PONTO Series Utilization Manual

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The industrial automation equipment, manufactured by Altus, is strong and reliable due to the stringent quality control it is subjected to. However, any electronic industrial control equipment (programmable controllers, numerical commands, etc.) can damage machines or processes controlled by them when there are defective components and/or when a programming or installation error occurs. This can even put human lives at risk.

The user should consider the possible consequences of the defects and should provide additional external installations for safety reasons. This concern is higher when in initial commissioning and testing.

The equipment manufactured by Altus does not directly expose the environment to hazards, since they do not issue any kind of pollutant during their use. However, concerning the disposal of equipment, it is important to point out that built-in electronics may contain materials which are harmful to nature when improperly discarded. Therefore, it is recommended that whenever discarding this type of product, it should be forwarded to recycling plants, which guarantee proper waste management.

It is essential to read and understand the product documentation, such as manuals and technical characteristics before its installation or use.

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Summary

1. Introduction

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

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

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

The Ponto Series offers extensive diagnostics and hot swap features, which drastically reduces maintenance costs.

The high capacity CPUs allows Internet access through browsers. This brings unprecedented functionality to the supervision, control and diagnostics of control equipments.

Figure 1-1 Ponto Series – Overview

Documents Related to this Manual

Consult additional documentation in order to get further information about the Ponto Series. You can find such documents at www.altus.com.br.

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

For further information, consult following manuals:

- Technical Characteristics of each product
- Utilization Manual of each product

Visual Inspection

Before installing any equipment, 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, contact your freighter or Altus.

CAUTION:
Before removing the modules from their packaging, be sure to discharge any static electricity from your body. In order to do that, 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.

Technical Support

To access Altus' Technical Support at São Leopoldo, RS, Brazil, please call para +55 51 3589-9500. To locate Altus' Technical Support centers in other locations, consult our website (www.altus.com.br) or send an e-mail to 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 the CPU
- Equipment revision and executive software version. These information are attached to the product side wall
- Information about CPU status, gathered through MasterTool programming software
- Application program (program modules), gathered through MasterTool programming software
- Programming tool version

Warning Messages Used in this Manual

The warning messages will have the following formats and meanings:

DANGER:
Reports potential hazard that, if not detected, may be harmful to people, materials, environment and production.

CAUTION:
Reports configuration, application or installation details that must be taken into consideration to avoid any instance that may cause system failure and consequent impact.

ATTENTION:
Identifies configuration, application and installation details aimed at achieving maximum operational performance of the system.

2. Techincal Description

This chapter presentes the technical aspects of the Ponto Series, presenting the series' different items, architecture, general and electrical characteristics.

Ponto Series Characteristics

Series' CPUs

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

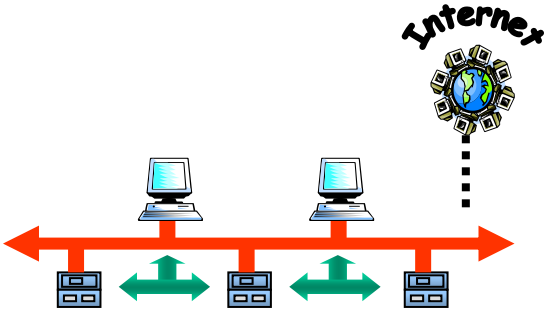

Figure 2-1 Ponto Series' Utilization

Modules

The modules carry high density I/Os. There are configurations with 4 to 32 I/Os per module. Every I/O has a monitoring LED. There is one LED for multifunctional diagnostics, 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 signals' tags. These tags are conveniently located by the I/O LEDs, thus facilitating I/O identification.

Figure 2-2 Ponto Series' Modules

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. It is not necessary to move any field wiring to remove modules.

Figure 2-3 Connection to Base

Modules Hot Swap

The hot swap feature allows modules replacement without the necessity to shut the system power down. 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 from the terminal block. 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 Mechanical switch code system which prevents the placement of a module different than the one intended for that base.

This switch has a code defined by the last digits of the module's name For example: module PO2021 must have its base adjusted by the user with the code 21.

Diagnostics

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

Figure 2-4 Diagnostic LED

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, which 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 ms acquisition time for 480 points
- Interconnection of 30 modules times 16 points = 480 points
- Featuring a dedicated integrated circuit

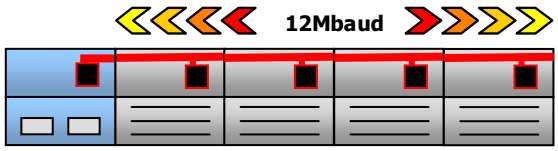

Figure 2-5 Bus

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 supports up to 30 I/O modules. These modules must be in segments composed by up to 10 modules. The architecture allows no more than 4 segments, granting high flexibility to electrical panel assembly.

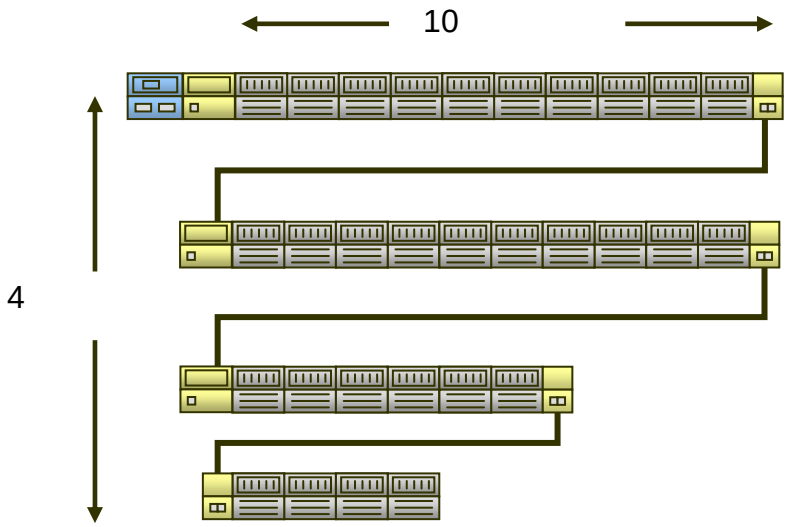

Figure 2-6 Local Bus

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 I/O modules capacity of the local bus, but are also limited to the network type specific characteristics. Consult the utilization manual for the field network head in order to get further details about it.

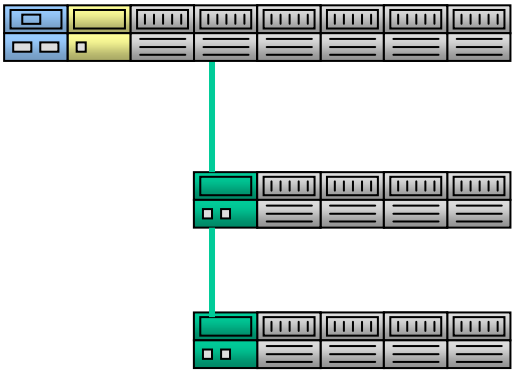

Figure 2-7 Remote Bus

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

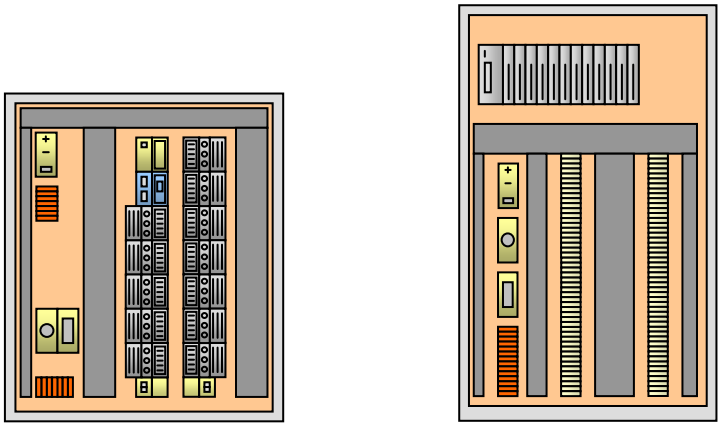

Figure 2-8 Panel with Ponto Series versus conventional panel

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.

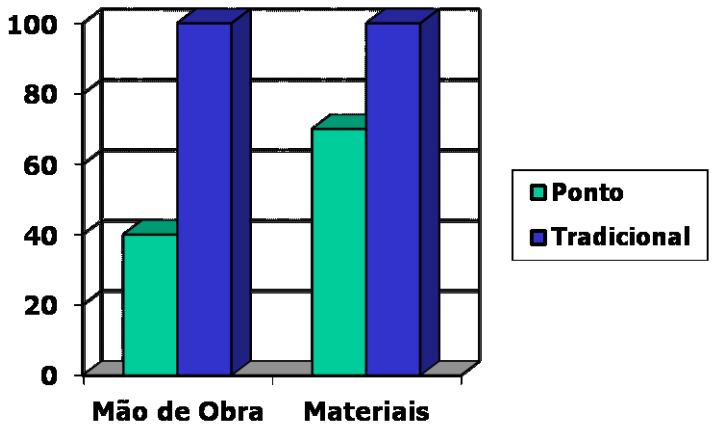

Figure 2-9 Cost Reduction

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 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.

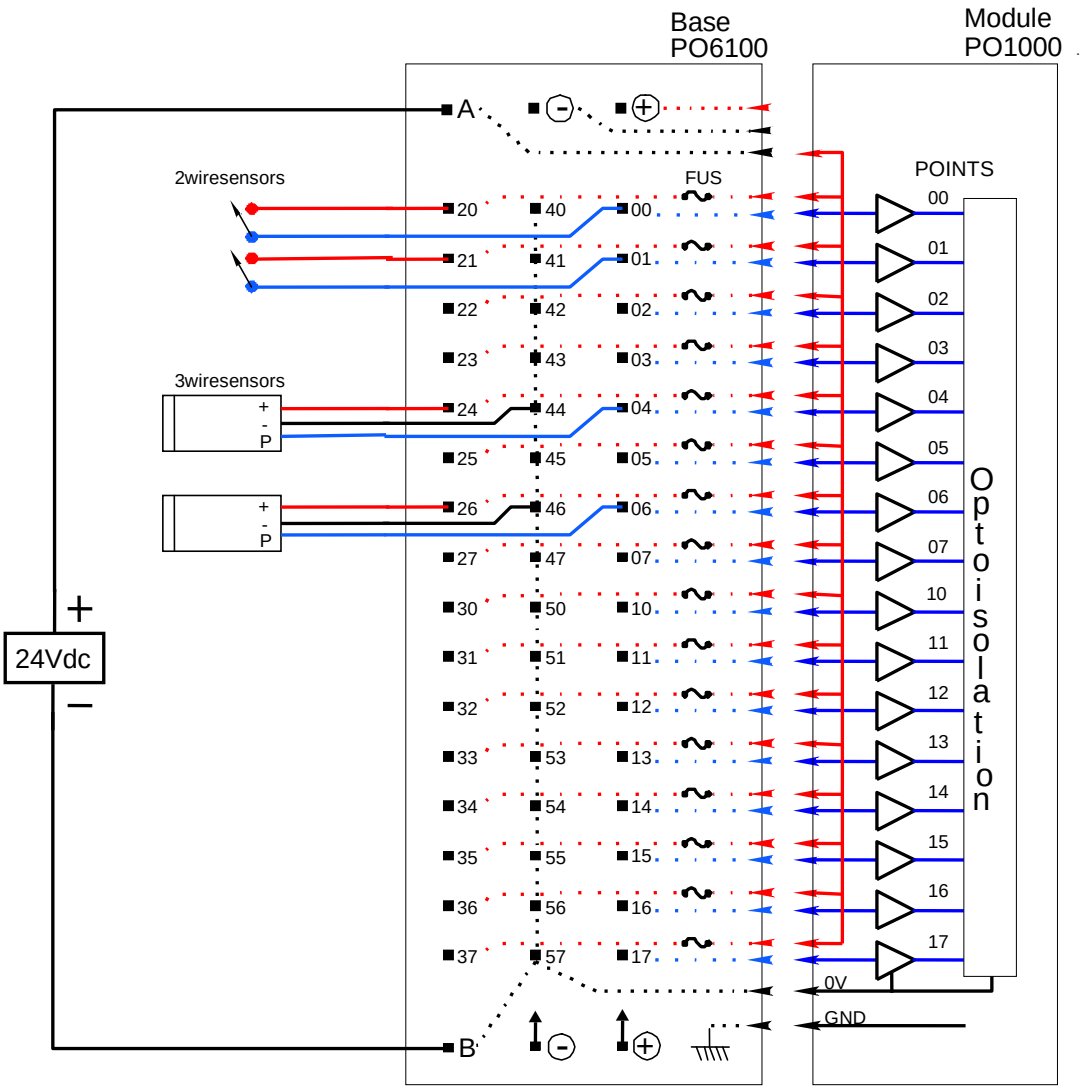

Figure 2-10 Wiring Simplification

Network Interfaces

The Ponto Series works with the following fieldbuses:

- PROFIBUS
- MODBUS
- ETHERNET

MT8000 - MasterTool Extended Edition

The MT8000 software enables both CPUs programming and bus configuration. It has the flexibility and power of using special functions for different applications.

MT6000 - MasterTool ProPonto

The MasterTool ProPonto MT6000 software helps the project of Ponto Series buses, making the configuration and documentation of a system a simple task

The software is required to configure Ponto Series' equipment. It performs the following functions in the development of a projet:

- Bus project in a graphical environment

- Configuration validation: it checks items such as power consumption, compatible bases and design limits.
- Tag attribution to system points
- Generation of labels for module identification
- Generation of Bill of Materials
- Configuration from a list of modules available in the "components tree"

Consult MasterTool ProPonto technical characteristics for further details.

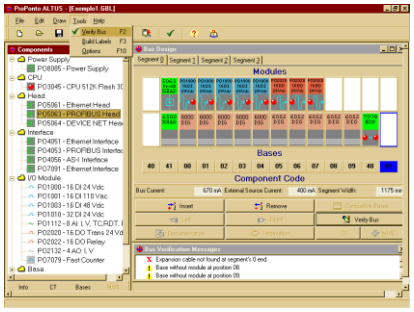

Figure 2-11 Graphical Configurator

Environment Conditions

The Ponto Series I/O modules comply with the following specifications:

Storage Temperature	-25 to 70°C
Operating Temperature	0 to 60°C
Relative Air Humidity	5 to 95%, non condensing
Noise Immunity	IEC 61131, several levels

3. Architecture

The Ponto Series architecture is extremely versatile, it allows the interconnection of I/O modules and other complex modules such as 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 is a brief description of the main architecture components.

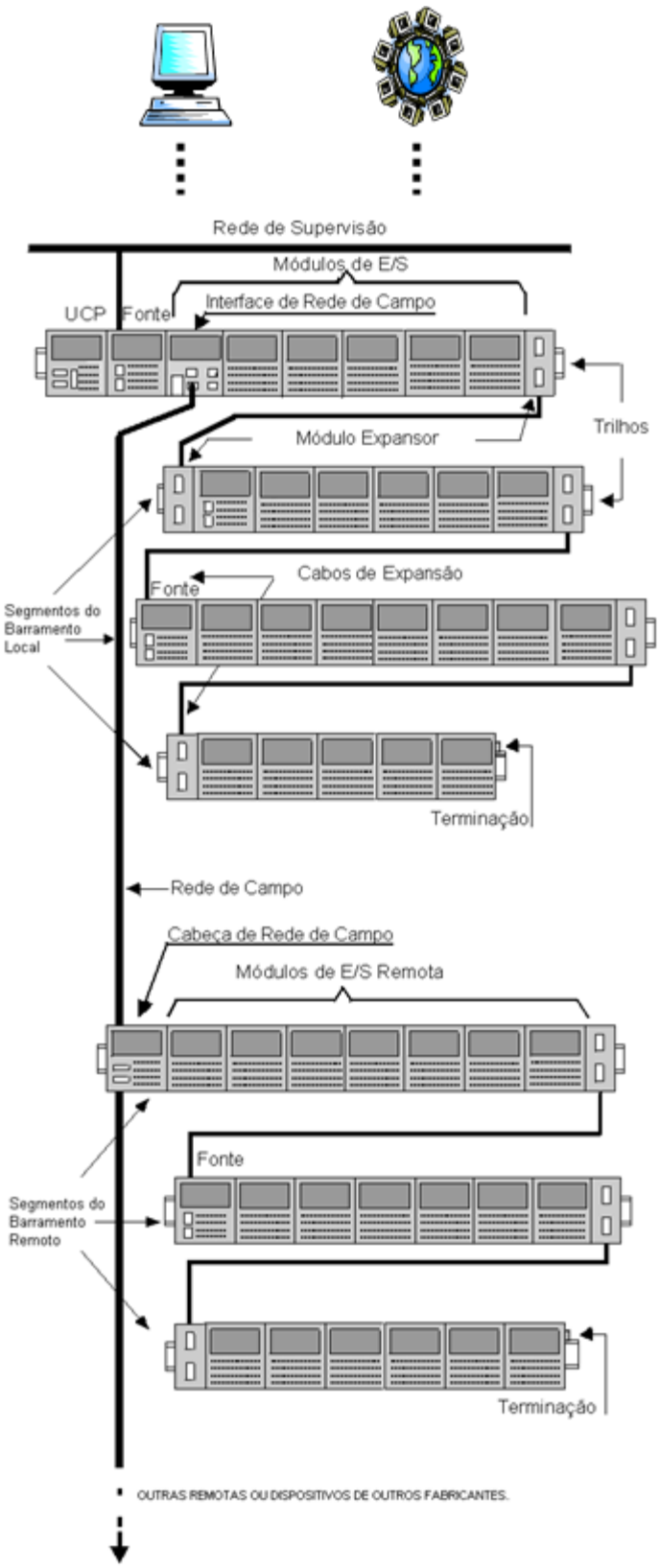

Figure 3-1 Architecture

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 CPUexecutes 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 I/O modules.

Figure 3-2 CPU

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 I/O modules.

The large size CPUs come with integrated power supply.

Figure 3-3 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 have terminals – spring or screw type - for field wiring interconnection, and optionally fuses for protection. The base selection depends upon the kind of module to be used. Refer to the Technical Characteristics of each module to define available bases options.

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.

Figure 3-4 Bases

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, which means they can be unplugged without turning the system power off.

External power supplies are necessary to provide energy for field circuits.

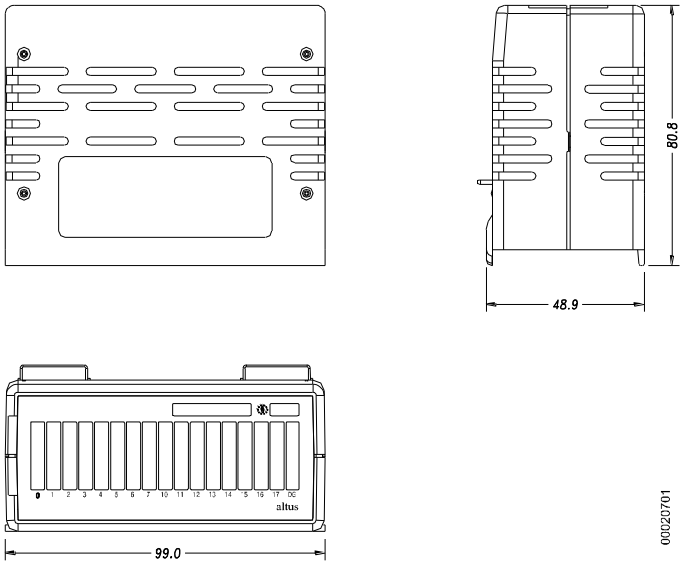

Figure 3-5 I/O Modules

Bus Expanders

Bus expanders interconnect 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.

Figure 3-6 Expansion Module

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.

Figure 3-7 Expansion Cable

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.

Figure 3-8 Termination

Fieldbus Interfaces

Fieldbus interfaces are fieldbus master nodes and allow the access to remote modules or other equipment based on PROFIBUS.

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 PROFIBUS networks.

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.

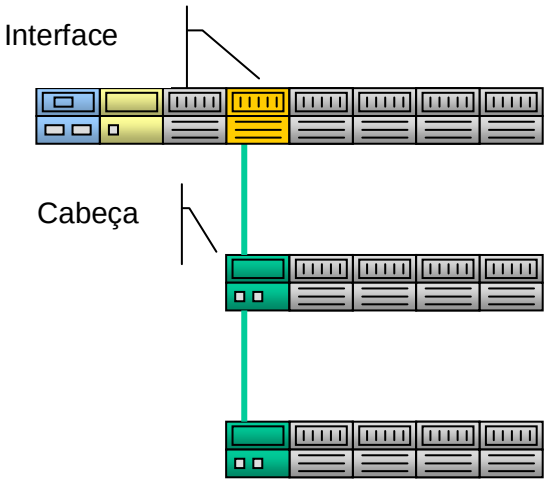

Figure 3-9 Fieldbus Heads

4. 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.

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 can be verified there.

Limits

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, 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 powered 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: Consult the module's respective technical characteristics and manuals in order to be sure about the maximum values to be used.

Configuration Steps

A system can be specified through the following configuration steps.

Step 1 - Define the input and output modules required

Consider:

1. The required number of IOs, based on the process to be controlled.

2. Group the inputs according to their characteristics: need to use outputs with dry contacts, isolated analog signals, etc.

3. Select the modules types. Use the following criteria when selecting the I/O modules:

- Working voltage
- Output type: transistor or relay
- Need to isolate digital signals
- Isolation for analog or digital modules
- Maximum currents (per I/O 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.

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 I/O modules

Consult the Technical Characteristics document (CE) of each module defined in the previous step. The Ponto Series has a broad range of bases to choose from, and that allows the set up of many different configurations. Then choose the bases types. Use the following criteria when selecting the bases:

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

Step 3 - Define the CPU or Head and respective base

The following table shows some available options:

	PO5063V1	**PO5064**	**PO5065**	**PO3142**	**PO3342**	**PO3047**	**PO3247**
Denomination	PROFIBUS -DP Head	PROFIBUS -DPV1 head	Redundant PROFIBUS -DPV1 head	CPU 256K Flash, 30 I/O Modules, 3 Serial, MODBUS	CPU 256K Flash, 30 I/O Modules, 2 Serial, MODBUS,PROFIBUS, WebServer	CPU 256K Flash, 16 I/O Modules, 1 USB, 1 RS-485, 1 RS-232, MODBUS, Display, Ethernet	CPU 1M Flash, 30 I/O Modules, 1 USB, 1 RS-485, 1 RS-232, MODBUS, Display, PROFIBUS, Ethernet, WebServer, Redundancy
Compatible Base	PO6500	PO6500	PO6500	PO6302	PO6302	PO6307	PO6307

Tabela 4-1 Módulos e Bases

For instance: for the PROFIBUS DP remote, the head is PO5064 and the compatible base is the PO6500. There is no need to add a power supply since the head already has one embedded.

Step 4 – Define the number of segments

The following constraints 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 constraints above allow more than one configuration for the number of segments. You should use the smallest amount of segments possible. Even though you may use more segments depending on the the panel's 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 one another.

The local bus, where the PLC is the master device, the CPU provides a power supply to feed the CPU and up to 12 I/O modules distributed in up to 2 segments. When this limit is exceeded, 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 I/O modules are conveniently installed.

For a remote bus, the PROFIBUS field network head with its own power supply will feed up to 12 I/O modules distributed in up to 2 segments. The same way as before, when this limit is exceeded, 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 I/O 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.

Below 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, expect 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, 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 two 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). Note that the second situation has the modules upside down. You may find further details on Mechanical Installation .

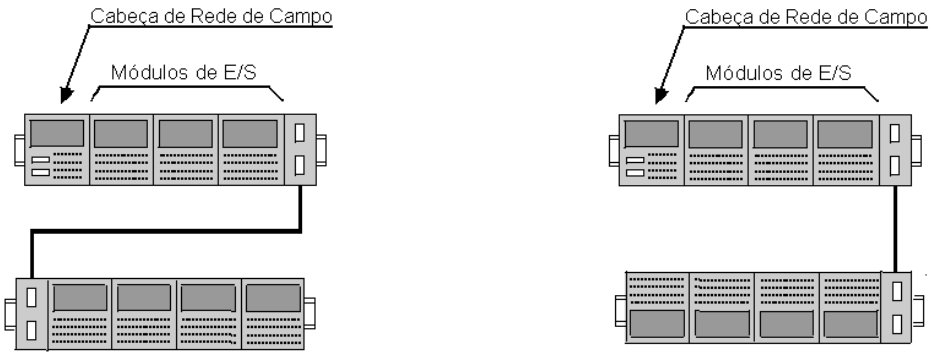

Figure 4-1 Expansion Cables

Step 7 – External Power Supply

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 using fuse for the powering of all outputs and field sensors. This will increase the system reliability gains field short circuits. 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.

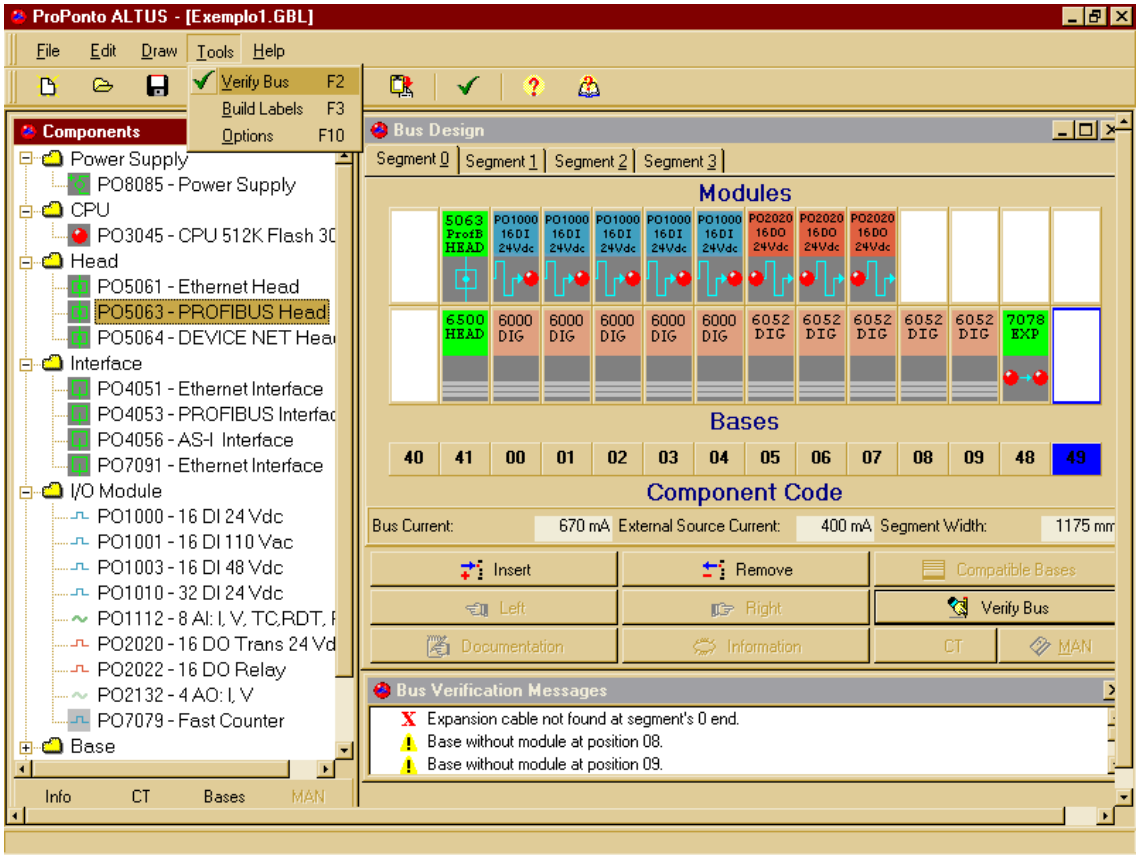

Figure 4-2 MasterTool ProPonto

Consult MasterTool ProPonto's manual for further information.

The MasterTool ProPonto has the following characteristics:

Design by Segment Screen

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 are 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 I/O modules.

Components Tree and Compatible Bases

The area to the left on the screen shows the "components tree". It includes folders for components such as Bases, Remote Heads, Expansion Cables, CPUs, Power Supplies, Bus Expansions, Network Interfaces and I/O 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 CTs and Manuals

The ProPonto provides easy access to the technical characteristics in Portuguese (CT) and/or manual of any component. You just need to select the component and press the bottom "CT" or "MAN". The files for CTs 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 I/Os, 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:

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

Labels Generation

The ProPonto can generate the labels to identify modules and its I/Os.

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.

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.).

5. Panel Project

Mechanical Project

Dimensions of Modules Assembled on the Bases

The following dimensions apply to CPUs, interfaces, headers, I/O 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.

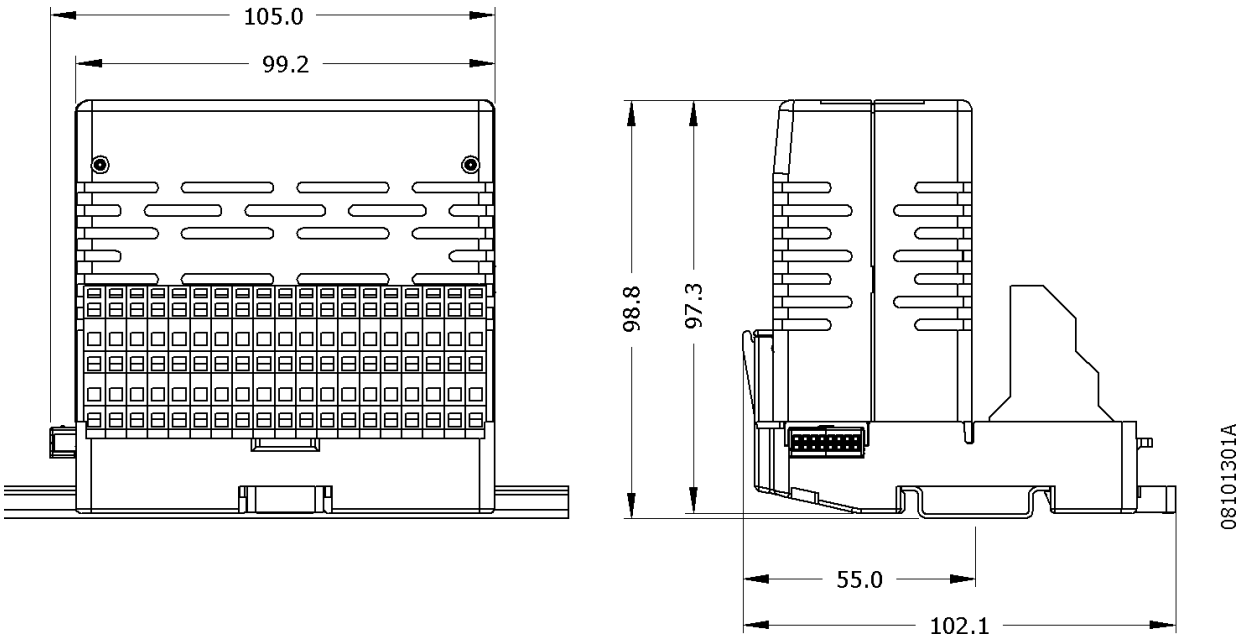

Figure 5-1 I/OModule assembled in a non fused Base

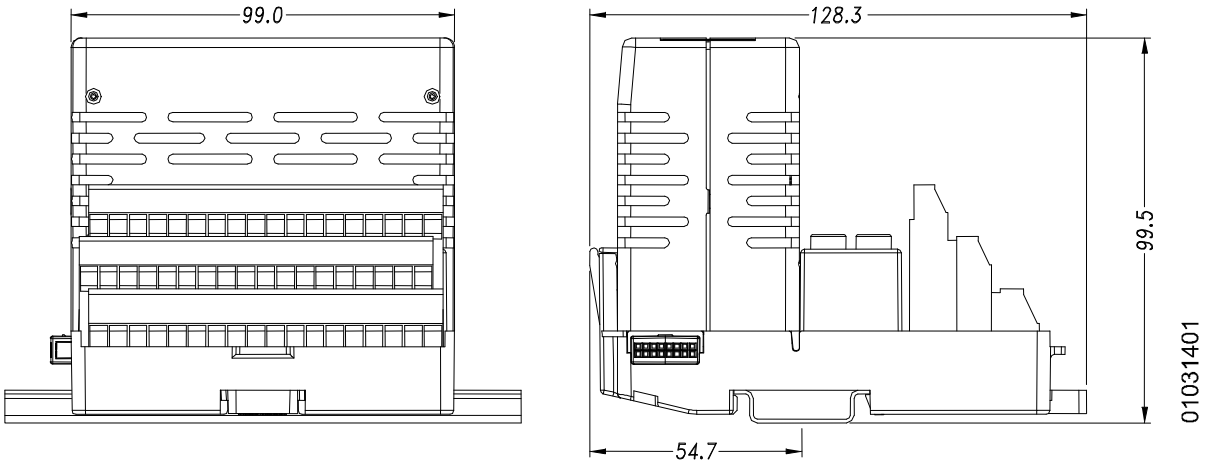

Figure 5-2 I/O Module assembled in a fused base

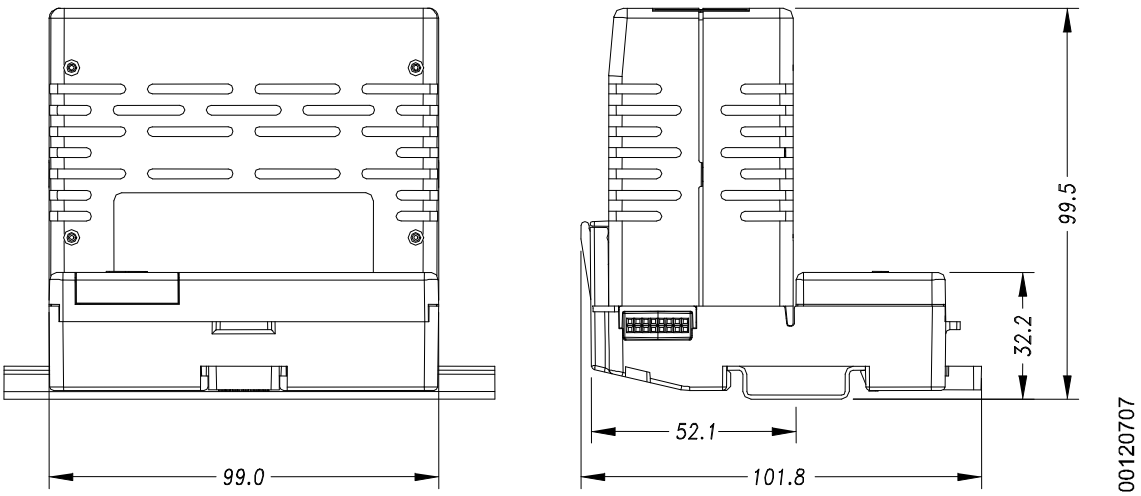

Figure 5-3 CPU assembled on a base

Dimensões do Módulo Expansor

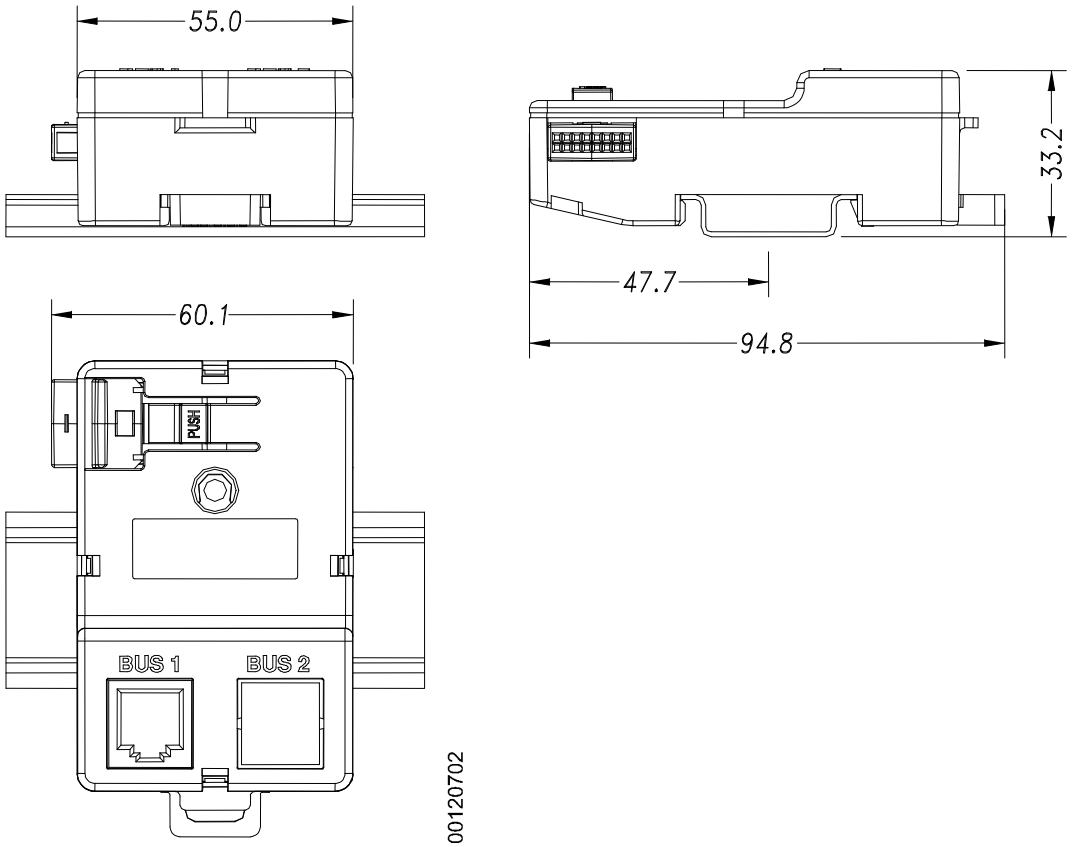

Figure 5-4 Expander Module

Space Between and other Panel Components

You must leave available space between the bus segments in order to have air circulation, field wiring space, replacement of modules and bases, and other maintenance operations. Follow the dimensions in the following figure:

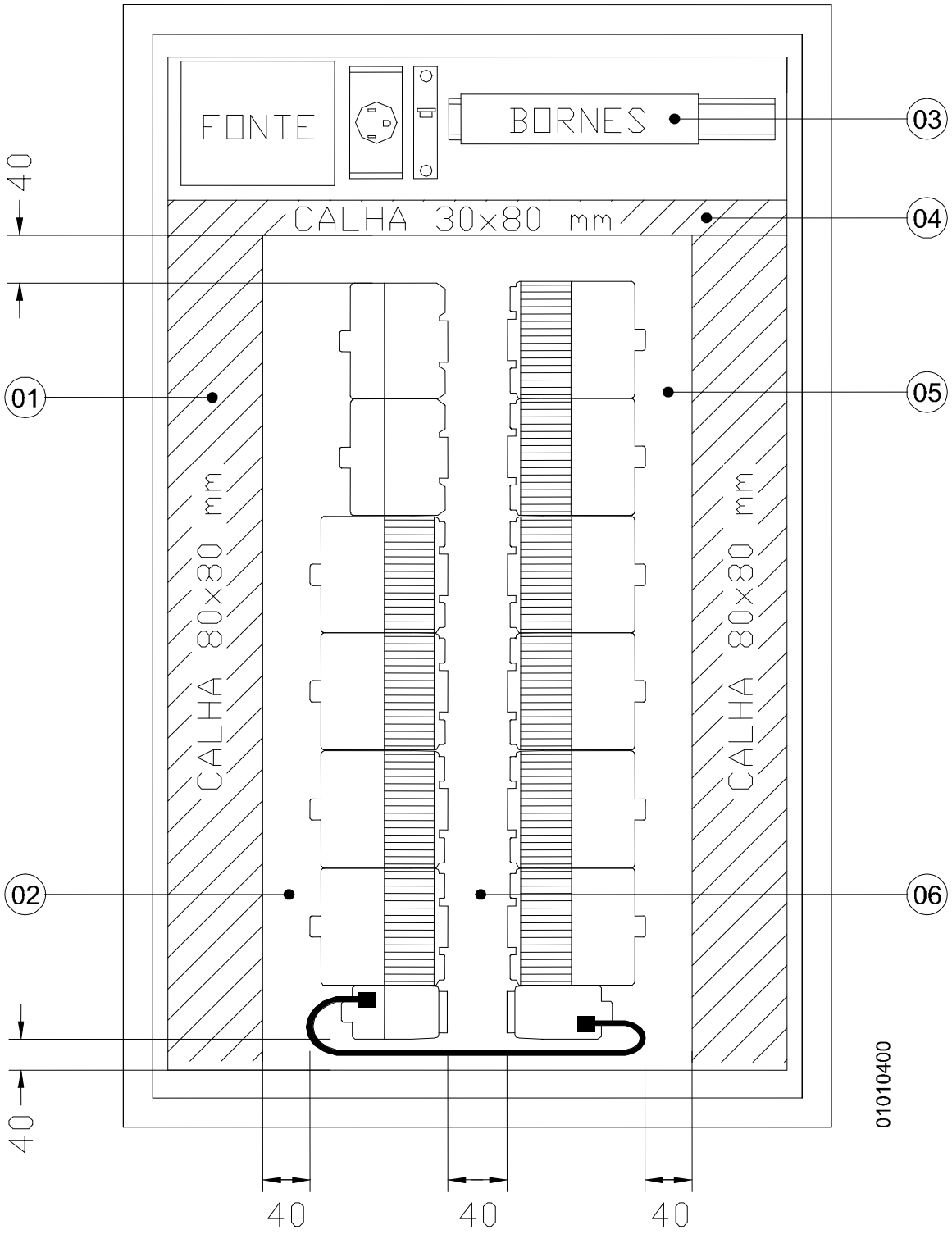

Figure 5-5 Required Space (mm)

1 – Space required by the conduit (80 mm for this example, but it depends on the specific project).

2 – Space between conduit and bus segment (the 40 mm 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 (according to project).

4 – Space for the conduit of internal 24Vdc power supply distribution (30 mm for this example)

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

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

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

Total Length of a Segment

The total lenth of a segment is the sum of the lengths of each component assembled on the rail. Use the following formula:

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

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

Table 5-1 Length of the Segment Components

Example:

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

Segment total length = 12 * 100 + 1 * 55 * 1 + 20

Segment total length = 1275 mm = 1.275 m

Rail Length

The rail must take into account the segment's total length. You must leave 25 mm room at each end of the rail.

Rail Total Length = Segment Total Length + 50 mm

Example:

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

Rail total length = 1275 + 50 = 1325 mm = 1.325 m

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

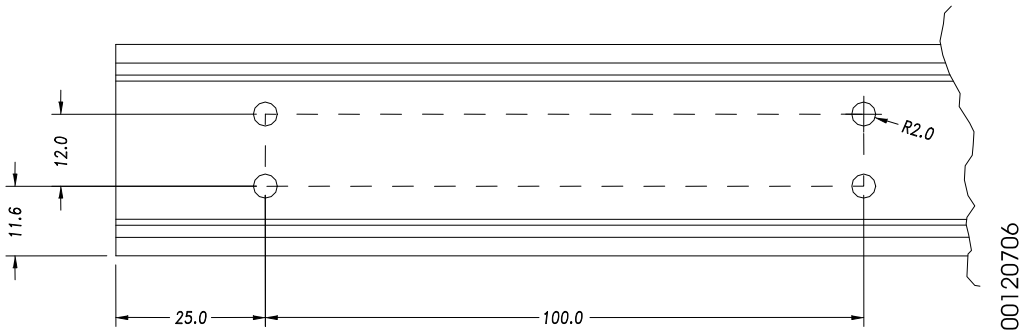

Figure 5-6 Rail

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 heat dissipated by them. Such behavior reduces the available conduit space.

Use the following rule: conduit area >= sum of the wiring area / 0.4

Wiring area = (3.14 * radius ^ 2)

The wiring area includes the wiring and isolation.

Vertical Assembly

Follow Figure 5-7 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.

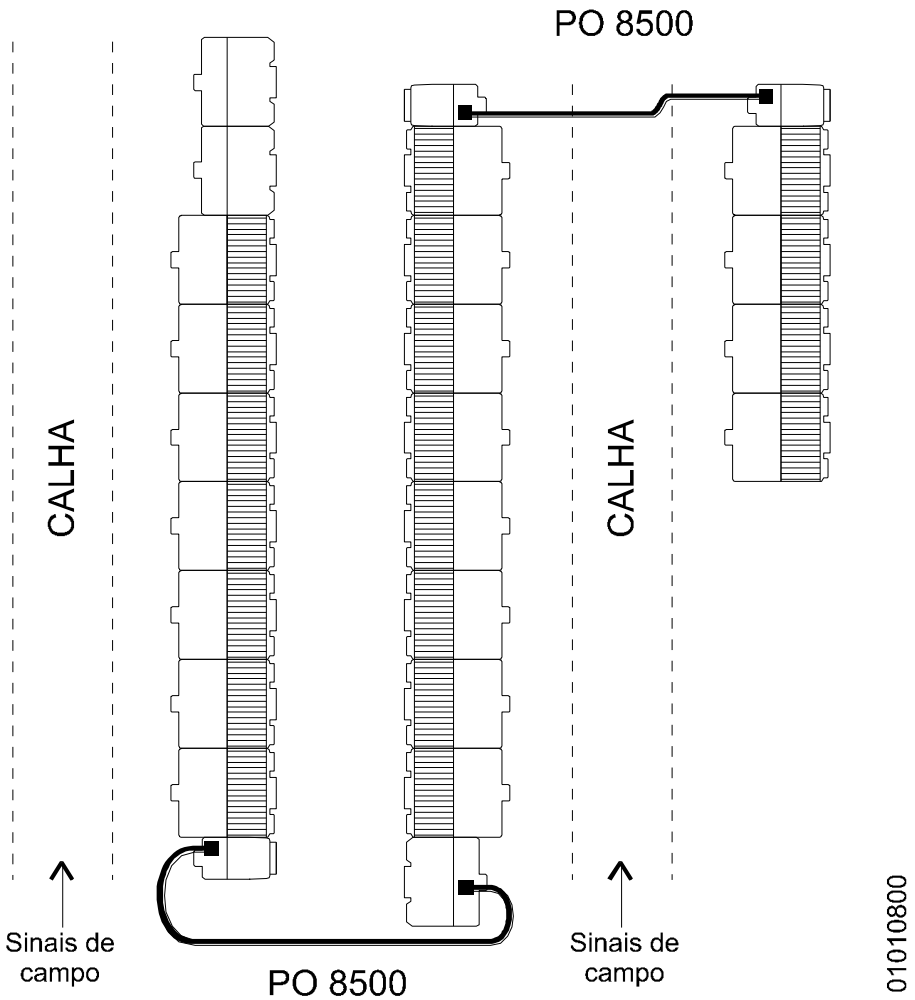

Figure 5-7 Vertical Assembly

Horizontal Assembly

Follow Figure 5-8 when building a horizontal assembly. This layout uses the PO8501 cable (1.4 m) that must run outside of the conduit. The field wiring runs through two conduits, one for each segment.

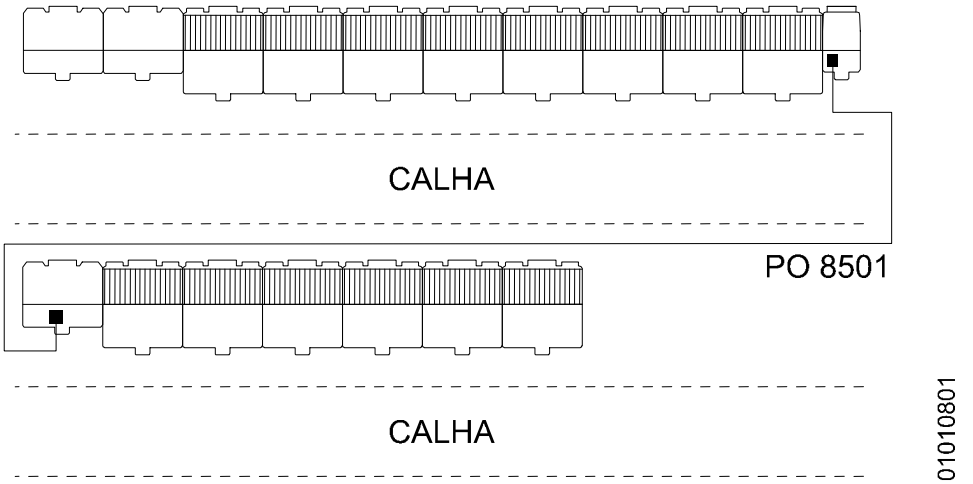

Figure 5-8 Horizontal Assembly (1)

The assembly on Figure 5-9 is more compact. It uses the PO8500 expander cable (0.4 m) and only one conduit. The second segment is positioned at 180 degrees from the first one.

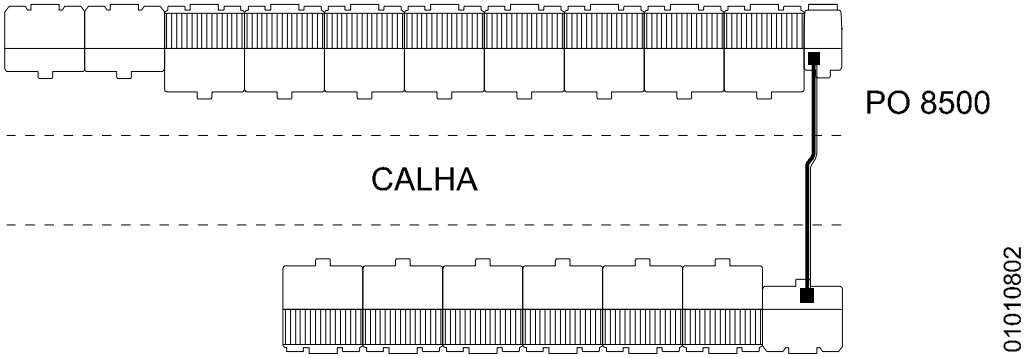

Figure 5-9 Horizontal Assembly (2)

Expansion Cable Installation

Keep the expansion cables away from the conduits in order to prevent electrical noise interferences. See Figure 5-7, Figure 5-8 and Figure 5-9.

Panel Project Examples

Following are examples of Ponto Series electrical panels. The panels are dimensioned according 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 I/O modules

When dimensioning the panel, it is important to take into account the power supply and CPU. I mean, a 4 module panel should include power supply, CPU and two I/O modules.

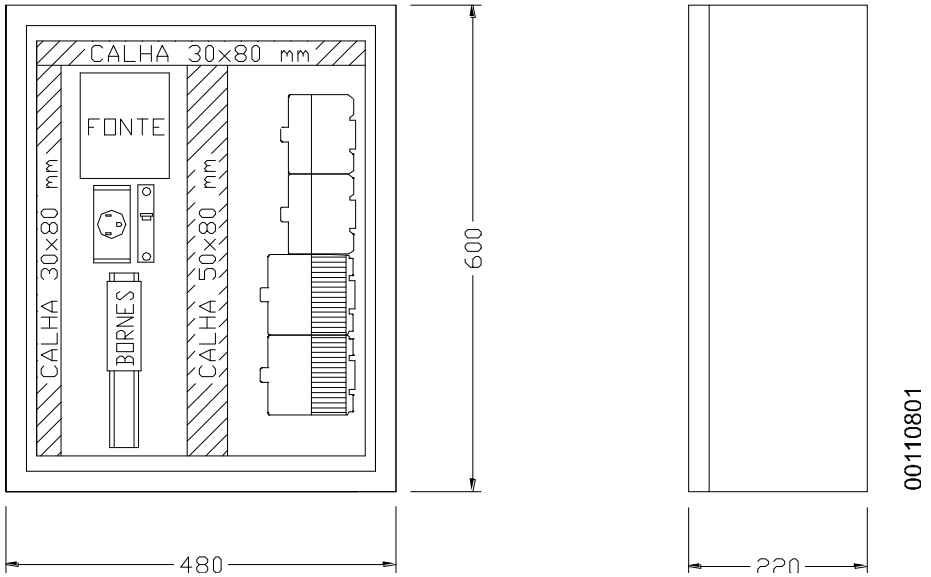

Figure 5-10 Panel for 4 modules

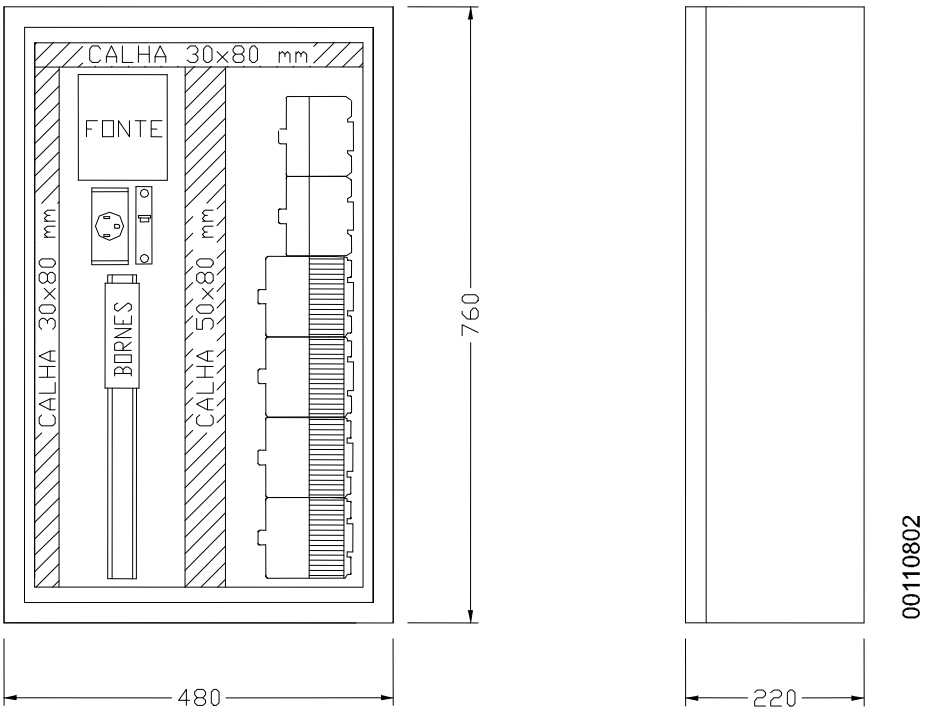

Figure 5-11 Panel for 6 modules

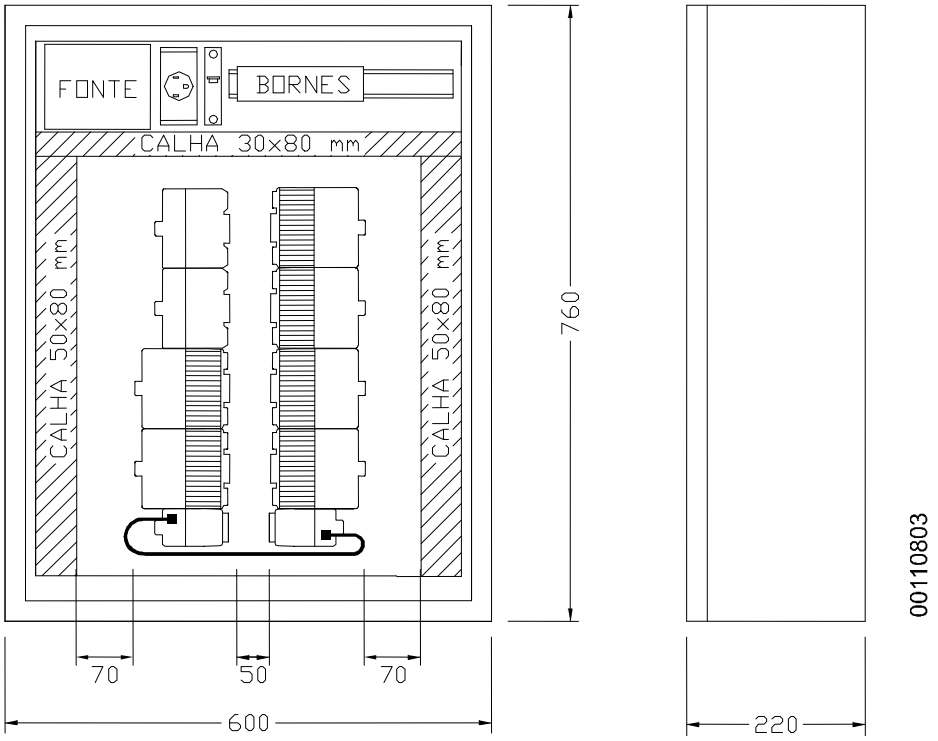

Figure 5-12 Panel for 8 modules

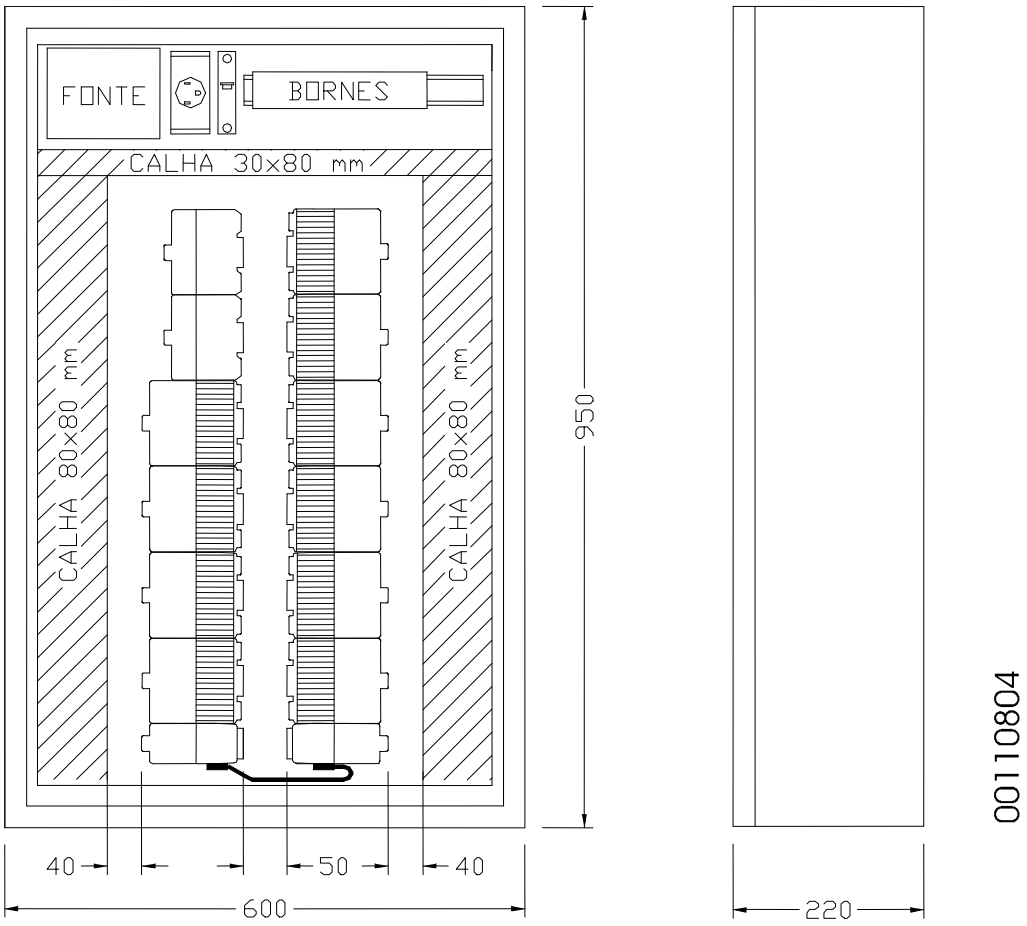

Figure 5-13 Panel for 12 modules

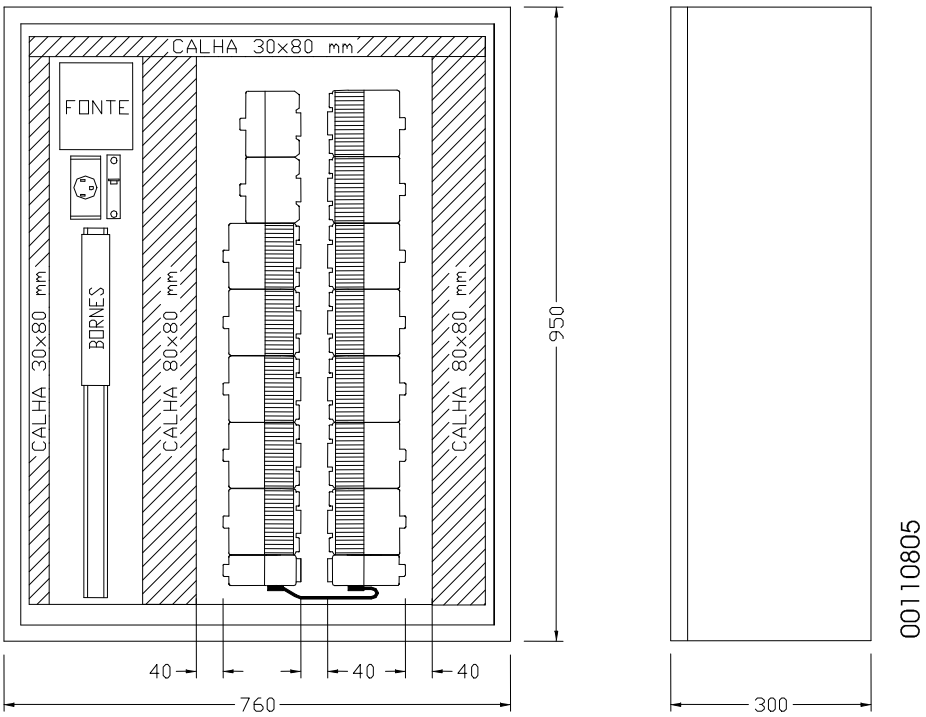

Figure 5-14 Panel for 14 modules

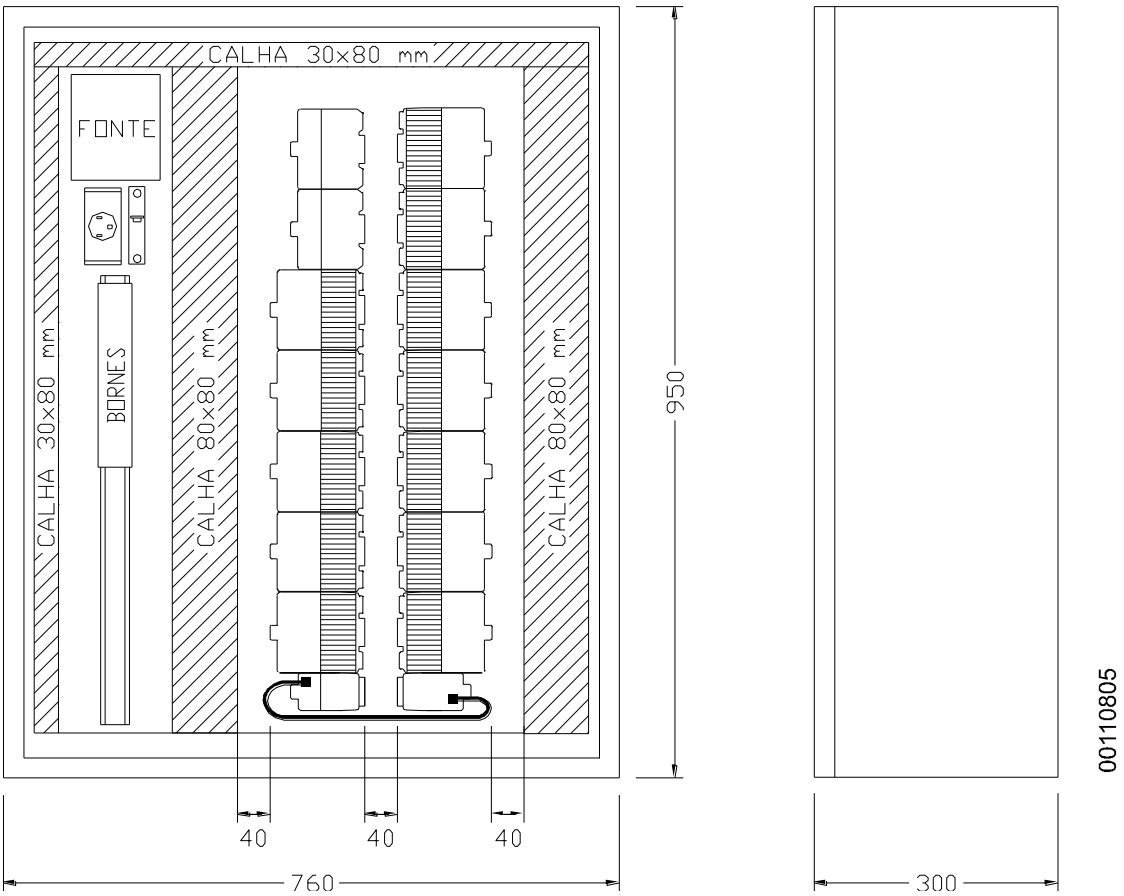

Figure 5-15 Panel for 18 modules

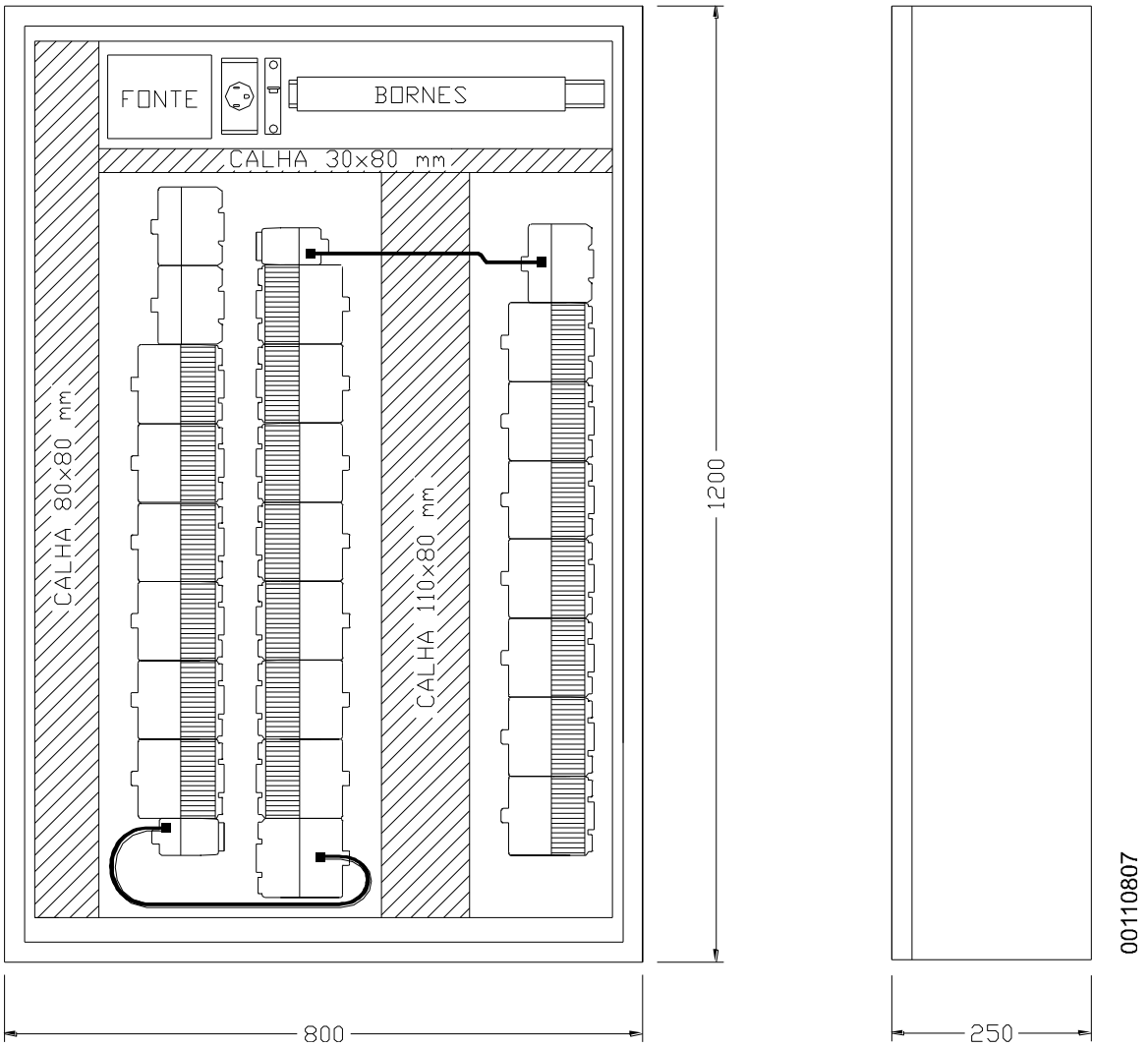

Figure 5-16 Panel for 23 modules

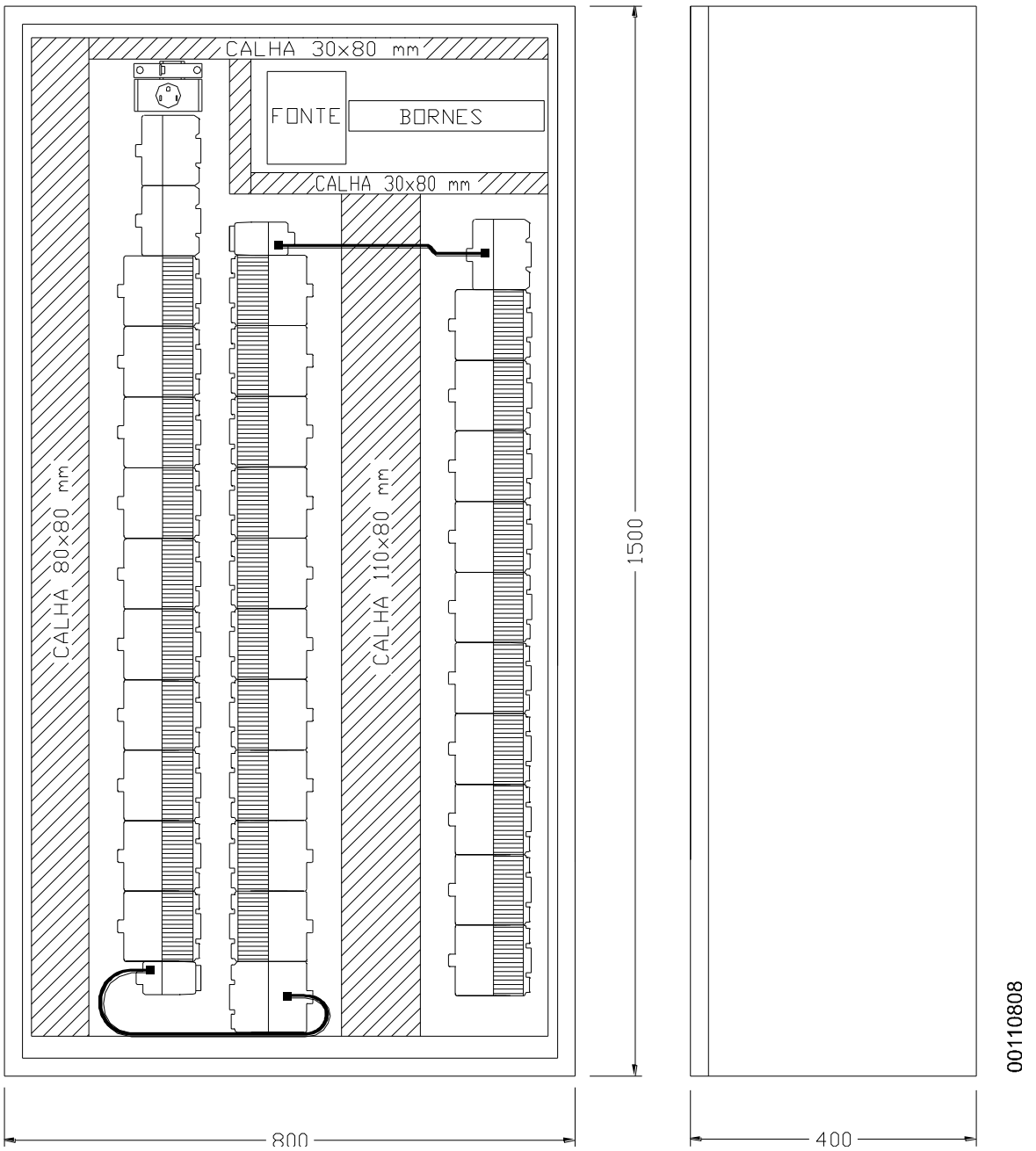

Figure 5-17 Panel for 33 modules

Thermal Project

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. Follow these instructions when designing the panel:

- The panels must have enough internal room to provide a good air circulation
- Insert funs 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 conducing high currents in order to avoid overheating the conduits.

ATTENTION:
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 as a function of 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. Consider the following values when calculating the heat dissipation for differences in internal and external temperature up to 50 ^{o}C:

- Panel effective dissipation surfaces: calculated according to the DIN-VED 0660 norm chapter 500, as indicated by the type of installation
- The dissipation constant for the painted iron sheet in W/m² ^{o}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 according to the DIN-VDE norm, and according to the panel installation type:

Installation type according to the DIN-VDE 0660/500 norm	Formula to Calculate A (m²)
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

Tabela 5-2 Cálculo da Superfície Efetiva de Dissipação

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 ^{o}C.

The panel dissipated power can be calculated by the equation Qs = k * A * (internal temperature– external temperature), or obtained from Figure 5-18.

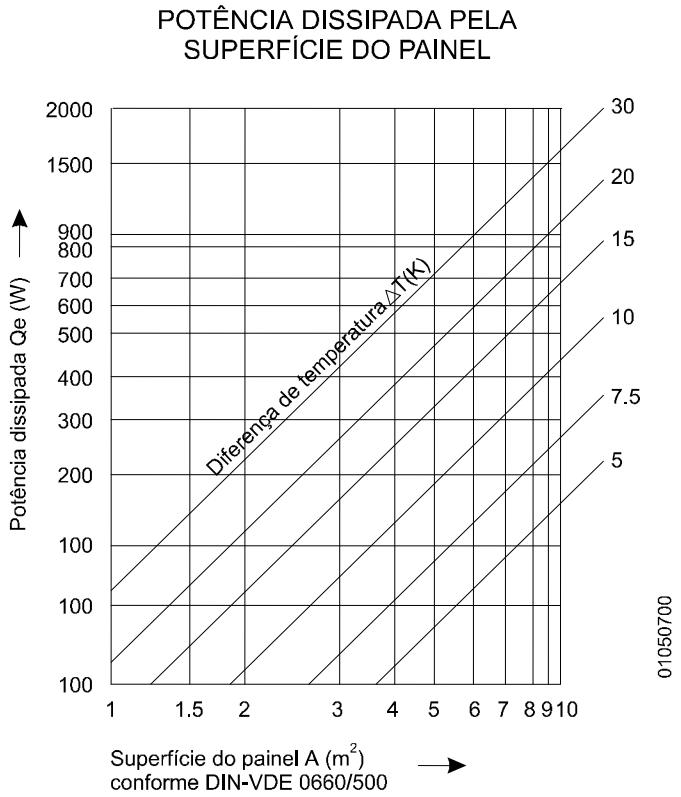

Figure 5-18 Dissipated Power x Superficies x Temperature Difference

This value may be tripled with external air circulation.

The equipment within a panel block the internal air circulation, thus creating localized heat spots. When such conditions occur you should add funs 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^2, installed power of 350W and external environment temperature of 30 ^oC.

Qs = k * A * (Ti – Te)

350 = 5,5 * 3,96 * (Ti – 30)

Ti = 46 oC

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

Qs = k * A * (Ti – Te)

1000 = 5,5 * 3,96 * (Ti – 30)

Ti = 76 °C,

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

Qs = k * A * (Ti – Te)

Qs = 5,5 * 3,96 * (60 – 30)

Qs = 653 W, being the limit 653 W, the remaining 347 W (1000 W – 653 W) must be removed, for instance, through air-conditioning equipment.

ATTENTION: 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.

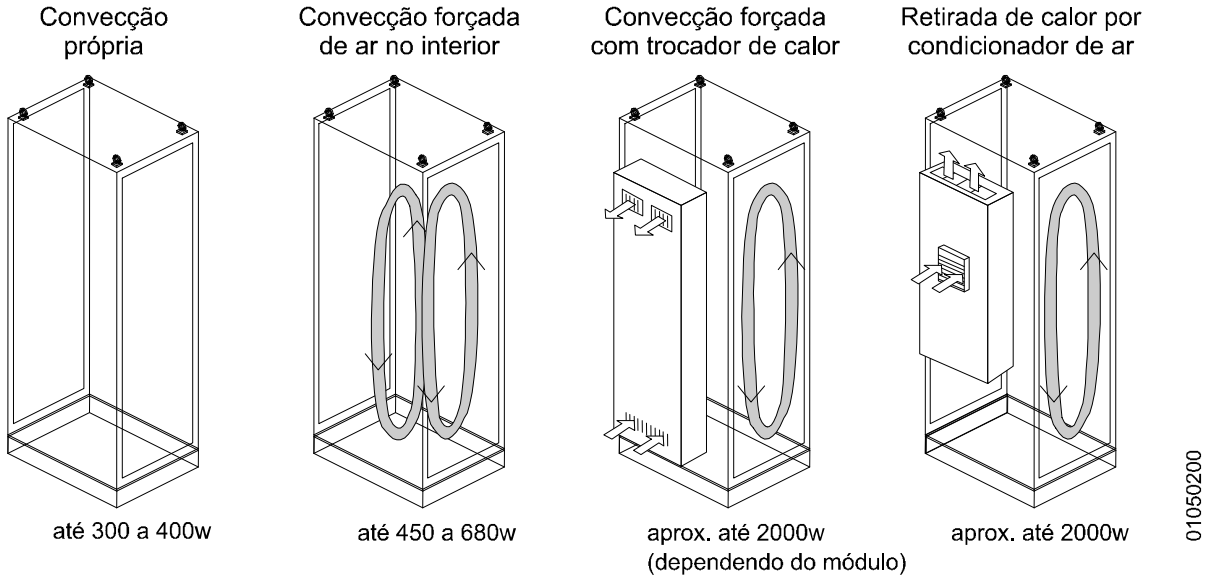

Figure 5-19 Examples of Head Circulation– Closed Installation

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. This will inevitably decrease the panel IP protection rating.

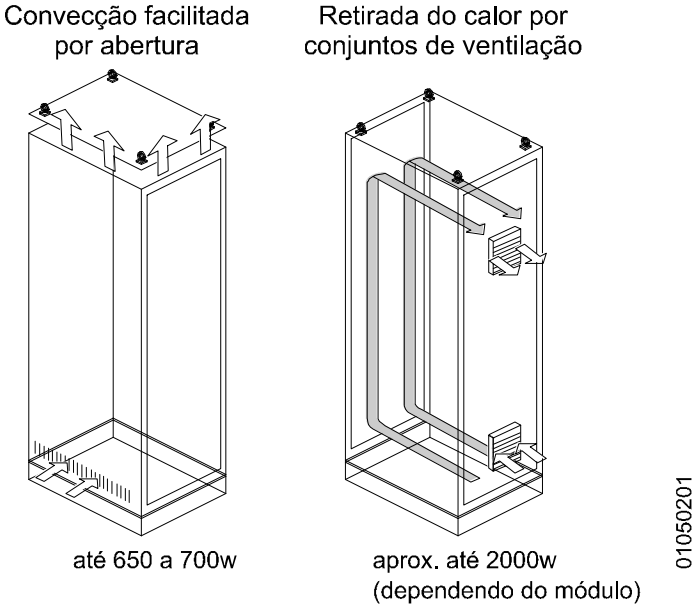

Figure 5-20 Example of Heat Circulation– Open Installation

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 can 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. Avoid using local module ramifications that will increase cable size and increase current circulation.

In order to improve equipment performance, 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. Leep such I/O and power signals (above 500V) at least 150 mm away from each other.

Panel Illumination

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

It is recommended to use incandescent lamps, because fluorescents may cause undesired interferences. 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 e 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.).

Figure 5-21 shows some examples of recommended elements for inductive loads noise suppression.

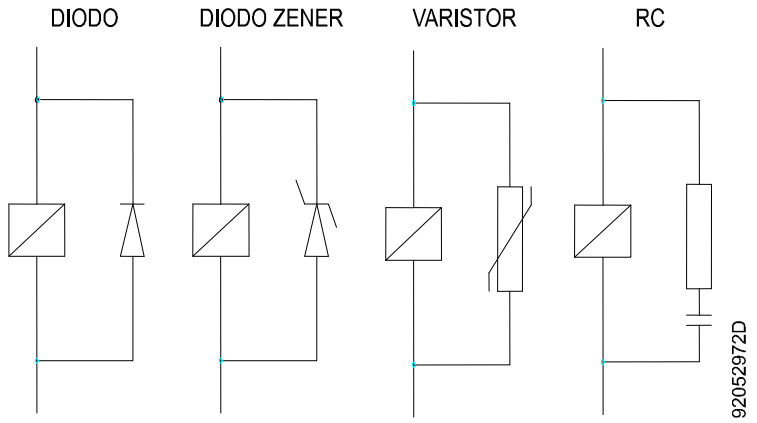

Figure 5-21 Inductive Loads Noise Suppressors

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 equipment such as 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 Diode Circuit

The Zener and diode circuit applies when the shut down time for the diode circuit it 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 pick 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 of AC circuits.The RC circuits are more efficient when used for voltages over 100 V.

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 1µF for each 1A of current. For example, if the load is 220 V / 1A, then the resistor should be 220 ohms and the capacitor 1µF (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 using Varistors or arrestors (with inert gases) for such cables. Also we recommend some shielding as shown bellow.

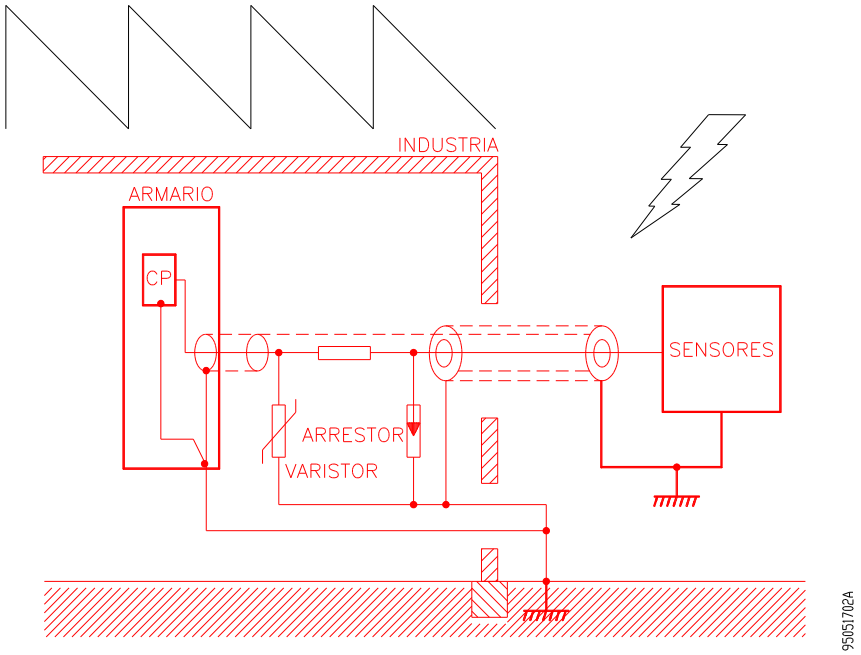

Figure 5-22 Lightning Protection

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

The above figure shows a correct installation for a generic system, but each application has its specific details that should be taken into consideration when designing the lightning protection system.

For critical situations, 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.

Powering the Bases

Follow the Technical Characteristics instructions when powering the bases of each module.

The bases have 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 scheme, consult the respective CE.

- **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 5-23. With such arrangements you may connect up to 10 bases within the same segment

The Figure 5-23shows 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.

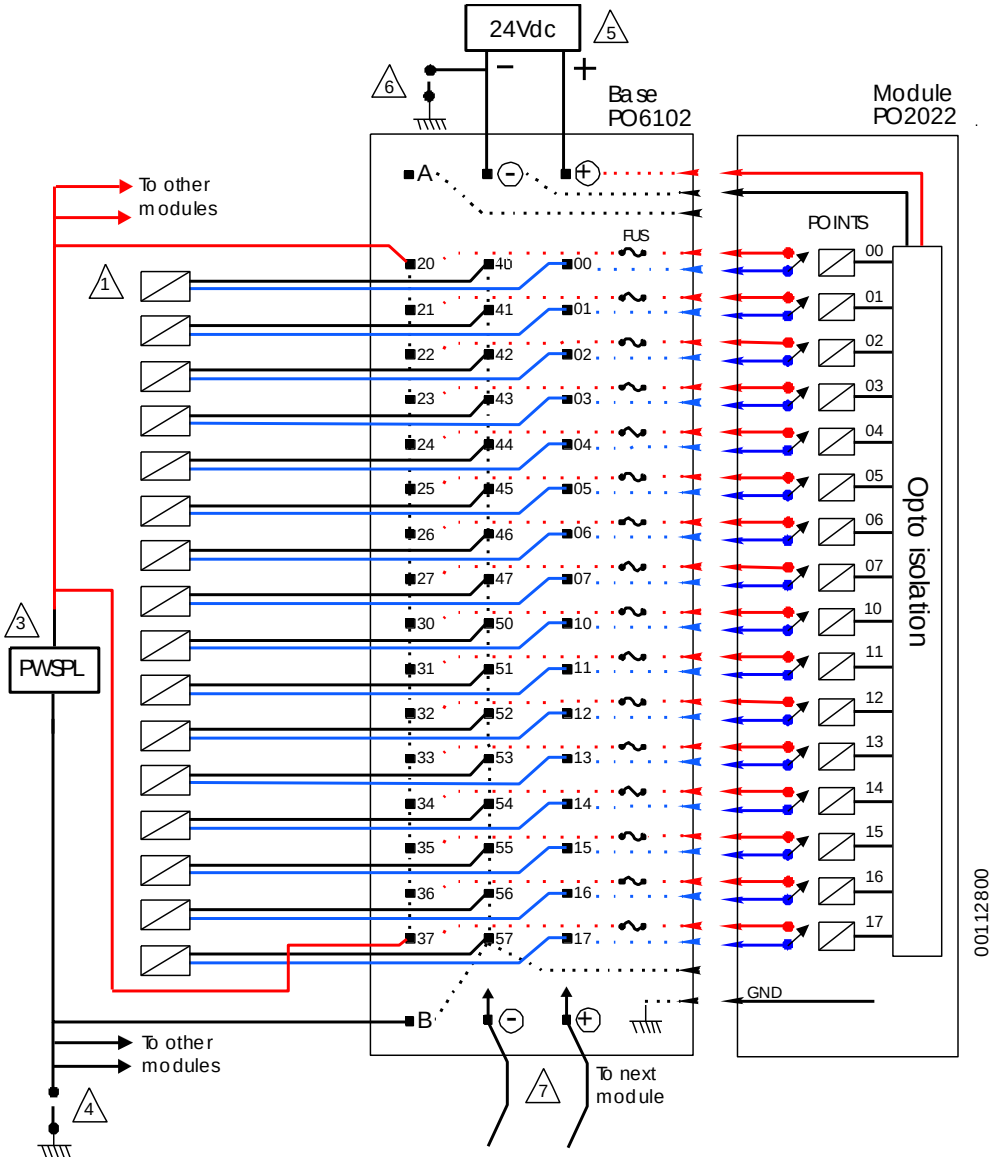

Figure 5-23 Powering the Bases

ATTENTION: Consult the Technical Characteristics for each utilized base in order to get connections details.

The Figure 5-24 shows the interconnection of power supply and modules

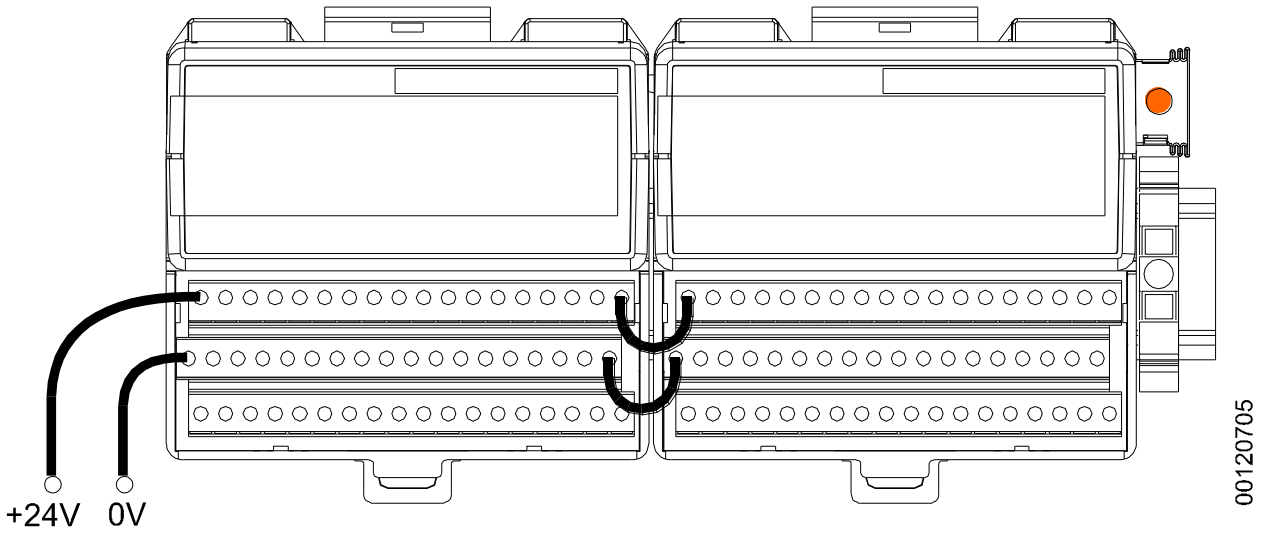

Figure 5-24 Field Voltages Connections

Module I/O Identification

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

Altus provides one type of label PO8510. Check Figure 6-11.

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.

Cable 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.
- MM is the module's number (values from 00 to 39). This number is printed in the panel label of each module.
- 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.

6. 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.

Mechanical Installation

Rail 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.

Be sure to securely fix the rails through screws so they can resist to mechanical vibrations – see Figure 5-6.

Base Assembly

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

1. Put the base in contact with the assembly panel superficies as shown on Figure 6-1.

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 6-2).

4. For the remaining bases, retract the sliding connector (see Figure 6-2), 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 6-2).

6. Finally connect the bus sliding the connector totally to the left towards the next base.

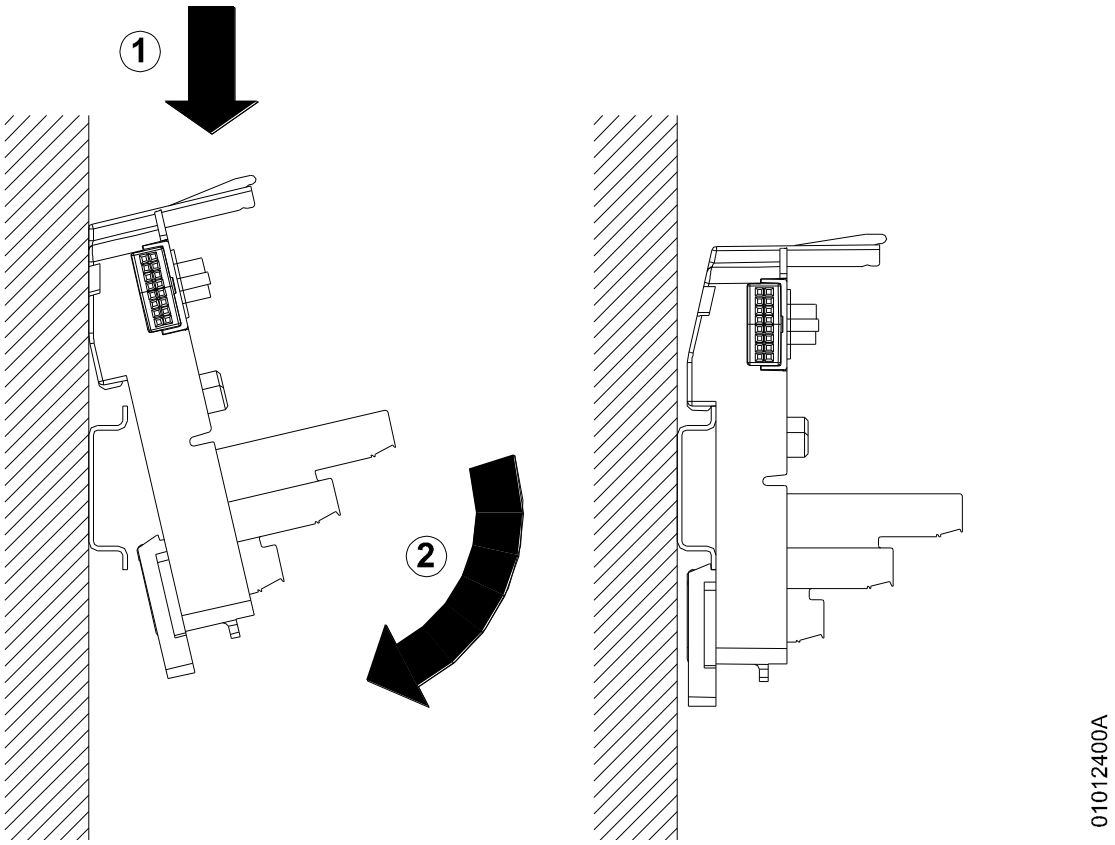

Figure 6-1 Base Installation

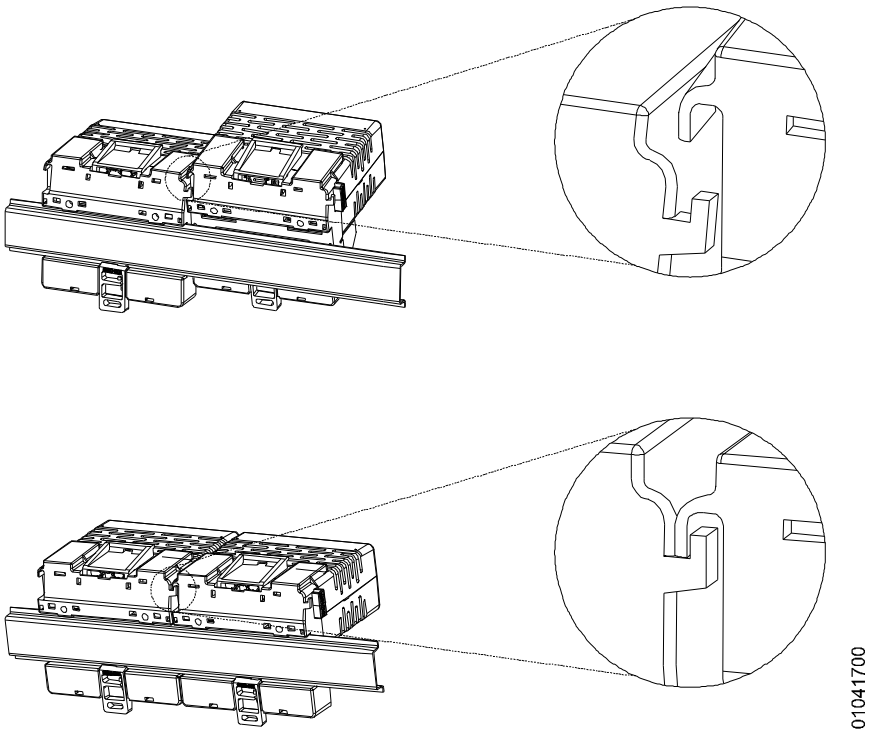

Figure 6-2 Base Installation – Hook

Base Disassembly

The disassembly procedure is:

1. Remove the module from the base and also the two modules beside it.

2. Loosen the bus connector from the base and also the two bases deside it.

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 6-3.

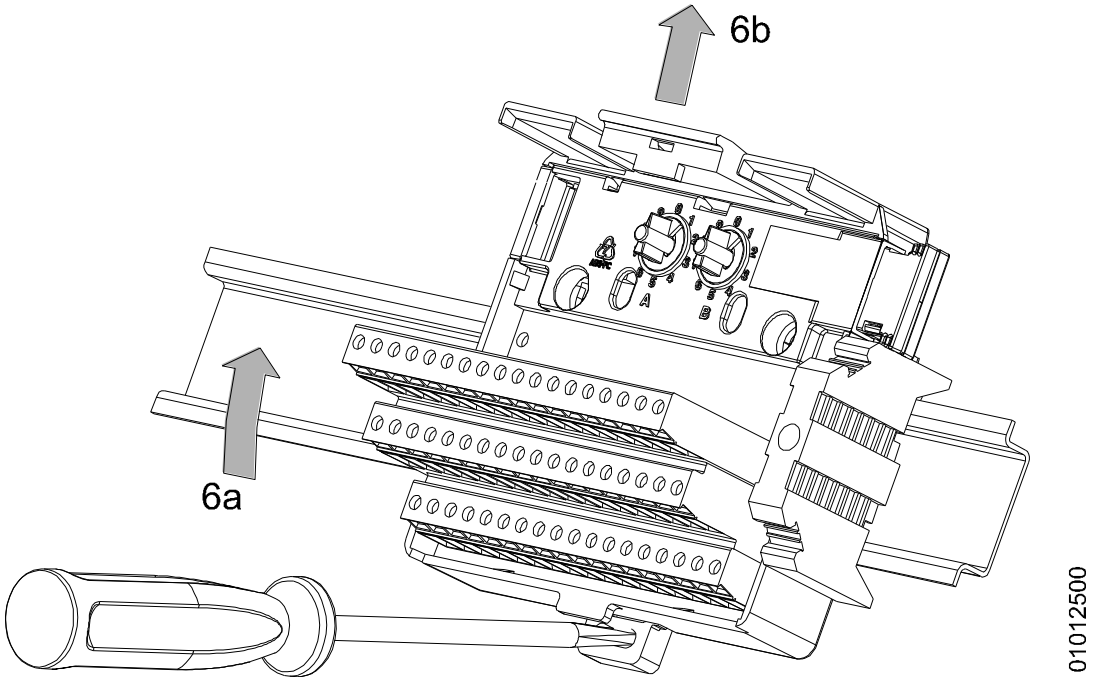

Figure 6-3 Base Disassembly

Mechanical Switches Adjustment

The mechanical switches located on the bases avoid the installation of a module different than the one specified in the project.

Adjust the switches according 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 6-5). For instance, the module PO2022 should have the base adjusted to the code 22.

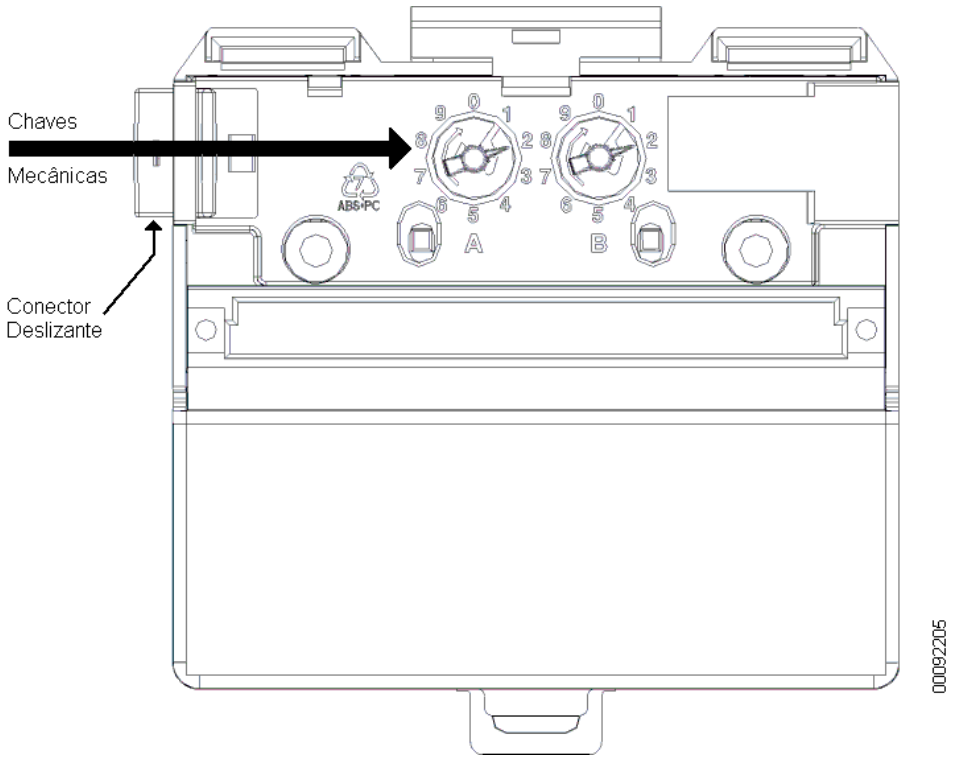

Figure 6-4 Mechanical switches and Sliding Connector

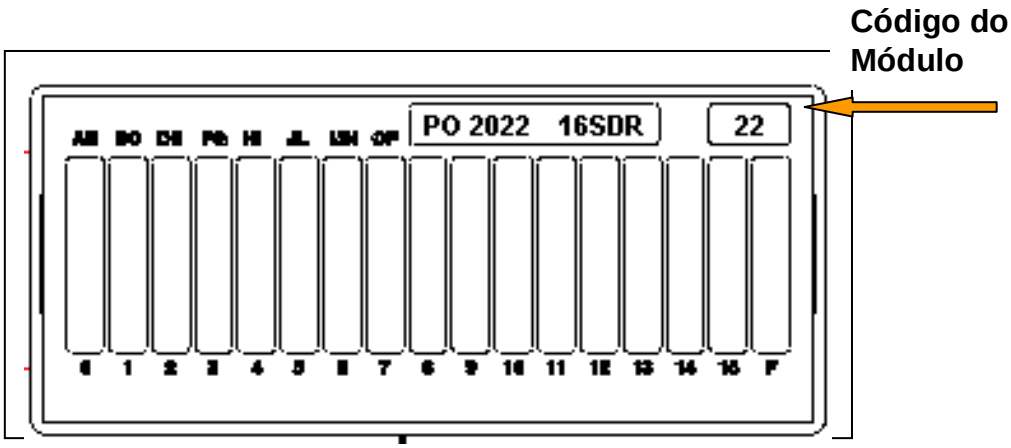

Figure 6-5 Module Code

Bus Expander Assembly

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

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

Figure 6-6 Bus Expander

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 labeled side must be installed upside.

Check Figure 6-7.

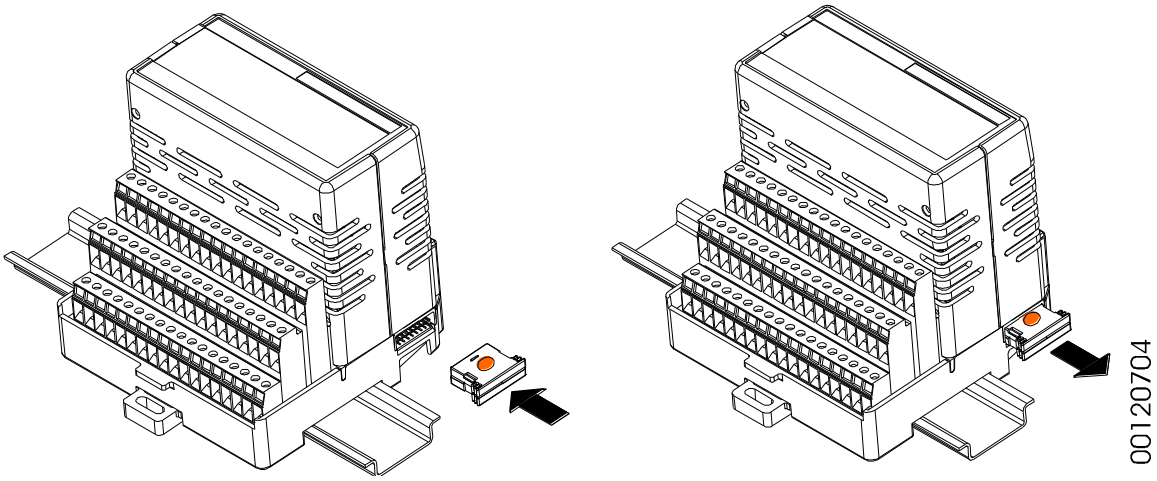

Figure 6-7 Termination Assembly

Lock Assembly

At the end, 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.

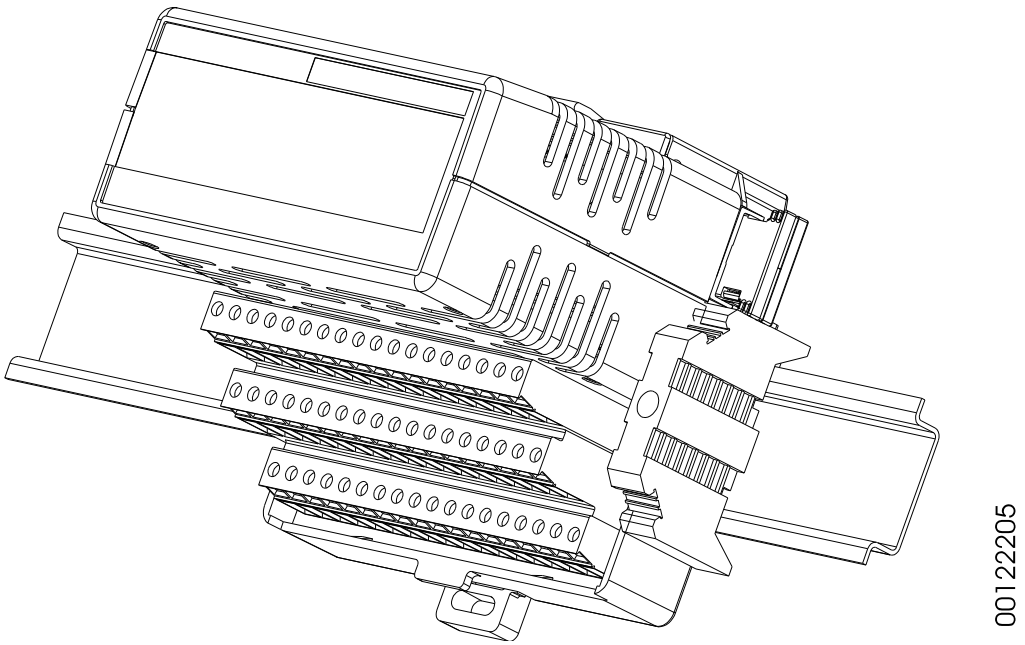

Figure 6-8 Lock Assembly

Module 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 6-10).

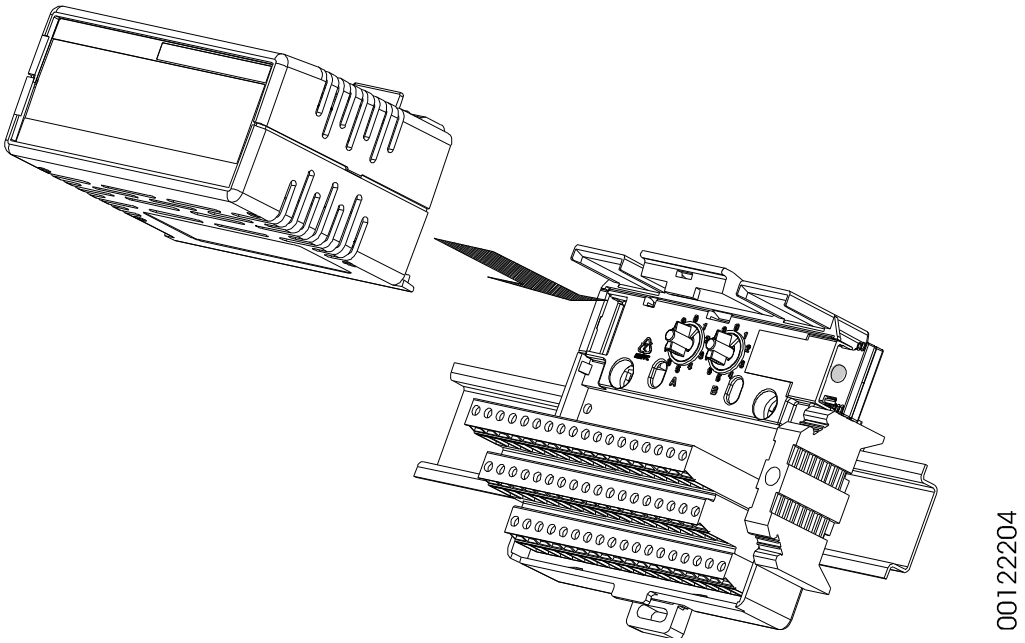

Figure 6-9 Module Insertion

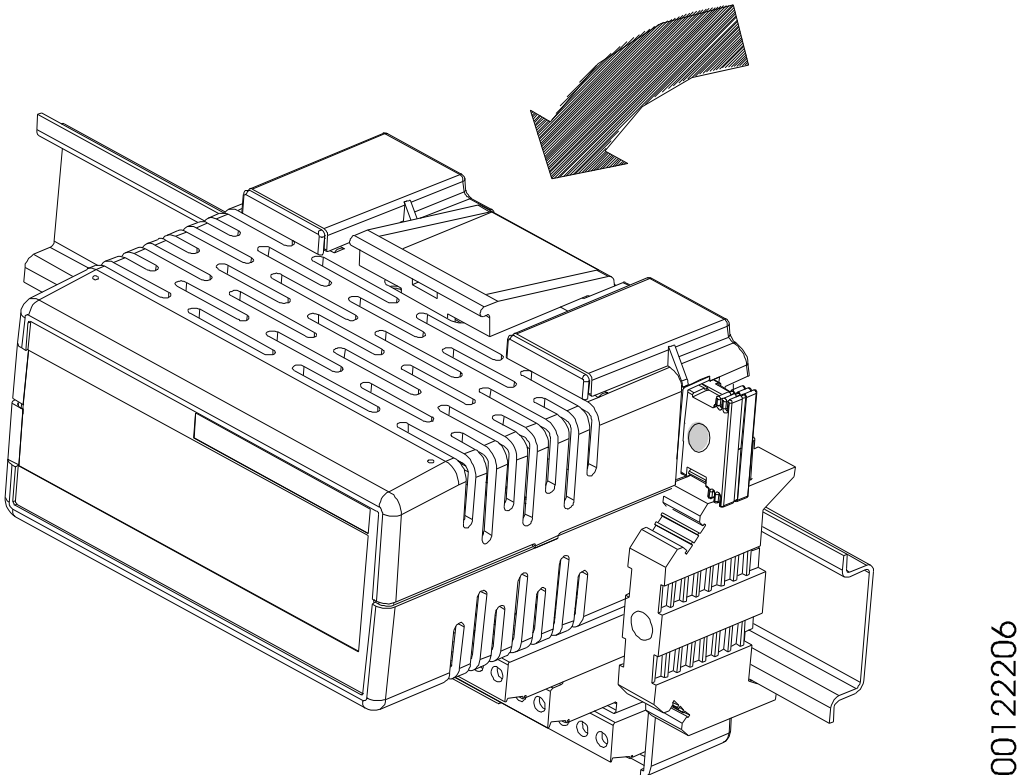

Figure 6-10 Module Fixation

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

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

Inserting the Modules' Labels

The modules labels can be printed with the I/O tags. The labels come in a pre-perforated paper sheet for ink jet printers. Follow the printing instructions described on the ProPonto software Utilization Manual.

You may also hand write the labels.

The labels go into the pocket on the module left side. The module front panel has transparent windows that allow seeing the labels. Check Figure 6-11.

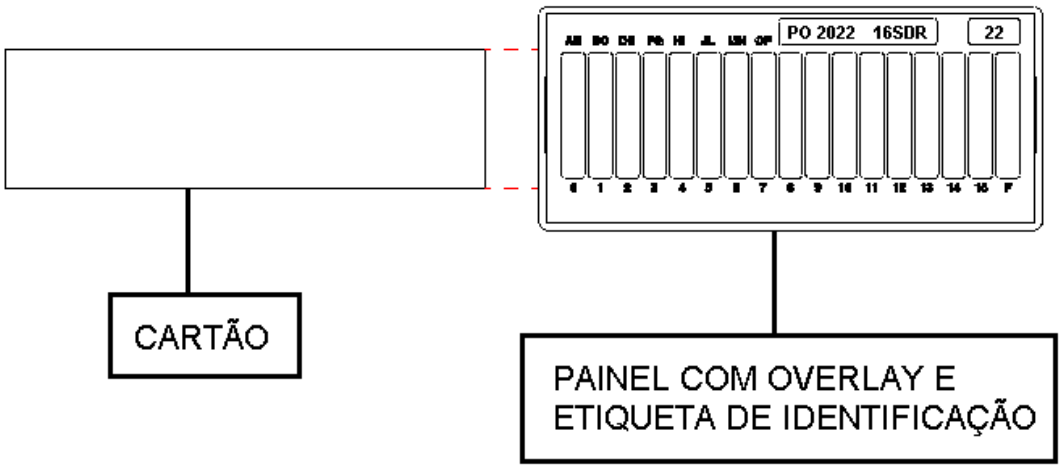

Figure 6-11 Labels Insertion

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

DANGER:
Be sure the panel general power is SHUT DOWN before installing any equipment in the panel.

Spring Terminal Block

This kind of terminal block has a fixation system based on a high reliability spring, even in environments subject to vibrations (Figure 6-14). Use the PO8523 tool to assemble it (Figure 6-13). This terminal block facilitates the installation of electrical cables. This terminal block maximum current is 12 A per I/O, on the other hand such current is limited according to the maximum current specified by the used module.

ATTENTION:
Terminals must be used in the wires, with length A = 8 mm to ensure effective contact (Figure 6-12). The terminal must be crimped in a hexagonal shape. One example of crimping tool is “Crimpfox 6H” of the manufacturer Phoenix Contact.

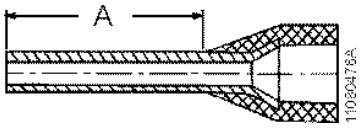

Figure 6-12 Terminal

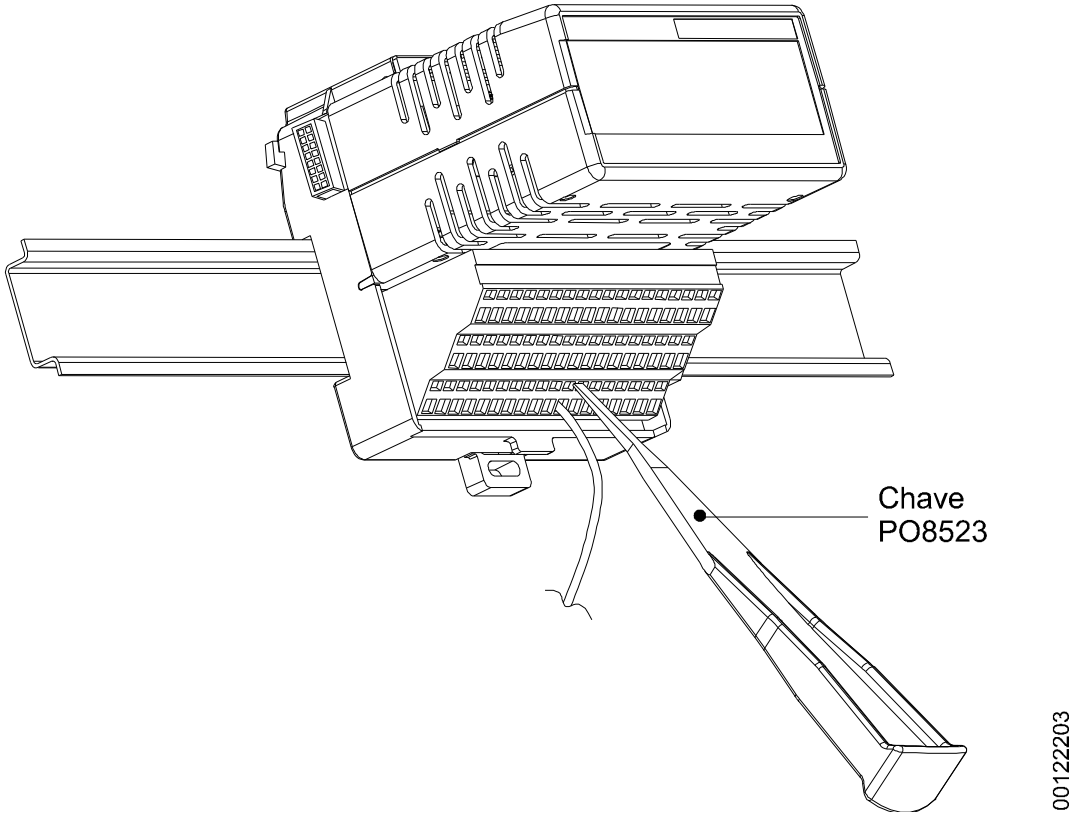

Figure 6-13 Spring Terminal Block

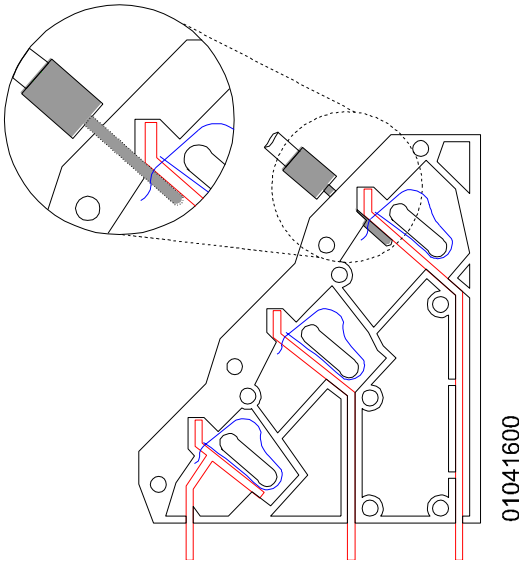

Figure 6-14 Spring Terminal Block

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 Block

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 I/O, on the other hand such current is limited according 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. 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

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

Check all the system fuses. Before powering the system up, 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, it might cause 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. 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, Altus' PROFITool and MT8500. All the configuration software required information may be found on the GSD file. This file is available at Altus' website, www.altus.com.br.

ATTENTION: Check the Technical Characteristics (CE) or the module Utilization Manual (MU) in order to identify the configurable parameters, their options and descriptions.

Diagnostics

The Ponto Series extensive diagnostics capabilities facilitate the modules' maintenance.

Check the Diagnostics item at the module CE for further information.

System Set Up

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

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

We recommend testing individually each I/O:

- If the field I/O is actuating the module I/O 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

7.Maintenance

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

Module Diagnostics

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

Diagnostics LEDs

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

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

When the module is working normally, the DG LED remains always on. The abnormal states 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.

ATTENTION: Consult the module Technical Characteristics (CE) and Utilization Manual (MU) in order to identify the cause and solution for each LED diagnostics indication.

Diagnostics Words

The modules operating status are also available through the diagnostics words using tools such as MasterTool and supervisory systems, or using the module's serial channel.

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

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

ATTENTION: Consult the module Technical Characteristics (CE) and the Utilization Manual (MU) in order to identify the diagnostics words addresses as well as the solution for their problems.

Hot Swap

The I/O modules hot swap is required for many control systems. It allows the replacement of I/O 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 diagnose and the remaining modules keep working normally
- The system generates a missing module diagnose and the remaining modules are shutting down

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

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

Below is the description of the hot swap procedure:

1. Release the lock that holds the module to the base.

2. Remove the module pulling it out firmly.

3. Insert the new module, pushing it perpendicularly towards the base, in a single and continuous movement.

4. Check if the lock that holds the module is totally connected to the module; otherwise, push it towards to the module.

5. Check the operating state of the new module by observing the status of DG LED. If this LED is turned off or blinking 1X, it indicates the existence of at least one of the following problems:

- the procedure described on item 3 was nor performed correctly, and it should be done again;
- the new module is damaged;
- the module base is damaged;
- the module is not declared on the application;

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 7-1.

7. Install the new base according to the instructions from Base Assembly.

8. Connect the wiring to the base.

9. Re-install the conduit cover.

10. Reinstall the modules.

11. Power the system up.

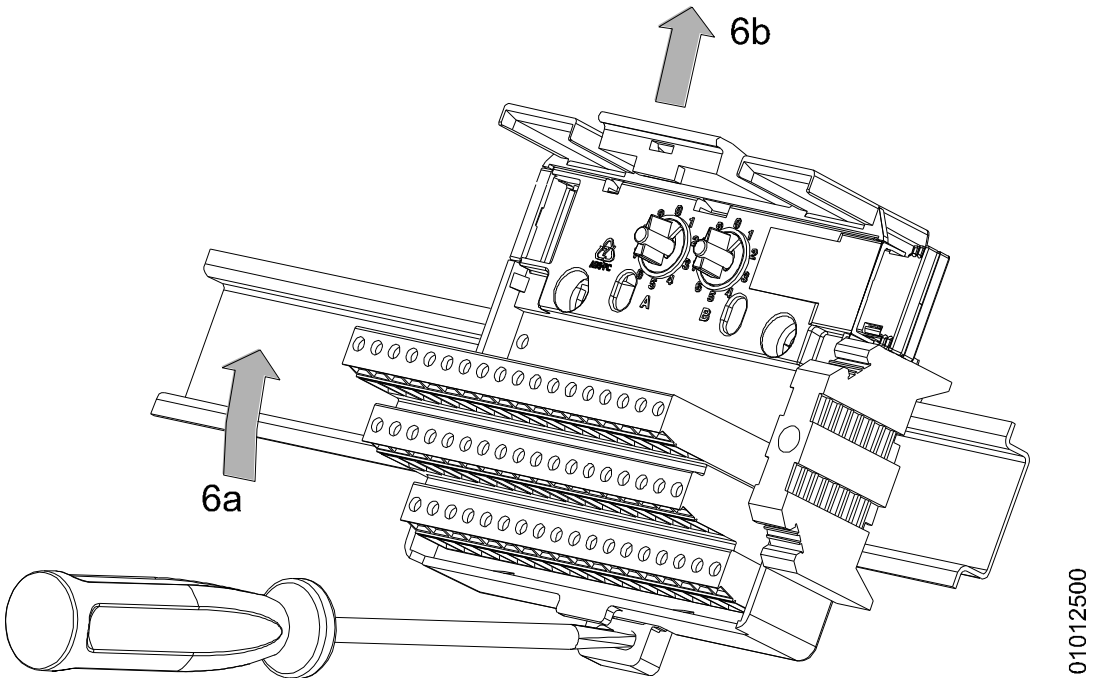

Figure 7-1 Removal of the Base from the Rail

Preventive Maintenance

- It should be verified every year if the interconnection cables are firmly connected, without dust, especially 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

8. Glossary

Application Program	Program downloaded into the PLC and has the instructions that define how the machinery or process will work.
Arrestor	Lightning protection device using inert gases.
Bit	Basic information unit, it may be at 1 or 0 logic level.
Bus	Set of I/O Modules connected to a CPU or Fieldbus head
Bus Expander	Module that connects one segment to another.
Bus Segment	Part of a bus. A local or remote bus may divide in up to four bus segments.
Bus termination	Module that must be connected to the last module in a bus.
Byte	Information unit composed by eight bits.
Commissioning	Final verification of a control system, when the application programs of all CPUs and remote stations are executed together, after been developed and verified individually.
CPU	Central Processing Unit. It controls the data flow, interprets and executes the program instructions as well as monitors the system devices.
Diagnostic	Procedures to detect and isolate failures. It also relates to the data set used for such tasks, and serves for analysis and correction or problems.
DIN Rail	Metallic element with standardized shape according to the DIN50032 standard. It is also called TS35 rail.
Expansion cable	Cable that connects bus expanders
Field cabling	Cables connecting sensors, actuators and other process devices to the Ponto Series I/O modules terminal bases.
Fieldbus Head	Slave module of a Fieldbus (field network). It is responsible for the exchange of data between the modules and the Fieldbus master.
Fieldbus Interface	Master module for the Fieldbus, located in the local bus and performing the communication with the Fieldbus heads.
Hardware	Physical equipment used to process data where normally programs (software) are executed
Hot swap	Procedure of replacing modules in a system without powering it off. It is a normal procedure for I/O modules.
I/O	See Input/Output.
I/O Module	Hardware module that is part of the Input/Output (I/O) subsystem.
IEC 61131	Generic international standard for operation and use of programmable controllers.
Input/Output	Also known as I/O. Data input or output devices in a system. In PLCs these are typically the digital or analog modules that monitor or actuate the devices controlled by the system.
Interface	Normally used to refer to a device that adapts electrically or logically the transferring of signals between two equipments.
Jumpers	Small connector to shortcut pins located on a circuit board. Used to set addresses or configuration.
LED	Light Emitting Diode. Type of semiconductor diode that emits light when energized. It's used for visual feedback.
Local Bus	Set of I/O Modules connected to a CPU.
MasterTool	The Altus Windows® based programming software that allows application software development for PLCs from the Ponto, Grano, Piccolo, AL-2000, AL-3000 and Quarks series. Throughout this manual, this software is referred by its code or as MasterTool Programming.
Mechanical Switch Code	Two decimal digits defined by the base terminal programmable mechanical switches with the goal of blocking the assembly of incompatible modules. Thus avoiding potential damage caused by assembly and/or maintenance operations.
Module (hardware)	Basic element of a system with very specific functionality. It's normally connected to the system by connectors and may be easily replaced.
Module address	Address used by the CPU in order to access a specific I/O module.
PLC	See Programmable Controller.
Programmable Controller	Also know as PLC. Equipment controlling a system under the command of an application program. It is composed of a CPU, a power supply and I/O modules.
RAM	Random Access Memory. Memory where all the addresses may be accessed directly and in random order at the same speed. It is volatile, in other words, its content is erased when powered off, unless there is a battery to keep its contents.
Remote Bus	Set of I/O Modules connected to the Fieldbus head.
Software	Computer programs, procedures and rules related to the operation of a data processing system
Supervisory Station	Equipment connected to a PLC network with the goal of monitoring and controlling the process variables
Tag	Name associated to an operand or to logic that identifies its content.

Terminal Base	Component where the I/O modules, CPUs, power supplies and remaining Ponto Series modules are inserted. Connection to bus signals and field signals are made through the terminal base.
Varistor	Protection device against voltage spikes.
Word	Information unit composed by 16 bits.