IEC 255-11
- Ripple should always be less than 20%

**Radio frequency emissivity**
- IEC-41B (5) 80

**Degree of protection provided by the enclosure**
- IP 51 for the metallic enclosure. IEC-529

**Susceptibility to radiated electromagnetic fields**
- IEC-255-22-3 Class III: 10 V/m
Connections diagram

CONFIGURABLE DIGITAL INPUTS:
* Breaker position
* Blocking, etc

CONFIGURABLE DIGITAL OUTPUTS:
* Alarms
* Pickup unit
* Signals
* Tripping outputs, etc.

* Configurable a/b

MODEL
3TP-B0B-212000DA