

# Ponto Series Utilization Manual

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altus



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# Preface

## Manual Description

This manual describes the Ponto Series and it's divided in 6 chapters and 1 addendum.

The chapter 1 **Ponto Series** covers the product generic features and applications.

The chapter 2 **Architecture** has the main characteristics of elements that belong to the Ponto Series.

The chapter 3 **Configuration** instructs how to configure a Ponto Series system.

The chapter 4 **Electrical Panel Project** shows the information for the mechanical and electrical project of the control panel.

The chapter 5 **Installation** instructs how to install the Ponto Series components, including physical installation, modules and bus connections, electrical installation and general procedures with environment conditions and grounding.

The chapter 6 **Maintenance** shows the procedures to be performed for the Ponto Series reliable operation, errors diagnosis procedures, hot swap as well as preventive maintenance.

The addendum A **Glossary** shows the expressions and acronyms used in this manual.

## Ponto Series Documentation

Please consult additional documentation in order to get further information about the Ponto Series. You may find such documents at [www.altus.com.br](http://www.altus.com.br)

Each product has its specific Technical Characteristics (TC) document, where the product is described in details. Some products also have its own specific utilization manual (in such cases the TC lists the respective manual code). For instance, the PO2022 module has all its characteristics, utilization and purchasing information described in its TC. On the other hand the PO5063 has its own TC and also a utilization manual.

For further information please consult following manuals:

- Technical Characteristics of each product
- MasterTool Programming User Manual
- Ponto CPUs Utilization Manual
- PROFIBUS Head Utilization Manual

# Terminology

The following expressions and acronyms are frequently used in this manual:

- PLC: Programmable Logic Controller – equipment with CPU, IO modules and power supply.
- CPU: Central Processing Unit – main PLC module responsible for the main data processing.
- MasterTool: they are ALTUS applications to run on IBM-PC<sup>™</sup> or compatible computers using Windows<sup>™</sup>. The MasterTool allows the application development for the PLCs series Ponto, PICCOLO, AL-2000, AL-3000 and QUARK. Throughout this document, MasterTool will be referred by its acronym or by “MasterTool programmer”.

Other expressions may be found on addendum C, **Glossary**.



# Utilized Conventions

Following are symbols utilized in this manual and their meaning:

- This mark indicates items or topics

SMALL UPPER CAPS indicates keyboard keys, for example ENTER.

KEY1+KEY2 is used for pressing simultaneously two keys. For example, CTRL+END.

KEY1, KEY2 is used for sequential pressing. For example, “Press ALT, F10” means pressing first ALT then releases it, and after F10 then release it.

BIG UPPER CAPS indicates files and folder names.

*Italic* indicates characters entered on the keyboard or visualized on the screen. For example, if it's requested to write *A:MASTERTOOL*, then those characters should be entered as requested.

**BOLD** is used for command names or options, or to bring attention on important issues been discussed.

The warning messages will have the following formats and meanings:

## DANGER:

The DANGER label indicates risk of life, risks of serious injuries or substantial material damage if needed precautions are not taken.

## WARNING:

The WARNING label indicates risk of life, risks of serious injuries or substantial material damage if needed precautions are not taken.

## ATTENTION:

The ATTENTION label indicates personal injuries and some material damage may take place if needed precautions are not taken.

# Technical Support

To access Technical Support please call +55 51 3337 3633 in Porto Alegre, RS, Brazil. Or please find the closes technical support site at:

- [www.altus.com.br](http://www.altus.com.br)
- E-MAIL: [altus@altus.com.br](mailto:altus@altus.com.br)

If your equipment is already installed, please gather the following information before contacting our technical support:

- Equipment models and system configuration
- Serial number of CPU, equipment revision and executive software version, and all these information is attached to the product side wall.
- Information about CPU status. For that, please use programming software MasterTool
- Application program (program modules). For that, please use programming software MasterTool
- Programming tool version.

## Manual Revisions

The reference code, revision and issuance date are printed on the cover of this manual. Revision changes mean functional specifications have been changed or improvements on the manual.

The following list presents the changes this manual has been through:

Revision: PRELIMINARY	Date: 03/2002
Approval: Luiz Gerbase	
Author: Alexandre Hessler / Joni Girardi	

Notes:

- Initial manual English version

Revision: B	Date: 07/2004
Approval: Luiz Gerbase	
Author: Leonel Poltosi	

Notes:

- General update

# The Ponto Series

The Ponto Series is distributed control system with remote I/O. It is based on flexible architecture that offers a wide variety of fieldbus protocols.

The I/O and fieldbus head modules work with either Altus or third parties CPUs.

Terminal blocks and fuses are integrated into the electronic module bases. This feature simplifies a lot the design, assembling and commissioning of control panels.

The Ponto Series offers extensive diagnostic and hot-swap features that drastically reduce maintenance costs.

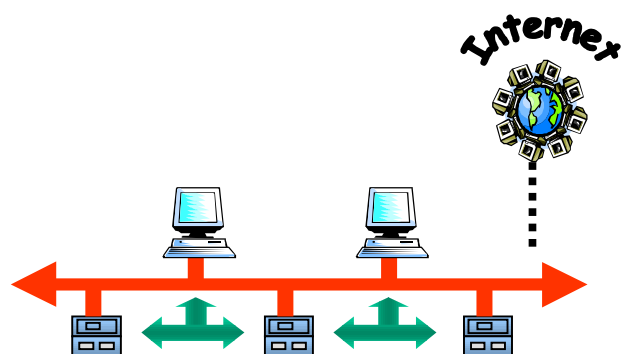
The high capacity CPUs allow Internet access through browsers. This brings unprecedented functionality to the supervision, control and diagnosis of control equipment's.



## Series Characteristics

### CPUs

The CPUs have highly integrated functions, online programming, high memory capacity and many integrated serial channels.



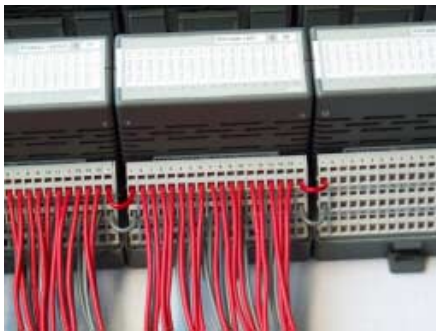
## Modules

The modules carry high density I/Os; there are configurations with 16 to 32 I/Os per module. Every I/O has a monitoring LED. There is one LED for multifunctional diagnosis, and that information is also accessible remotely by the CPU, fieldbus head or by the MasterTool ProPonto configuration tool.

The I/O modules have labels where the user can identify the field tags. These tags are conveniently located by the I/O LEDs, thus facilitating I/O identification.



## Terminal Blocks Integrated to the Base



The Ponto Series has direct connection to the field wiring, thus reducing installation costs with less wiring and terminals. In order to remove modules it is not necessary to move any field wiring.

## Modules Hot Swap

The hot-swap feature allows modules replacement with no need to shut the system power off. The CPU keeps controlling the whole process, and the modules can be replaced whenever needed.

The modules can be replaced individually, and there is no need to disconnect any cabling once they are unplugged. When a module is unplugged all its I/Os values are stored and set inactive by the CPU.

## Fuses

Optionally, there are fuses for the protection of outputs and field wiring. The 4-20 mA analog signals are also protected in this way. Therefore there is a gain in operational safety and an economy, eliminating additional wiring for blocks with fuses.

## Mechanical Switch

The bases have a key switch system which prohibits the placement of a module different from the one previously thought and adjusted to the base. This key has a code defined by the last digits in the modules name. For example: module PO2021 must have its base adjusted by the user with the code 21.

## Diagnosis

CPUs, heads and I/O modules have several diagnostics available. Each module has a multifunctional diagnostic LED. The diagnostics are available in the CPU, fieldbus heads and can be consulted via configuration software - MasterTool ProPonto. Some examples are:

- Wrong module for the position
- Missing field power supply
- Load short circuited



## Address System

The GBL communication bus implements the address system. It is a brand new technology developed and patented by Altus.

The modules have automatic addressing that eliminates the need for addressing keys or jumpers.

The address is defined by the module position, thus avoiding accidental addressing or undue field signals activation.

## High Speed Bus

The communication between the CPU or head is based on a high speed bus, implemented with a single ASIC chip, achieving in this way unsurpassed acquisition and parameterization speed. The main features of this bus are:

- Automatic addressing and identification of the modules
- Hot-swapping
- 12 Mbaud serial bus, 0,5 acquisition time for 480 points
- Interconnection of 30 modules X 16 = 480 points
- Featuring a dedicated integrated circuit



## Automatic Identification

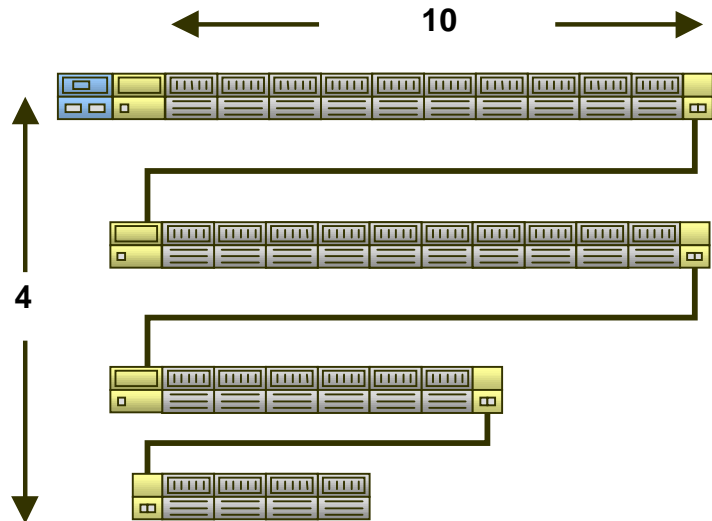
This is a built-in system which allows the master of the bus (CPU or head) to identify its type, avoiding mistakes in the system assembling or after module replacement. This is an additional protection to the mechanical switch and it allows the configuration check up previously made during the project phase.

## Local Bus

Each bus can handle up to 30 I/O modules.

Each bus can be divided in up to 4 bus segments, and each bus segment composed by up to 10 modules.

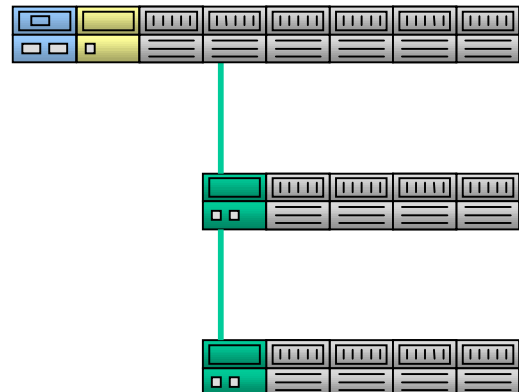
A great amount of flexibility is achieved in this way.



## Remote Bus

For this type of configuration the modules are connected to the Field Network Head. The field network interconnects the heads to a Field Network Interface located in the local bus.

The remote buses may carry the same limits of IO modules capacity of the local bus, but are also limited to the network type specific characteristics. Please consult the utilization manual for the field network head in order to get further details about it.

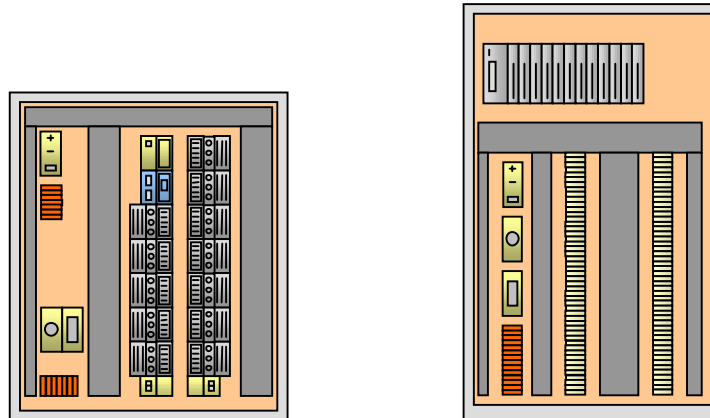


This picture shows the PROFIBUS network head that includes a power supply.

## Panel Assembly Advantages

Following are the advantages on building a panel using Ponto Series against a panel with the same configuration built on a conventional system.

- Reduction of 47% on total panel depth
- Reduction of 20% on total panel area
- Reduction of 50% on total panel volume
- Ponto Series reduces intermediary terminal blocks, wiring, identifiers and rails.
- Ponto Series eliminates fused terminal blocks

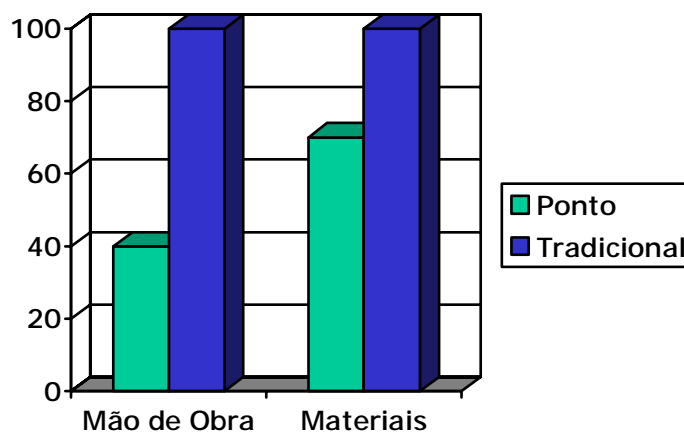


Panel with Ponto Series versus conventional panel

## Assembly Cost Reduction

The assembling of a control panel using Ponto Series reduces drastically the total cost of the system. The reduction of design time, assembling labor and materials are the crucial factors for this reduction.

The total cost reduction is about 30% in a typical panel.

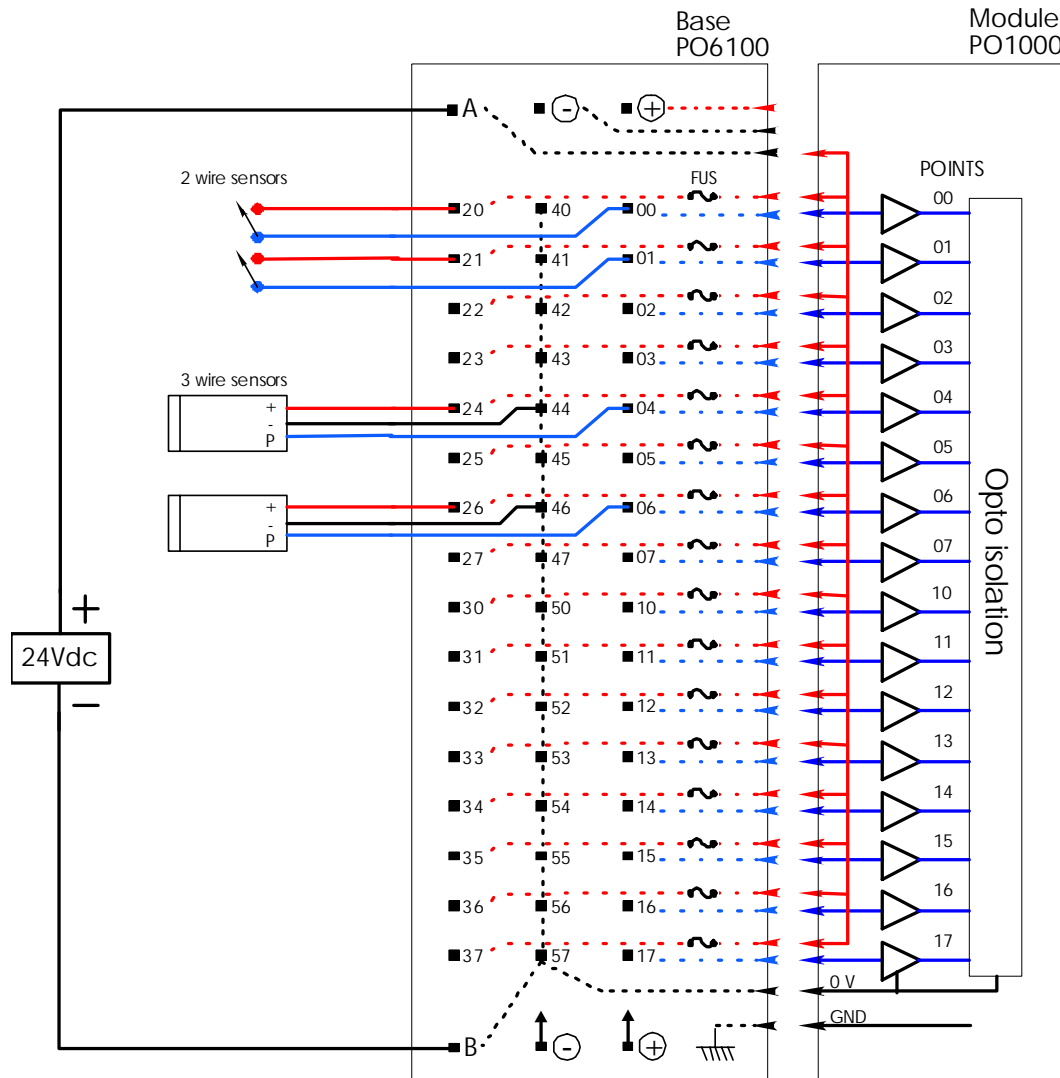




## Control Panel Wiring Simplification

The diagram shows the wiring for a PO1000 module ( 24 Vdc 16 DI input ) , installed on a PO6100 base. The field power supply is connected to the base that distributes the power to the field sensors. The sensors can have a 2 or 3 wire configuration, protected or not with individual fuses.

With this configuration there is no need for additional terminal blocks and their respective wiring.



## Network Interfaces

The Ponto Series works with the following fieldbuses:

- PROFIBUS
- MODBUS
- ETHERNET
- DEVICE-NET
- AS-i

## MT4100 - MasterTool Programming

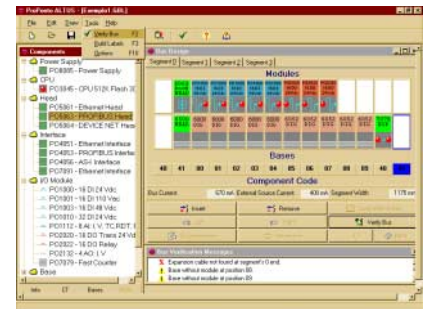
It is the programming software for CPU and buses configuration.

The MT4100 is one of the most efficient tools available in the market for ladder programming. It has the flexibility and power of using special functions for different applications.

## MT6000 - MasterTool ProPonto

The MT6000 helps the project of Ponto Series buses. It is not required to configure the Ponto Series equipment, but it makes it very easy to configure and document the whole system. Following are the functions available:

- Graphical design of buses
- Configuration validation: it checks items like power consumption, compatible bases and design limits.
- Tags definition. Generation of labels for module identification.
- Modules parameterization; for example, configuring the type of analog signal for an input or output.
- List of materials generation
- Configuration from a list of modules available in the “components tree”
- Leverage of tags from MasterTool.



Please see MasterTool ProPonto technical characteristics for further details.

## Environment Conditions

The Ponto Series IO modules comply with the following specifications:

<b>Storage Temperature</b>	-25 to 70°C
<b>Operating Temperature</b>	0 to 60°C
<b>Relative Air Humidity</b>	5 to 95% non condensing
<b>Noise Immunity</b>	IEC 1131, several levels, CE depending on module

# Architecture

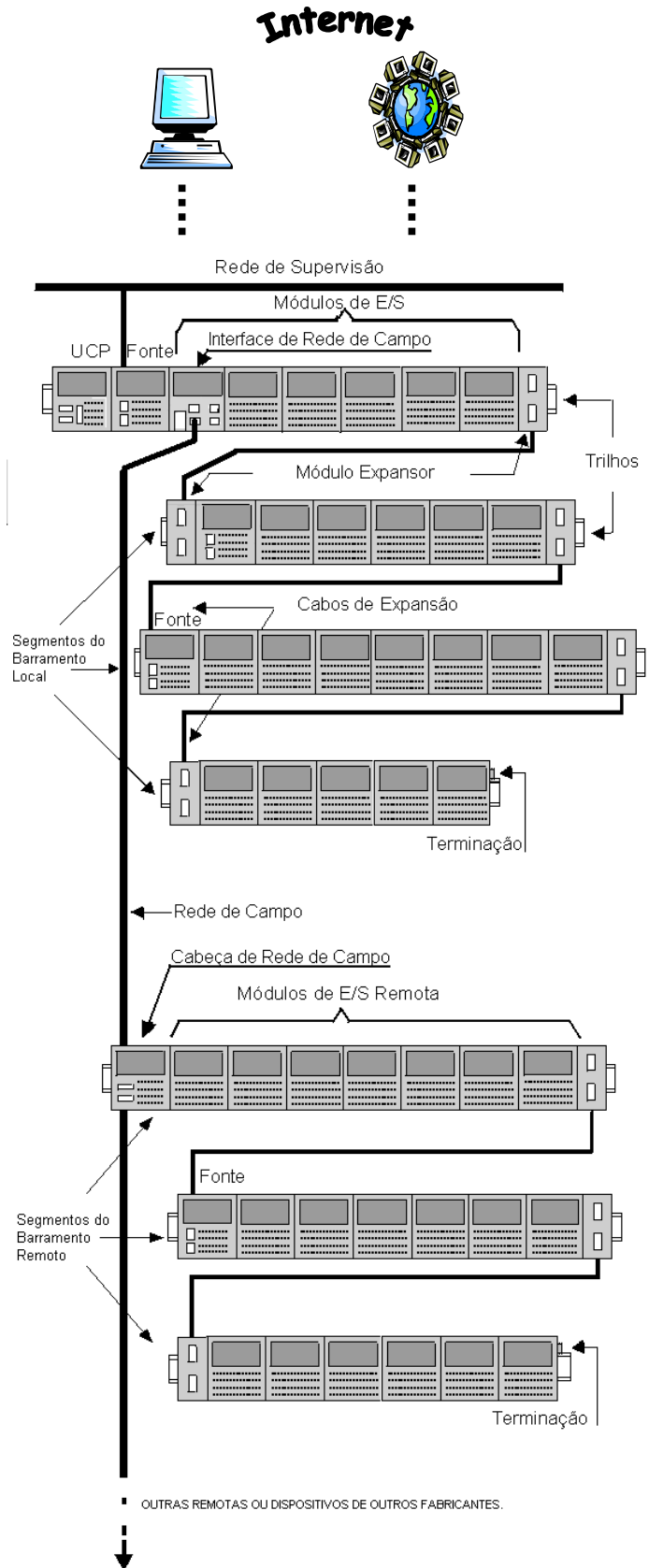
The Ponto Series architecture is extremely versatile, it allows the interconnection of I/O modules and other complex modules like fieldbus interfaces and coprocessors.

The wide variety of supported fieldbus protocols and no need of intermediary terminals blocks make the Ponto Series an ideal solution for control of machinery and systems of any size.

The flexible and functional architecture drastically reduces materials and labor on system installation. There are huge savings on cabling, cabinet size and long term maintenance costs.

Other major advantages are: high-speed data communication, compact and economic solutions and interconnection with third party CPUs.

Following a brief description of main architecture components:



# Ponto Architecture Elements

## Rail

The Ponto Series is mounted on TS35 DIN standard rails. The modules are easily plugged in and out of the rails.

## CPU



The CPU performs the control functions. Among other functions, the CPU runs the basic control cycles composed by: reading inputs, running application algorithm, writing outputs, and communicating with the supervision system.

The CPU size is the same as the IO modules.

## Power Supply



It supplies power for the local CPU and I/Os. Extra power supply units are added for bus segments when extra current is needed.

The power supply size is the same as the IO modules.

The small size CPUs come with integrated power supply.

## Bus

A typical system consists of a Local Bus (CPU and its I/Os) and Remote Buses (sets of Fieldbus Heads and I/Os).

Every Local Bus or Remote Bus can handle up to 30 modules, each Bus divided in up to 4 Bus Segments. The remote bus may have additional limitations based on the used protocol and data quantity to be exchanged.

## Bases



The bases are modular elements that gather buses. They are plugged into TS35 rails and act as interconnection agents for power, bus and I/O signals for all modules.



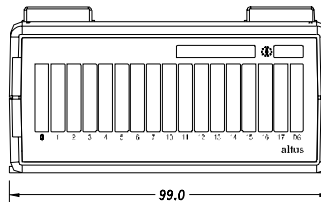
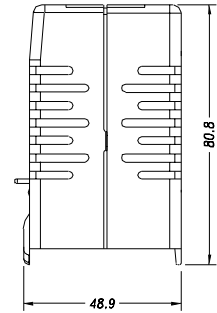
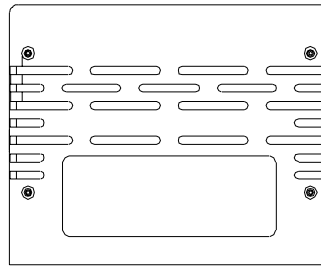
The bases have terminals – spring or screw style - for field wiring interconnection, and optionally fuses for protection. The base selection depends upon the kind of module to be used. Please refer to the Technical Characteristics of each module to define available bases options.

## I/O Modules

The I/O modules plug into the bases. They act as adapters for different types of field signals, and also for sending the signals to the CPU or Network Head. The Ponto Series supports a wide variety of I/O types and operational ranges, thus covering all the typical needs for an automation system.

The modules are hot swappable, meaning they can be unplugged without turning the system power off.

Please use external power supplies to provide energy for field circuits.



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## Bus Expansions



Bus expansions interconnect the bus segments, thus bridging communication and power lines between them.

The bus expander that begins a bus segment can be replaced by a power supply if needed. If so, more current will be available for the I/O modules that follow.

## Expansion Cables



Expansion cables interconnect the expander modules, thus creating the bus segments. They allow more flexibility when putting together different system configurations in control panels.

## Termination



It couples the impedance for a local or remote bus. The termination is a connector that should be placed at the last bus base. This element comes along with the CPU base and the field network head.

## Fieldbus Interface

Fieldbus interfaces are fieldbus master nodes and allow the access to remote modules or other equipment based on PROFIBUS, MODBUS, DEVICENET and AS-i protocols.

The fieldbus interfaces are plugged into local buses, and use one I/O module slot.

## Fieldbus Heads

The fieldbus heads connect the Ponto Series modules to different field networks. They can communicate with CPUs from different vendors, supporting several protocols like PROFIBUS, MODBUS and DEVICENET.

The fieldbus heads have integrated power supply that feeds the modules connected to them. When required, another power supply may be connected at the beginning of a bus segment.

# Configuration

This chapter covers how select the modules to put together a local or remote bus. Initially it will explain the maximum limits allowed for any project. We recommend you to read the modules Technical Characteristics and specific manuals in order to take full advantage of the flexibility offered by the Ponto Series.

Please use the MasterTool ProPonto software to configure the system. You may easily access the complete list of available products and documents from within it. Also all the configuration limits are checked there.

## Limits

Please respect the following limits when designing a CPU with local bus:

- Maximum number of modules per segment: 10
- Maximum number of segments: 4
- Maximum total number of modules: 30
- Maximum number of modules fed by one power supply: 12, distributed at most for two segments. This limit may be exceeded if the ProPonto software indicates so. The software calculates the actual limit considering the specific consume per module.

When designing the remote bus for a field network head, please check specifically limits for it. For instance, for the PROFIBUS PO5063 head:

- Maximum number of modules per segment: 10
- Maximum number of segments: 4
- Maximum total number of modules: 20
- Maximum number of 200 bytes for input and 200 bytes for output
- Maximum number of modules fed by one power supply: 12, distributed at most for two segments. This limit may be exceeded if the ProPonto software indicates so. The software calculates the actual limit considering the specific consume per module.

**ATTENTION:**

Please consult the respective technical characteristics and manuals in order to be sure about the maximum limits per used module.

## Configuration Steps

### Step 1 – Define the input and output modules required

Please consider:

1. The required number of IOs based on the process to be controlled.
2. Grouping the inputs accordingly to their characteristics: need to use outputs with dry contacts, isolated analog signals, etc.

3. Select the modules types. Please use the following criteria when selecting the IO modules:

- Working voltage
- Output type: transistor or relay
- Need to isolate digital signals
- Isolation for analog or digital modules
- Maximum currents (per IO and per module)
- Filter timing for inputs
- Protection for inputs and outputs

4. Determine the number of modules for each type in order to cover all IOs.

5. Check the capacity of the CPU or Field Network Head

Due to the system modularity, the user must carefully specify each Ponto Series component: modules and bases. Those parts are available separately in order to rationalize the required number of items.

Please check the technical characteristics of all modules in order to be sure they meet the application requirements.

## Step 2 – Define the required bases for the IO modules

Please consult the TC – Technical Characteristics for each module defined in the previous step. The Ponto Series have a broad range of bases to choose from, and that allows the set up of many different configurations. Then please choose the bases types. Please use the following criteria when selecting the bases:

- Terminal block type required: spring or screw
- Fuse protection
- Need for separated IOs (ex.: dry contact) or common ones

## Step 3 – Define the CPU or Head and respective base

The following table shows some available options:

	<b>PO5063 and PO5063V4</b>	<b>PO3042</b>	<b>PO3142</b>	<b>PO3242</b>	<b>PO3342</b>
Denomination	PROFIBUS Field Network Head	CPU 128 K Flash, 16 IO modules, 2 RS232 Serial Interfaces	CPU 256 K Flash, 30 IO modules, 3 Serial Interfaces 2 - RS232 1 - RS485 MODBUS	CPU 256 K Flash, 30 IO modules, 2 Serial Interfaces 1 - RS232 1 - RS485 Ethernet TCP/IP Interface, PROFIBUS	CPU 256 K Flash, 30 IO modules 2 Serial Interfaces 1 - RS232 1 - RS485 Ethernet TCP/IP Interface with WebServer PROFIBUS
Compatible Base	PO6500	PO6302	PO6302	PO6302	PO6302
Compatible Power Supply	No need				



For instance: for the PROFIBUS-DP remote, the head is PO5063 and the compatible base is the PO6500. There is no need to add a power supply since the head already comes with one embedded.

### Step 4 – Define the number of segments

The following factors determine the number of segments:

- Maximum number of segments in a local or remote bus: 4
- Maximum number of modules in a segment: 10
- Physical distribution in the panel.

The factors above allow more than one configuration for the number of segments. You should use the lowest number of segments that is possible. Even though you may use more segments depending on the the panel available physical space.

### Step 5 – Define the number of power supplies

There way you define the power supply for local and for remote bus is different from each other.

The local bus, where the PLC is the master device, the CPU provides a power supply to feed the CPU and up to 12 IO modules distributed in up to 2 segments. When this limit is exceeded, please create a new segment including a PO8085 power supply positioned on the first module slot (same as the PO7078 bus expander module). This supplementary power supply may feed up to 12 modules. This kind of arrangement can go on until all the IO modules are conveniently installed.

The PO7091 – Ethernet Industrial Interface - feeds the power for the PO3242 and PO3342 CPUs.

For a remote bus, the PROFIBUS field network head with its own power supply will feed up to 12 IO modules distributed in up to 2 segments. The same way as before, when this limit is exceeded, please create a new segment including a PO8085 power supply positioned on the first module slot (same as the PO7078 bus expander module).

#### ATTENTION

The limit of 12 modules may be exceeded if the ProPonto software indicates so. It calculates the maximum limit of modules per power supply considering the specific consumption for each used module. The limit of 12 modules is always valid for IO modules, but it does not apply to modules with higher consumption.

### Step 6 – PO7078 Expansion modules and expansion cables

The expansion modules and respective cables are responsible to connect one bus segment to the next.

Following are the rules to determine the number and position of the expansion modules:

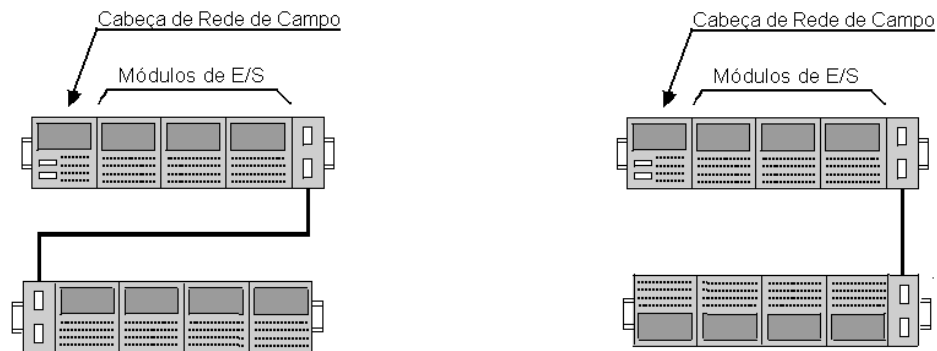
- Each end of segment requires one expansion module and one PO80500 cable (0.4 meters length) or PO8501 (1.40 meters length). The last segment does not require the expansion module nor the expansion cable.
- Each beginning of segment requires a expansion module, except the ones starting with a power supply. The PO8085 power supply has in its PO6800 base a connector with the same functions of the expansion module.

The length of the expansion cable is a function of the segments within the panel. When designing such distribution, please be careful not to position the field signal cables close to the power ones, thus avoiding electrical noise interferences.

#### ATTENTION

The beginning of the segments always occurs at the left extremity. It is right there to install the CPU, power supply or the bus expansion module.

The expansion cables are determined by the physical distribution. The following 2 distributions are valid. The first one use a long cable ( PO8501 with 1.40 meters length) and the second one use a short cable ( PO8500, with 0.4 meters length). Please note that the second situation has the modules upside down. You may find further details on the chapter 5.



Expansion cables

### Step 7 – External power supply

Please consider the following loads when determining the capacity for the 24VDC external power supply:

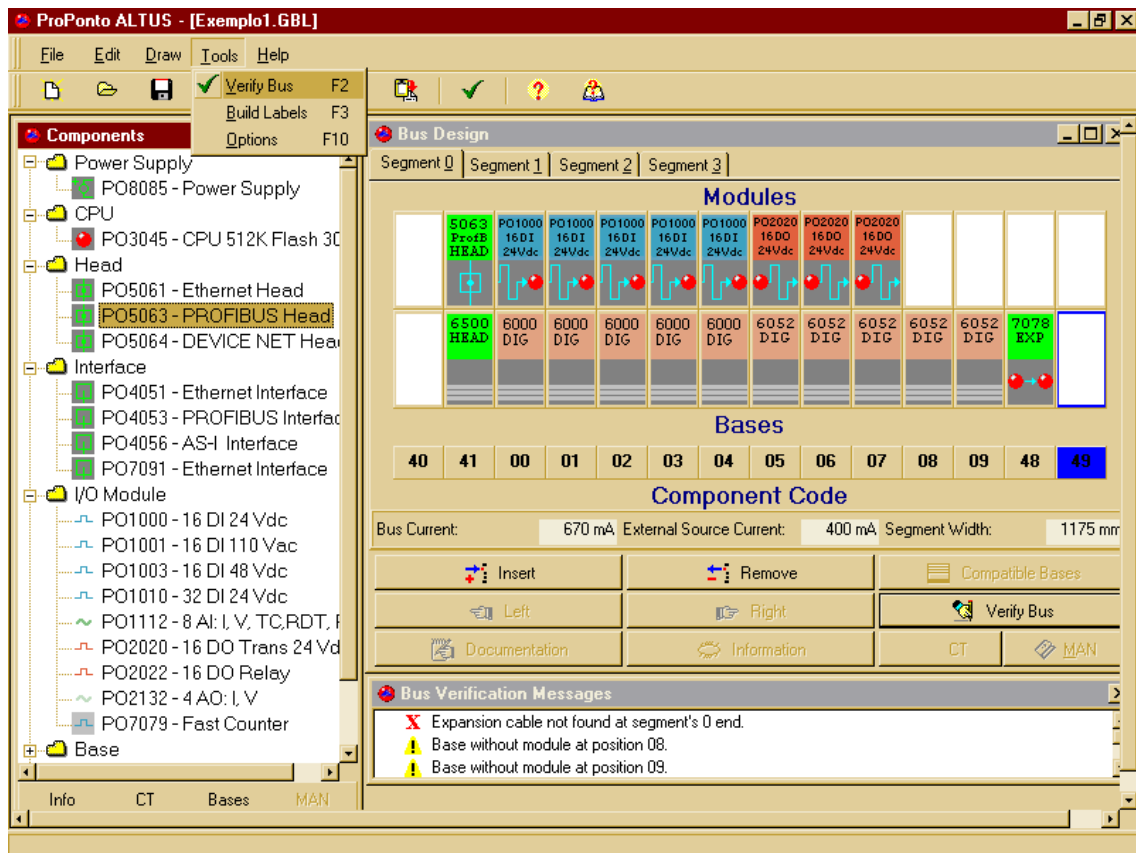
- Modules with external power supply of 24 Vdc
- Current consumed by the field sensors and inputs
- Current consumed by the loads on the outputs

We recommend to use fuse for the powering of all outputs and field sensors. This will increase the system reliability gains field short circuits. Please use the fused bases for such extra protection.

The PO6101 and PO6151 bases protect the current signals for analog modules through 32 mA fuses; and the powering of 24 Vdc through 3A fuses.

# MT6000 - MaterTool ProPonto

Altus provides the MasterTool ProPonto software to configure local and remote Ponto Series buses.



Please consult its manual for further information.

The MasterTool ProPonto has the following characteristics:

## Design Screen by Segment

The ProPonto design screen allows the buildup of Ponto buses through the graphical addition of components (bases and modules).

There are 14 positions reserved for each segment. In each position you may insert up to 2 components: one base (bottom area of the physical position) and one module (upper area of the physical position). The first two positions must be used for the remote heads, CPUs and/or power supplies. The final two positions must be used for bus expander, bus expanders cables and terminators. The ten central positions must only be used for IO modules.

## Components Tree and Compatible Bases

The area to the left on the screen shows the "components tree". It includes folders for components like Bases, Remote Heads, Expansion Cables, CPUs, Power Supplies, Bus Expansions, Network Interfaces and IO Modules. This tree may be expanded into the component detail (one module and one base). Such tree makes it very easy to find the components you are looking for.

The ProPonto has a list of compatible bases for each module, then facilitating the bases insertion.

## Visualization of TCs and Manuals

The ProPonto gives easy access to the technical characteristics (TC) and/or manual for any component. You just need to select the component and press the button “CT” or “MAN”. The files for TCs and manuals come along in the CD or may be downloaded from the Internet.

The ProPonto also has summarized information about the components: commercial description and code. Such information facilitates the identification of the module main characteristics, for instance, if it is input or output, how many IOs, what is the working voltage/current, etc.

## Bus Verification

The ProPonto also checks the correct configuration from a topology and energy distribution perspectives. Following are the items checked:

- Elements missing (ex.: termination, cables...);
- Missing module on top of a base;
- Element in the wrong position (ex.: incompatibility between module and base);
- Number of modules per power supply and whole bus
- Capacity of data (ex.: 200 bytes for input and 200 bytes for output);

## Labels Generation

The ProPonto can generate the labels to identify modules and its IOs.

You may print the labels through Microsoft Excel™, using a predefined spreadsheet called “ETQ.XLS” that comes along with ProPonto. This file has the label layout ready to be printed. You may select what labels to bring using a macro. The macro will import the data directly from the ProPonto project, store it in the respective Excel cells and then print on the selected labels.

The ProPonto integrates with MasterTool MT4100 programmer in a way to take advantage of all the tags and descriptions defined there.

## Bill of Materials

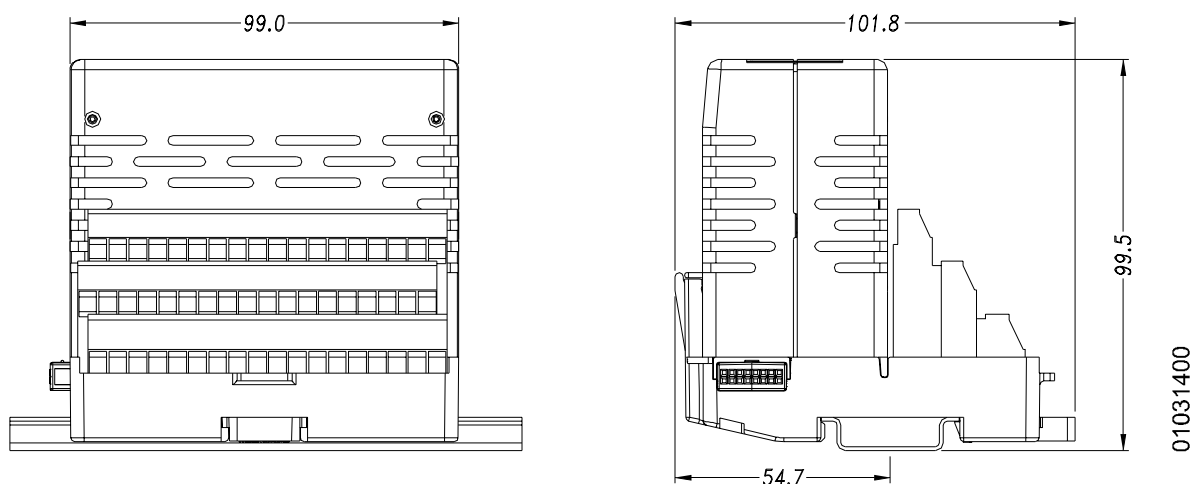
The ProPonto generates bill of materials containing all the ALTUS components to construct buses (modules, bases, cables, terminators, expanders, power supplies, etc.).

# Panel Project

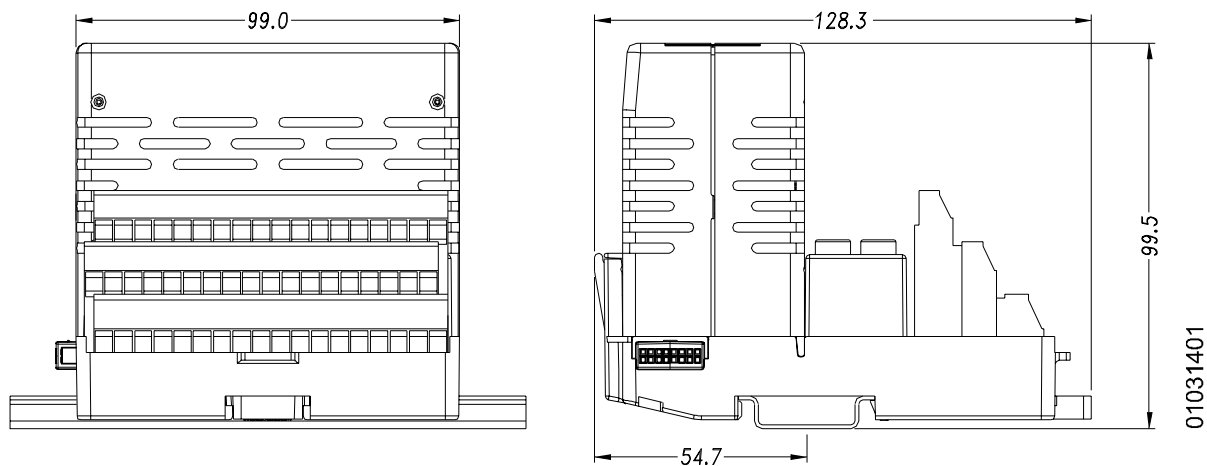
## Mechanical Project

### Dimensions of Modules Assembled on the Bases

The following dimensions apply to CPUs, interfaces, headers, IO modules and power supplies. All modules have the same dimensions. The bases have 2 different sizes, one for non fused and another for fused ones.



**Figure 4-1 IO Module assembled in a non fused Base**



**Figure 4-2 IO Module assembled in a fused base**

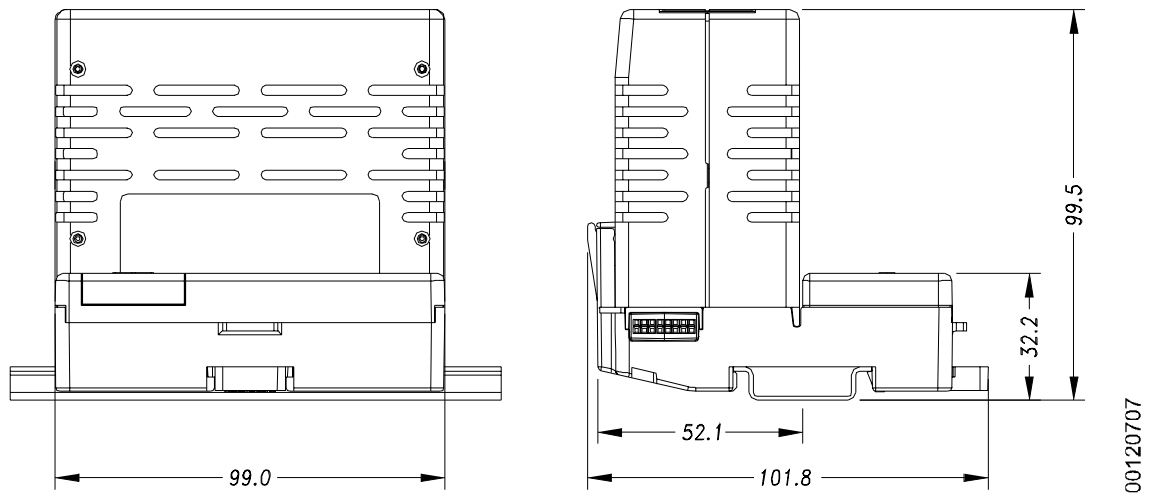


Figure 4-3 CPU assembled on a base

### Expander Module Dimensions

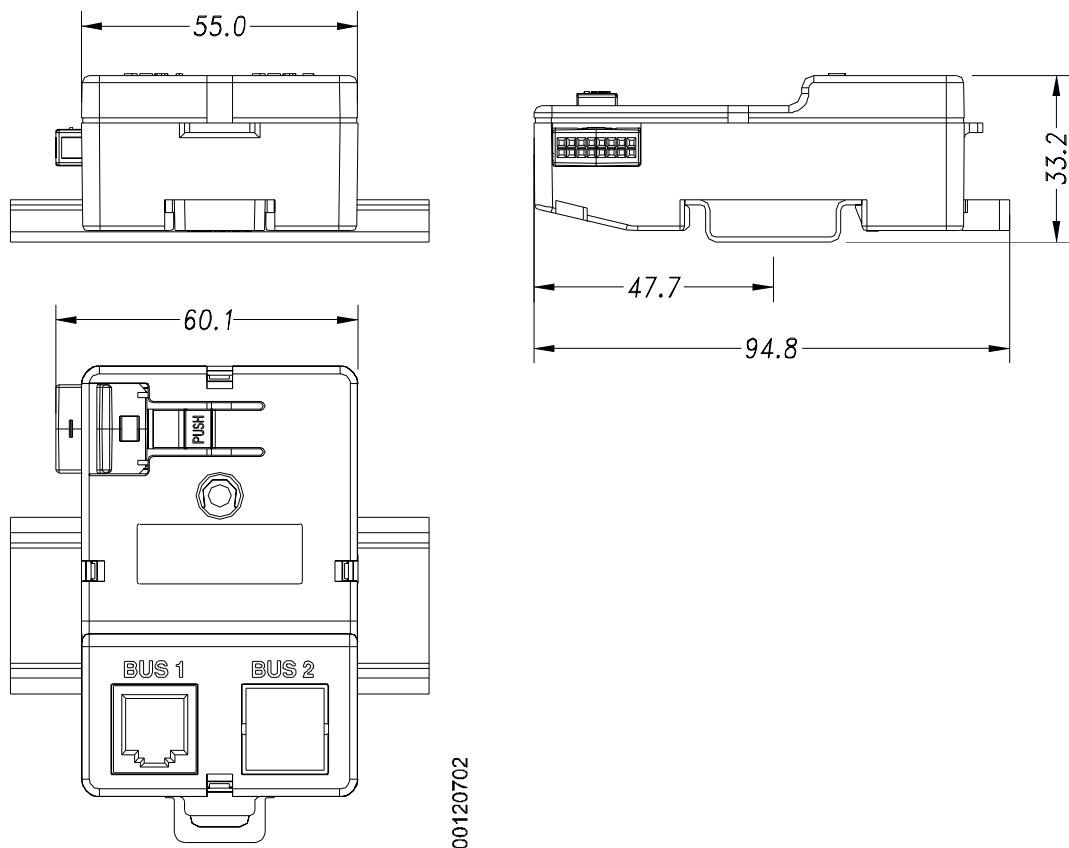
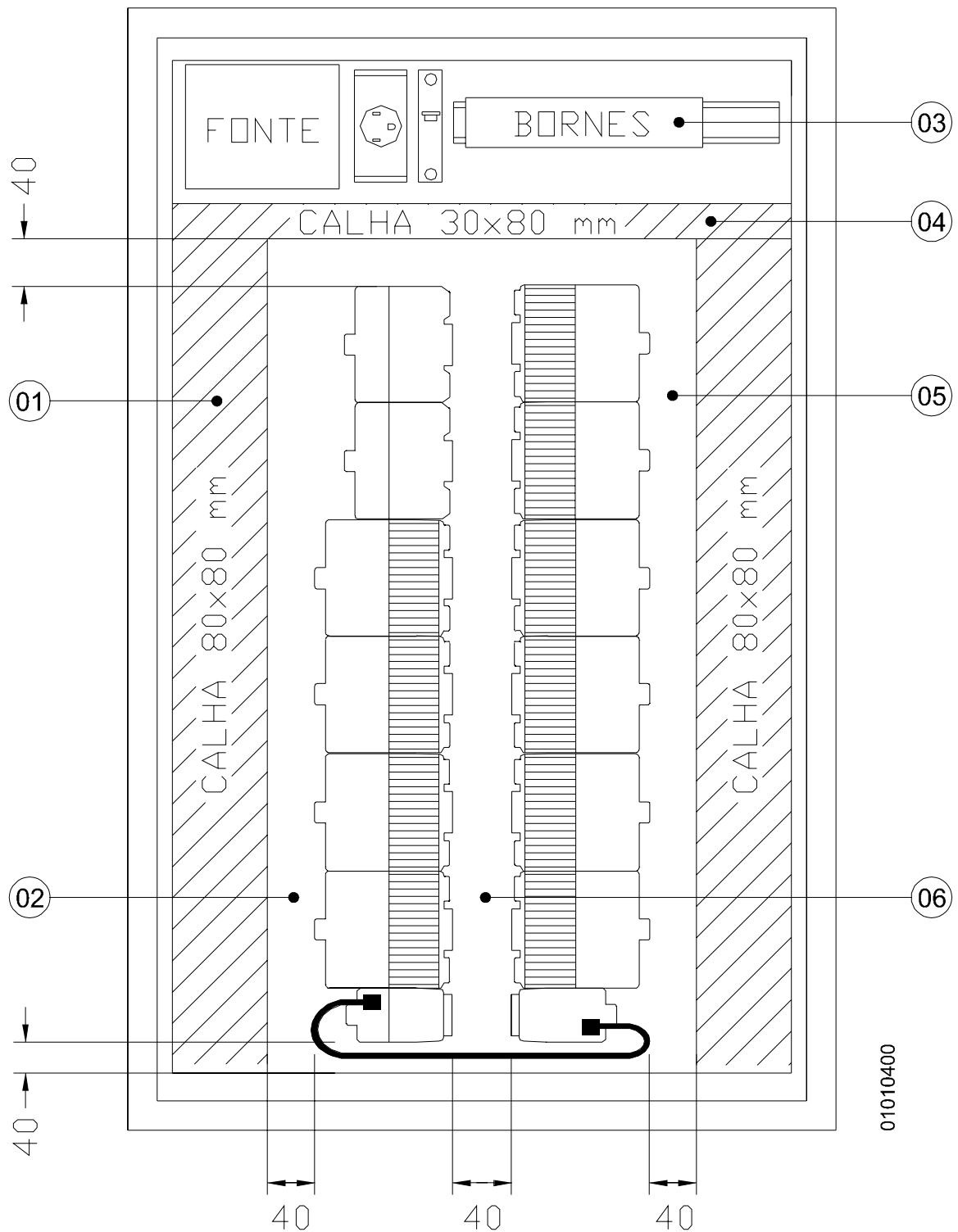


Figure 4-4 Expander Module

### Room Among Modules and other Panel Components

You must leave available room among the bus segments in order to have air circulation, field wiring space, replacement of modules and bases, and other maintenance operations. Please follow dimensions on incoming figure:



**Figure 4-5 Required Room (in mm)**

- 1 – Room required by the conduit (80mm for this example, but it depends on the specific project)
- 2 – Room between conduit and bus segment (the 40mm is required for field wiring manipulation and for utilization of screwdriver for spring terminal blocks)
- 3 – Area with terminal blocks for distribution of 24VDC internal power supply, external powering and other (accordingly to project)
- 4 – Room for the conduit of internal 24VDC power supply distribution (30mm for this example)

5 – Room between conduit and bus segment (the 40mm is required for field wiring manipulation and for utilization of screwdriver for spring terminal blocks)

6 – Minimum room between bus segments in order to guarantee ventilation and handling of modules (40 mm)

If all bases of a segment were non fused then the panel total width may be smaller.

## Total Dimension of a Segment

The total dimension of a segment is the sum of the dimensions of each component assembled on the rail. Please use the following formula:

**Segment Total Dimension** = Number of Bases \* 100 + Number of Bus Expanders \* 55 + 20 (2 lock terminal blocks, please see Installation chapter)

Component	Dimension (mm)
Bases	100
Bus Expander	55
Lock	10

### Dimensions of the Segment Components

Example:

Calculate the total segment length with 1 power supply, 1 CPU, 10 IO modules, 1 bus expander and 2 locks (one in each end).

Segment total dimension =  $12 * 100 + 1 * 55 + 2 * 10 = 1275$  mm

Segment total dimension = 1275 mm = 1.275 m

## Rail Dimensions

The rail must take into account to segment total dimension. You must leave 25mm room at each end of the rail.

**Rail Total Dimension** = Segment Total Dimension + 50 mm

Example:

Calculate the required length for a rail to the segment calculated in the previous example.

Rail total dimension =  $1275 + 50 = 1325$  mm = 1.325 m

The rail must have 2 holes for fixation each 100 mm, as shown below:

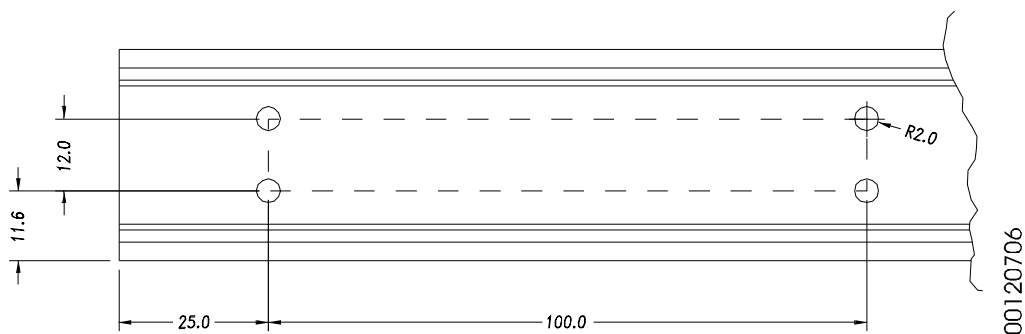


Figure 4-6 Rail

Such fixation will guarantee the rail will stay still while installing or removing Ponto Series bases.



## Conduit Dimensions

When calculating the conduit dimension you have to consider not only the area occupied by the wires but also the heating dissipated by them. Such behavior reduces the available conduit space.

Please use the following rule: conduit area  $\geq$  sum of the wiring area / 0.4

Wiring area =  $(3.14 * \text{radius}^2)$

The wiring area includes the wiring and isolation.

## Vertical Assembly

Please use the figure 4-7 when building a vertical assembly. It is more compact and use shorter PO8500 expansion cables. In general the vertical assembly occupies less room and also facilitates the disposition of field wiring in the conduit.

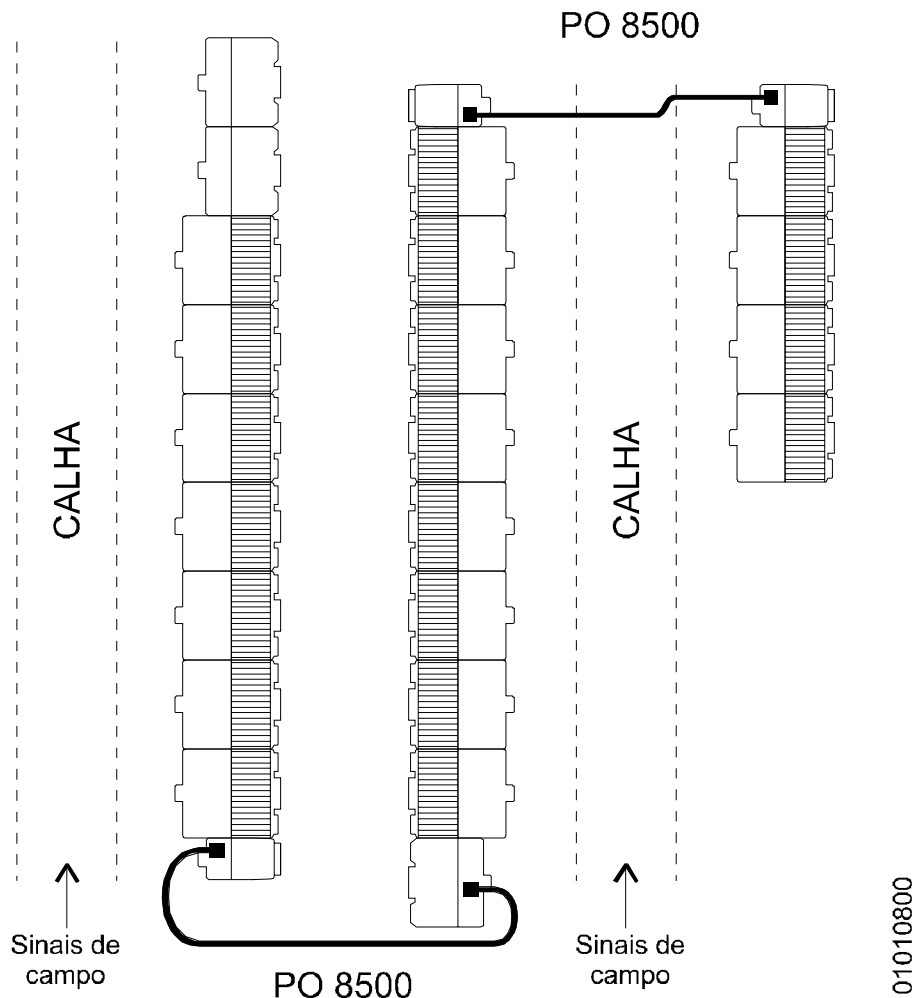
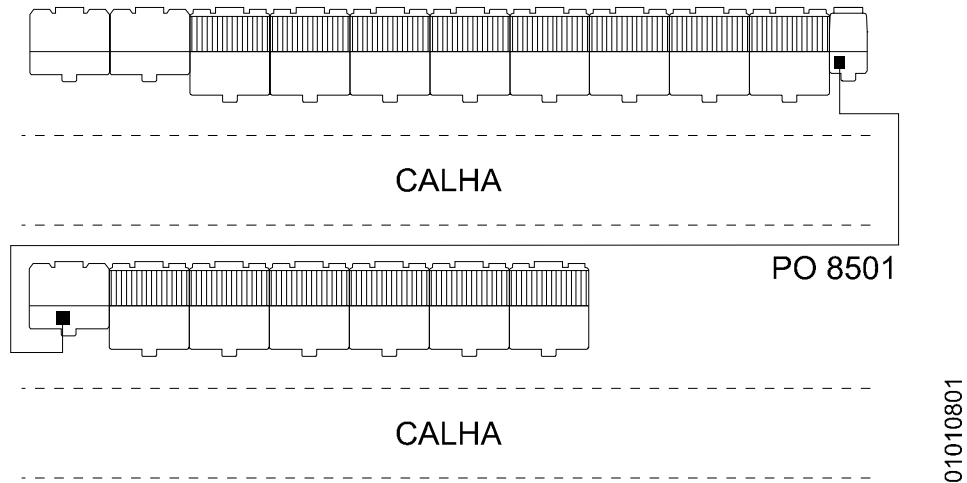


Figure 4-7 Vertical Assembly

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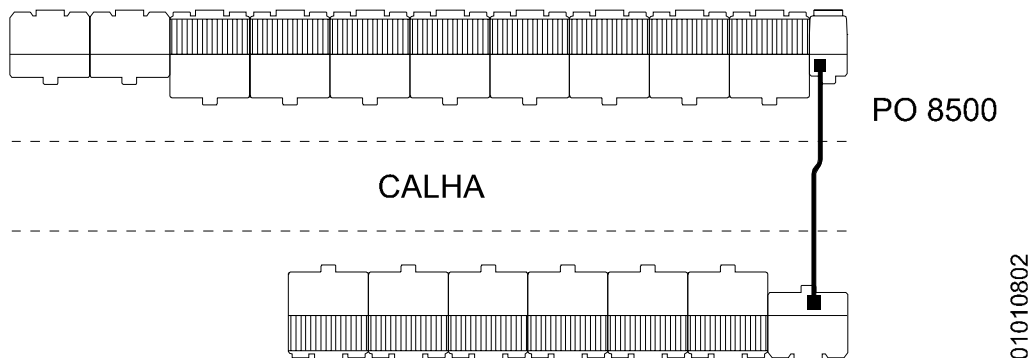
## Horizontal Assembly

Please use the figure 4-8 when building a horizontal assembly. This layout uses the PO8501 cable (1.4m) that must run outside of the conduit. The field wiring runs through two conduits, one for each segment.



**Figure 4-8 Horizontal Assembly (1)**

The assembly on figure 4-9 is more compact. It uses the PO8500 expander cable (0.4m) and only one conduit. The second segment is positioned at 180 degrees from the first one.



**Figure 4-9 Horizontal Assembly (2)**

## Expansion Cable Installation

Please keep the expansion cables away from the conduits in order to prevent electrical noise interferences. Please see figures 4-7, 4-8 and 4-9.

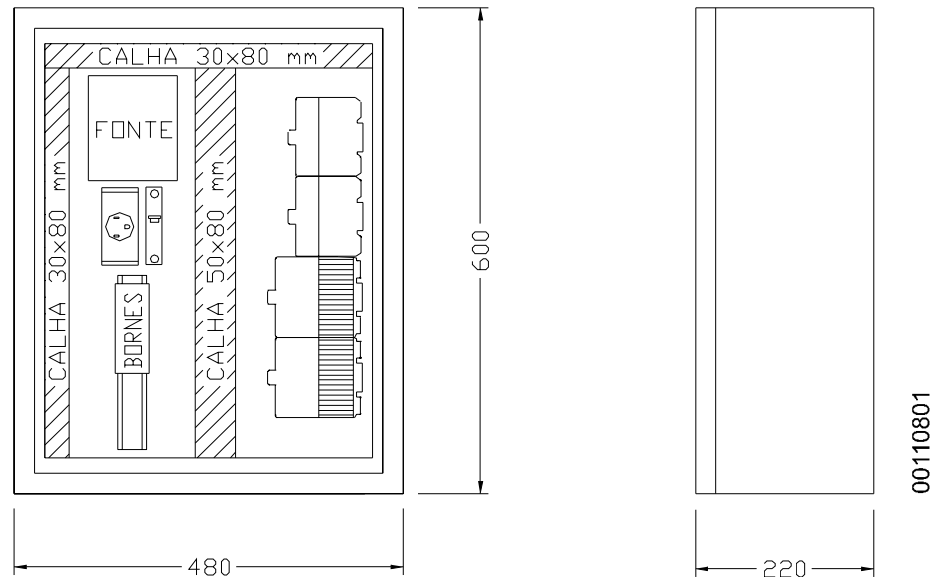
## Panel Projects Examples

Following are examples of Ponto Series electrical panels. The panels are dimensioned accordingly to the main panel providers in the market.

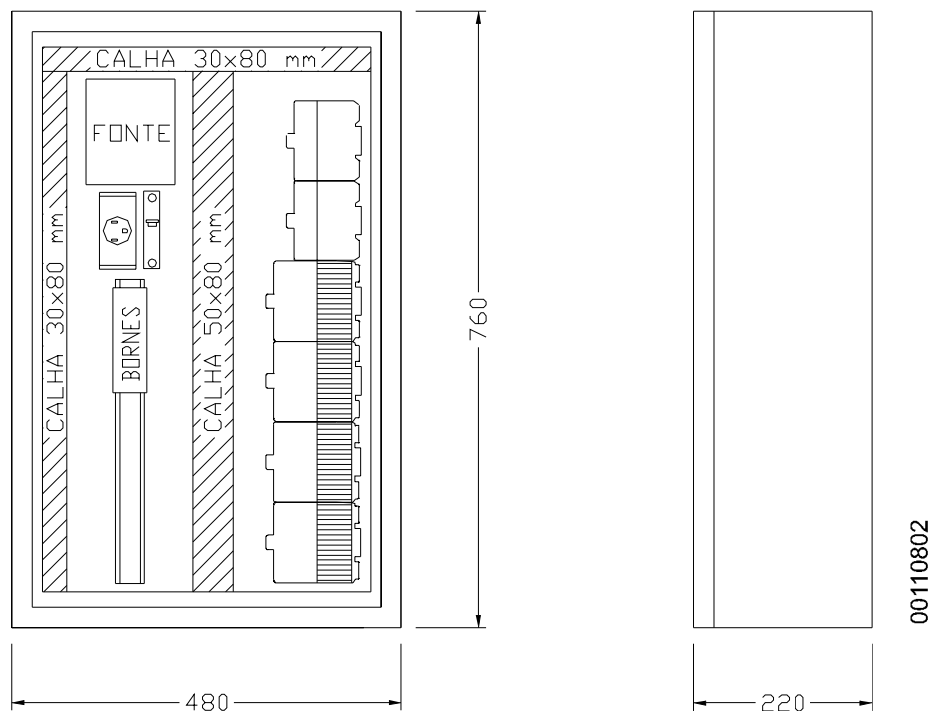
Their main characteristics are:

- Small volume
- Small area for installation
- Easy maintenance
- Easy installation
- Enables any configuration of IO modules

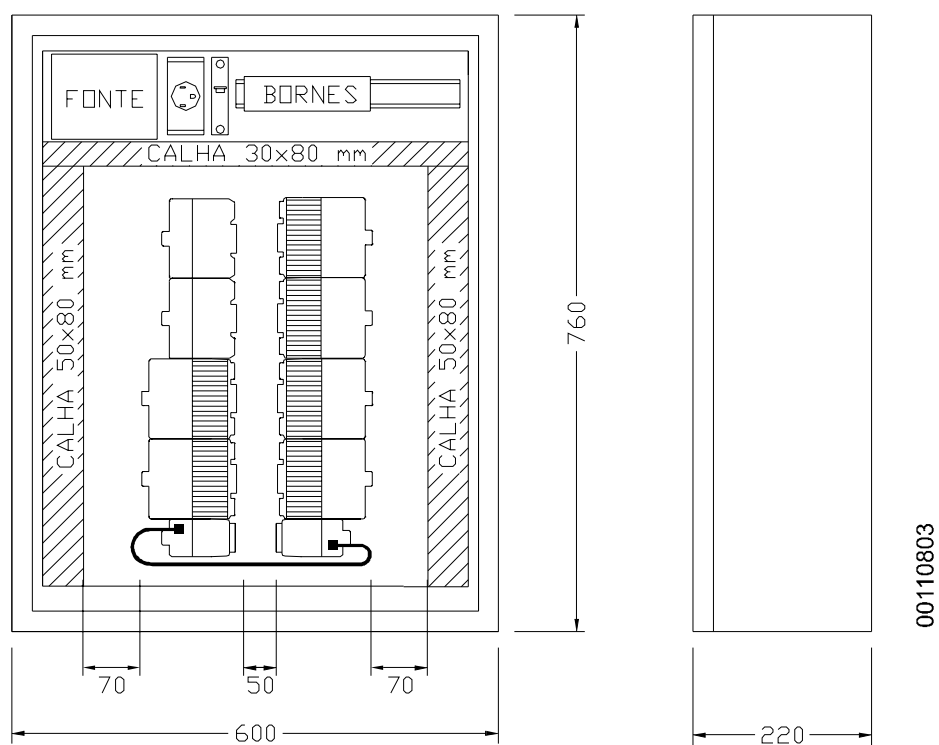
When dimensioning the panel, please take into account the power supply and CPU. I mean, a 4 module panel should include power supply, CPU and 2 IO modules.



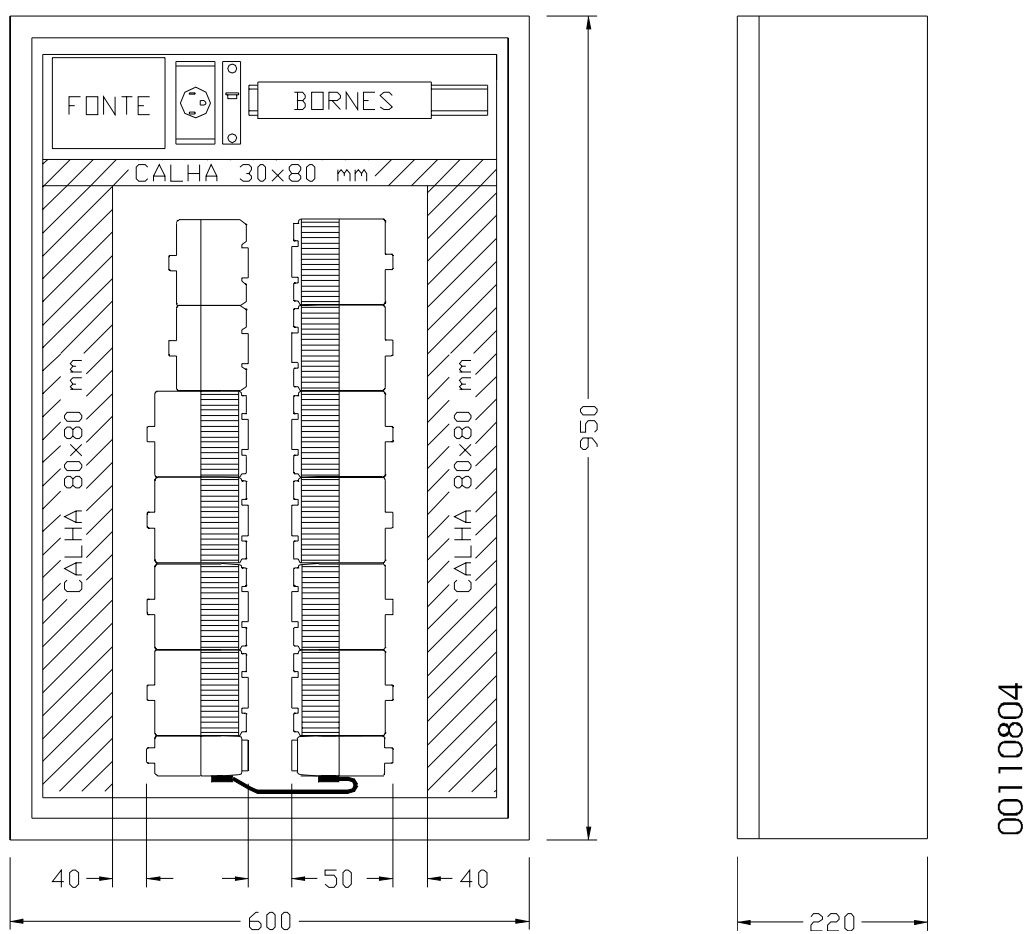
**Figure 4-10 Panel for 4 modules**



**Figure 4-11 Panel for 6 Modules**



**Figure 4-12 Panel for 8 modules**



**Figure 4-13 Panel for 12 modules**

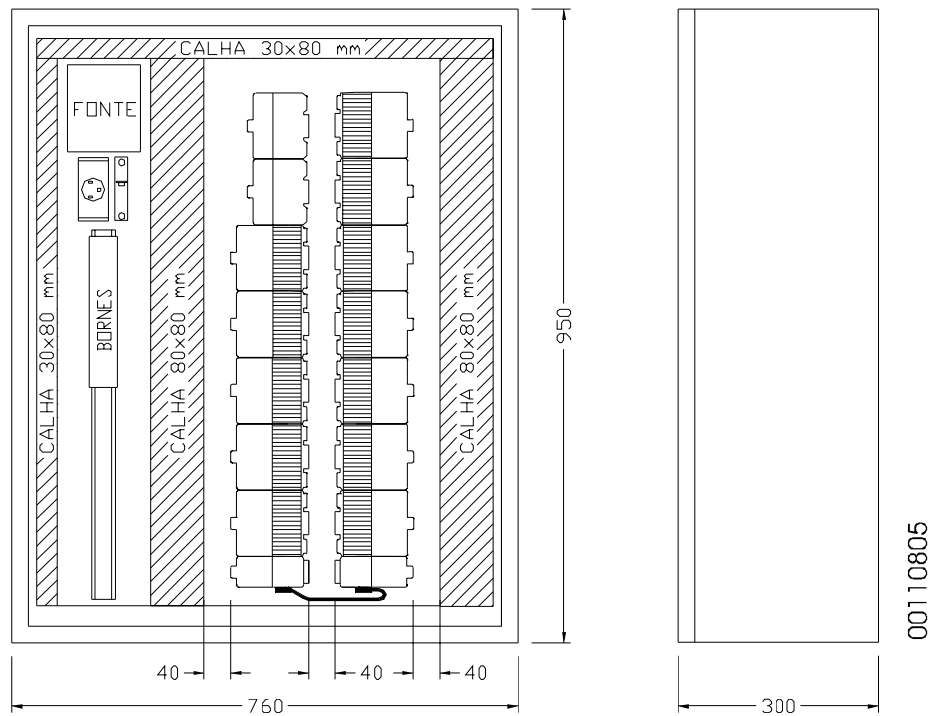


Figure 4-14 Panel for 14 modules

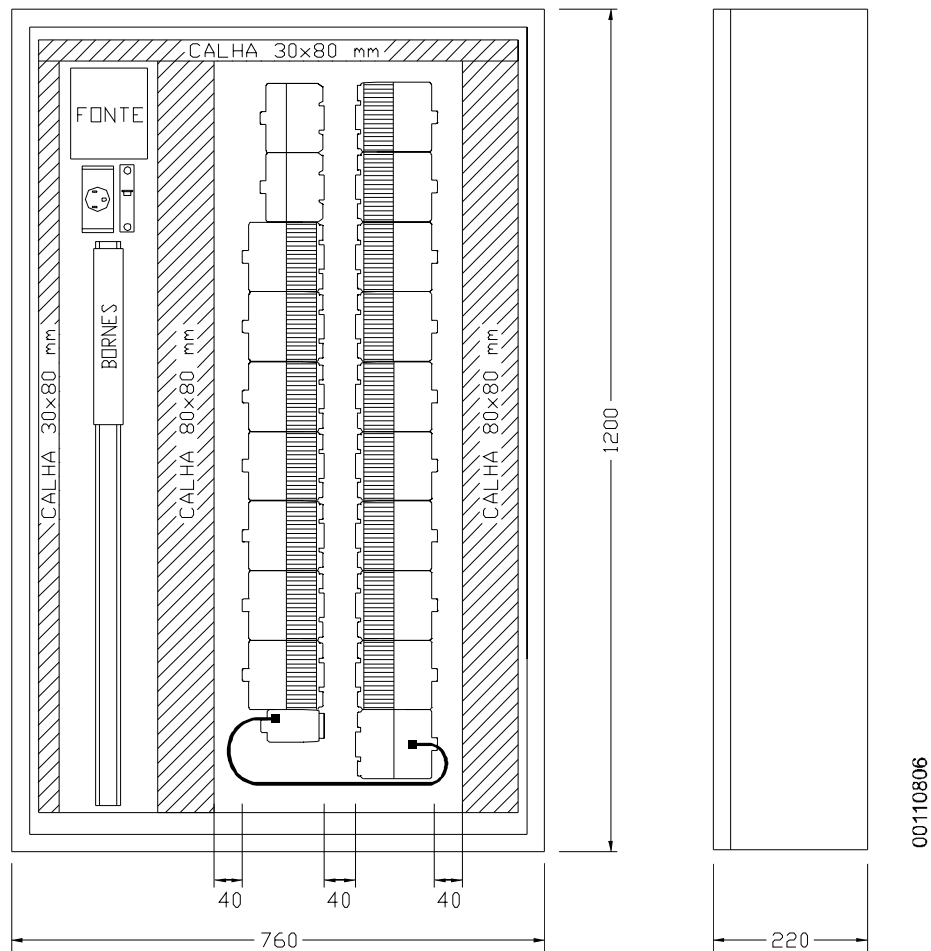


Figure 4-15 Panel for 18 modules

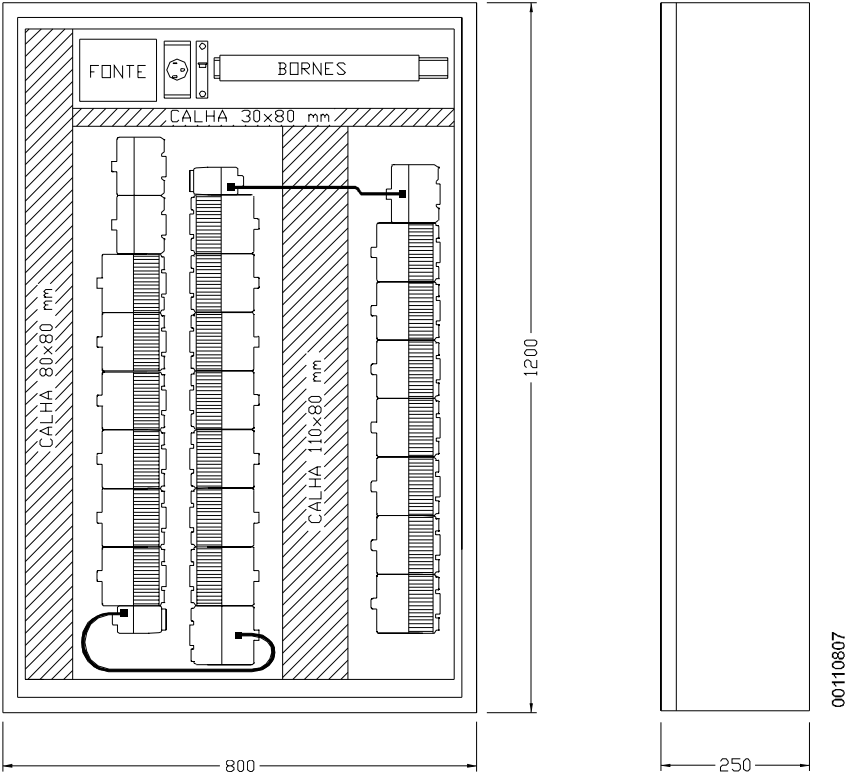


Figure 4-16 Panel for 23 modules

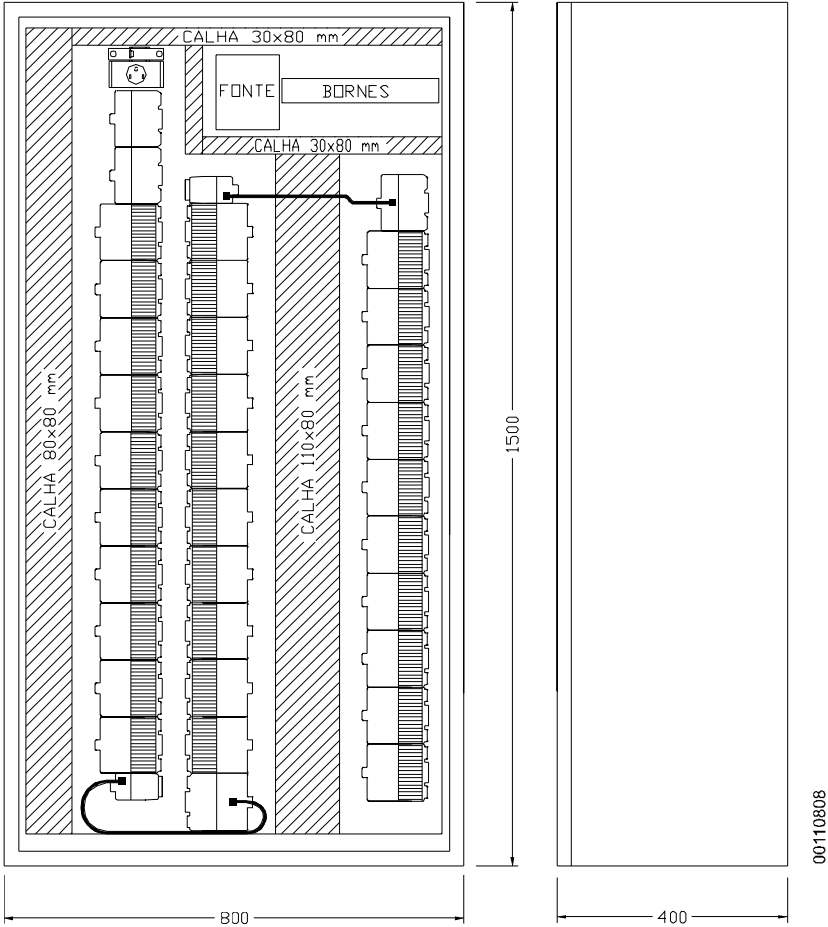


Figure 4-17 Panel for 33 modules

# Thermo Project

The Altus equipment are designed to work with a environment temperature up to 60°C (except when specified). Thus, that is the maximum internal panel temperature. Please follow these instructions when designing the panel:

- The panels must have enough internal room to provide a good air circulation
- Insert fans to force air exchange with the external environment when needed. This should prevent increasing temperature over the maximum limit. In critical applications we recommend to use refrigeration equipment in order to keep the panel temperature within operating limits.
- Distribute homogeneously the heat sources within the panel.
- Consider the heat dissipation from cables conducting high currents in order to avoid overheating the conduits.

## ATTENTION

Please consult the Technical Characteristics of each module in order to find out its respective heat dissipation.

Following there is a method to calculate the panel internal temperature in function of the its power dissipation.

## Electrical Panel Heat Dissipation

Each electrical panel dissipates through its walls a certain heat quantity depending on the difference between the internal and external temperature. Please consider the following values when calculating the heat dissipation for differences in internal and external temperature up to 50 °C:

- Panel effective dissipation superficies: calculated accordingly to the DIN-VED 0660 norm chapter 500, accordingly indicated by the type of installation
- The dissipation constant for the painted iron sheet in  $W/m^2\text{ }^{\circ}C$
- The panel ventilation conditions (installation location)
- Panel internal occupation degree (impedance to the internal air circulation)

From the values listed above, just the panel superficies value may be exactly calculated.

Calculus of the dissipation effective superficies  $A$  ( $m^2$ ) in a panel:

The “A” superficies calculus is done accordingly to the DIN-VDE norm, accordingly to the panel installation type:

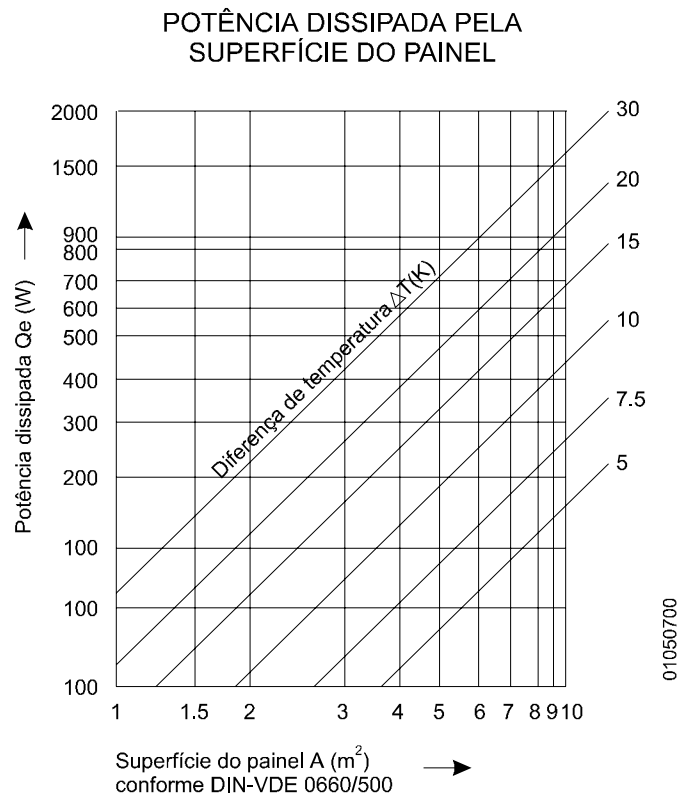
Installation type accordingly to the DIN-VDE 0660/500 norm	Formula to calculate $A$ ( $m^2$ )
Panel free in all walls	$A = 1,8 * H * (L + P) + 1,4 * L * P$
Panel with rear superficies blocked	$A = 1,4 * L * (H + P) + 1,8 * P * H$
Panel with one side superficies blocked	$A = 1,4 * L * (H + L) + 1,8 * L * H$
Panel with one side and rear superficies blocked	$A = 1,4 * H * (L + P) + 1,4 * L * P$
Panel with two side walls blocked	$A = 1,8 * L * H + 1,4 * L * P + P * H$
Panel with the rear and two side walls blocked	$A = 1,4 * L * (H + P) + P * H$
Panel with the rear, top and two side walls blocked	$A = 1,4 * L * H + 0,7 * L * P + P * H$

**Table 4-1 Dissipation Effective Superficies Calculus**

$L$  = width (m),  $H$  = height(m),  $P$  = depth (m)

For applications with painted steel sheet built panels, for the surrounding air, the heat dissipation constant may be considered at  $5,5 W/m^2\text{ }^{\circ}C$ .

The the panel dissipated power may be calculated by the equation  $Q_s = k * A * (\text{internal temperature} - \text{external temperature})$ , or get from the figure 4-18.



**Figure 4-18 Dissipated Power x Surfaces x Temperature Difference**

This value may be tripled with external air circulation.

The equipments within a panel block the internal air circulation, thus creating localized heat spots. When such conditions occur you should add fans within the panel that will circulate the air.

The forced internal air circulation helps to keep the whole panel within the same temperature. Without the air circulation the temperature in the top of the panel will increase due to the convection effect.

Examples:

Calculate the average internal temperature for a panel free in all walls, with effective area of 3,96 m<sup>2</sup>, installed power of 350W and external environment temperature of 30 °C.

$$Q_s = k * A * (T_i - T_e)$$

$$350 = 5,5 * 3,96 * (T_i - 30)$$

$$T_i = 46^\circ\text{C}$$

For the same panel, calculate the internal temperature for a installed power of 1000 W.

$$Q_s = k * A * (T_i - T_e)$$

$$1000 = 5,5 * 3,96 * (T_i - 30)$$

$$T_i = 76^\circ\text{C},$$

In such case the temperature exceeded the equipment operating limit (60 °C), thus you must provide other ways to remove the extra heat. The installed power limit for such panel is (internal temperature of 60 °C):

$$Q_s = k * A * (T_i - T_e)$$

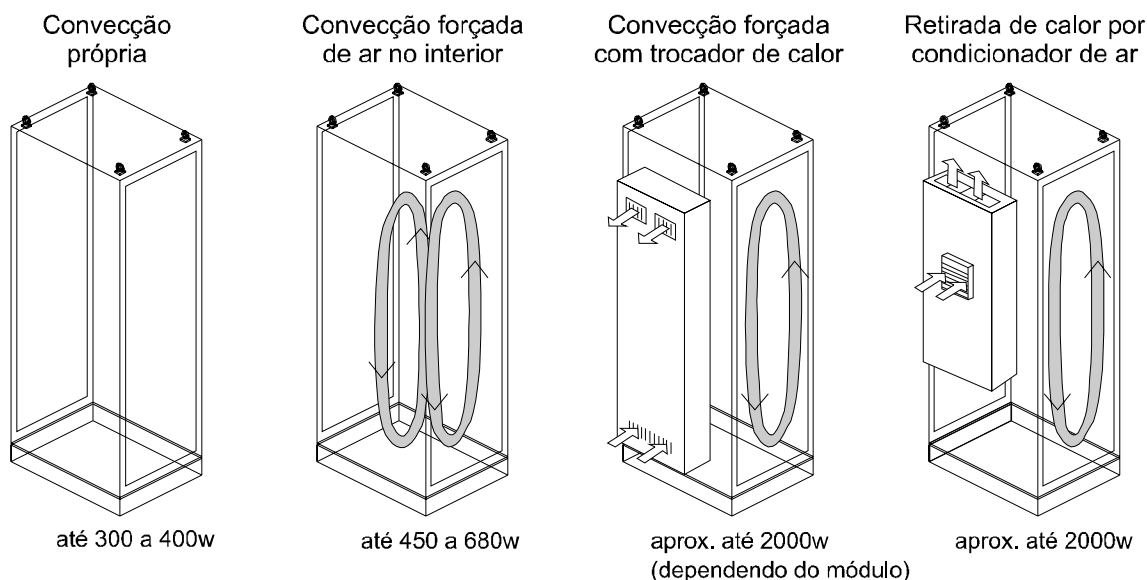


$$Q_s = 5,5 * 3,96 * (60 - 30)$$

$Q_s = 653 \text{ W}$ , being the limit  $653 \text{ W}$ , the remaining  $347 \text{ W}$  ( $1000 \text{ W} - 653 \text{ W}$ ) must be removed, for instance, through air-conditioning equipment.

**ATTENTION:**

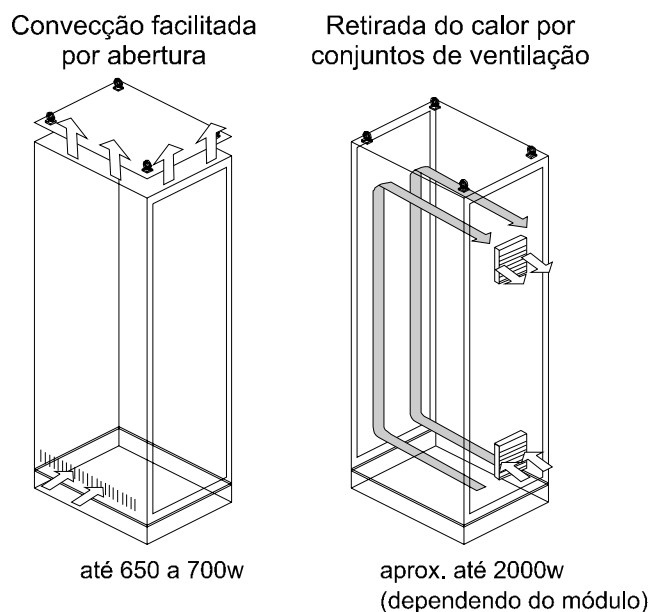
Please observe that in the previous calculation the outcome is the average internal temperature. Thus the temperature on the upper part of the panel may be higher if the panel doesn't have forced internal air circulation. This may result in heat spots. You should keep extra safety room for each case.



**Figure 4-19 Examples of Head Circulation– Closed Installation**

If you allow external air exchange you may get a much higher heat dissipation. Adding vents on the side, doors or back walls will provide such ventilation. Obviously this will decrease the panel IP protection rating.

**Figure 4-20 Example of Heat Circulation– Open Installation**



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# Electrical Project

## General Information

The programmable controllers comply with the international norms that establish acceptable levels for environmental conditions and noise normally found on industrial processes. It is also paramount to follow the procedures established by the installation norms. Deficient electrical project or installation may cause electromagnetic interferences (EMI), communication failures, program execution failures, analog variables noise and even program lost.

The Altus PLCs electrical project must respect the IEEE 518/1977 norm, "Guide for Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers External Sources". Following you will find its most important issues.

## Powering the Panel

The control system must have a power general switch. We recommend to make the panel internal power available through fused terminal blocks, and adding at least one 127 or 220 VAC outlet to connect the programming terminal. Such outlet must have a ground pin because the programming terminal must be connected to the system ground. All the panel outlets must have clearly posted their voltages.

## Panel Cable Distribution

One of the most important issues when installing the programmable controllers is the way how the signal and power cables are distributed. The correct cable distribution and grounding guarantees the installation electromagnetic compatibility (EMC).

It is also important to distribute the panel powering through distribution bars or connection terminal blocks.

Each point will be individually fed directly from such general distribution points. Please avoid using local module ramifications that will increase cable size and increase current circulation.

In order to improve equipment performance please separate the circuits based on their type as stated bellow. This will reduce electromagnetic interferences.

- AC powering circuits from AC and DC loads
- Low current input and output circuits (less or equal to 1A)
- Analog and communication circuits

Such circuits should be laid in separated conduits thus avoiding being in parallel to each other. Please keep such IO and power signals (above 500V) at least 150 mm away from each other.

## Panel Illumination

In order to facilitate the panel operation we recommend to include internal illumination activated by an interrupter.

Please use incandescent lamps because fluorescents may cause undesired interferences. Please take the following precautions when using fluorescent lamps:

- Include a grounded metallic net between the lamp and the panel – this will reduce noise emissions
- Include shielded cables to power the lamp

- Protect the interrupter with a metallic box and include a filter by the lamp cables

## Grounding

All modules and power supplies grounding should connect to a grounding bar or general terminal blocks. Such bar or terminal block should have a low resistance connection to the ground.

## Electromagnetic Interference

The electromagnetic interference (EMI) causes most of the problems found on installed equipment.

Taking into consideration the following procedures during the project phase will dramatically reduce such problems:

- Distribute and arrange the cables within the conduits, separating the signal cables from the power ones
- Inactive metallic parts should be grounded as well
- Use shielding for elements that generate electrical noises
- Put a filter at the panel power input

Altus recommends the following filters for the cables powering the panel:

Phoenix Contact Manufacturer

- Line FILTRAB NEF1-1, NEF 1-3 and NEF 1-10

Murr Elektronik Manufacturer

- Line NEF

Weidmüller Manufacturer

- Line EGF-GL

## Shielding

Strong electromagnetic interference sources (transformers, motors, high current or voltage cables) that are inside the panel and less than 50cm away from the electronic components of PLCs should be covered by grounded metallic sheets. The cables feeding those equipment also should be shielded and filtered.

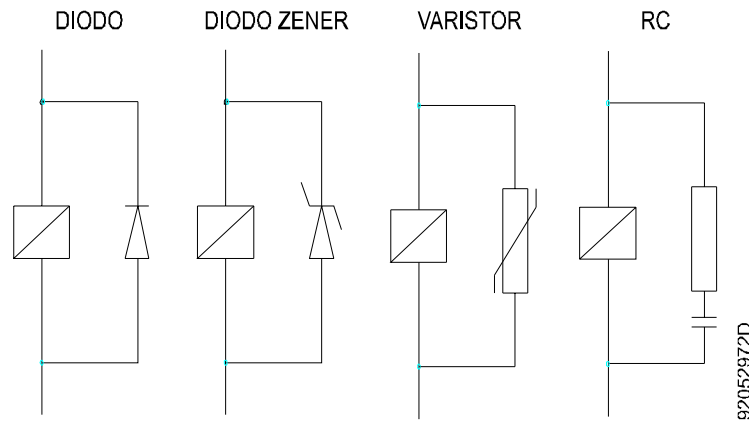
The panel shielded cables should be grounded as per respective equipment instructions.

## Noise Suppressors

It is paramount to connect adequate noise suppressors to all inductive loads (relays, contactors, solenoids, etc.) – connected or not to the PLC. The switching of inductive loads generate strong electrical noises that may surpass the norms established limits. Such noises not suppressed at the origin may reach the PLC and affect its normal operation.

The protection circuits should be assembled close to the load, and as a rule they should be within 0.5 meters distance. There is no need to add such devices for resistive loads (incandescent lamps, signalization LEDs, heating resistors, etc.).

Following are some examples of recommended elements for inductive loads noise suppression.



**Figure 4-23 Inductive Loads Noise Suppressors**

### Diode Circuit

This is the most efficient way to eliminate the sparks created when the contact opens. On the other hand it takes longer to stop the load in cases like contactors or solenoids.

This circuit applies only to DC and its reverse voltage must be higher than the power supply voltage and the minimum current should be higher than the load current.

### Zener and Diode Circuit

The Zener and diode circuit applies when the shut down time for the diode circuit is too long. The same way as the diode circuit it should be used just with DC. The Zener voltage must be higher than the power supply peak voltage and the minimum current should be higher than the load current.

### Varistor Circuit

The Varistor circuit limits the inductive circuit voltage in a similar way to the Zener circuit. Its conduction voltage in general is higher than the Zener and it is bi-directional, allowing its use in DC and AC circuits (more used in AC).

The Varistor should be specified taking into consideration the maximum power supply voltage, load stored energy and desired life time.

### RC Circuit

The RC (R in line with C) circuit may be assembled in parallel to the load. The assembly in parallel to the contacts is recommended for DC circuits. The assembly in parallel to the load is recommended for either DC or AC circuits. The RC circuits are more efficient when used for voltages over 100V.

It is recommended the resistor to have from 0.5 to 1 ohm for each 1V of voltage, and the capacitor to have 0.5 to 1 $\mu$ F for each 1A of current. For example, if the load is 220V / 1A, then the resistor should be 220 ohms and the capacitor 1 $\mu$ F (the capacitor should be adequate to accommodate the type of load and voltage).

## Power Distribution Outside the Panel

We recommend the following procedures when the panel is away from the machinery or controlled system (but within the same building):

- The panel cables should run through metallic conduits
- Ground those conduits every 20 meters
- Separate the cables into two groups:
  - digital signal cables up to 60V, shielded cables carrying analog signals and shielded cables carrying power supply up to 230V

- cables with voltage higher than 230V

## **Lightning Protection**

For external applications, for instance when the cables or PLC communication lines get outdoors, you must assess protection against lightning.

We recommend to use Varistors or arrestors (with inert gases) for such cables. Also we recommend some shielding as shown bellow.

### **Figure 4-24 Lightning Protection**

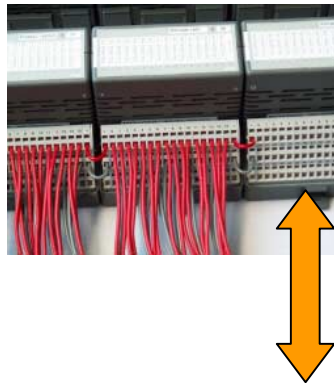
We recommend to install such devices by the building entrance or even by the panel.

The previous figure shows a correct installation for a generic system. But each application may have its specifics details that should be taken into consideration when designing the lightning protection system.

For critical situations please contact Altus technical support.

## Terminal Block Identification for Ponto Series Bases

The bases terminal blocks have 18 columns and 3 rows. The extremities are designed for the powering and the central ones for the field cabling.



+	00	01	02	03	04	05	06	07	10	11	12	13	14	15	16	17	+
-	40	41	42	43	44	45	46	47	50	51	52	53	54	55	56	57	-
A	20	21	22	23	24	25	26	27	30	31	32	33	34	35	36	37	B

## Powering the Bases

Please follow the Technical Characteristics instructions when powering the bases for each module.

The bases has two types of powering:

- **Field power.** It is the voltage that feeds the field circuits.

The terminal blocks A and B are designed to connect to the field power supply, and then distribute it to actuators and sensors.

Each module has its own connection way. Please consult the respective TC.

- **Module power.** It is the voltage to feed the module, when needed.

The extremity terminal blocks marked with + are interconnected. The same happens to the terminal blocks marked with -. Those terminal blocks are designed to connect the power supply to some modules.

The terminal blocks identified with “+ “ and “- “ must receive 24VDC as specified on the technical characteristics. The power may be extended to the next base through the connection shown on the figure 4-20. With such arrangements you may connect up to 10 bases within the same segment.

The figure 4-21 shows the connection of power supplies to a PO2020 relay output module in a PO6002 base. In such case the field power connects to the terminal blocks 20, 37 and B. The A terminal block is not utilized. The cabling details may be found on the PO2020 Technical Characteristics.

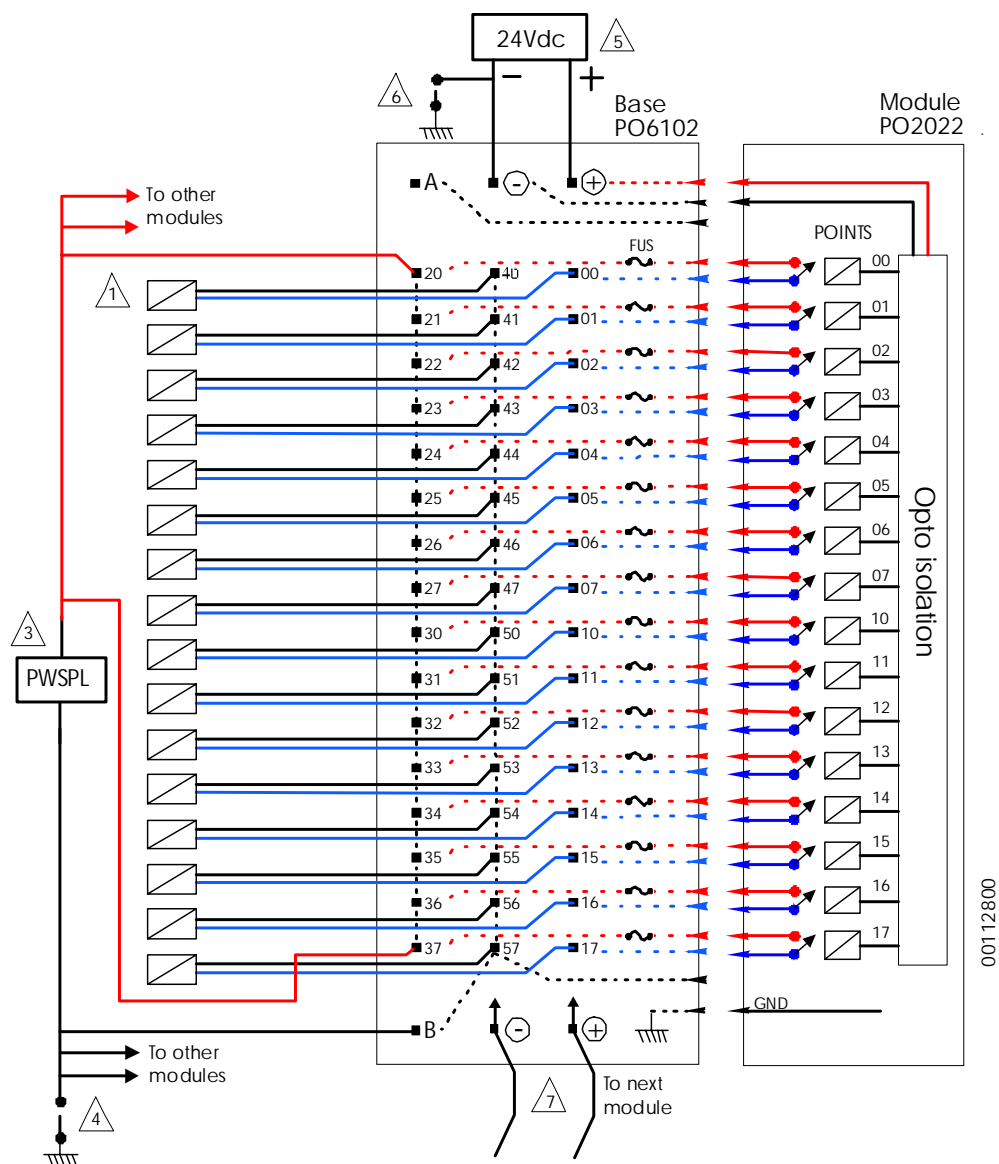
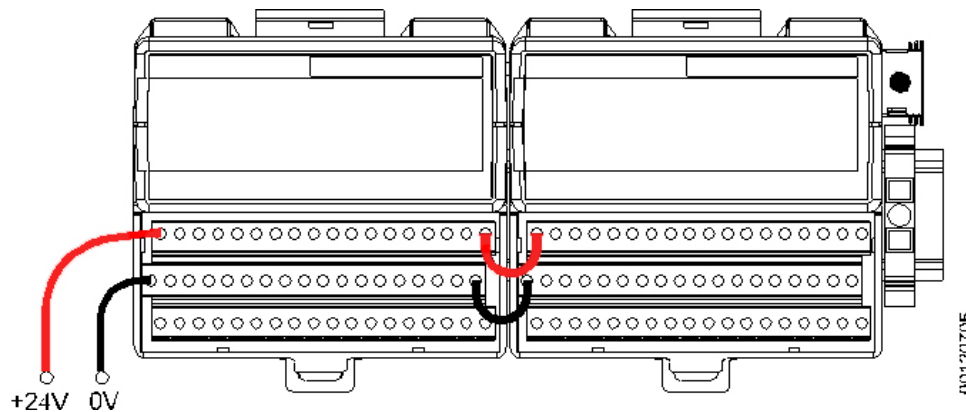


Figure 4-21 Powering the Bases

**ATTENTION**

Please consult the Technical Characteristics for each utilized base in order to get connections details.

The figure 4-22 shows the interconnection of power supply and modules.



**Figure 4-22 Field Voltages Connections**

### Module IO Identification

The Ponto Series modules have an identification system through labels inserted into the module panel.

Altus provides 2 types of labels: the PO8540 label set for modules with 4, 8 or 16 IOs, and the PO8511 label set for modules with 32 IOs. Please see figure 5-9.

Those labels have fields to identify each signal connected to the module, as well as the module identification. You may hand write on the labels or use the PROPONTO software to print them on a ink jet printer.

### Cables Identification

We recommend to identify all cables connecting to the panel. We also suggest to identify as follow the cables connecting to the Ponto Series bases:

NNN.MM.PP

where,

- NNN is the prefix to identify the panel element type, in this case we recommend ALT to identify the PLC modules. Such prefix may be configured on the PROPONTO software and then printed before the module identifier (MM) on the panel label. MM is the module number (values from 00 to 39). This number is printed for each module panel label.
- PP is the base terminal block number (values from 00 to 07, 10 to 17, 20 to 27, 30 to 37, 40 to 47 and 50 to 57).

This identification system facilitates the identification of elements during the panel assembly and also for later maintenance.



# Installation

This chapter covers the procedures to physically install the Ponto Series elements. Also it will explore procedures for installation of other equipment in the same PLC panel.

## Visual Inspection

Before installing any equipment please go through a careful visual inspection to check if there is any damage caused by the shipping and handling. If you find any problem on any of the ordered components please contact your freighter or Altus.

**WARNING:**

Before removing the modules from their packaging please be sure to discharge any static electricity from your body. In order to do that please touch with bare hands any grounded metallic superficies. Such a procedure will guarantee the static electricity levels would be within the module acceptable limits.

Also please register each equipment serial number and software versions. Such information will be important if you need to contact Altus technical support.

## Mechanical Installation

### Rails Assembly

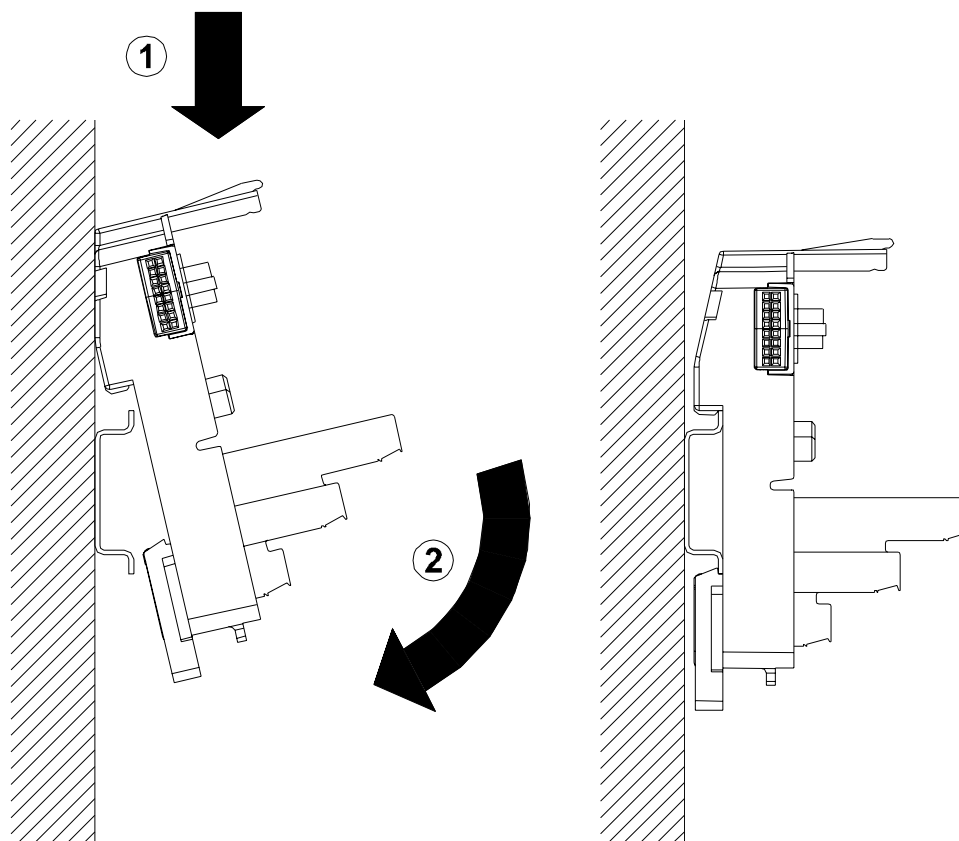
The rails must be metallic and corrosion resistant. The rails must be grounded for EMI protection purposes. They should comply with the DIN EN 50032 norm, specially for the dimensions and also have good quality.

Please be sure to securely fix the rails through screws so they can resist to mechanical vibrations – see figure 4-8.

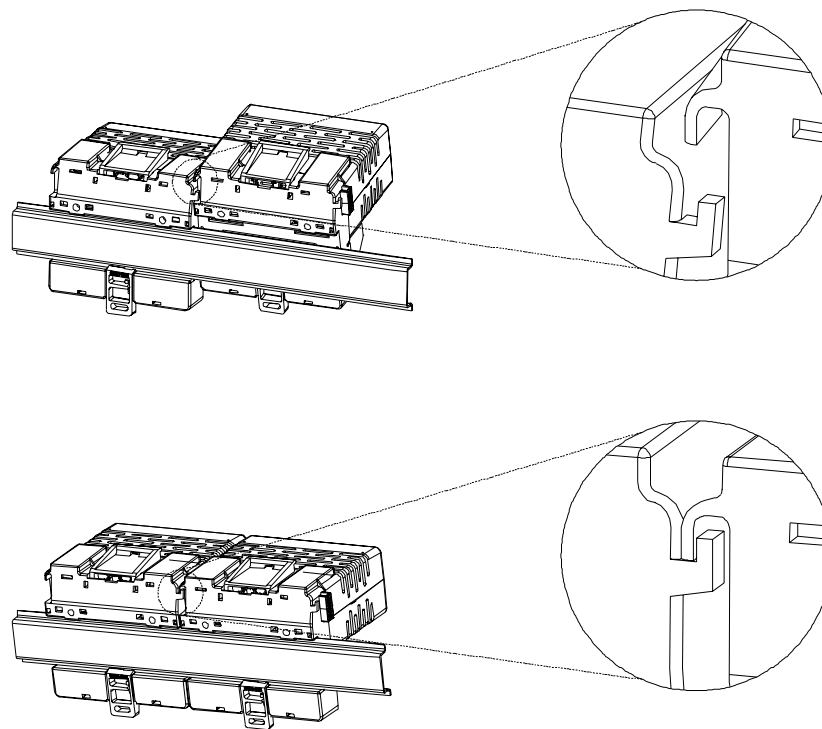
### Bases Assembly

Once the rails are installed, proceed to install the bases accordingly to the following steps and always respecting the project definitions:

1. Put the base in contact with the assembly panel superficies as shows on figure 5-1;
2. Slide the base in direction to the rails until touching it;
3. Rotate the base towards the rail until the lock plugs in (see figure 5-1 );
4. For the remaining bases, retract the sliding connector (see figure 5-3), and follow the steps 1, 2 and 3, until the base securely plugs to the rail;
5. Double check if the hook located on the base left side is hooked to the left base (see figure 5-2);
6. Finally connect the bus sliding the connector totally to the left towards the next base.

**Figure 5-1 Base Installation**

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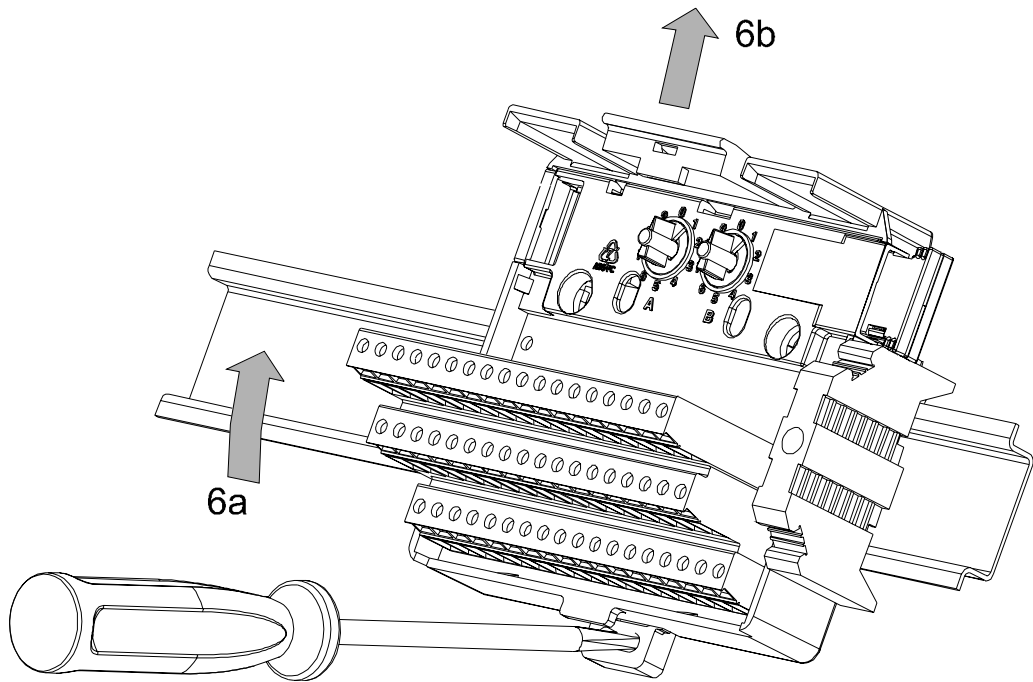
**Figure 5-2 Base Installation - Hook**

01041700

## Bases Disassembly

The disassembly procedure is:

1. Remove the module from the base and also the other two modules by its side;
2. Loosen the bus connector from the base and also the two bases by the its side;
3. Loosen the lock that locks the base to the rail with a screw driver, rotate the base outward the rail (6a) and slide the base, removing it from the rail (6b), as shown on figure 6-1;



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## Mechanical Switches Adjustment

The mechanical switches located on the bases avoid the installation of a wrong module into it accordingly to the project specifications.

Please adjust the switches accordingly to the module code to be plugged, turning them clockwise. The switch should have the same code defined by the module last 2 digits. Such code is located at the window on the module upper right corner (see figure 5-4). For instance, the module PO2022 should have the base adjusted to the code 22.

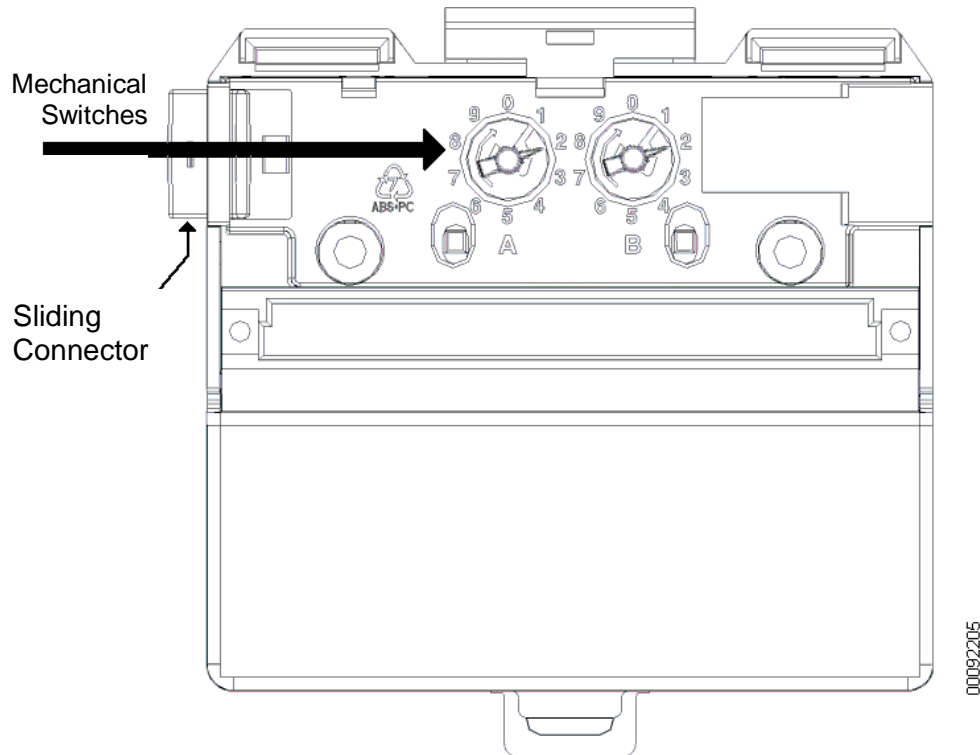


Figure 5-3 Mechanical switches and Sliding Connector

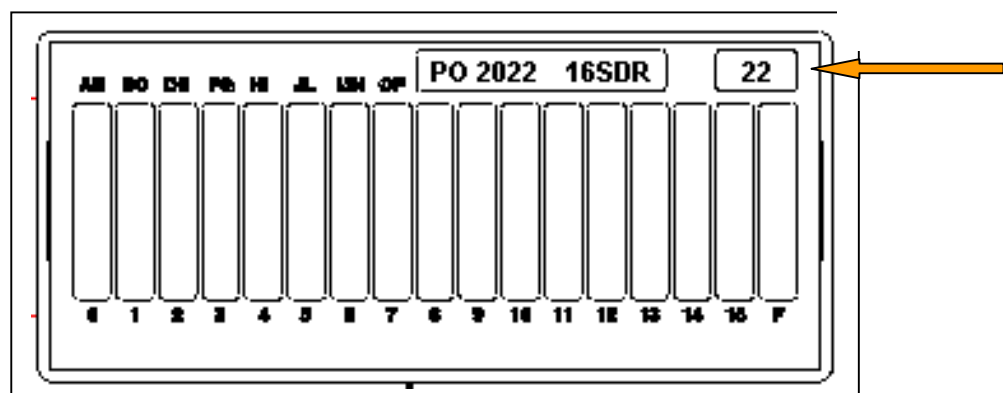


Figure 5-4 Module Code

## Bus Expander Assembly

The expanders are assembled at the end of each segment, and at the beginning of the next one.

Please assemble them the same way as a base, and please be careful with the bus connector and the expander left hook.



## Termination Assembly

The last base of the last segment must have a termination, otherwise the system will not work properly. The termination comes along with the head or CPU base.

### ATTENTION:

The termination is polarized. The label side must be installed upside.

Please see figure:

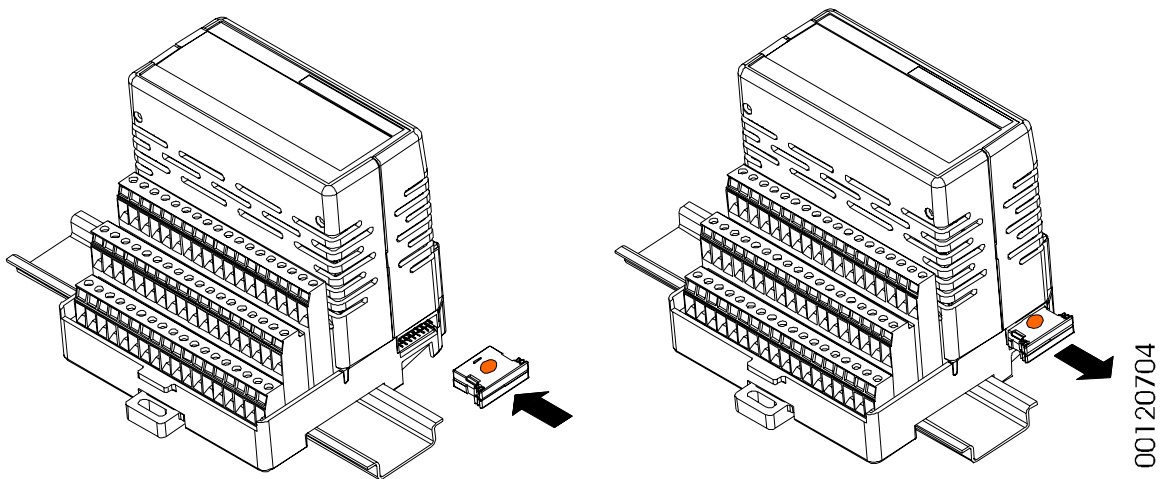


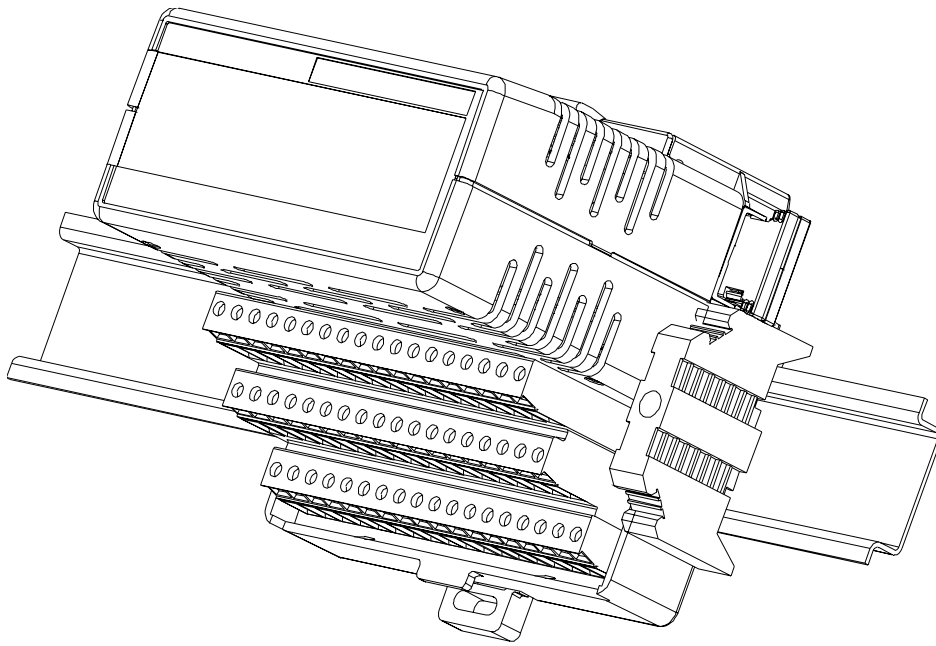
Figure 5-5 Termination Assembly

## Locks Assembly

Then you must install the PO8522 locks before the first base and after the last base of each segment. The lock will keep the whole segment installation even upon mechanical vibrations.

### ATTENTION:

The locks installation is crucial on vertical installations.



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**Figure 5-6 Lock Assembly**

## Modules Insertion

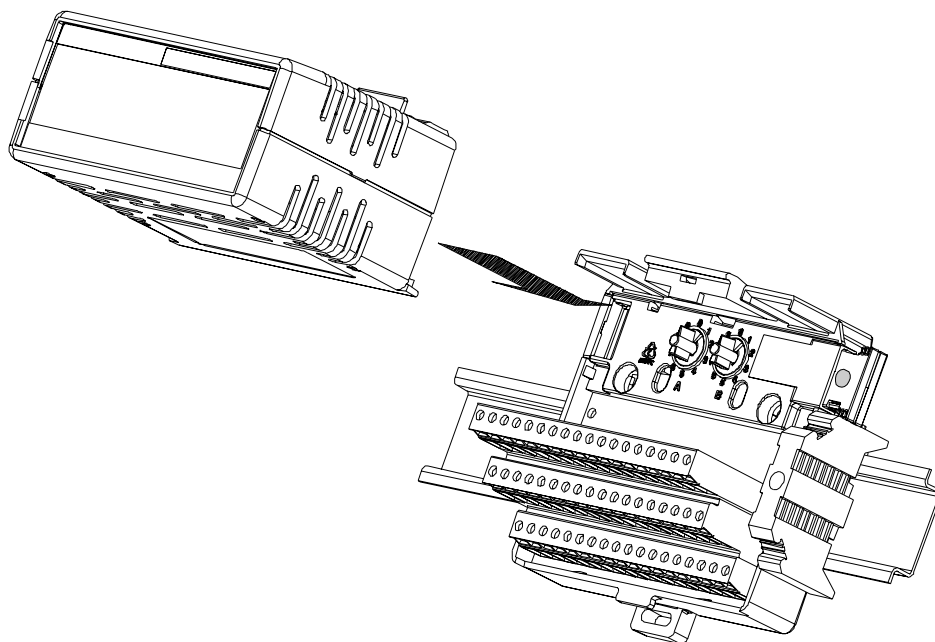
Only plug in the modules after all the bus sliding connectors are plugged.

### ATTENTION

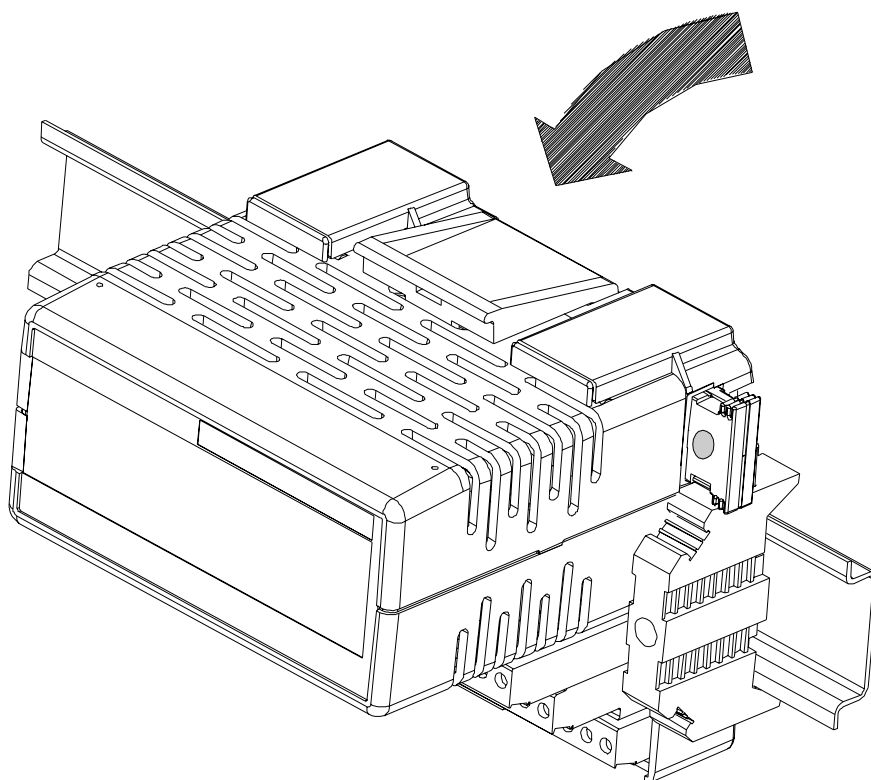
There is a mechanical interference that blocks the module connection when the bus is unplugged or the base switch is incorrect. In the first bus base the sliding connector also must be located outside.

In order to assemble a module in its base:

1. Push the module towards its base, aligning the connector to the base guides;
2. Once the module is securely plugged into the base, push the base upper lock towards the module (see figure 5-7).



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**Figure 5-7 Module Insertion**

00122206

**Figure 5-8 Module Fixation**

3. Double check if the module is also plugged in its connector side.

**ATTENTION**

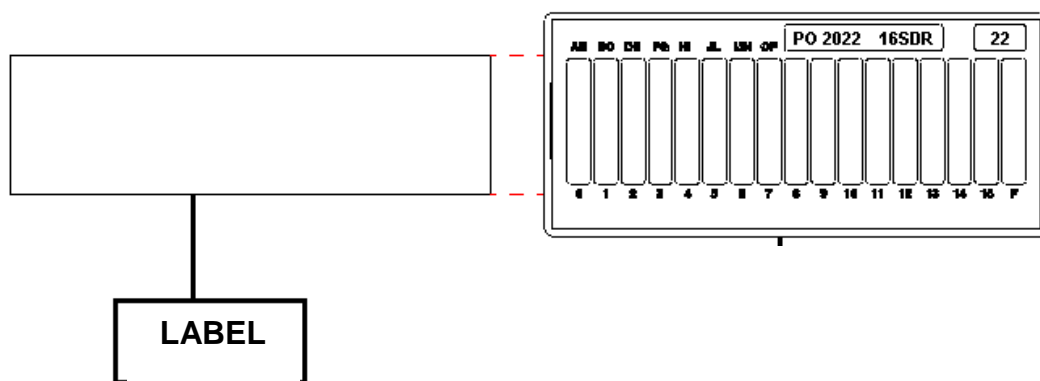
Firmly push the module in the connector area until it complete touches the base and the connector is inserted to the end.

## Inserting the Modules Labels

The modules labels may be printed with the IO tags. The labels come in a pre-perforated paper sheet for ink jet printers. Please follow the printing instructions described on the ProPonto software Utilization Manual.

You may also hand write on the labels.

The labels go into the pocket on the module left side. The module front panel has transparent windows that allow to see the labels. Please see following figure.



**Figure 5-9 Labels Insertion**

## Expansion Cables

Connect the Expansion Cables PO8500 ( 0.4 meters ) or PO8501 (1.4 meters), interconnecting the expander module at the end of a segment to the one beginning the next segment. This may also be an expander module, and in such case it must be connected to the BUS1 connector or a power supply that should be connected to the EXPANSION base connector..

# Electrical Installation

**WARNING:**

Please be sure the panel general power is shut down before installing any equipment in the panel.

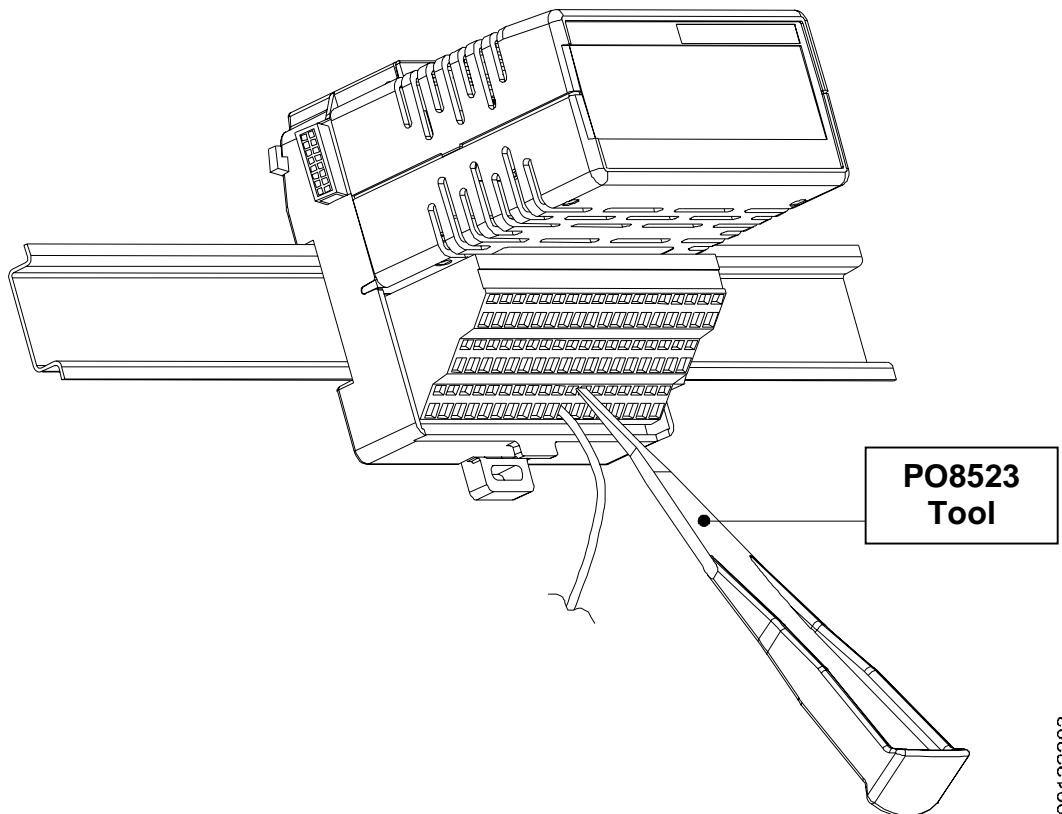


## Spring Terminal Blocks

This kind of terminal block has a fixation system based on a high reliability spring, even in environments subject to vibrations (see figure 5-11). Please use the PO8523 tool to assemble it (see figure 5-10). This terminal block facilitates the installation of electrical cables. This terminal block maximum current is 12 A per IO, on the other hand such current is limited accordingly to the maximum current specified by the used module.

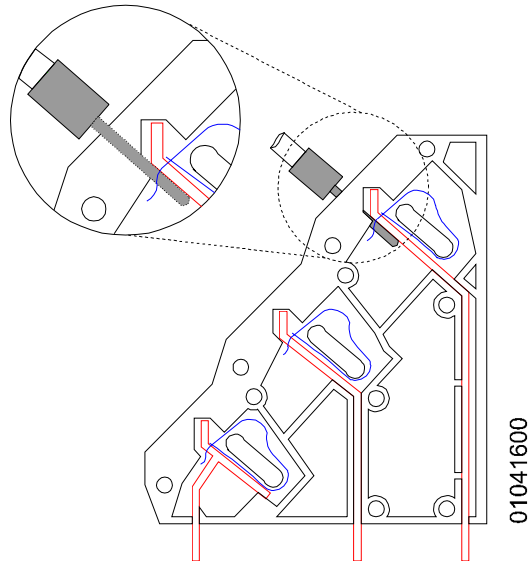
**ATTENTION:**

We do not recommend to use wires with terminals. The bare wire guarantees a good electrical contact. We recommend to use tinned wire tips.



**Figure 5-10 Spring Terminal Blocks**

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**Figure 5-11 Spring Terminal Blocks**

In order to assemble the wire into the terminal block:

1. Insert the PO8523 tool into the hole right on top of the block in order to open the terminal block spring.
2. Insert the bare wire into the hole.
3. Remove the tool to secure the wire.

### Screw Terminal Blocks

This terminal block uses a screw to secure the wiring. It has high reliability for wiring with tinned tips or terminals. We recommend to use screw drivers with 3.5 mm width and isolated handler. This terminal block maximum current is 24 A per IO, on the other hand such current is limited accordingly to the maximum current specified by the used module.

### Connections

The correct fixation of the CPU cables and the system modules guarantee the equipment security and operation. Please check this issues:

- All the cables by the panel terminal blocks must be securely connected
- The power supply and grounding terminal blocks must be secured and well connected, thus guaranteeing good current flow.
- The equipment grounding connection to the panel ground must be secured and with right size cables, this will guarantee good grounding and immunity to electrical noises.

### Power Supplies

Please check if the power supplies ranges are within the required technical characteristics.

**ATTENTION:**

Insert warning labels and protections to avoid easy access to high voltage points.

## Fuses

Please check all the system fuses. Before powering the system up please check if they are in good shape and with correct type and value.

**ATTENTION:**

You should never replace a fuse for another one with higher current value, otherwise it may incur serious damage to the equipment.

## Parameterization

The Ponto Series modules need configuration parameterization that define their own operation. Parameterization is the definition and insertion of parameters using the programming tools.

The ProPonto and MasterTool can do the parameterization for CPUs. Please check the MasterTool Utilization manual for further details.

On the other hand the heads receive the configuration parameters from the Network Masters. You should use the Network Master configurators in order to edit the Head and its modules parameters. For instance, the Altus PROFITool and the Siemens SIMATIC STEP7. All the configuration software required information may be found on the GSD file. This file is on the ProPonto CDROM and also at [www.altus.com.br](http://www.altus.com.br).

**ATTENTION:**

Please check the Technical Characteristics (TC) or the module Utilization Manual (UM) in order to identify the configurable parameters, their options and descriptions.

## Diagnosis

The Ponto Series extensive diagnosis capabilities facilitate the modules maintenance.

Please check the Diagnosis item for the module TC for further information.

## System Set Up

When setting the system up, we recommend to perform a whole system operating test before putting into actual operation.

Through the modules diagnosis LEDs you may verify at first the correct power supply distribution.

We recommend testing individually each IO:

- If the field IO is actuating the module IO as projected
- If the input voltage is within the module limits
- If the loads are being actuated properly
- If the analog signals are noise free and with correct calibration

# Maintenance

This chapter covers the system maintenance. Following are the most common problems and procedures to be taken to fix them up.

## Module Diagnoses

The Ponto Series generates diagnoses upon abnormalities, like failures, errors or operation modes, thus allowing the problem identification and solution.

### Diagnosis LEDs

All the Ponto Series modules have diagnosis LEDs to quickly inform the equipment operating status.

There is a special LED, identified by DG, present to all Ponto Series modules. It indicates any abnormality or any exceptional operation through its intermittent code (blinking).

When the module is normally working the DH LED remains always on. The abnormal symptoms are identified by a sequence of fast blinks, from one to four, and then longer periods with the LED off; and they are classified by its priority: when there are more than one indication to take place, only the higher priority will show up; the indication of lower priority problems will only come out once higher priority problems are solved.

Please consult the module Technical Characteristics (TC) and Utilization Manual (UM) in order to identify the cause and solution for each LED diagnosis indication.

### Diagnosis Words

The modules operating status are also available through the diagnosis words using tools like the MasterTool, or SCADA software, or MMIs as the FOTON Series connected to the module serial channel.

In some cases the diagnosis indication by words may be more specific than through the LEDs. The later case may only represents four types of indications (one to four blinks), while the former may carry larger quantity of information.

For modules such as the PROFIBUS Field Network Head, the diagnosis information may also be sent to the PROFIBUS master.

Please see the module Technical Characteristics (TC) and the Utilization Manual (UM) in order to identify the diagnosis words addresses as well as the solution for the their problems.

## Hot Swap

The IO modules hot swap is required for many control systems. It allows the replacement of IO modules without shutting the system power down.

The system behavior during the hot swap is configured by a parameter. The system may have two different behaviors upon a module removal:

- The system generates a missing module diagnosis and the remaining modules keep working normally
- The system generates a missing module diagnosis and the remaining modules are shutting down

Please check the CPUs and heads Utilization Manuals for further information about parameterization.

**WARNING:**

Before removing the modules from their packaging please be sure to discharge any static electricity from your body. In order to do that please touch with bare hands any grounded metallic superficies. Such a procedure will guarantee the static electricity levels would be within the module acceptable limits.

Following we describe the hot swap procedure:

1. Free the lock holding the module to the base;
2. Remove the module pulling it out;
3. Insert the new module, pushing it perpendicularly towards the base in only one movement;
4. Check if the lock that holds the module is totally connected to the module; otherwise push it towards the module;

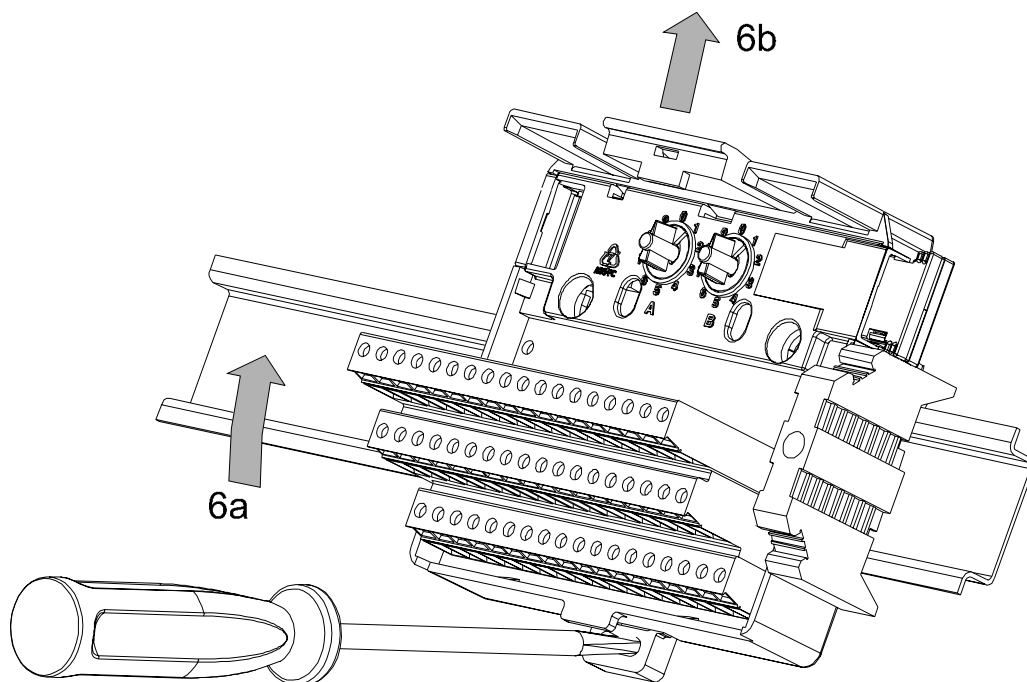
Please shut down output modules when replacing them. This may be done through the field power supply shut down or by forcing the outputs through software. This procedure will reduce module connector sparks. But this will not be necessary if the load is small.

## Base Exchange

**ATTENTION:**

Removing a base, expander module, or expander cable will interrupt the data communication and power supply thus deactivating the whole bus.

1. Shut down all system power supplies;
2. Remove the module connected to the base and the two modules by its side;
3. Remove the conduit cover in order to facilitate removing the wires connected to the base;
4. Disconnect the base wiring;
5. Loosen the bus connector from the base and next bases;
6. With a screw driver loosen the lock holding the base to the rail, then rotate the base outward the rail (6a) and slide the base removing it from the rail (6b), as shown on figure 6-1;
7. Install the new base accordingly to the instructions from **chapter 5 Installation, Bases Assembly**;
8. Connect the wiring to the base;
9. Re-install the conduit cover;
10. Re-install the modules;
11. Power the system up.



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**Figure 6-1 Remove the Base from the Rail**

## Preventive Maintenance

- You should verify each year if the interconnection cables are firmly connected, with no dust, specially on protection equipment
- In environments subject to extreme contamination, the equipment should go through periodic cleaning removing residues, dust, etc.
- Regularly check the Varistors used for lightning transient protection, because they may be damaged or destroyed due to absorbing more energy than it can bear. In many situations the failure may not be easily noticed. In critical applications, we recommend periodic replacement of Varistors, even if they seem in good shape.

# Glossary

## Ponto Series Glossary

- **Address of the Field Network Head:** it is the address of a node in the field network. It is adjusted in the field network head module base.
- **Base:** component where the IO modules are inserted, CPUs, power supplies and remaining Ponto Series modules.
- **Bus:** set of IO modules connected to a CPU or Field Network Head.
- **Bus Expander:** module that connects one segment to the next
- **Bus Segment:** part of a bus. A local or remote bus that may divided into four segments.
- **Bus termination:** component that must be connected to the last module in a bus.
- **Commercial Code:** it is the product code, formed by the letters PO and followed by four digits.
- **CPU:** central processing unit. It is responsible for the application program execution.
- **Expansion cable:** cable that connects bus expander.
- **Field cabling:** cables connecting the sensors, actuators and other process devices to the Ponto Series IO modules.
- **Field network cable:** cable that connects the nodes in a field network, such as the Field Network Interface and the Field Network Head.
- **Field Network Interface:** master module for the field networks, located in the local bus and performs the communication with the field network heads.
- **Field Network Head:** slave module of a field network. It is responsible for the exchange of data between the modules and the field network master.
- **Local Bus:** set IO modules connected to a CPU.
- **Mechanic Switch Code:** two digits defined by mechanical switches, programmable in the base and with objective of avoiding the connection of incompatible modules.
- **Rail:** metallic element with normalized shape accordingly to the DIN50032 norm. It is also called TS35 rail.
- **Remote Bus:** set of IO modules connected to a Field Network Head.

## Network Glossary

- **Backoff:** time that a node in a CSMA/CD network takes before transmitting data after a collision has occurred.
- **Baud rate:** rate that the information bits are transmitted through a serial interface or communication network ( measured in Bits/second )
- **Bridge:** equipment to connect two communication networks with the same protocol.
- **Broadcast:** simultaneous communication to all the nodes in a communication network.
- **CSMA/CD.** Type of access to the physical media based on data collisions. It is used for Ethernet networks.
- **Communication network:** set of equipment (nodes) interconnected by communication channels.



- **Deterministic communication network:** communication network where the transmission and reception of information among the nodes is guaranteed to occur within a maximum established time period.
- **EIA RS-485:** industrial standard (physical level) for data communication.
- **Frame:** information until transmitted in the network.
- **Gateway:** equipment to connect two communication networks with different protocols. The AL 2400/S-C or QK2400 gateways allows interconnection of ALNET I and ALNET II networks.
- **Media access:** method used by all nodes in a network to synchronize data transmission and resolve possible conflicts in simultaneous transmissions.
- **Master:** equipment connected to a communication network originating all the command requests to other network equipment.
- **Master-slave communication network:** communication network where the data transfer are initiated only by one node (the network master). The remaining network nodes (slaves) only reply when requested.
- **Multicast:** simultaneous communication with a group of nodes connected to a network.
- **Multi-master communication network:** communication network where the data transfer are initiated by any node connected to the data bus.
- **Node:** any station in a network with the capacity to communicate using a established network.
- **Peer to peer:** type of communication where two partners exchange data without relying on the master.
- **Protocol:** rules of procedures and formats that, under control signals, allow the establishment of data transmission and error recovery among equipment.
- **Serial Channel/Canal:** equipment interface that transfer data in the serial mode.
- **Slave:** equipment connected to a communication network that only transmits upon the master requests.
- **Sub network:** segment of a communication network that connects a group of equipment (nodes) with the goal of isolating the local data traffic or utilizing different protocols or physical media.
- **Time-out:** maximum preset time to a communication to take place. When exceeded then an error is generated.
- **Token:** it is a mark that indicates who is the bus master in a moment.

## General Glossary

- **Active CPU:** in a redundant system is the CPU that is controlling the system – reading the inputs, executing the application program and activating the outputs.
- **Adjustment bridge:** Switch for selection of addresses and configuration. It is composed by pins on the circuit board and one small removable connector used for a selection.
- **Algorithm:** finite and well defined sequence of instructions with the goal to solve problems.
- **Altus Relay and Block Language:** it is a set of rules, conventions and syntaxes utilized when building a application program to run in a PLC.
- **Application Program:** it is the program uploaded into the PLC and has the instructions that define how the machinery of process will work.
- **Arrestor:** lightning protection device using inert gases.
- **Bus:** electrical signal set logically grouped with the goal of transferring information and control among several system elements.

- **Assembly language:** microprocessor programming language, it is also known as machine language.
- **Backup CPU:** in a redundant system, it is the CPU supervising the active CPU. Thus it is not controlling the system, but ready to take control when the main CPU fails.
- **Bit:** information basic unit, it may be at 1 or 0 status.
- **Byte:** information unit composed by eight bits.
- **Configuration Module (C Module):** unique module in a remote application program that carries several needed parameters for its operation, such as the operands quantity and disposition of IO modules in the buses.
- **CPU:** central processing unit. It controls the data flux, interprets and executes the program instructions as well as monitors the system devices.
- **Default:** pre defined value for a variable. It is used when there is no definition.
- **Diagnostic:** procedures to detect and isolate failures. Also it relates to the data set used for such tasks, and also serves for analysis and correction of problems.
- **Download:** load of program of module configuration.
- **E2PROM:** non volatile memory that may be erased by electricity.
- **Encoder:** position measurement transducer.
- **EPROM (Erasable Programmable Read Only Memory):** memory for read only, erasable and programmable. The memory doesn't lose its contents upon shutting its power off.
- **Execution Modules (E Modules):** modules that have the application program. It may be one of the three types: E000, E001 and E018. The E000 module is executed just once upon system powering or when setting programming into execution mode. The E001 module has the main program that is executed cyclically, while the E018 module is activated by the time interruption.
- **Executive Program:** it is the operating system of a PLC. It controls the PLC basic functions and executes the application programs.
- **Flash EPROM:** non volatile memory that may be erased by electricity.
- **Function Module (F Module):** PLC module called from the main module (M module) or from another module or procedure. It passes parameters and return values, and serves as a sub-routine.
- **Hardkey:** connector normally attached to the parallel port of a microcomputer with the goal to protect illegal execution of a software.
- **Hardware:** physical equipment used to process data where normally programs (software) are executed.
- **Hot swap:** procedure of replacing modules in a system without shutting it down. It is normal procedure for IO modules.
- **IEC Pub. 144 (1963):** norm for protection of accidental access to equipment, and sealing for water, dust and other foreign objects to the equipment.
- **IEC 1131:** generic norm for operation and utilization of programmable controllers.
- **IEC-536-1976:** norm for electrical shock protection
- **IEC-801-4:** norm for tests of immunity against interference by pulses train
- **IEEE C37.90.1 (SWC- Surge Withstand Capability):** norm for oscillatory wave noises protection.
- **Interface:** device that adapts electrically or logically the transferring of signals between two equipment.
- **Interruption:** priority event that temporarily halts the execution of a program. The interruptions are divided into two generic types: hardware and software. The former is caused by a signal coming from a peripheral, while the latter is caused within a program.

- **IO (input/output):** input or output devices in a system. In the PLCs they are typically the digital or analog modules that monitor or actuate the devices controlled by the system.
- **IO Module:** module belonging to the IO subsystem.
- **IO Subsystem:** set of digital or analog IO modules of a PLC.
- **Kbytes:** unit that assesses memory size. It represents 1024 bytes.
- **LED (Light Emitting Diode):** type of semiconductor diode that emits light when energized. It's used for visual indication.
- **Logic:** graphic matrix where are inserted the relay diagram language instructions that are part of an application program. A set of sequentially organized logics makes up a program module.
- **Menu:** set of available options for a program, they may be selected by the user in order to activate or execute a specific task.
- **Module (hardware):** basic element of a system and has very specific functionality. It's normally connected to the system by connectors and may be easily replaced.
- **Module (software):** part of a program capable of performing a specific task. It may be executed independently or in conjunction of other modules through the passing of information and parameters.
- **Module address:** address used by the CPU in order to access a specific IO module.
- **Nibble:** information unit composed by four bits.
- **Non-operant CPU:** CPU that is not in the active status (controlling the system) neither on the backup status (supervising the active CPU), thus not ready to control the system.
- **Octet:** set of eight bits numbered from 0 to 7.
- **Operands:** elements over which the instructions work. They may represent constants, variables or set of variables.
- **PC:** Programmable Controller
- **Procedure Module (P Module):** PLC module called from the main module (M module) or from another module or procedure and it does not pass parameters.
- **Programmable Controller:** equipment that controls a industrial system based on a application program written in relay and blocks language. It is composed by a CPU, power supply and a structure of IOs.
- **Programming language:** it is a set of rules, conventions and syntaxes utilized when building a program.
- **RAM (Random Access Memory):** memory where all the addresses may be accessed directly and in a random order at the same speed. It is volatile, in other words, its content may be erased when the energy is shut down, unless there is a battery to keep its contents.
- **Redundant CPU:** it is the other CPU in a redundant system. For instance, the redundant CPU of CPU2 is CPU1 and vice versa.
- **Redundant system:** system that has backup or double elements to execute specific tasks. Such system may suffer failures without stopping the execution of its tasks.
- **Ripple:** undulation present in continuous voltages.
- **Scanning cycle:** a complex execution of the PLC application program.
- **Slot:** device to plug in integrated circuits or other components, thus facilitating their substitution and maintenance.
- **Software:** computer programs, procedures and rules related to the operation of a data processing system.
- **System Setup:** procedure when the control system is finally tested. It consists of a through test when all the programs from remote stations and CPUs are put to work together.

- **Supervision Station:** equipment connected to a PLC network with the goal of monitoring and controlling the process variables.
- **Tag:** name associated to a operand or to a logic that identifies its content.
- **Toggle:** element with two stable states that are switchable at each activation.
- **Upload:** program reading or module configuration.
- **Varistor:** protection device against voltage spikes.
- **Word:** information unit composed by sixteen bits.
- **Watchdog timer:** electronic circuit that checks the equipment operation integrity.

## Acronyms

- **BAT** - battery
- **BT** – battery test
- **CPU** – central processing unit
- **DP:** Decentralized Periphery
- **EEPROM** - Electric Erasable Programmable Read Only Memory
- **EMI:** Electromagnetic Interference.
- **EPROM:** Erasable Programmable Read Only Memory
- **ER** - error
- **ESD:** Electrostatic Discharge.
- **EX** - execution
- **E2PROM:** Electric Erasable Programmable Read Only Memory
- **IO** – inputs and outputs
- **FC:** Forcing
- **Flash EPROM:** Flash Erase Programmable Read Only Memory
- **FMS:** Fieldbus Message System
- **INTERF:** Interface
- **ISOL:** Isolation
- **LED** –light emitting diode
- **Max:** maximum
- **Min:** minimum
- **Obs:** notes
- **PAs** – adjustment jumps
- **PA:** Process Automation
- **PG** - programming
- **PID** – proportional, integrated and derivate control
- **RAM** - random access memory
- **ref:** reference
- **RX** – serial receiving
- **SELEC:** selectable

- **TC** – Technical Characteristics
- **TX** – serial transmitting
- **UTIL**: utilization
- **WD** - watchdog timer