# 1) Introduction

The teleprotection unit (TPS-HU) consists of:

- 1x 24/48Vdc Power Supply Unit
- 1x Service Unit (for interface with configurator/viewer software on PC)
- 1x Processing Unit with DSP
- 1x Digital or Analog Line Interface
- 1 up to 4 x Command Units.

## Service Unit – SU:

The TPS-HU Service Unit (SU) contains all the centralised circuits used for programming the equipment with a PC via the RS232 serial connection, and handling the alarms.

The following contacts are available:

A. Three switching contacts

− equipment alarms OR

− line alarms OR

− generic alarm which can be associated to one or more of the equipment alarms during the configuration phase

Each alarm can be configured with a delay.

B. Two normally closed relay contacts for alarm signals; a normally closed relay contact, with an adjustable delay, can be associated with each alarm.

The Service Unit is not involved in processing transmitted or received signals.

## Processing Unit – PU:

The Processing Unit has been designed using DSP devices, so that it can be used for:

- equipment configurations created by the user, who can set-up the following parameters:
    - number of commands
    - line interface type
    - event command associations
    - select desired safety and dependability level
    - high command type programmability
    - command redundancy

- storing/displaying the event history accurate to one millisecond
- updating the time tag
- updating the configurator SW
- accurate alarm indications
- indicating command statistics
- remote machine management service channel (digital carrier).

## Line Interface Units - LU:

The TPS equipment transmits and receives the commands via analog or digital carrier (with electrical or optical interface)

1. E1/G.703 Line Unit interface with 2.048 Mbps bitrate of digital electrical interface.

2. Line Unit Interface with a LONG.REACH fiber optic module (LU -FO LR-FC) used for long range digital connections (≅80Km), with a bit rate of 576 Kb/s and a proprietary data interface

3. Line Unit Interface with an INTERMEDIATE .REACH fiber optic module (LU -FO IR-FC), for use with medium range digital connections (40Km), with a bit rate of 576 Kb/s and a proprietary data interface.

4. Line Unit Interface with a POF module "Plastic Optical Fiber" (LU-FO POF), for use with SELTA STE-N II Analog PLC terminal connections only (up to 50 m). Proprietary data interface for transmitting events from/to PLC system.

5. Low Frequency interface (LF) unit for connection to SELTA STE-N or STE-N II Analog PLC terminals by wired analog electrical connection.

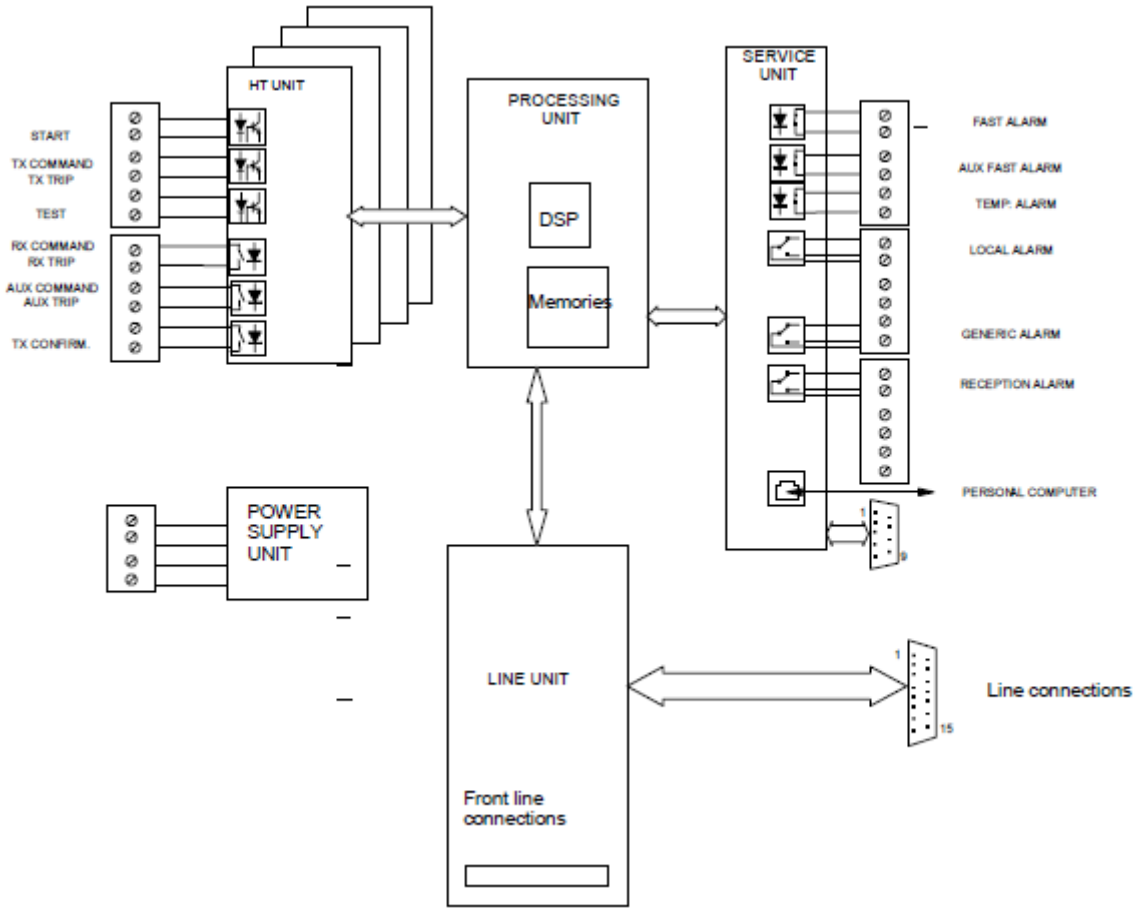
## High Voltage Unit – (HVU) for sending/receiving command:

Up to four "commands" are managed, with the following characteristics:

- High command safety guaranteed by a dedicated card,
- Completeness, since each command consists of 5 relays:
  - Two are used to transmit the command (Start and command)
  - Two provide command recognition
  - One acknowledges/duplicates the command
    - local in the case of transmission recognition
    - remote in the case of reception duplication
- Configurability in terms of the minimum activation delay integration period, etc.

## 2) Architecture:

The equipment architecture is as follows:




## 3) Subrack:

The equipment is housed in a metric sub-rack whose shape and external dimensions are indicated in following figure.

Note the sub-frame drill holes that make it compatible with ETSI mechanical structures and 19” industrial standard mechanical structures.

The field cables are connected on the back panel of the sub-rack.

The sub-rack has an ID label that includes the following information:

- Manufacturer
- equipment type or model
- serial number
- date of construction

The plastic guides mounted on the sub-rack at the industrial standard pitch distances make it easy to insert and extract the cards.

The cards are interconnected through the printed circuit card mounted at the back of the sub-rack. The field interface connectors are also mounted on this card. In particular:

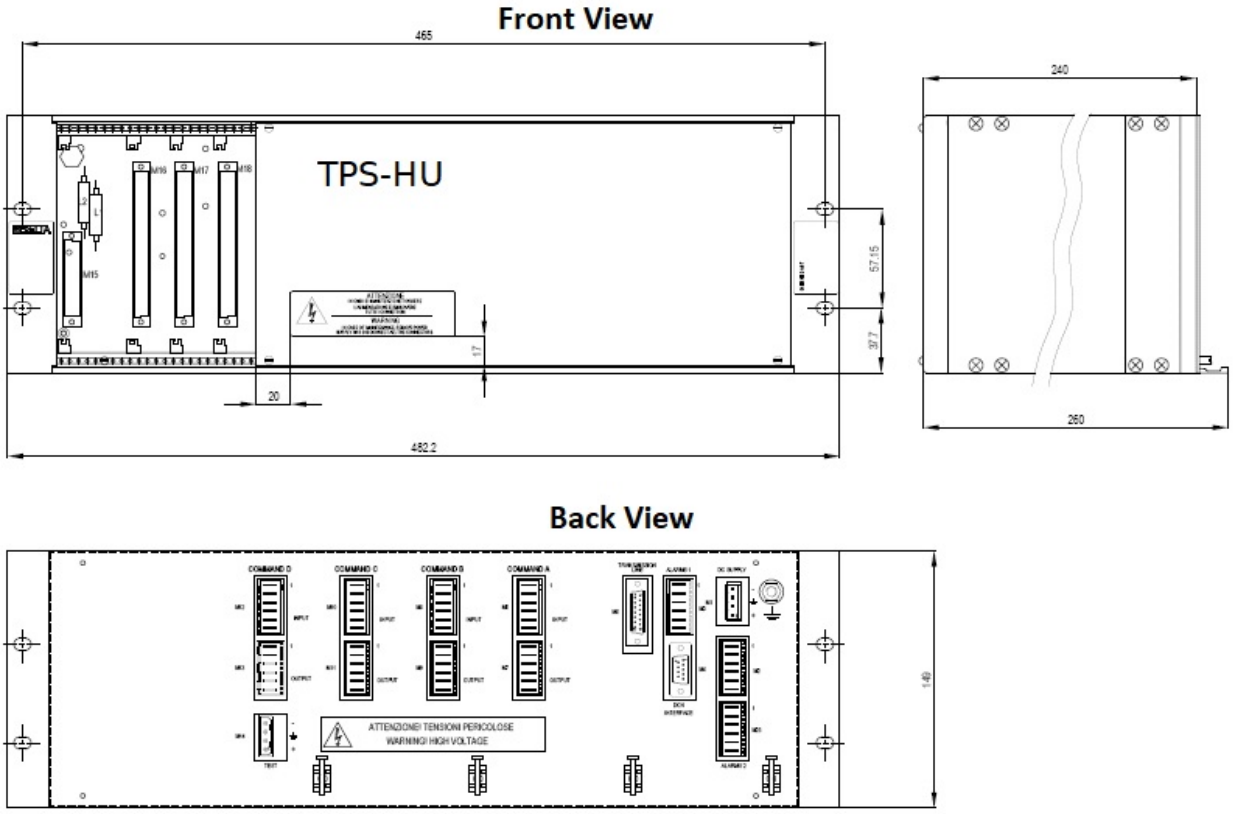
Connectors belonging to the equipment internal bus

- 1 x 32-pole DIN 41612 female connector - type C/2 (“a” and “c” rows) reserved for the direct current Power Supply Unit. ( 2 connectors in case of redundant PS option)
- 6 x dedicated 64-pole DIN 41612 type C (“a” and “c” rows) female connectors corresponding to the remaining card slots.
- 1 x 96-pole DIN 41612. C type (“a”, “b” and “c” rows) female connector.

“Field” connectors mounted on the top of the frontal panel of the sub-rack:

- 1 x 4-pole 5.08 mm pitch male connector for the equipment power supply
- 1 x 15-pole DB15 DIN 41652 male PCB connector for interconnections between TPS-NU and the transmission equipment in all cases apart from optical fiber connections.
- 3 x 6-pole 5.08 mm pitch male connectors for the equipment and summary alarms
- 4 x 6-pole 5.08 mm pitch male connectors for interconnections between TPS-NU and the distance protections (input commands)
- 4 x 6-pole 5.08 mm pitch male connectors for interconnections between TPS-NU and the distance protections (output commands)
- 1x ground terminal made up of screw and M.6 nut

Near each connector there’s an explanatory printing.



## 4) Electrical Characteristics:

DC Power Supply Unit

| | |
|---|---|
| Nominal supply Voltage (Vn) | 24/48 Vdc (+20/-15%) |
| Incorrect polarity and overload protection | self-resetting |
| In-rush current protection | I < 10 In (In = nominal current consumption) |
| Max. power consumption | < 25 W |

During the switching on and off or during any slow change in the power supply voltage (from 0 to the max. level allowed and vice versa), the equipment never carries out any false command.

HVU (High Voltage Unit) command interface

| | |
|---|---|
| COMMAND INPUT | |
| Type | opto-isolated |
| Nominal applicable voltages | 24/48/110 Vdc |
| Minimum applicable voltages | 8, 15 Vdc depending on the selected nominal voltage (≤48V or >48V) |
| Max. applicable voltage | 200 Vdc |
| Min. current | 3 mA |
| Max. current allowed | 20 mA |
| Protection against polarity Inversion | up to 300 Vdc |
| COMMAND OUTPUT | |
| Type | solid state relay - SSR |

- Data concerning solid state relays (HV –SSR)

Main output:

| | |
|---|---|
| Contact type | normally open |
| Max. switchable voltage | 200 Vac/200 Vdc |
| Max. current | 1A |
| Max. switchable power | 200 VA |

Auxiliary confirm command/anomaly outputs:

| | |
|---|---|
| Contact type | normally open |
| Max. switchable voltage | 200 Vac/200 Vdc |
| Max. current | 0.5A |
| Max. switchable power | 100 VA |

The contacts don't show any bounce phenomena.

Alarm interface characteristics

| | |
|---|---|
| ALARM OUTPUTS | |
| Type | Electromechanical relays |
| | Solid state relays |

- Electromechanical relay characteristics

| | |
|---|---|
| Contact type | switching contacts |
| Max. switchable voltage | 200 Vdc |
| Max. current | 2A |
| Max. switchable power | 400 Vaac |

110 Vdc 1 A, 48 Vdc 2 A

- Solid state relays characteristics

| | |
|---|---|
| Contact type | normally closed |
| Max. switchable voltage | 200 Vdc |
| Max. current | 0.5 A |
| Max. power | 100 VA |

Interface characteristics toward communication carrier – Line Units (LU):

*E1/G.703 digital data interface*

| | |
|---|---|
| Bit rate | 2.048 kb/s ± 50ppm |
| Line code | HDB3 |
| Nominal peak to peak voltage | 4.75 V (75Ω) |
| 6 V (120Ω) | |
| Impedance | 75Ω Unbalanced/120Ω balanced |
| Reflection attenuation | in compliance with ITU-T G.703 |
| Jitter | in compliance with ITU-T G.823 |

*SFP Long/Intermediate.Reach optical module data interface*

| | |
|---|---|
| Transmission support | mono-mode optical fiber (10/125µm) |
| Wavelength | 1550 nm for LongR (1310 nm for Interm. Reach) |
| Optical transmission power | -5 dBm≤ |
| Minimum sensitivity | -34 dBm |
| Guaranteed attenuation | 28 dB |
| Reception overload | -10 dBm |
| Optical connectors | LC |
| Opto-emitter safety limits | Compliant with EN 60825-1 |

*POF optical module data interface* (interfacing with Selta Analog PLC – Type: STE-N II)

| | |
|---|---|
| Transmission support | POF type optical fiber (plastic 1mm) (POF= Plastic Optical Fiber) |
| Wavelength | 650 nm |
| Optical transmission power | ≥-7dBm |
| Minimum sensitivity | -20dBm |
| Guaranteed attenuation | 12 dB |
| Reception overload | 0 dBm |
| Optical connectors | Latching Duplex |

*[Alternative] Power Line Carrier (PLC) equipment analog interface*

| | |
|---|---|
| Type | 4 wires |
| *TRANSMISSION TO PLC* | |
| Output type | unbalanced |
| Transmission band | 0 - 4 kHz |
| Command nominal level | -15 dBm ± 0.5 dB |
| Impedance | 600 Ω |
| Return loss | > 20 dB |
| Symmetry loss | > 46 dB (if balanced) |
| Carrier boost criterion<br>ground: R < 500 Ω with 20 mA<br>open: R > 10 kΩ, -24 Vcc | ground contact |
| Carrier cut criterion<br>ground: R < 500 Ω con 20 mA<br>open: R > 10 kΩ, -24 Vcc | ground contact |
| Local TPS-HU alarm | ground contact<br>electromechanical relay |
| RECEPTION FROM PLC | |
| Input type | unbalanced |
| Reception band | 12 - 16 kHz |
| Guard nominal level in idle mode | -33 dBm ± 3 dB |
| Guard nominal level during carrier boost | -15 dBm ± 3 dB |
| Command nominal level | -15 dBm ± 1 dB |
| Impedance | 600 Ω |
| Return loss | > 16 dB |
| Symmetry loss | > 46 dB (if balanced) |
| Reception dynamic | 25 dB |
| PLC alarm | ground contact; it is possible to invert the criterion by jumper setting |
| Remote TPS alarm | ground contact<br>electromechanical relay |

Local Supervision and Programming Interface data (SU)

Compliant with EIA RS-232C standard at 9600 b/s

ENVIRONMENTAL CONDITIONS

| | |
|---|---|
| *Normal operation:* | |
| Normal operating Temperature range | -10° / +55 °C |
| Relative humidity | ≤ 93% a 40 °C (in accordance with IEC721-3-3class 3K5 |
| Mechanical conditions | in accordance with IEC 721-3-3class 3M2 |
| *Storage:* | |
| Storage temperature range | -40 / +70 °C (in accordance with IEC 721-3-1 class 1K5 |
| Mechanical conditions | in accordance with IEC721-3-1 class 1M1 |
| *Transport:* | |
| Temperature range | -40 / +70 °C (in accordance with IEC721-3-2 class 2K4 |
| Mechanical conditions | in accordance with IEC 721-3-2 class 2M1 |