PowerLogic T500 Substation Controller

T500 Platform

User Manual

BQT7944801-00
06/2024

www.se.com

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Table of Contents

Foreword

Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

EU Directives

This equipment complies with the following Directives of the European Parliament and of the Council:

- EMC Directive 2014/30/EU
- LVD Directive 2014/35/EU
- RoHS Directive 2015/863/EU

Safety Instructions

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Electrical equipment must be installed, operated, serviced and maintained only by qualified personnel.
- All safety instructions in the Operation Manual must be read, understood and strictly followed, and the technical characteristics of the device must be checked before installing or working on this equipment.
- Do not work alone.
- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS-2011, CSA Z462, NFC 18–510 and UTE C18–510–1.
- Turn off all power supplying this unit before working on or inside the equipment. Consider all sources of power, including the possibility of back feeding.
- Before working on the equipment, check for hazardous voltage between all terminals, including the protective earth ground. Always use a proper rated voltage sensing device to confirm that the power is off.
- Start by connecting the device to the protective earth ground and to the functional ground.
- To open a live current transformer secondary circuit, turn off the primary side of the transformer and short-circuit the transformer secondary circuit.
- Screw tight all terminals, even those not in use.
- Set all devices, doors, and covers before turning on power to this unit.

Failure to follow these instructions will result in death or serious injury.

About the Book

Document Scope

This manual provides general information about PowerLogic™ T500 platform, including installation, wiring and other useful data for installers and designers.

Document Revision History

Document reference-revision	Release date	Modifications
BQT7944801 T500 Platform User Manual	06/2024	Creation

Conformity

The PowerLogic T500 platform has been developed in accordance with the requirements for a quality management system, complying with the ISO 9001:2015 standard.

Related Documents

Product	Title of documentation	Reference number
PowerLogic HU280 module	User Manual	BQT7944901
webApp Maintenance and Monitoring Tool	User Manual	BQT7944802
PowerLogic T500 webUI	User Manual	BQT7944803
Easergy Builder	User Manual	SE-S856-MSS
AI160	User Manual	BQT7988301
AX160	User Manual	BQT7988401
XS280	User Manual	BQT7988501
DI180	User Manual	BQT7945101
DO180	User Manual	BQT7945201
DO280	User Manual	BQT7945301

Information on Non-Inclusive or Insensitive Terminology

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T500 Platform Product Family

PowerLogic T500 Platform

The PowerLogic T500 substation controller range addresses applications in the energy automation domain. It is a high-technology platform which provides a solution to the business areas of Schneider Electric.

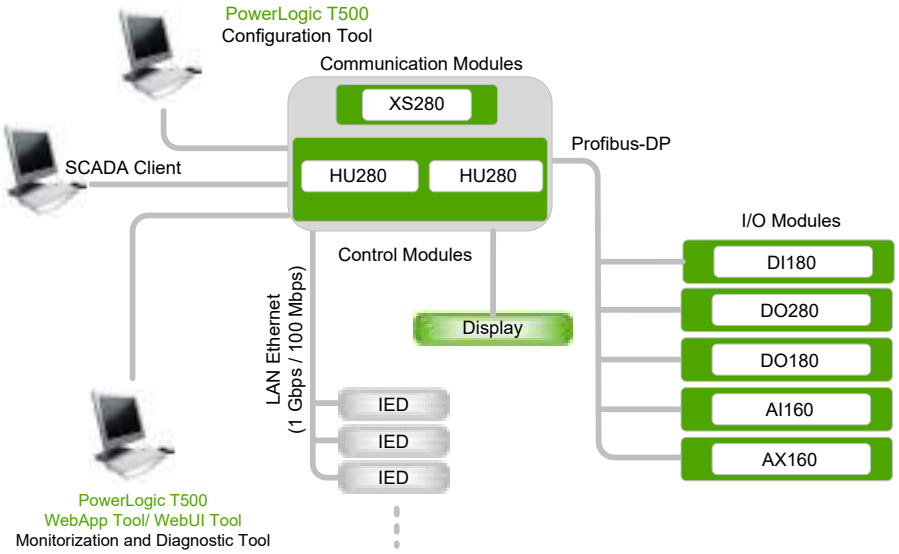
The following figures show a PowerLogic T500 in chassis (left) and in backplane (right).

PowerLogic T500 in chassis and backplane

The PowerLogic T500 design has been optimized to meet the most demanding requirements of multiple sectors:

- Cost-efficiency, minimum downtime, and compliance with electrical safety, electromagnetic compatibility and environmental standards.
- Safety and reliability requirements for power, gas, water, residual water supply, etc.
- Centralized monitoring and control of geographically-distributed systems which support hierarchical data acquisition and redundant networks.
- Local monitoring and control with data sharing capabilities of plant-distributed devices.
- Quick troubleshooting by means of programmable automation execution.
- Modular design: all I/O, power supply and communication modules have an identical format.

PowerLogic T500 architecture



PowerLogic T500 Modules

The PowerLogic T500 electronic modules have been designed to operate in aggressive industrial environments, complying with the highest standards, such as electromagnetic compatibility (EMC). The low-consumption design allows modules to operate without a forced ventilation system, which creates a wide range of possible applications.

General Features

The following figure shows an example of a T500 module:

T500 module

The modules have a plastic enclosure that is designed to facilitate the insertion and the wiring of the modules. The level of protection provided by the enclosure is IP20.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Do not open the enclosure of the module.
- Do not install an electronic board without the plastic enclosure.

Failure to follow these instructions will result in death or serious injury.

Internally, all modules are electrically connected to the backplane using a 48-pin connector on the rear side. In connection with external devices, all the elements required for the module operation and maintenance tasks are located on the front side.

Configuration Switches

The modules integrate a 12-position switch on the rear side. The function of these switches depends on the module type, but in general, the switches are used to set the addresses and communication rate.

Module configuration switches

For more information, refer to Profibus Configuration, page 57.

LED Indicators

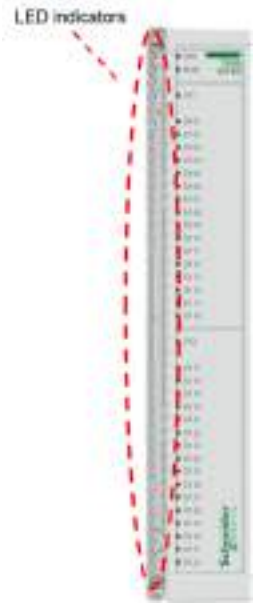
The T500 modules include some LEDs on the front side. All acquisition modules have common LEDs, and the remaining are specific for each module, which are detailed in the corresponding user manual.

The front panel of each acquisition module has a red indicator **DIA** and a green indicator **RUN**. The module performs a self-check during the start-up process. When successful, the red indicator is switched off and the green indicator displays the configuration status of the module.

If an issue is detected, the red indicator **DIA** is switched ON. The status of these LEDs depends on the module type.

This information is valid if the module is completely configured and operational.

LED indicators



For more information regarding the interfaces, configuration switches and LED indicators, refer to the user manual of the specific module.

Type of Modules

Module types	Module ID	Images	Description
Head unit	HU280		• OS: Linux • Web tool: webApp and webUI • Ethernet: 4 x 1 Gbps ports (copper or fiber optic) and 3 x 100 Mbps copper ports • SD card • Synchronization: GPS / SNTP / IRIG-B / IEEE1588 / Protocol • Serial communications: 2 ports (RS-232 / RS-485) • Watchdog output • Cybersecurity For more information, refer to the HU280 User Manual (BQT7944901).
Communication	XS280		• 8 serial ports • RJ-45 • Synchronous and asynchronous communications • RS-232 / RS-485 /RS-422 For more information, refer to the XS280 User Manual (BQT7988501).

Module types	Module ID	Images	Description
Digital inputs	DI180		• 32 digital inputs (single/double/slow counter) • Two removable connectors • Field connection: terminal connection or flat ribbon • Terminal block available for DI180 flat ribbon option: TB_DI32/N-TI180 • Auto-range for DI polarization. The available levels are: ◦ 12 - 24 Vdc ◦ 48 - 60 Vdc ◦ 110 - 125 Vdc For more information, refer to the DI180 User Manual (BQT7945101).
Digital outputs to transistor	DO280		• 32 digital outputs to transistor • Two removable connectors for signals • One removable connector for polarization (only for field connection using flat ribbon) • Field connection: terminal connection or flat ribbon • Output type: normally open or normally closed contacts (configurable in the external terminal lock) • Two models of terminal blocks available for DO280 flat ribbon option: TB_DO16/T – TO180/P2 – TO180/P3 and TB_DO16/P – TO180H DO polarization (auto-detected). The available levels are: ◦ 12 Vdc ◦ 24 Vdc ◦ 48 Vdc For more information, refer to the DO280 User Manual (BQT7945301).
Digital outputs to relay	DO180		• 16 digital outputs to relay • Two removable connectors for signals • Field connection: terminal connection or flat ribbon • Outputs type: SPST or normally open contacts • Terminal block available for DO180 flat ribbon option: TB_DO16/N – TO180/P0 • The 24 Vdc polarization level is available for DO For more information, refer to the DO180 User Manual (BQT7945201).
Analog inputs	AI160		• 16 analog inputs ◦ Voltage ◦ Current (external resistor is required) • Two removable connectors for signals • Field connection: terminal connection or flat ribbon • Terminal block available for AI160 flat ribbon option: TB_AI8/N – TA160 For more information, refer to the AI160 User Manual (BQT7988301).

Module types	Module ID	Images	Description
Analog inputs and analog outputs	AX160		• 8 analog inputs ◦ Voltage ◦ Current (external resistor is required) • 4 analog outputs ◦ Voltage (external resistor is required) ◦ Current multirange • Two removable connectors for signals • Field connection: terminal connection or flat ribbon • Terminal block available for the connection of analog outputs in AX160 flat ribbon option: TB_AO4/N – TS160 • Terminal block available for the connection of analog inputs in AX160 flat ribbon option: TB_AI8/N – TA160 For more information, refer to the AX160 User Manual (BQT7988401).
Power supply	PS280		Designed to power the electronic components on the backplanes and provide the required polarization voltage to the acquisition modules. • Power input depending on the part number: ◦ V2: 24 Vdc ◦ V3: 48 Vdc ◦ V4: 110 / 125 Vdc • Power output: 5.4 Vdc to the backplane • Auxiliary power output: 24 Vdc
9-slot or 4-slot backplane	BP260		• Power input: 5.4 Vdc (if a PS280 module is not used) • Two connectors for expansion and one connector for external power supply • Configuration switches for Profibus and synchronization expansion • LED indicators for bus communications and power • The number of slots depends on the selected option: ◦ N4: 4-slot ◦ N9: 9-slot
19-inch (48 cm) chassis	BP270		The electronic board backplane can be mounted in a 19-inch chassis: • Power input: 5.4 Vdc (if a PS280 module is not used) • Connectors: ◦ N8: two connectors for expansion and one connector for external power supply (each of the two individual backplanes) ◦ N9: two connectors for expansion and two connectors for external power supplies • Configuration switches for Profibus and synchronization expansion • LED indicators for bus communications and power • The number of slots depends on the selected options: ◦ N8: 8-slot (2 x 4-slot individual backplanes) ◦ N9: 9-slot

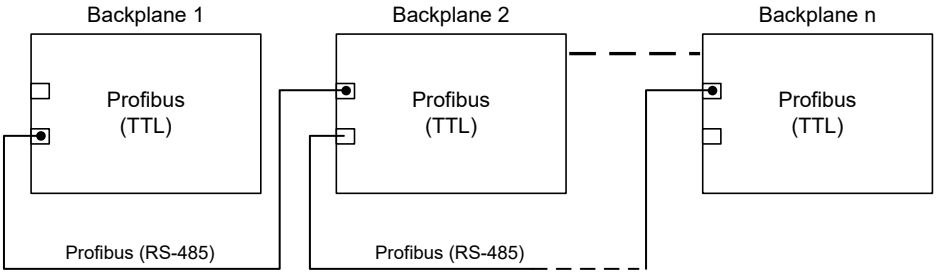
Profibus and T500

System Buses

Each backplane includes a multifunctional bus (Profibus TTL) that covers the power and intercommunication requirements. The Profibus TTL bus is designed to be tolerant to power and communication interruption. Additionally, a Profibus RS-485 bus is included to support backplane expansion.

The figure below shows the location of each bus in the system:

Profibus TTL and Profibus RS-485



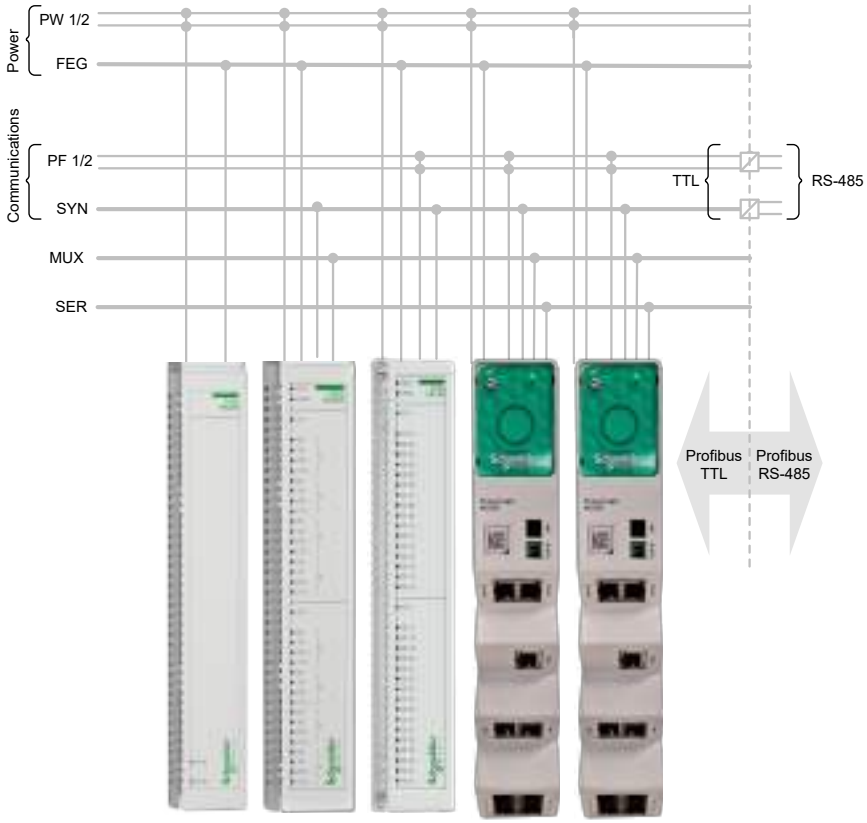
NOTICE
HAZARD OF INCORRECT WIRING Configure the first chassis and the last chassis or backplane as bus terminations. For more details, refer to Backplane Modules, page 24. **Failure to follow these instructions can result in equipment malfunction.**

The system buses integrate the following bus lines:

- Profibus TTL:
  - **FEG** – Functional earth ground
  - **PW1/2** – Power bus (primary and redundant)
  - **PF1/2 (TTL)** - Primary and redundant Profibus TTL buses
  - **MUX** - Serial data bus for communications with the XS280 module
  - **SYN (TTL)** - Bus for synchronization between the modules. (Pulse Per Second or PPS)
  - **SER** - Serial bus for synchronization between redundant CPU modules
- Profibus RS-485:
  - **PF1/2 (485)** - Primary and redundant Profibus RS-485 buses
  - **SYN (485)** - RS-485 bus for synchronization between the modules (PPS)

The figure below shows the buses available in the backplane:

Buses in a backplane

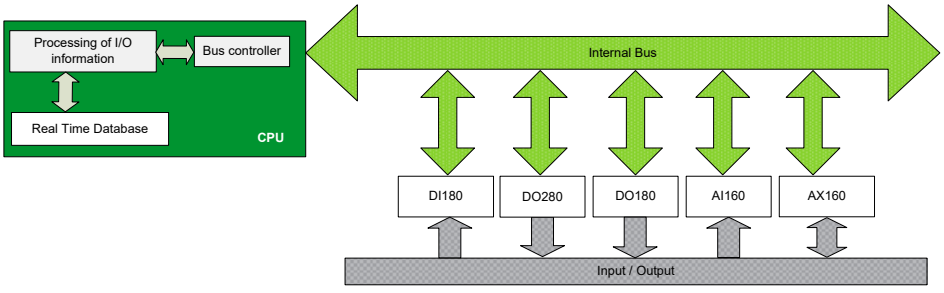


RTU Basic Functions

The control unit (CPU) performs the control functions for the complete system, centralizes the information acquired by other modules, and executes the programmable logic control, communication protocols and user-specific applications.

The communication with I/O modules is established by an internal high-speed bus that makes the system highly reliable even in noisy environments. This bus is implemented in the backplane.

Communication between the CPU and I/O modules



The CPU module controls and manages the following functions:

- Bus controller
- RTU configuration
- RTU synchronization
- Module communication
- I/O acquisition
- Real-time database

Bus Controller

The baseline software installed in the CPU controls the operation of both, CPU and I/O modules connected to the backplane.

This control includes:

- Operation mode monitoring, which includes:
  - Hardware and software Watchdog control, CPU and I/O state monitoring.
  - Diagnostic information about RTU status through LED indicators and log files.
- Interface with the operator through webApp, and webUI (for supervision and maintenance) and PowerLogic T500 configuration tool.
- Firmware upgrade by webApp (using an Ethernet port).

PowerLogic HU280 Module Configuration

The CPU module maintains and manages the information of the real-time database (coreDb). In this database, the I/O signals are related to the communication protocols signals.

The configuration of the module is based on XML files that are generated with the PowerLogic T500 configuration tool. These XML files are generated on a PC and sent to the CPU via the web services through Ethernet ports.

For configuration upload, refer to the webApp – Maintenance and Monitoring Tool User Manual (BQT7944802).

For configuration management, refer to the Easergy Builder User Manual (SE-S856-MSS).

RTU Synchronization

Two different synchronization sources can be used. In the case of two sources, the priority level is defined with a primary and a secondary source. If both sources are active, only the primary source synchronizes the system.

NOTE: If the primary source is available, it is used to synchronize the PowerLogic HU280 module. Otherwise, the secondary source is used.

The available synchronization sources are the following:

- **GPS**: a GPS connected to COM1 serial port.
- **SNTP**: the synchronization module includes a SNTP client and server, which can be used to synchronize from a network SNTP clock or as a time reference for other modules.
- **Protocol**: most control protocols can be used as synchronization source of the system.
- **PTP**: as indicated in the IEEE-1588 standard, a PTP primary device can synchronize other PTP devices (secondary devices) through one or several Ethernet interfaces.
- **IRIG-B**: you can configure the PowerLogic HU280 synchronization module as an IRIG-B server and/or client. The compatible formats are: IRIG-B002, IRIG-B003, IRIG-B006 and IRIG-B007.

If the synchronization source is not configured, the manual synchronization via webApp is created by default.

PowerLogic HU280 Module Communication

PowerLogic HU280 module supports the following communication protocols:

- IEC101 client and server
- IEC103 client
- IEC104 client and server
- DNP 3.0 client and server
- Modbus client and server
- IEC61850 client, Edition 1 and 2
- IEC61850 server, Edition 2

I/O Acquisition

The PowerLogic HU280 module manages the information exchange with the I/O modules. This information is sent from the acquisition module to the PowerLogic HU280 module through the Profibus internal bus available in the backplane.

The software in the PowerLogic HU280 module has the following features:

- Access to the processing of I/O information, which offers added value to the information from field.
- Access to the internal bus to exchange information with the I/O modules.

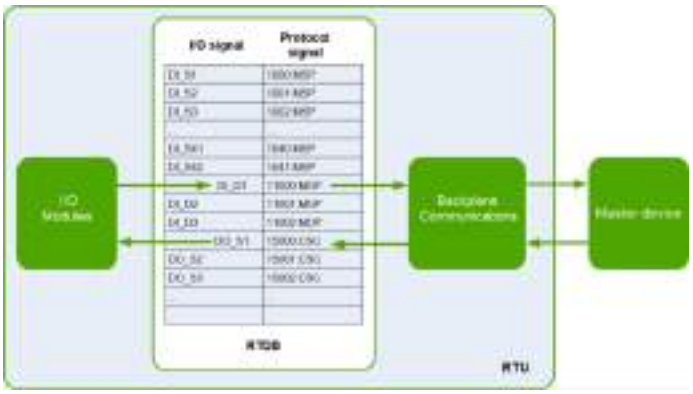
Real-Time Database (coreDb)

The core of the baseline software platform is the real-time database or coreDb which stores not only the information acquired from field devices, but also the information about the status of the PowerLogic HU280 module and I/O modules included in the product.

The coreDb also links the acquisition signals to the communication protocol signals. This database is generated in the PowerLogic HU280 module by using the configuration information.

The information received from the field in real time is processed, stored in the coreDb. It is then linked to the communication protocol signals of the PowerLogic HU280 module, which function is to transfer the information to the primary device.

coreDb operation example



The coreDb can also receive information from a logic, which can be implemented by a third-party software such as ISaGRAF® or within the database itself with a formula type - internal device.

For more information about this functionality, refer to the Easergy Builder User Manual (SE-S856-MSS).

Redundancy Configurations in PowerLogic T500

Due to the wide range of redundancy configurations supported by the baseline software platform and PowerLogic T500, you need to make a detailed analysis to determine the concepts applicable to the functionalities and to set a common terminology.

It should be highlighted that redundancy always intends to increase the level of reliability and availability of the critical elements within a control system.

Redundancy configurations are defined to strengthen the following parts of the control system:

- **Power supply**: this is the first duplicated element in the system to avoid the system to power off. All PowerLogic T500 modules and most auxiliary elements support a redundant power supply.
- **CPU**: the HU280 modules allow the configurations to be defined with redundancy in CPU with a high level of flexibility, meeting the specific requirements of any system.
- **Acquisition bus**: the acquisition bus allows the CPU to acquire data from acquisition modules. PowerLogic T500 backplanes include a duplicate acquisition bus. The CPU module together with the acquisition modules implement the functions to make efficient use of these redundant communications.
- **Communication channels**: several client and server communication protocols support a double communication channel, which are switched with certain rules according to the protocol.
- **System duality**: all the system components are duplicated under this configuration. This is the typical configuration of data hubs and communication front-ends.

The different types of redundancy can be combined to make the system as robust as possible with duplicated elements.

Redundant Power Supply

Redundant power supply allows the use of two power supply units on the same backplane. Thus, the power supply reliability is much improved.

The BP260 and BP270 backplanes have two different power supply options available:

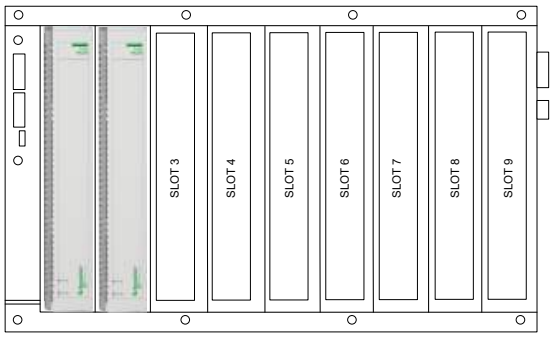
- Power supply using PS280 units
- Power supply using external power supply units.

In both cases, you can have a simple or redundant configuration.

Power Supply Redundancy in BP260

In the redundant configuration, the first PS280 module is connected to the slot 1 in the backplane and the second PS280 module is connected to the slot 2 in the backplane.

BP260 backplane with two PS280 modules



If an external power supply module is used to power the backplane, it is connected to the lateral connector (see connector 5 on BP260/N9 – Front view, page 29). The pinout of this connector is detailed in section Connections, page 37.

The combination of an external power supply unit and a PS280 module is not supported.

⚠WARNING

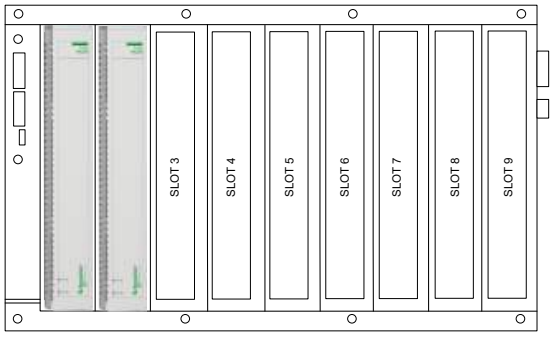
UNINTENDED EQUIPMENT OPERATION

Do not connect PS280 and external power supplies simultaneously to the same BP260/BP270 backplane.

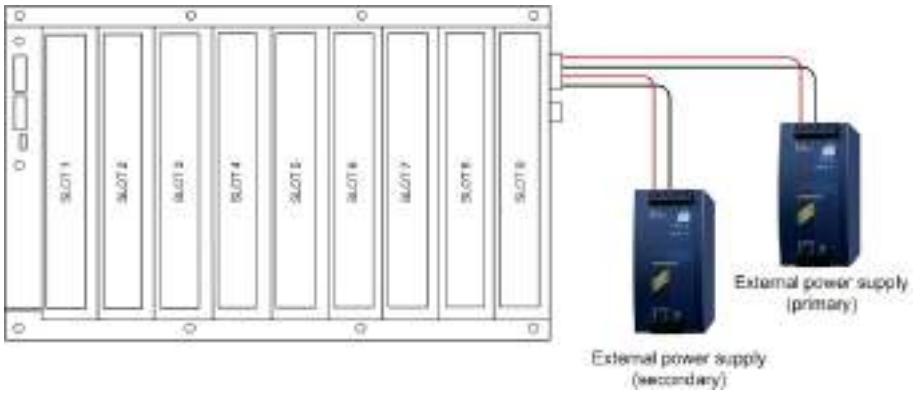
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Each power supply must be available to provide 100% of the required power, regardless of whether a PS280, or an external power supply (considering the temperature derating) is used. Therefore, two redundant configurations are possible.

Two PS280 modules



Two external power supplies



For any of the configurations described above, the power redundancy is achieved using the appropriate wiring.

Power Supply Redundancy in BP270

The BP270 backplane has the same power supply options as the BP260 backplane, so the redundancy configuration is similar.

The difference is that the connectors for external power sources are located at the back of the circuit board rather than on the side (see connector 3 in BP270/N8 – Back view , page 31). The pinout of this connector is detailed in section Connections, page 37.

Two redundant configurations are possible.

Two PS280 modules

Two external power supplies

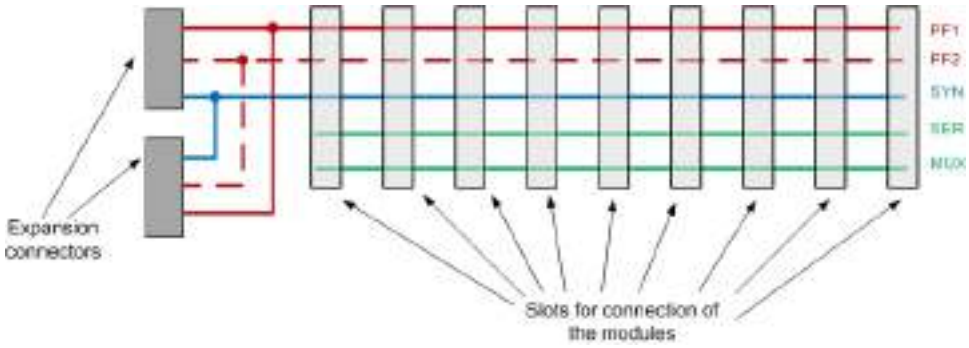
CPU Redundancy

Refer to the BQT7944901 PowerLogic HU280 User Manual.

Acquisition Bus Redundancy

The backplanes in PowerLogic T500 include four communication buses for module interconnection.

Communication buses in the backplane



These four buses are:

- Double Profibus-DP communication bus for the communication between I/O modules and control modules (PF1 and PF2).
- Communication bus for synchronizing acquisition modules (SYN).
- High-speed communication bus for the communication between the control module and communication modules, XS280.
- High-speed communication bus for the communication between the two control modules installed in the same backplane (CPU).

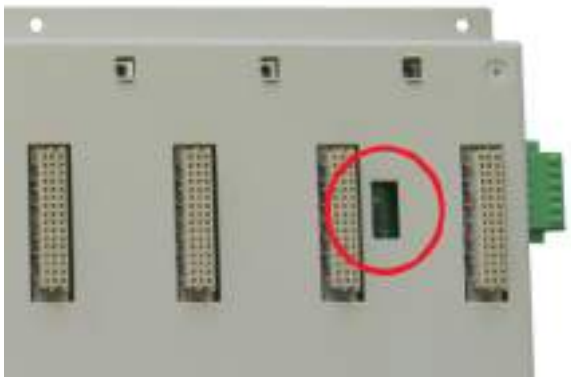
The acquisition bus redundancy in PowerLogic T500 is achieved by the Profibus DP (RS-485) double bus. This bus enables distributed acquisition architectures to be defined; it is highly flexible and robust and can cover distances of up to 1200 m at 9.6 kbps. The communication rate for these channels is selectable from 9.6 kbps to 1.5 Mbps.

Profibus redundancy is expandable to other backplanes since the channels PF1, PF2 and SYN are outputs in the backplane through the expansion connectors.

NOTE: The backplanes in PowerLogic T500 family have a jumper (J2) that is required to configure the system with Profibus-DP redundant communications.

NOTICE
HAZARD OF INCORRECT CONFIGURATION Install the jumper (J2) to enable Profibus-DP redundancy. **Failure to follow these instructions can result in equipment malfunction.**

Jumper for redundancy



Profibus implementation for PowerLogic T500 has the following features:

- Only one serial controller is available for the two Profibus buses.
- Messages both from the primary device and the secondary devices are transmitted through the two buses.
- Both the primary device and the secondary devices select the receiving bus.
- The redundant bridge must be installed in the backplane to select the receiving bus. If uninstalled, the receiving bus is the bus 1.
- When the primary device (including the attempts) does not respond, the system switches to the active receiving bus.
- If communication is lost between a secondary device and the primary device through the two channels during more than 8 seconds, this event is detected and the adequate diagnostic LED is lit.
- The buses are alternatively monitored every minute. Therefore, both fault detection and recovery may be delayed by one minute.

Physical Mounting and Installing

Installation

Handling Modules

While all electronic components are installed into their enclosure, they are protected for relevant levels of electrostatic discharge.

⚠WARNING

HAZARD OF EQUIPMENT DAMAGE

Do not remove the enclosure of the modules in any case.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Modules Location within the Backplane or Chassis

Recommendations for installing modules in a backplane or chassis are:

- Install modules in vertical position.
- Install PS280 power supply module in position 1. In redundancy power supply configurations, reserve positions 1 and 2 for the two power supply modules.
- Install remaining modules in any position within the backplane / chassis.
- Group the modules to minimize adverse effects from noise and heat, for example, install the HU280 modules as far as possible from the PS280 modules.
- Install the HU280 and XS280 modules in the first backplane when the RTU is extended to other backplanes.

Backplane positions

NOTICE

HAZARD OF IMPROPER INSTALLATION

When installing a HU280 module with fiber optics, make sure the space between the front of the module and the cabinet door accommodates the fiber optics. Do not pinch the fiber optics.

Failure to follow these instructions can result in equipment damage.

Assembling Modules

PowerLogic T500 modules can be installed in a 19-inch (48 cm) chassis (BP270) or a backplane (BP260).

To mount the module in the backplane, follow the instructions below:

1. Switch off the power supply.
2. Mount the module at the required position. If you are using a wall-mounted backplane, verify that the rear rails are properly mounted using the pre-drilled holes on the backplane.
3. Firmly press the module to fit the connector properly. Check that the module is correctly mounted to the backplane base.
4. Fix the module using the screw located at the top.
5. Insert the terminal (mounting option C1) or flat ribbon (mounting option C2) connectors.

To install in a BP260/BP270 backplane, make sure the modules are correctly installed.

NOTICE
HAZARD OF UNINTENDED EQUIPMENT OPERATION When using the BP260/BP270 backplane, make sure that the module is installed correctly. **Failure to follow these instructions can result in equipment damage.**

The following graphic shows two modules inserted into the wall-mounted backplane. The module on the left is incorrectly installed. It may appear to be functional. Adjust the installation before use.

Incorrect installation of a module on the left:

Backplane Modules

All PowerLogic T500 modules (power supply, CPU, communications, I/O acquisition) are installed into a backplane. These backplanes work as an electromechanical device that provides the following functions:

- Mechanical function: allows insertion and removal of the modules into the system and its physical support. The backplane provides the mechanical integration in the location or enclosure that it is located.
- Electrical function: allows the distribution of:
  - The power supply to the modules
  - The internal bus for the modules installed in the backplane
- Expansion: allows electrical connection (at data level) between different backplanes to increase the number of modules integrated into the system.

The backplane allows the following functions:

- Supervision: monitoring and control of the power supply to the modules and signaling Profibus communication lines between modules.
- Protection: protection against permanent damage from overload from external power supplies.

Each PowerLogic T500 subsystem is made up of:

- A main backplane where the HU280 module is installed. If you have HU280 module redundancy, you can install both modules into the same backplane or you could install each HU280 module into a different backplane.
- Depending on the requirements, the system must have one or more acquisition backplanes.
- The main backplane and as many expansion backplanes are required (up to 16 backplanes).

The main backplane supports one or two control units, acquisition modules, and XS280 communication modules, if necessary.

The acquisition backplanes are used when the available positions in the main backplane are occupied, or when implementing a distributed system of I/O modules. These secondary backplanes do not include any control units or communication modules.

There are two basic backplane models, which use different mechanical solutions.

Panel-mounted solution

Chassis solution

Both models are based on the same board ST_BPX4S or ST_BPX9S depending on the ordering options (number of slots).

Both backplane models have the same electrical features:

- 4 or 9 slots to connect the PowerLogic T500 modules.
- High-speed internal bus for the communication between the HU280 module and the communication modules XS280.
- High-speed internal bus for the communication between the HU280 modules (in redundant HU280 configurations).
- High-speed internal bus (Profibus) for the communication between the acquisition modules and the HU280 module.
- Profibus (TTL) - Profibus (RS-485) conversion for backplane interconnection.

- Duplicate power-supply bus (redundancy). Both can be used in two ways (mutually exclusive):
  - Using a PowerLogic T500 power supply (PS280) in a simple or configuration redundancy.
  - Using external power supplies, in a simple or configuration redundancy.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not connect PS280 and external power supplies simultaneously to the same BP260/BP270 backplane.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

BP260 Model

In this model, the electronic board is installed in a metal enclosure where the electronics are hidden. Only the necessary elements for the configuration are accessible. Two models are:

- BP260/N4 with 4 slots.
- BP260/N9 with 9 slots.

The difference is the number of modules that can be mounted. The other features are identical.

The following figure shows an example of this type of backplane:

BP260/N9 – Front view

Mechanical Features

The modules can be mounted in a panel or flat wall made of any material capable of supporting the total weight of the assembly. The modules weight and connection cables must be considered.

If several backplanes need to be mounted in a column structure, leave a minimum space of 57 mm between the lower and upper fixing flanges of the backplanes.

⚠WARNING

HAZARD OF INCORRECT EQUIPMENT INSTALLATION

- Do not cover the modules ventilation grates with feed-through, cable trays, or any other assembly elements.
- Respect the necessary space around the backplane to allow assembly and disassembly of the modules.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

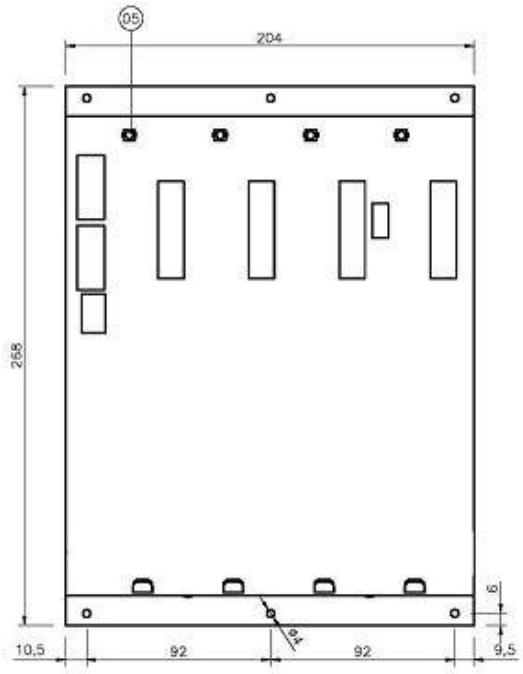
In order to facilitate the connection of cables to the two bottom SFP connectors of HU280, it is recommended to leave a space of at least 1U between the backplane and the cable tray, thus, avoiding an excessive curvature of the cabling.

The BP260 module has two fixing flanges located at the upper and lower parts respectively, with drill holes of 4 mm in diameter for wall or panel mounting.

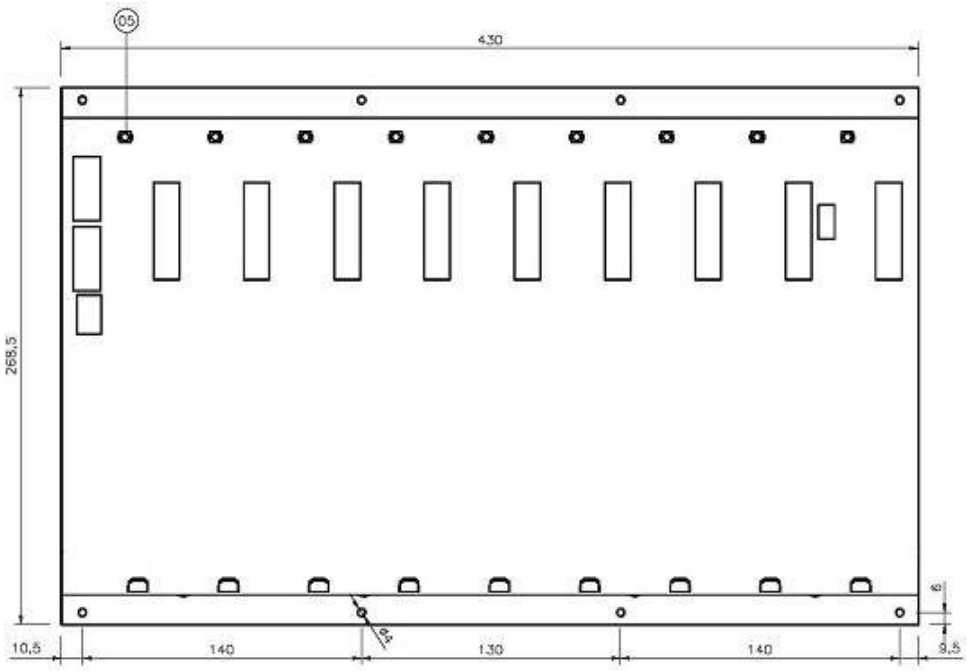
Number and location of holes vary with the model:

- 6 drill holes in the BP260/N4
- 8 drill holes in the BP260/N9

BP260/N4 - Drill-hole arrangement

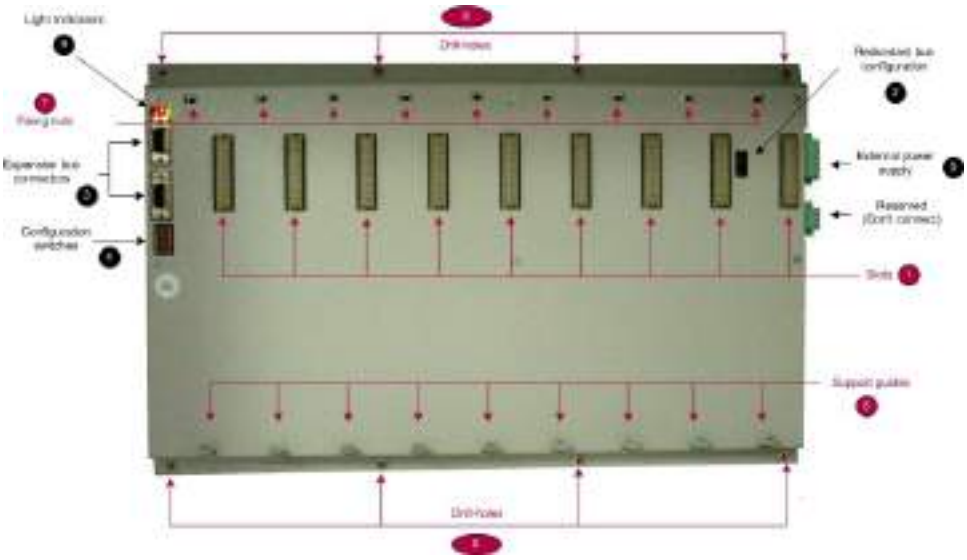


BP260/N9 - Drill-hole arrangement



The dimension values are given in millimeters. All connectors are located on the front and right sides of the module.

BP260/N9 – Front view



1. Connectors (slots) for the PowerLogic T500 modules. The socket connectors are installed on the backplane and on the rear panel for each module the plug-type connector is installed.
2. Jumper to configure communication systems redundancy. If the jumper is mounted, it enables Profibus-DP redundancy.
3. Two connectors to expand the internal bus to other backplanes. For more details, refer Backplane Expansion, page 44.
4. Configuration switches for the expansion of the internal bus.
5. External power supply connector. It allows connecting up to two different power supplies: primary and secondary.
6. Guides for supporting PowerLogic T500 modules when they are mounted on the backplane.
7. Nuts to install the module on the metal enclosure.
8. Drill-holes to install the backplane to the bottom panel.
9. LED indicators.

Technical Specifications

BP260 Technical specifications

BP260			
Mechanical features	Slots	BP260/N4	4
		BP260/N9	9
	Dimensions	BP260/N4	268 x 204 x 25.5 mm
		BP260/N9	268.5 x 430 x 25.5 mm
	Weight	BP260/N4	1.25 kg
		BP260/N9	3.35 kg
Consumption	100 mW		
Connectors	PowerLogic T500 module		48-contact DIN 41612 connectors
	External power supply		6-way screw terminal (1.5 mm² / 15 AWG)
	Profibus expansion (0.5 mm² / 20 AWG)		2 socket DB9 connectors

BP260 Technical specifications (Continued)

Voltage levels	Operating nominal voltage	5.4 Vdc
	Startup nominal voltage	> 5.3 Vdc
	Maximum current (for each power supply bus)	7 A
	Maximum consumption (for the entire backplane)	38 W
	Overcharge voltage (safe for the electronic parts)	< 24 Vdc
	Overcharge voltage (with risks for the electronic parts)	> 30 Vdc
	Safety power-off (overvoltage)	> 5.9 Vdc
	Safety power-off (undervoltage)	< 4.9 Vdc

BP270 Model

The BP270 model uses the same electronic board as BP260, but it is mounted using a standard 482 mm (19 inches) wide chassis. Two models are:

- BP270/N8, with 2x4 slots
- BP270/N9 with 9 slots

Mechanical Features

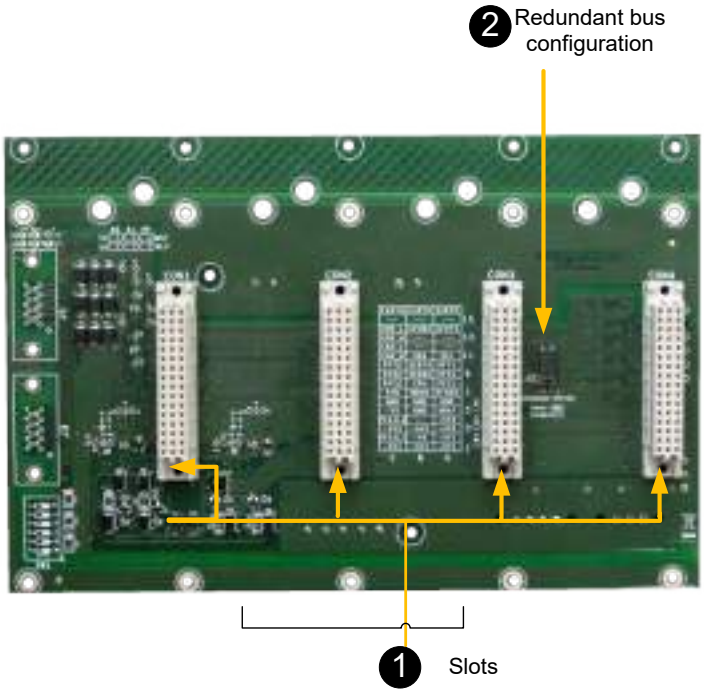
BP270/N8 and BP270/N9 backplanes are designed to be mounted on a 482 mm (19 inches) wide, 6 U high and 180 mm deep metallic panel. The chassis provides the mechanic support to mount all the modules. The BP270/N8 format allows the mounting of two boards in the same chassis (one next to the other). This option is the most suitable solutions to give access to the back part of the electronic components.

For BP270, the power connector, bus expansion connectors and configuration switches are located on the back side of the card to be accessible from the back of the chassis.

In order to facilitate the connection of cables to the two bottom SFP connectors of HU280, it is recommended to leave a space of at least 1U between the backplane and the cable tray, thus, avoiding an excessive curvature of the cabling.

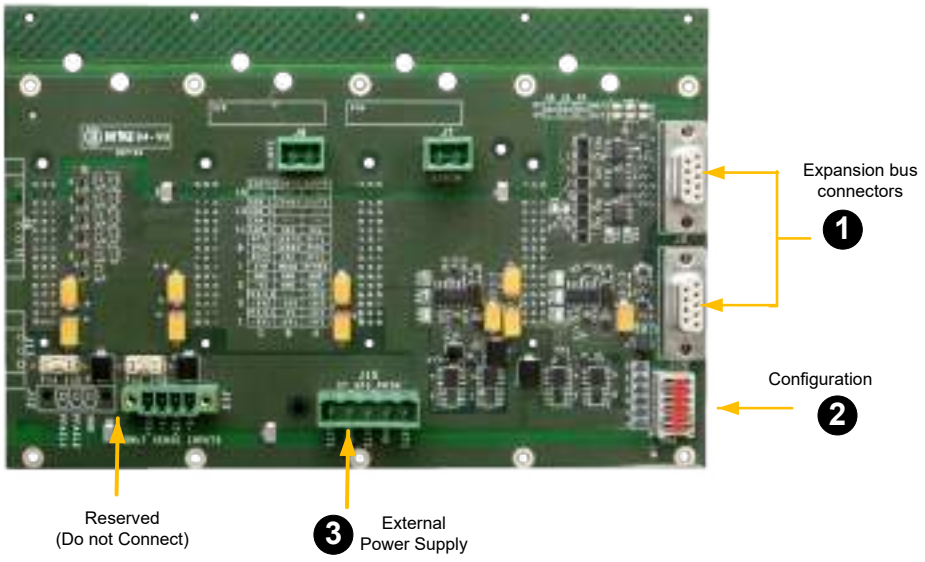
You need to distinguish the front side from the back side since both sides present connectors.

BP270/N8 – Front view



1. Connectors (slots) for the PowerLogic T500 modules. The socket connectors are installed on the backplane and the plug-type connector is installed on the back panel.
2. Jumper to configure redundant communication systems. If the jumper is mounted, it enables redundant Profibus-DP.

BP270/N8 – Back view



1. Two connectors to expand the internal bus to other backplanes.
2. **Configuration** switches for the expansion of the internal bus.
3. External power supply connector. It allows the connection of up to two different power supplies: primary and secondary.

   For the module with 9 slots, two power connectors allow to maintain the power when it is necessary to disconnect one power supply.

Technical Specifications

BP270 Technical specifications

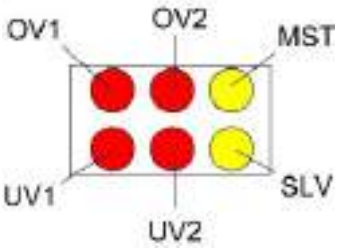
BP270			
Mechanical features	Slots	BP270/N8	8 (4 + 4)
		BP270/N9	9
	Dimensions	19-inches rack (482 mm)	
Consumption	100 mW		
Connectors	PowerLogic T500 module		48-contact DIN 41612 connectors
	External power supply		5-way screw terminal (2.5 mm² / 13 AWG)
	Profibus expansion		2 female DB9 connectors
Voltage levels	Operating nominal voltage		5.4 Vdc
	Startup nominal voltage		> 5.3 Vdc
	Maximum current (for each power supply bus)		7 A
	Maximum consumption (for the entire backplane)		38 W
	Overcharge voltage (safe for the electronic parts)		< 24 Vdc
	Overcharge voltage (with risks for the electronic parts)		> 30 Vdc
	Safety power-off (overvoltage)		> 5.9 Vdc
	Safety power-off (undervoltage)		< 4.9 Vdc

Supervision

Using the light indicators above the expansion connectors (refer to the figure BP260/N9 – Front view, page 29) you can monitor the activity of the Profibus communication and the power status.

Each LED is identified as follows:

Supervision LEDs on the backplane



- **MST**: Supervision of the transmission from CPU.
- **SLV**: Supervision of the transmission from secondary device modules.
- **OV1 / UV1**: Supervision of the power bus PW1 (refer to the section System Buses, page 14). This power bus is associated with the PS280 installed on slot 1 or with the external power supply on the left in the connector, identified in the document as PS1.
- **OV2 / UV2**: Supervision of the power bus PW2 (refer to the section System Buses, page 14). This power bus is associated with the PS280 module installed on slot 2 or with the external power supply on the right, identified in the document as PS2.

Supervision of the Profibus

The yellow LEDs MST and SLV show the status of the Profibus communication. The following table describes the LEDs:

MST	SLV	Status	Description
		Idle	No queries nor responses have been detected from client nor server module.
		Correct	• Queries have been detected from a client in both channels (with redundancy). • Responses have been detected from a server in both channels.
		No answer	• Queries have been detected from a client in both channels. • No responses have been detected from any server.
		Abnormal answer	• Queries have been detected from a client in both channels (with redundancy). • Responses have been detected from a server in only one channel.
		Abnormal query	• Queries have been detected from a client in only one channel (with redundancy). • Responses have been detected from a server in both channels.
		Problem in the question	• The transmission lines of the client modules in both channels are blocked. It is impossible to communicate with the server modules. • The Profibus supervisor is not working properly.

MST	SLV	Status	Description
		Problem in the answer	• The transmission lines of the server modules in both channels are blocked. It is impossible to communicate with the client modules. • The Profibus supervisor is not working properly.

NOTE:

On

Fast blinking

Slow blinking

Off

Supervision of the Power

The backplane includes a power supervision function. It has three main functions:

- Prevent the modules from being powered with incorrect voltages.
- Indicate the quality of the power supplied by the backplane to the modules.
- Limit the number of startups when a problem is detected regarding consumption.

The power status is displayed by the LEDs OV1/OV2 and UV1/UV2. The following table describes the LEDs:

OVx	Uvx	Status	Description
		Power-off for overvoltage	Power voltage > 5.80 Vdc.
		High-high voltage (very high voltage)	Power voltage between 5.65 and 5.80 Vdc. The system can startup but cannot work correctly.
		High voltage (warning voltage)	Power voltage between 5.50 and 5.65 Vdc. Correct state for startup and working.
		Optimum	Power voltage between 5.35 and 5.50 Vdc. Optimum state for startup and working. Both LEDs are lit each 3 s.
		Low voltage (warning voltage)	Power voltage between 5.20 and 5.35 Vdc. Correct state for working but not for the startup. Depending on voltage level the system could be restarted.
		Low-low voltage (very low voltage)	Power voltage between 5.05 and 5.20 Vdc. The system can startup but cannot work correctly. Inappropriate state for working and startup. If the voltage level is decreased, the backplane could power off.
		Power-off for undervoltage	The voltage level is < 5.05 Vdc.
		Blocked	The maximum number of retries to boot has been exceeded. The supervisor does not attempt more reconnections until the power supply is completely removed.

		No operative	Without power supply or the voltage supervisor is not operative.

NOTE:

On

Fast blinking

Slow blinking

Off

Powering a PowerLogic T500 RTU

Several options to power a PowerLogic T500 RTU are available:

- Using PowerLogic T500 power supplies (redundancy or not)
- Using external power supplies (redundancy or not)

For more information about configurations redundancy, refer to the section Power Supply Redundancy, page 18.

If external power supplies are used, depending on the type of backplane, BP260 or BP270, refer to the sections BP260 Model, page 26 and BP270 Model, page 30.

Power Supply Requirements

NOTICE

HAZARD OF TERMINAL DAMAGE OR INCORRECT POWER SUPPLY

- Use appropriate tightening torques as indicated in this document when tightening connector screws.
- The power supply can be one or two PS280 modules or one or two external power supplies.
- When using an external power supply, the voltage input for the backplane is 5.4 Vdc. The external voltage input is not protected against overvoltage nor reverse polarity, so an incorrect wiring or an incorrect adjustment of the supply voltage could damage electronic parts.

Failure to follow these instructions can result in equipment damage.

The PS280 module supplies power to the modules connected to the backplane, as required. When using auxiliary power supplies, you need to rate the output power according to the maximum loads installed on the backplane. Take also into consideration the power derating for this calculation.

The power consumption for each module is indicated on the technical label and is included in the technical specification table in the user manual of the module. The consumption of all modules is added plus a safety margin (between 20% and 50% of the full power). The power supply efficiency (typically, 70 - 90%) should also be considered, to protect the chassis and the power supply from overloading.

PS280 (PowerLogic T500 Power Supply)

PS280 – Front view

The PS280 module converts the input power into a regulated 5.4 Vdc output to power the electronic control components of the modules within the backplane. Additionally, depending on the ordering option, this module can provide an auxiliary voltage for the polarization of the I/O interfaces of the acquisition modules.

The functional features of this block are:

- Compliance with EMC standards for industrial environments
- Direct input current can be used.
- Auxiliary output of 24 Vdc is available.
- Galvanic isolation
- Communication of power input loss to the CPU
- Two test points are available to allow the checking of the voltage on the bus using a voltmeter.

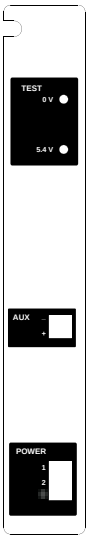
NOTICE

HAZARD OF TERMINAL DAMAGE OR INCORRECT POWER SUPPLY

- Use appropriate tightening torques as indicated in this document when tightening connector screws.
- The power supply can be one or two PS280 modules or two external power supplies.
- When using an external power supply, the voltage input for the backplane is 5.4 Vdc. The external voltage input is not protected against overvoltage nor reverse polarity, so an incorrect wiring or an incorrect adjustment of the supply voltage could damage electronic parts.

Failure to follow these instructions can result in equipment damage.

PS280 – User interface



⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not connect the module to the power supply, when you are installing the PS280 module into the backplane.

Failure to follow these instructions will result in death or serious injury.

The PS280 module can be used in two different modes:

- **Simple**: the module is installed in the first slot (left-hand-side) in the backplane.
- **Redundant**: two identical modules are used. In the backplane, the modules are mounted side by side, in slots 1 and 2 from the left-hand-side.

Ordering Options

The available options are:

- Option V2: EMS71120 – Mains 24 Vdc input and auxiliary 24 Vdc output
- Option V3: EMS71130 – Mains 48 Vdc input and auxiliary 24 Vdc output
- Option V4: EMS71140 – Mains 110/125 Vdc input and auxiliary 24 Vdc output

Connections

Main power input

Connect the input power supply with the 3–poles connector **POWER**:

- Model: Phoenix Contact Combicon: 3-MC 1.5/2 –ST-5.08
- Screw-terminals for cables with a maximum 2.5 mm^2 gauge
- Two terminals for direct current (1,2)
- A terminal for functional ground connection

The following table shows how to connect:

Connector Power	Direct Current
1	Positive
2	Negative
⏚	⏚

NOTE: The power supply input is provided with reverse polarity protection.

Auxiliary power output

The auxiliary output is available through a front two-pole connector with the following features:

- Model: Phoenix Contact Combicon: 2-MC 1,5/2 –ST-3.5
- Screw-terminals for cables with a maximum 1.5 mm^2 gauge
- Two terminals for direct current (with the labels “-“ and “+”)
- Recommended cable: rigid or flexible. 0.14-1.5 mm^2 / 28-16 AWG

LED Indicators

The following table shows the meaning for each LED:

● → On

○ → Off

PWR	AUX	Description
●	○	Power supply is powered. Auxiliary output is not installed in the module.
	●	Power supply is powered. Auxiliary output is installed in the module.
○		Main power supply is not powered.

Technical Specifications

PS280 Technical specifications

PS280		
Input voltage level	Option V2	24 Vdc
	Option V3	48 Vdc
	Option V4	110 / 125 Vdc
Isolation	Input / Output	3 kVrms
	Input / Functional earth ground	1.5 kVrms
	Output / Functional earth ground	0.5 kVrms
Power output	Main	5.4 Vdc (40 W at 25 ºC / 30 W at 70 ºC)
	Auxiliary (Option B0)	Not available
	Auxiliary (Option B2)	24 Vdc (25 W)

PS280 Technical specifications (Continued)

Protection	Output	Permanent short-circuit
	Input	Overvoltage / Overcurrent
Maximum dip time	50 ms	
Typical efficiency (full load)	85%	
Consumption	60 W Max.	
	The typical efficiency at full load is 80%	
Weight	900 g	

Certification Tests

Directive / Test	Identification	Details
European and British Directives		
Low Voltage (LVD)	2014/35/EU	CE Mark Directive
	IEC 61010-1:2010	Standard of product for electrical safety requirements
	IEC 61850-3:2013 (Clause 6.9.3)	Climatic environmental tests
	IEC 61850-3:2013 (Clauses 6.10.1, 6.10.2, 6.10.3)	Mechanical performance
Electromagnetic Compatibility (EMC)	2014/30/EU	CE Mark Directive
	IEC 60255-26:2013	Standard for measuring relays and protection equipment
	IEC 61850-3:2013	Standard for communication networks and systems for power utility automation
	EN 61000-6-4: 2018	Emission standard for industrial environments
	EN 61000-6-5: 2015	Immunity for equipment used in power station and substation environment
RoHS	2011/65/EU, including the delegated Directive 2015/863	European Directive
	EN IEC 63000:2018	Technical documentation for the RoHS assessment
WEEE	2012/19/UE	European Directive
EMC - Emission tests		
Radiated emission. EF measure	CISPR16-2-3:2016 CISPR 32:2015+A1:2019 EN 55022:2011	30 MHz to 6 GHz
Continuous conducted emission on power leads	EN 55032:2015 / AC:2016-07 CISPR 16-2-1:2014 / AMD1:2017 CISPR 32:2015+A1:2019	0.15 MHz to 30 MHz
EMC - Immunity tests		
Radiated RF Electromagnetic field immunity test	EN 61000-4-3:2006 / A1:2008 / A2:2010	80 – 6000 MHz, AM 1 kHz Prof: 80 %, 10 V/m 1000 – 2700 MHz, AM 1 kHz Prof: 80 %, 3 V/m 2700 – 6000 MHz, AM 1 kHz Prof: 80 %, 1 V/m
Immunity to conducted disturbances, induced by radiofrequency fields	IEC 61000-4-6:2014	0.15 – 80 MHz, AM 1 kHz Prof: 80 %, 10 Vrms

Directive / Test	Identification	Details
Electrical fast transient / burst immunity test	IEC 61000-4-4:2012	±4 kV, 5 kHz
Surges immunity test	IEC 61000-4-5:2014	±0.5, ±1, ±2 kV (symmetrical coupling) ±0.5, ±1, ±2, ±4 kV (asymmetrical coupling)
Damped oscillatory wave	EN 61000-4-18:2007 / A1:2011	1 kV (1 MHz) DM / 2.5 kV (1 MHz) CM
Power frequency magnetic field immunity test	IEC 61000-4-8:2010	50 Hz, 100, 30, 3 A/m continuous 50 Hz, 1000 A/m for 1 s 50 Hz, 300 A/m for 3 s
Electrostatic discharge immunity test	IEC 61000-4-2:2009	±4 kV, ±6 kV (direct and indirect contact discharge) ±2 kV; ±4 kV; ±8 kV (air discharge)
DC Voltage dips, short interruptions and voltage variations	IEC 61000-4-29:2000	100 % during 100 ms. Criterion A 100 % during 5000 ms. Criterion C 60 % during 200 ms. Criterion C 30 % during 500 ms. Criterion C Applies to PS280
Mains frequency voltage	IEC 61000-4-16:2016	30, 10 V continuous 100, 300 V 1 s 100 V (differential), 300 V (common)
Ripple on DC input power port	IEC 61000-4-17:1999	15 % Un, 100 Hz / 10 % Un, 50 Hz
Gradual shut-down / start-up (dc power supply)	60255-26:2013 (Clause 7.2.13)	Shut-down ramp, 60 s Power-off, 5 min Start-up ramp, 60 s
Electrical Safety		
Compliant with all requirements	IEC 61010-1:2010	Overvoltage category II Pollution degree 2
Environmental tests		
Cold test	IEC 60068-2-1:2007	Test Ad (-40 ºC / 16 h) Test Ab (-40 ºC / 72 h)
Dry heat test	IEC 60068-2-2:2007	Test Bd (+70 ºC / 16 h) Test Bb (+80 ºC / 72 h)
Damp heat, cyclic test	IEC 60068-2-30:2005	+25 ºC / +55 ºC, 93 % RH / 96 % RH, 6 cycles (24 h)
Damp heat steady state test	IEC 60068-2-78:2001	Test Cab 93 % / +40 °C / 10 days
Change of temperature	IEC 60068-2-14:2009	Test Nb -40 ºC / +70 ºC / 2 ºC/min / 1 h / 10 cycles
Mechanical tests (Chassis mounting)		
Vibration (sinusoidal)	IEC 60068-2-6:2008 IEC 60255-21-1:1988	Test Fc Section 1
Shock and bump	IEC 60068-2-27:2011 IEC 60255-21-2:1988	Test Ea and guidance Section 2
Seismic tests	IEC 60068-2-6:2008 IEC 60255-21-3:1988	Section 3
Drop test	IEC 60068-2-31 :2008 ISO 4180:2019	1 m (with packaging)

Using External Power Supplies

The backplane model determines the power supply wiring. The following passage shows the external power supplies.

BP260 Power Supply

On the right side of the BP260 module is located a connector to connect one or two external power supplies. It is identified as number 5 in the front view representation, page 26.

The pin 1 is the first one from the right when the backplane is horizontal or the upper one when the backplane is in vertical position. The following table shows the connections:

Pinout of the connector for external power supplies

Pin	Signal	Description
1	GND	Functional earth ground
2	-	Do not connect
3	PS2	Power supply 2
4	GND	
5	PS1	Power Supply 1
6	GND	

For more information about the connection of two external power supplies, refer to the section Redundant Configurations in PowerLogic T500, page 18.

Connecting external power supplies to a BP260

BP270 Power Supply

Two power supply options for the modules, through the backplane are:

- Using power supply (PS280)
- External power supply

When selecting the BP270 backplane, it is important to distinguish the four-position models from the nine-position models because the nine-position model has connectors J14 and J15 for primary and secondary power, while the four-position models have only connector J15. It is identified as number 3 in the back view representation.

⚠WARNING

HAZARD OF INCORRECT CONNECTION

Only use J14 and J15 connectors for power input.

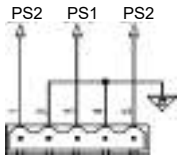
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The power connectors of the BP270/N9 module have the following pins:

Pinout of the power supply connector in BP270/N9

Connector J15

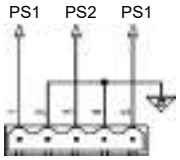
Connector J15 Pin-out



Pin	Signal	Description
1	**PS2**	Positive external power supply 2
2	**GND**	Negative external power supply 2
3	**PS1**	Positive external power supply 1
4	**GND**	Negative external power supply 1
5	**PS2**	Positive external power supply 2

Connector J14

Connector J14 Pin-out



Pin	Signal	Description
1	**PS1**	Positive external power supply 1
2	**GND**	Negative external power supply 1
3	**PS2**	Positive external power supply 2
4	**GND**	Negative external power supply 2
5	**PS1**	Positive external power supply 1

According to the description of these connectors, the following options for wiring the power supply are:

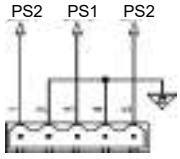
- Use a single connector, wiring all pins as indicated in the table above. In this case, the two power supplies are associated with the same connector.
- Use both connectors, which is the recommended option. In this case, you need to wire only the pins 1 and 2 of each connector (J14 and J15).

For BP270/N8, only connector J15 is available, so two external power supplies are associated with the same connector.

Pinout of the power supply connector in BP270/N8

Connector J15

Connector J15 Pin-out



Pin	Signal	Description
1	**PS2**	Positive external power supply 2
2	**GND**	Negative external power supply 2
3	**PS1**	Positive external power supply 1
4	**GND**	Negative external power supply 1
5	**PS2**	Positive external power supply 2

Recommendations for External Powering

NOTICE
HAZARD OF TERMINAL DAMAGE OR INCORRECT POWER SUPPLY • When tightening screws, use appropriate tightening torques, as indicated in this document. • The power supply can be one or two PS280 modules or two external power supplies. • The voltage input for the backplane is 5.4 Vdc. The external voltage input is not protected against overvoltage nor reverse polarity, so an incorrect wiring or an incorrect adjustment of the supply voltage could damage electronic parts • On a voltage drop, the backplane is shut down when the voltage level falls to 4.9 Vdc. • On a power surge, the backplane is shut down when the voltage level exceeds to 5.9 Vdc. **Failure to follow these instructions can result in equipment damage.**

To power the backplanes, consider:

- the number of available power supplies, and
- the distance between the power supplies and the backplanes

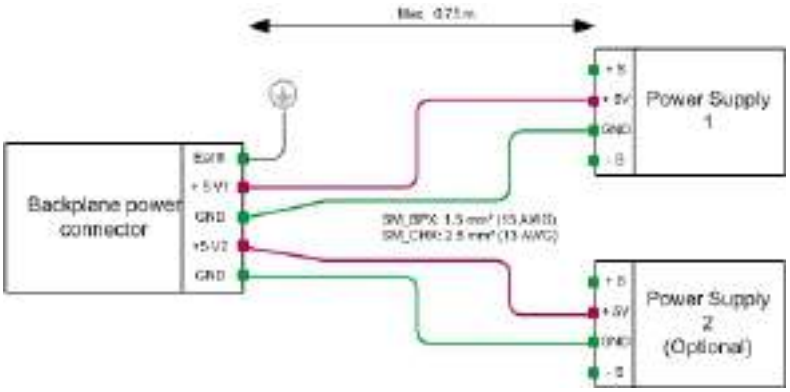
The total power of the power supplies used must be greater than or equal to the sum of the power required for all backplanes powered plus a margin (usually from 25% to 50% of the total power).

To reduce the voltage drop on the wires, apart from using the right section on these wires; it is recommended to install the external power supplies as close as possible to the backplane, thus reducing the wires length.

One Power Supply for Each Backplane

Make sure the distance between each power supply and the backplane is less than 0.75 m.

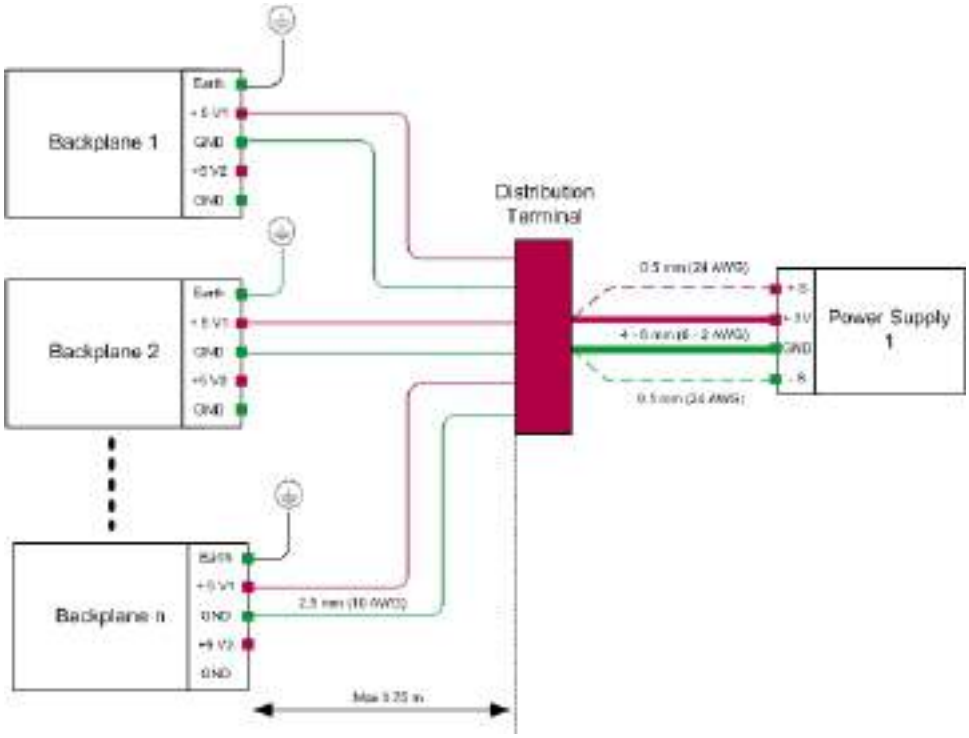
One power supply for each backplane



One Power Supply for Several Backplanes

Although a power supply per backplane/chassis is recommended, it is possible to use a single power supply for several backplanes. In this case, a distribution terminal should be installed. Make sure the distance between the terminal and the backplanes is less than 0.75 m.

One power supply for several backplanes



NOTICE

HAZARD OF INCORRECT OPERATION

The powering of several backplanes must not be wired cascaded, that is, the power of the first backplane must not be extended to the others. For each backplane, the power is received directly by the source, using a star configuration, as shown in One power supply for several backplanes, page 44

Failure to follow these instructions can result in equipment damage.

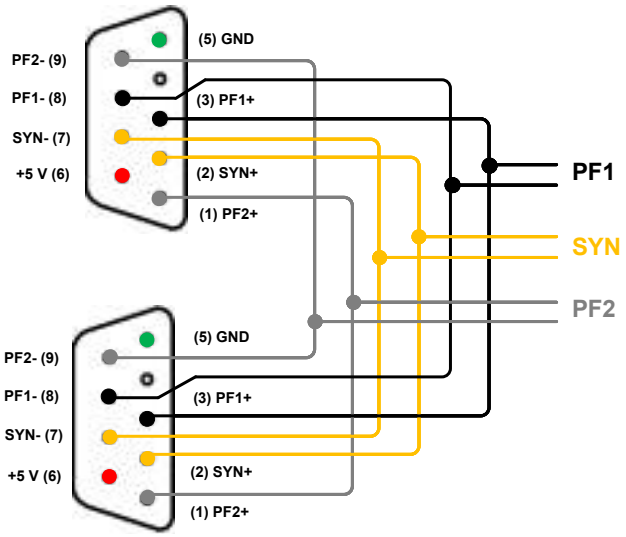
Backplane Expansion

The first point to consider is whether it is necessary to distribute the PPS (Pulse Per Second signal) timestamp or not, and if the communications are simple or redundant. The BP260 and BP270 backplanes include electronics for expansion of the three buses, including the terminating resistors.

Once buses to expand are known; from the electrical point of view, the two connectors for expansion are alike. The two connectors are:

- number 3 in BP260/N9 – Front view, page 29, and
- number 1 in BP270/N8 – Back view, page 31.

Connectors for expansion



The backplanes can be expanded by interconnecting the channels GND, SYN and Profibus of the different backplanes (PF1 and PF2).

In the backplane, the socket connector is installed and the plug-type connector is installed in the cable used for the expansion. Use a metallic and shielded connector with an output angle for the cable of 180 °(reference: FCK1GA).

Expansion cable connector

Each bus in use (PF1, PF2, SYN) requires a shielded twisted-pair connection cable. Two types of cables are available depending on the distance between the backplanes (in accordance with EIA RS-485):

- Cable type A:
  - Impedance: 135 - 165 Ω (f = 3 to 20 MHz)
  - Capacity < 30 pF/m
  - Resistance < 110 Ω/km
  - Conductor area ≥ 0.34 mm^2 (22 AWG)
- Cable type B:
  - Impedance: 100 - 130 Ω (f <100 kHz)
  - Capacity < 60 pF/m
  - Conductor area ≥ 0,22 mm^2 (24 AWG)

The following table shows the maximum length of cable type A and cable type B for the different transmission speeds.

Cable length for the different transmission speeds

Rate (kbit/s)	9.6	19.2	93.75	187.5	500	1500
Cable A length (m)	1200	1200	1200	1000	400	200
Cable B length (m)	1200	1200	1200	600	200	70

The cables shield must be connected to the functional ground protection using the fixing screws of the connector.

NOTICE
HAZARD OF INCORRECT EQUIPMENT INSTALLATION OR INCORRECT POWER SUPPLY • Connect the cable shield to the protective earth ground with the fixing screws of the connector. • Use a cable with mechanical protection, such as Belden 9841, for example. **Failure to follow these instructions can result in equipment damage.**

Expansion using RS-485

This section details how to wire the bus expansion depending on the system needs. For each backplane, the position of the switches is shown.

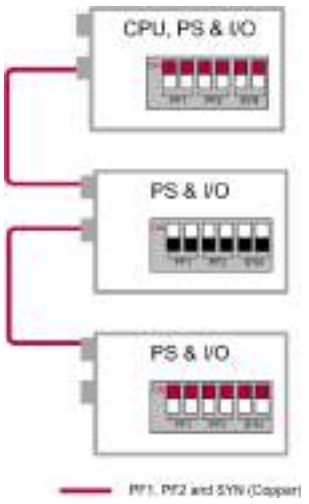
The following scenarios are described:

- One main backplane (with single or dual CPU) and a single cable for PF1, PF2 and SYN.
- One main backplane (with single or dual CPU), a cable for PF2 and another cable for PF1 and SYN.
- Two main backplanes, a cable for PF2 and another cable for PF1 and SYN.

One Main Backplane / One Single Cable for PF1, PF2 and SYN

A main backplane and other acquisition backplanes are available. Regarding bus redundancy, although there is a duplicate bus, in this case, both use the same cable for the expansion.

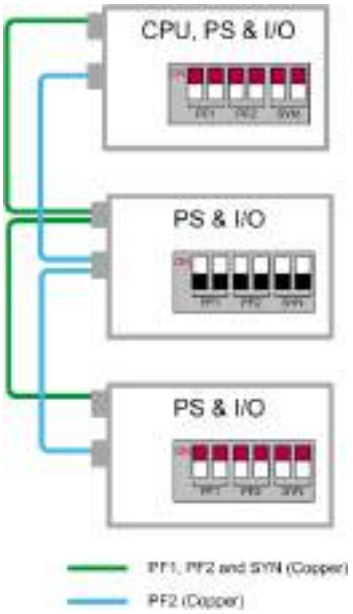
Backplane expansion (using copper) – One main backplane / One single expansion cable



One Main Backplane / One Cable for PF1 and SYN / One Cable for PF2

If the system requires a cable (a cable for each Profibus) redundancy, the configuration is shown in the following figure:

Backplane expansion (using copper) – A main backplane / A cable for each profibus



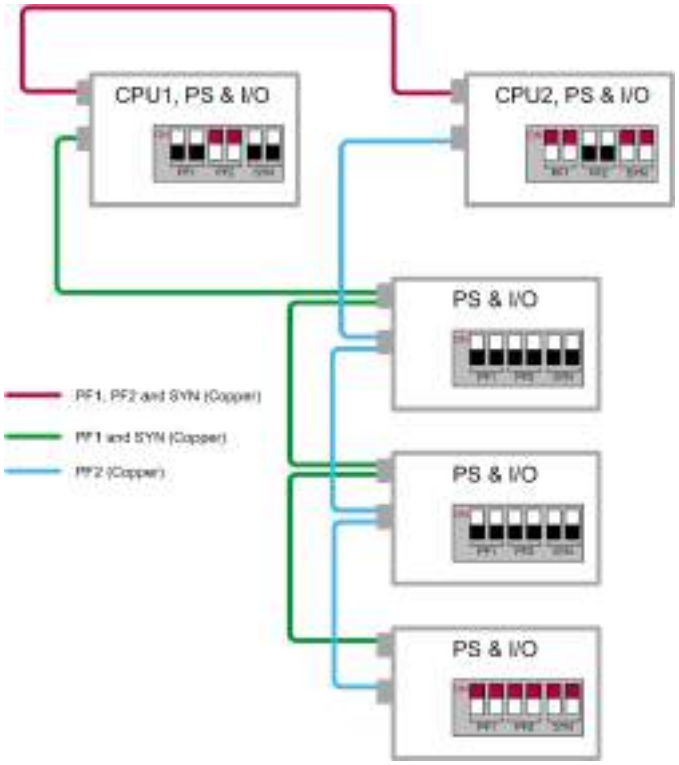
NOTICE
HAZARD OF INCORRECT EQUIPMENT OPERATION Expand the synchronization bus (SYN) by using either PF1 or PF2 cable to avoid synchronization issues in the acquisition backplanes. **Failure to follow these instructions can result in equipment damage.**

Two Main Backplanes / One Cable for PF1 and SYN / One Cable for PF2

If you have two main backplanes but you do not need to use a double wiring, the backplane expansion is shown in BP260/N9 – Front view, page 29 and BP270/N8 – Back view, page 31, where the second main backplane is considered as an acquisition backplane. In these backplanes, all switches must be set to OFF.

If you need a cable for each profibus, see the following figure:

Backplane expansion – Two main backplanes / Two expansion cables



Field Connection

Acquisition modules can be connected to the field using two different procedures:

- C1: **Terminal connection** or direct connection. It is used when the length of the field cabling is short, for example, when interconnections and assemblies are done within the cabinet, signals are generated in a close site or proceed from an interface cabinet located at the same site.
- C2: **Flat-ribbon connection** through terminal blocks. It is used when the distance between the module and the signal source is long or when the cable gauge needs to be bigger than 0.5 mm^2 due to the cabling layout.

Terminal connection (C1)

Flat ribbon connection (C2)

A module can be easily replaced by disconnecting the two field-connectors and removing the module from its slot, in both direct and terminal-block connections.

In some modules, input circuits need to be polarized to perform signaling and command functions.

C1 – Terminal Connection

The acquisition modules have Eurostyle™ 20-way and 3.81 mm connectors. These modules offer multiple solutions to the header connector (terminal screw, spring, small screw...). An example is shown in the following figure:

Header connector for PowerLogic T500 acquisition modules

- **Manufacturer**: Phoenix Contact
- **Reference**: FMC 1.5/20 STF 3.81 (1748532)

C2 – Flat Ribbon Connection (Terminal Blocks)

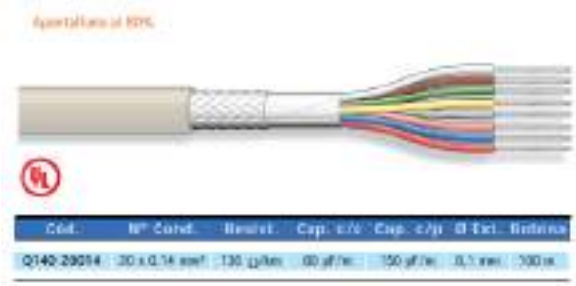
When the connection is established through terminal blocks, they can be simple connecting interfaces made up by a flat ribbon and terminals. These spring-type terminals with capacity for 2.5 mm^2 gauge cables have a DIN 35 rail mounting base. The flat ribbon cable has 20 ways, so two terminal blocks for each module are required.

Wiring Recommendations for I/O Modules

Consider the following recommendations regarding the wiring of the modules:

- **Recommended cable type**: low voltage computer with 20 x 0.14 by EMELEC.

Cable for field connection



Remove 8 to 10 cm of the shield at the end of each cable. Place insulating material around the cut as shown in the following figure.

Prepared cable for field connection

Remove 0,5 cm of the shield at the end of each cable. Insert the exposed copper into the terminal.

Wiring a module with terminals

Close the door when the space accommodates the cables.

Position of the cables when they are installed

When the module is installed in the cabinet, join the two wires in a plastic bracket and attach them to the cabinet or the chassis.

Example of mounting cables to the cabinet or chassis

Wiring recommendations for EMC

To improve the EMC behavior of the equipment, follow the following indications in the wiring of the cabinet.

Considering the wiring types that can be used, there are several wiring groups:

Group	Connection type
1	Analog inputs and outputs
2	Digital inputs and outputs
3	Communications
4	Main and auxiliary power supply and polarization of the field signals
5	Ground protection for safety and EMC

General Recommendations

- Whenever possible, cables of groups 1, 2 and 3 should be wired separately. That is, the analog, digital, and communication signals should have separate gutters.
- If separate wiring is not possible and the number of signals is low, exceptionally this gutter may be shared. In this case, as analog and communication signals are the most sensitive, these two types of signals should be wired through the same gutter, whereas digital signals should be wired separately.
- When none of the above is possible, you need to avoid analog, digital and communication signals to be wired in parallel. If there are some sections in which parallel wiring cannot be avoided, these should be as short as possible.
- If the cables need to be crossed, these crossings should be perpendicular to each other.
- To increase protection in the field inputs and outputs, terminal blocks are normally used to reinforce the protection barrier. The power supply and protection terminal blocks of DI, DO, AI and AO are protection barriers. The input wiring to these elements must always be independent from the output wiring of these barriers. They should never share the gutter.

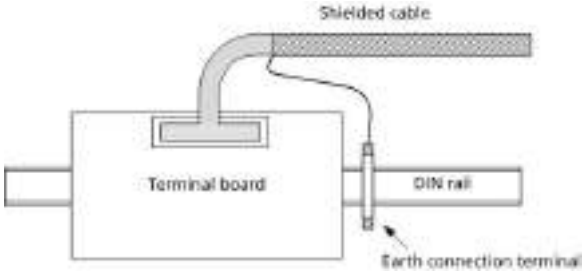
NOTICE
HAZARD OF INCORRECT EQUIPMENT OPERATION Make sure that analog, digital and communication cables should never share the gutter with power supply or polarization cables. Make sure that field input signal cables must never be laid using cables with filtered signals. **Failure to follow these instructions can result in equipment damage.**

Analog Inputs and Outputs Signals

In the case of analog signals, always shielded cables should be used for the connection of the analog module to the resistor and protection terminal block. Ground the shield cable corresponding to the terminal block connection with a DIN-rail terminal.

⚠WARNING
HAZARD OF INCORRECT EQUIPMENT INSTALLATION Connect the shielded twisted pair of cables properly. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Analog signals wiring



Communications

The communication bus can be installed using 2-wires communication or 4-wires communication. To increase the immunity to electromagnetic interference (EMC), use a shielded twisted pair of cables.

NOTICE
HAZARD OF INCORRECT EQUIPMENT INSTALLATION Connect the shielded twisted pair properly. **Failure to follow these instructions can result in equipment damage.**

The shield connection depends on the equipotentiality between the connected devices:

- **Guaranteed equipotentiality**: both devices are connected to a ground system, so that the same potential level is guaranteed. The shield must be connected at both ends.

- **Limited equipotentiality**: both devices are connected to ground but not to the same ground system. To limit the difference of potential that can be produced among them, a cable with the appropriate cross-section is installed between both grounding. The shield must be connected at one end.
- **No guaranteed equipotentiality**: ground connection of both devices cannot be guaranteed (both devices must be connected to a ground system). Copper must not be used in this case.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not connect non equi-potential devices.

Failure to follow these instructions will result in death or serious injury.

RS-485 Communications

For RS-485 communication, use twisted pairs, shielded individually or all together by a copper braid. The recommendations for the cable are:

- Resistance: < 100 Ω/km
- Section: 0.22 mm^2 (24 AWG)
- Characteristic impedance: 120 Ω
- Maximum length: 1200 m

RS-422 Communications

For RS-422 the twisted pairs must be shielded individually. The recommendations for the cable are:

- Resistance: < 100 Ω/km
- Section: 0.22 mm^2 (24 AWG)
- Characteristic impedance: 100 Ω
- Maximum length: 1200 m

RS-232 Communications

For RS-232 communication, use a wire shielded with a copper braid. The recommendations for the cable are:

- Resistance: < 100 Ω/km
- Section: 0.22 mm^2 (24 AWG)
- Maximum length: 15 m

Group 4 (Power Supply)

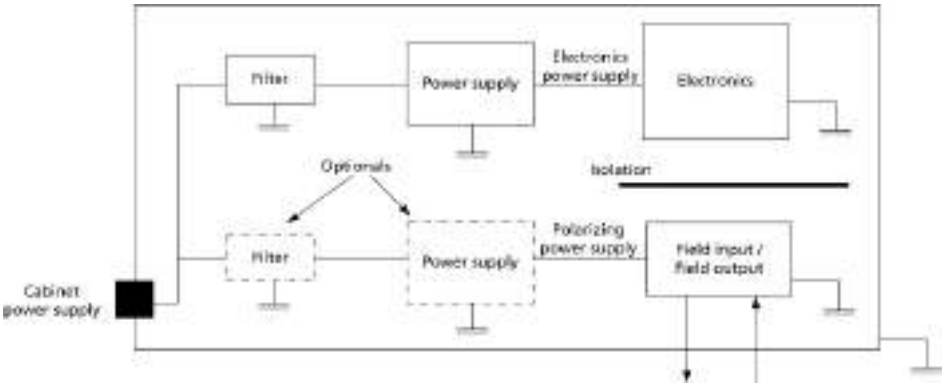
The power supply for the electronic elements is the main barrier between the existing disturbances in the power supply line and the system. That is the reason why, this power supply is equipped with some additional filters to achieve a good EMC behaviour of the system. You need to keep the filters input wiring independent from the output wiring.

Polarization

The output of the polarizing power supplies follows the same route in the field as the digital signals in which they are used, so the treatment is the same as for a

field input/output signal. In some projects, supplementary filters are installed. In these cases, the wiring should be independent for the filters input and output.

Polarizing power supply output



Auxiliary

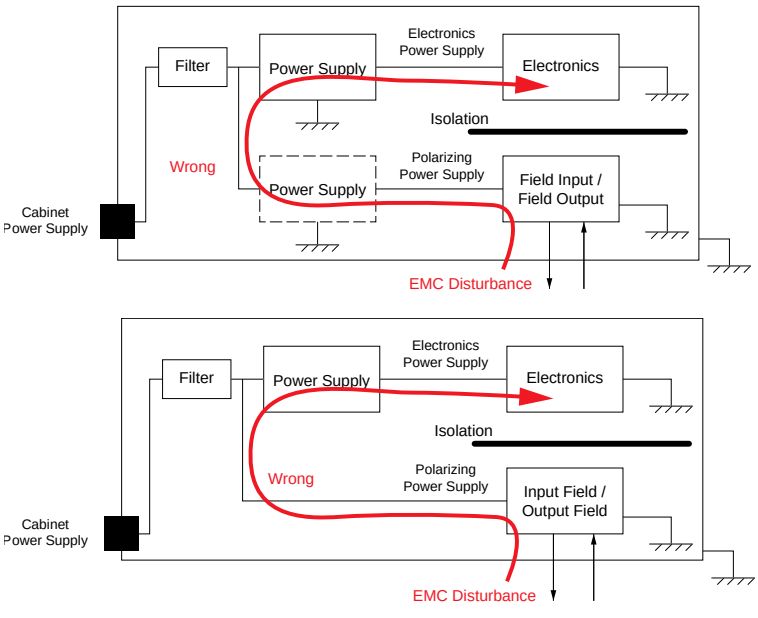
The auxiliary power supply and its wirings do not have any galvanic connection to PowerLogic T500, so they should be sufficiently separated from each other (independent gutters and layout) to avoid possible disturbances to reach the PowerLogic T500 wiring itself. In some projects, supplementary filters are installed. In these cases, the wiring should be independent for the filters input and output.

Filtering

Generally, a filter is included to reinforce the protection of the power supply of the electronic elements. The use of filters for the polarizing power supply is optional.

The polarizing power supply should never be combined with the power supply for electric elements. The filter cannot be shared in any case, as the polarizing power supply goes to field with the rest of inputs/outputs. As shown in the figures, an incorrect connection of the polarization power supply reduces the effect of the protection barriers.

Example of incorrect connections of the polarization power supply



Group 5 (Ground Connection)

General Recommendations

In general, each cabinet should have both a grounding bar and a metal sheet for grounding purposes. All shielded cables and external protective circuits need to be connected according to figure General scheme of a CORRECT ground connection, page 55.

The size of the cable section should be appropriate for each installation, and grounding braids should be used whenever possible.

⚠WARNING

HAZARD OF INCORRECT GROUND CONNECTION

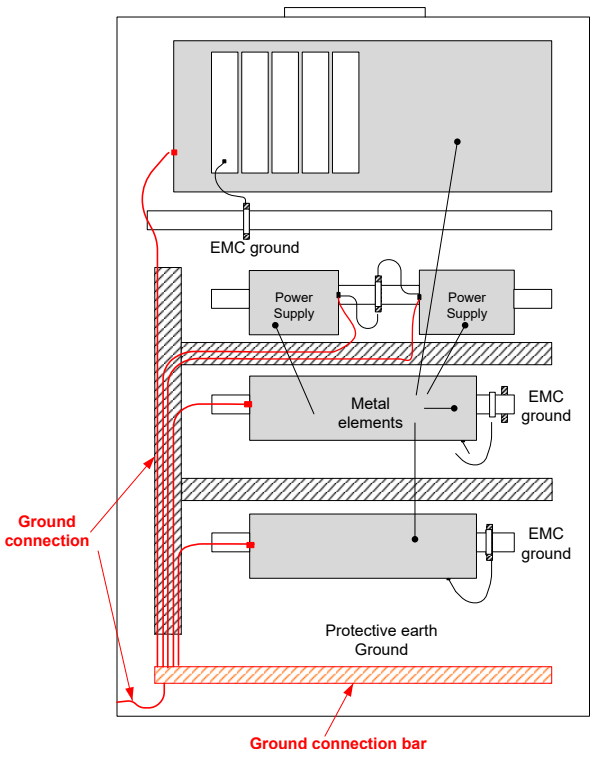
- Provide a ground wire in a given point to the equipment or cabinet to achieve a low impedance for the rest of the elements.
- Assemble horizontal copper bars, as well as vertical copper bars (whenever possible).
- Connect all the metallic parts of the equipment to the ground protection.
- Use the cabinet metallic walls or metal sheet (when applied) to distribute the EMC ground.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Ground Connection

For the ground connection, the equipment wiring must be done in star configuration, as shown in the following figure.

General scheme of a CORRECT ground connection



⚠WARNING

HAZARD OF INCORRECT GROUND CONNECTION

- Ensure to use an individual and dedicated cable connection between each equipment (power supply, metallic equipment, and the ground connection bar).
- Do not share the same wiring with more than one equipment.
- When using external power supplies, particularly in CAT I power supply, it is needed to establish two connections. One connection is for the protective earth connection, as specified in the power supply user manual, while the other connection is for the EMC protection. The EMC protection must be connected to the same terminal as for the protective earth connection and kept as short as possible (below 15 cm).

Failure to follow these instructions can result in death, serious injury, or equipment damage.

NOTICE

HAZARD OF INCORRECT EQUIPMENT OPERATION

- For the functional earth ground (EMC ground), the metal sheet of the cabinet can be used as the functional grounding reference.
- Keep the EMC protective wiring of the equipment as short as possible (less than 15 cm) between the connections and the metal sheet.

Failure to follow these instructions can result in equipment damage.

The best connection is direct to the metal sheet with the support of a terminal block or another firmly connected method to the metal sheet.

Configuration and Maintenance

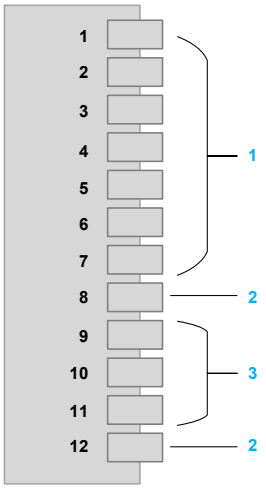
Profibus Configuration

The identification and Profibus communication speed of the module can be set using the microswitches on the module rear panel.

NOTE: You can connect up to 96 PowerLogic T500 modules.

Each microswitch has the following functions:

Profibus switches for module configuration



1. **Profibus address**
2. **Reserved**
3. **Profibus speed**

I/O Module Addressing

The identification of the module must be unique. Use the microswitches 1 to 7 to set the identification and select a number between 1 and 96.

The addresses 0 and starting from 97 to 127 are reserved and should not be assigned. In the case that they are assigned, messages are generated when the system boots.

The address definition is as follows:

$P1*2^0 + P2*2^1 + P3*2^2 + P4*2^3 + P5*2^4 + P6*2^5 + P7*2^6$

It is assumed that P_x is the value assigned to the position of microswitch x (0 is OFF and 1 is ON). For example, if the switches 2, 4 and 5 are in the ON position, the Profibus address of the module is 26.

NOTICE
HAZARD OF INCORRECT EQUIPMENT OPERATION
Make sure that the same address is not assigned to two modules.
Failure to follow these instructions can result in equipment malfunction.

Profibus Communication Rate

The Profibus communication rate is the same for all PowerLogic T500 modules. The rate is determined by the rate configured by software in the HU280 module. The rate is set using microswitches 9, 10 and 11 as shown in the following table:

Profibus configuration

Position 11	Position 10	Position 9	Profibus Rate
OFF	OFF	OFF	19.2 kbaud
OFF	OFF	ON	93.75 kbaud
OFF	ON	OFF	187.5 kbaud
OFF	ON	ON	500 kbaud
ON	OFF	OFF	1.5 Mbaud
ON	OFF	ON	Not available
ON	ON	OFF	Not available
ON	ON	ON	Not available

NOTE: For optimal system performance, it is recommended to set the Profibus rate to 1.5 Mbaud.

Microswitches 8 and 12 are reserved and must be set to OFF.

Communication Modules

For communication modules, the microswitches 1 to 4 are used to identify the position of the module in the bus. This position identifies the physical name of each serial port.

For example, the serial ports XS280 in position 1 are MUX1 to MUX8. The serial ports in the XS280 are MUX9 to MUX16 in position 2.

Profibus Redundancy

In the Profibus-DP redundancy, the jumper used to configure the internal bus as redundant or not is identified with number 2 in BP260/N9 – Front view, page 29 and BP270/N8 – Front view, page 31.

If the jumper is mounted, the internal bus is redundant.

NOTICE
HAZARD OF INCORRECT EQUIPMENT OPERATION If you do not use the configuration of Profibus-DP redundancy, remove the jumper, as indicated in the following image. **Failure to follow these instructions can result in equipment malfunction.**

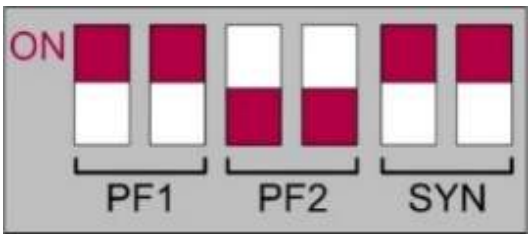
Removing the jumper

RS-485 Termination Resistor

Apart from the expansion connectors, six micro-switches are available in the backplane front panel to set the RS-485 termination resistors.

The RS-485 standard defines an asynchronous serial communication with differential levels, which requires termination resistors to be included in the bus ends. When interconnecting the backplanes, you need to include the termination resistors in the first and last backplanes of the bus. To connect the termination resistors, the micro-switches next to the expansion connectors must be set to ON, where PF1 is associated with Profibus 1, PF2 with Profibus 2 and SYN with the synchronization bus.

Backplane microswitches

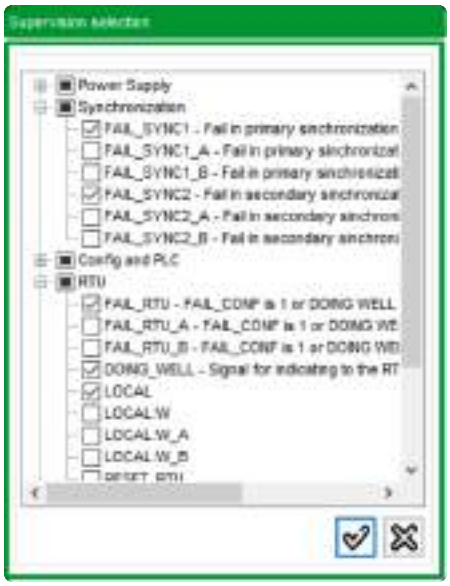


Supervision

The **Supervision** device is a default device in Easergy Builder. The device is used to monitor the status of CPU components and generates information about other components in the RTU.

You can double-click the **Supervision** device in the tree to view a complete list of all the functions you can monitor in this type of CPU.

Supervision points for T500



It is advised to always load the supervision device that is required to monitor the mentioned elements of the CPU and is essential in redundant configurations. The CPU itself cannot arbitrate with another CPU in redundant systems, so there must be a monitoring part. Currently, only the supervision device can perform these tasks, and in practice only this device is used.

For redundant configurations, most of the supervision points are also available with **_A** and **_B** suffixes to provide CPU-related information. For example, the points PS1_V, PS1_V_A, and PS1_V_B are available for power supply voltage. Regardless of which CPU is in online mode, information is available for both CPUs.

The information generated by the monitoring module is supplemented with the control and diagnostic information generated in each device.

> **NOTE:** For supervision device, the coordinates are the points name. For example, the coordinate associated to the FAIL_PLC point is FAIL_PLC.

Glossary

A

AI160: PowerLogic T500 analog input module.

AX160: PowerLogic T500 analog input/output module.

B

BP260: PowerLogic T500 backplane.

BP270: PowerLogic T500 chassis.

C

CPU: Central Processing Unit.

D

DI180: PowerLogic T500 digital input module.

DI: Digital Input.

DNP: Distributed Network Protocol

DO180: PowerLogic T500 digital output module with relays.

DO280: PowerLogic T500 digital output module with transistors.

DO: Digital Output.

DP: Decentralized Periphery

E

Easergy Builder: Easergy Builder is the official configuration tool for T500 equipment. This tool can be used to configure all the advanced RTU functions (for example, database, protocol addressing, events) and to carry out maintenance tasks on the equipment.

F

FEG: Functional Earth Ground.

G

GND: Ground.

GPS: Global Positioning System.

I

IEC: International Electrotechnical Commission. The international standards organization for the fields of electricity, electronics, electromagnetic compatibility, nanotechnology, and related technologies. It complements the International Organization for Standardization (ISO), which is responsible for other fields.

IED: Intelligent Electronic Device.

IEEE: Institute of Electrical and Electronics Engineers. The IEEE is a professional association comprising members from the fields of electrical engineering, information technology, telecommunications, etc. The organization's mission is to advance knowledge in the field of electrical engineering and publish associated standards and other texts written by its members.

IP: Internet Protocol.

IRIG-B: mode B of the standard IRIG.

L

LAN: Local Area Network.

LED: Light Emitting Diode.

LV: Low Voltage.

M

Module: Hardware device comprising a functional component of the T500 (for example, DI180, DO180, and PS280 are modules on the T500).

MUX: Serial data bus for communication with the XS280 module.

O

OS: Operating System.

P

PC: Personal Computer.

PE: Protective Earth Ground.

PF1/2 (485): Primary and redundant Profibus RS-485 buses.

PF1/2 (TTL): Primary and redundant Profibus TTL buses.

PPS: Pulse Per Second Signal

PS280: PowerLogic T500 power supply.

PTP: Precision Time Protocol.

R

RS: Serial link.

RTDB: Real-Time DataBase.

RTU: Remote Terminal Unit.

S

SCADA: Supervisory Control And Data Acquisition.

SD: Secure Digital

SER: Serial bus for synchronization between redundant CPU modules

SNTP: Simple Network Time Protocol.

SYN (485): Bus RS-485 for synchronization of the modules (PPS).

SYN (TTL): Bus for synchronization of the modules (Pulse Per Second or PPS).

T

TTL: Time To Live

W

webApp: Web tool for online maintenance and monitoring of the RTU.

webUI: Advanced tool for the design and operation of a local web-based substation user interface.

X

XS280: PowerLogic T500 serial communication module.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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