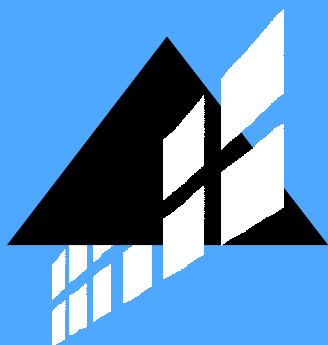


PO5063 Profibus Head Utilization Manual

Rev. Preliminary 3/2002

Code: MU219503



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Summary

<u>PREFACE</u>	1
<hr/>	
<u>MANUAL DESCRIPTION</u>	1
<u>PONTO SERIES DOCUMENTATION</u>	2
<u>TERMINOLOGY</u>	3
<u>UTILIZED CONVENTIONS</u>	4
<u>TECHNICAL SUPPORT</u>	5
<u>MANUAL REVISIONS</u>	6
<u>INTRODUCTION</u>	7
<hr/>	
<u>THE PONTO SERIES™</u>	7
<u>PROFIBUS</u>	8
<u>PO5063</u>	9
<u>TECHNICAL DESCRIPTION</u>	10
<hr/>	
<u>PRODUCT PACKAGING</u>	13
<u>PRODUCT CODE</u>	13
<u>RELATED PRODUCTS</u>	13
<u>NOTES</u>	13
<u>MT6000 –MASTER TOOL PRO PONTO</u>	14
<u>GSD FILES</u>	15
<u>BLOCKS DIAGRAM</u>	15
<u>MICROPROCESSOR</u>	15
<u>GBL MASTER</u>	15
<u>PROFIBUS</u>	16
<u>FLASH</u>	16
<u>RAM</u>	16
<u>POWER SUPPLY</u>	16
<u>GSD FILE</u>	17
<u>RESPONSE TIME FOR THE PROFIBUS HEAD</u>	18
<u>RESPONSE TIME CALCULATION EXAMPLE</u>	20
<u>INSTALLATION</u>	21
<hr/>	
<u>MECHANICAL INSTALLATION</u>	21
<u>PONTO BUS AND TERMINATION</u>	21
<u>ELECTRICAL INSTALLATION</u>	22
<u>24 VDC POWER SUPPLY</u>	22
<u>NETWORK INSTALLATION</u>	23
<u>PROFIBUS NETWORK</u>	23
<u>ADDRESS SWITCHES</u>	23
<u>PROFIBUS TERMINATION SWITCH</u>	24
<u>CONFIGURATION</u>	25

<u>PROFIBUS HEAD</u>	25
<u>STEP 1</u>	25
<u>STEP 2</u>	28
<u>STEP 3</u>	28
<u>STEP 4</u>	28
<u>STEP 5</u>	30
<u>STEP 6</u>	30
<u>STEP 7</u>	33
<u>PROFIBUS HEAD WITH AL-2000</u>	34
<u>PROFIBUS HEAD WITH QUARK CPUS</u>	36
<u>PROFIBUS HEAD WITH OTHER CPUS</u>	37
<u>PROFIBUS HEAD WITH MICROCOMPUTER</u>	38
<u>PARAMETERIZATION</u>	39
<u>BUS CONFIGURATION</u>	39
<u>MODULES ORDER</u>	39
<u>PO9999 – RESERVE MODULE</u>	40
<u>PO7078 – BUS EXPANDER</u>	40
<u>PO9098 – VIRTUAL MODULE TO USE WITH MMIs</u>	40
<u>MODULES PARAMETERIZATION</u>	42
<u>HEAD PARAMETERS</u>	42
<u>MODULES PARAMETERS</u>	44
<u>PARAMETERS BYTES ASSEMBLY</u>	46
<u>MMI CONFIGURATION</u>	49
<u>UTILIZATION EXAMPLE</u>	50
<u>USING THE FOTON SERIES</u>	51
<u>MAINTENANCE</u>	53
<u>MOST COMMON PROBLEMS</u>	53
<u>DIAGNOSES LEDS</u>	54
<u>OPERATING STATUS</u>	55
<u>ON LINE STATUS DIAGNOSES</u>	55
<u>OFF LINE STATUS DIAGNOSES</u>	56
<u>ERROR STATUS DIAGNOSIS</u>	56
<u>DIAGNOSES MESSAGES</u>	57
<u>HEAD DIAGNOSES</u>	57
<u>MODULES DIAGNOSES</u>	59
<u>PROFIBUS HEAD STATUS</u>	59
<u>HEAD PARAMETERS</u>	59
<u>PROFIBUS DIAGNOSIS</u>	60
<u>STANDARD DIAGNOSIS</u>	60
<u>EXTENDED DIAGNOSIS</u>	61
<u>DIAGNOSIS RELATED TO THE DIVIDE</u>	62
<u>DIAGNOSIS RELATED TO THE MODULE</u>	62
<u>DIAGNOSIS RELATED TO THE CHANNEL</u>	63
<u>PROFIBUS HEAD EXTENDED DIAGNOSIS</u>	64

<u>DIAGNOSIS VIA SERIAL</u>	68
<u>DIAGNOSIS OPERANDS</u>	68
<u>SYSTEM DIAGNOSIS</u>	69
<u>MODULES DIAGNOSIS</u>	69
<u>ADDENDUM A - GLOSSARY</u>	71
<u>ACRONYMS</u>	76

Preface

Following we describe this document contents, conventions, as well as a list of manuals for products related to the PROFIBUS field head.

Manual Description

This manual describes the PO5063 - PROFIBUS Field Network Head – that connects the Ponto Series to a PROFIBUS network.

Chapter 1, **Introduction**, describes the PROFIBUS head main features.

Chapter 2, **Technical Description**, describes the PROFIBUS head.

Chapter 3, **Installation**, describes the installation of the PO5063 interface to the Ponto bus and to the PROFIBUS network.

Chapter 4, **Configuration**, describes the physical configuration for the PROFIBUS head and Ponto modules.

Chapter 5, **Parameterization**, describes how the PROFIBUS head is configured and parameterized by the network master device.

Chapter 6, **MMI Configuration**, describes how to configure the man machine interface (MMI) that may be used through the PROFIBUS head serial port.

Chapter 7, **Maintenance**, explains the maintenance, most common diagnoses and LEDs for the PROFIBUS Head.

Chapter 8, **PROFIBUS Diagnoses**, shows the format for the PROFIBUS network diagnosis register.

Chapter 9, **Diagnoses via Serial**, explains how to get diagnoses via serial and its format.

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

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 further information please consult following manuals:

- MU209000 – Ponto Series Utilization manual – IP20
- MU299026 – PROFIBUS Network Utilization manual
- CT109000 – Series General Characteristics
- CT109001 – PROFIBUS Head Configuration
- Technical Characteristics of each product
- MU209100 – PO3045 CPU Utilization Manual
- MU203028 - MasterTool MT4100 Utilization Manual
- MU203026 - ProfiTool - AL3865 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-PCtm or compatible computers using Windowstm. 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”.
- **Browser:** interface to see HTML pages via the HTTP protocol.

Other expressions may be found on addendum A, **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

E-MAIL: 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: 11/03/2002
Approval:	
Author: Leonel Poltosi	

Notes:

Initial manual revision

Introduction

The Ponto Series™

The Ponto Series is a set of modules, intelligent interfaces and CPUs that compose a distributed control system. It is based on flexible architecture that allows access to remote modules via different 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.



Figure 1-1 The Ponto Series™

PROFIBUS

The field networks have been growing a lot as a communication means between automation systems and field devices. When comparing to the conventional technology, the field networks has proven to reduce in average 40% of costs in installation, configuration and maintenance.

The field networks only need a pair of wires to transmit control and supervision information. Such information may be input or output status, parameters, diagnoses, programs or even power for the field devices.

The field networks have been in the market for a long time. The initial versions were vendor proprietary and incompatible among them, thus incurring in high costs for configuration or interconnection of different equipment. The new networks are based on open standards, thus eliminating the need for complex interfaces. The open systems allow the user to choose the best solution for each application based on a wide varied of products.

PROFIBUS is the leading field network in the industrial automation arena. It covers applications such manufacturing, process control and building automation.

PROFIBUS is a open field network based on a European standard but with international acceptance and usage. It is defined by the norm EN 50170.

PO5063



Figure 1-2 PO5063

The PROFIBUS PO5063 Field Network Head belongs to the Ponto Series Remote Inputs/Outputs. The PROFIBUS head may connect up to 20 Ponto modules to a PROFIBUS-DP network.

The figure 1-3 shows the Ponto Series modules connection to the PROFIBUS network through the head. In this example the network master is a QK801 PLC with a QK1405 interface.

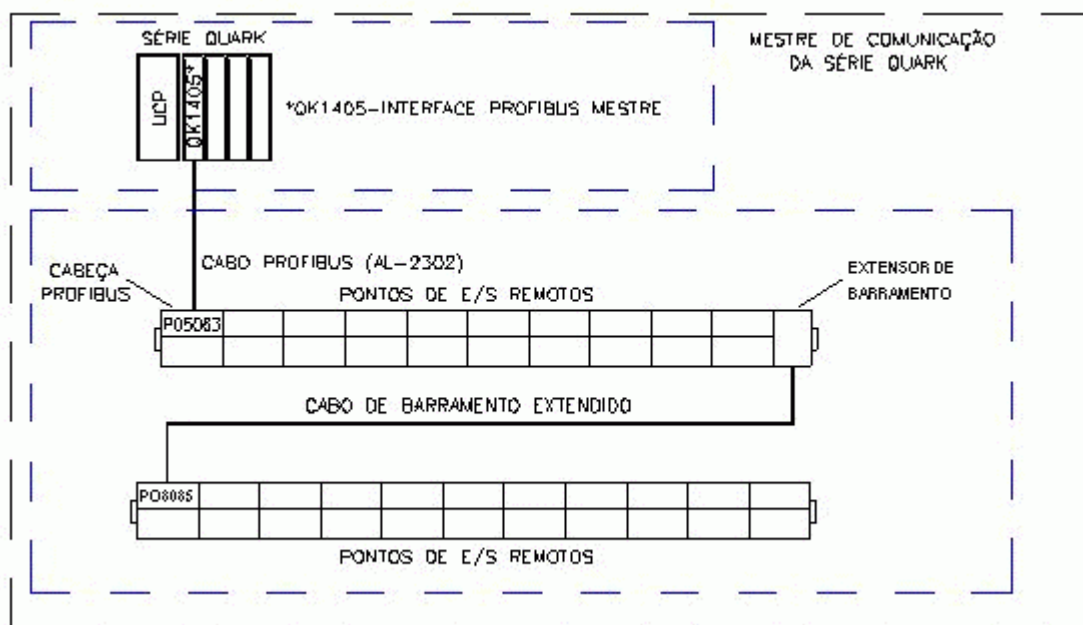


Figure 1-3 Ponto Series in the PROFIBUS Network

Technical Description

The PROFIBUS Field Head controls and connects to the PROFIBUS-DP network up to 20 IO modules from the Ponto Series. The table 2-1 shows the module characteristics.

	PO5063
Module type	PROFIBUS-DP field network head
Communication protocol	PROFIBUS-DP, norm EN50170
Maximum number of digital IOs	320 with 16 IO modules 640 with 32 IO modules
Maximum number of modules	20
Maximum number of segments	4
Inputs capacity	200 bytes
Outputs capacity	200 bytes
Baud rate	Baud rate automatic detection 9.6 to 12000 Kbit/s
Terminal blocks configuration with PO6500 bases	1 block with 3 inputs for power (+ Vdc, 0 Vdc, GND). 1 block with 3 inputs for PROFIBUS-DP network input (+ , - , GND) 1 block with 3 inputs for PROFIBUS-DP network output (+ , - , GND) 1 connector RJ45 for local supervision or MMI
Terminal blocks configuration with PO6504 bases	1 borne block with 3 inputs for power (+ Vdc, 0 Vdc, GND). 1 connector DB9 for PROFIBUS network 1 connector RJ45 for local supervision or MMI
Diagnosis indication	LED DG multifunctional with indication for Ok module, no configuration, module with diagnosis, forcing on output modules or internal bus error
Status indication	LEDs OL, LC and ER
Hot swap	Yes for IO modules Yes for PO5063 module with external power on
Protections	Fuse on the base power supply
External power supply	19 to 30 Vdc including ripple max consumption 620 mA @ 24 Vdc with fifteen IO modules
Isolation	
External power supply for logic	1500 Vac per 1 minute
Power consumption	4,5 W @ 24 Vdc with fifteen IO modules
Maximum operating temperature	60 °C
Dimensions	99 x 49 x 81 mm
Supervision interface	RS232 in RJ45 – AL-1715 cable to interconnect through RS232 IBM-PC standard
Communication protocol to the supervision interface	ALNET I V 2.0
Norms	PROFIBUS norm, European EN 50170 IEC 61131 CE Please see Series general characteristics
Compatible bases	PO6500: PROFIBUS / MODBUS field network head base PO6504: PROFIBUS, DB9 field network head base

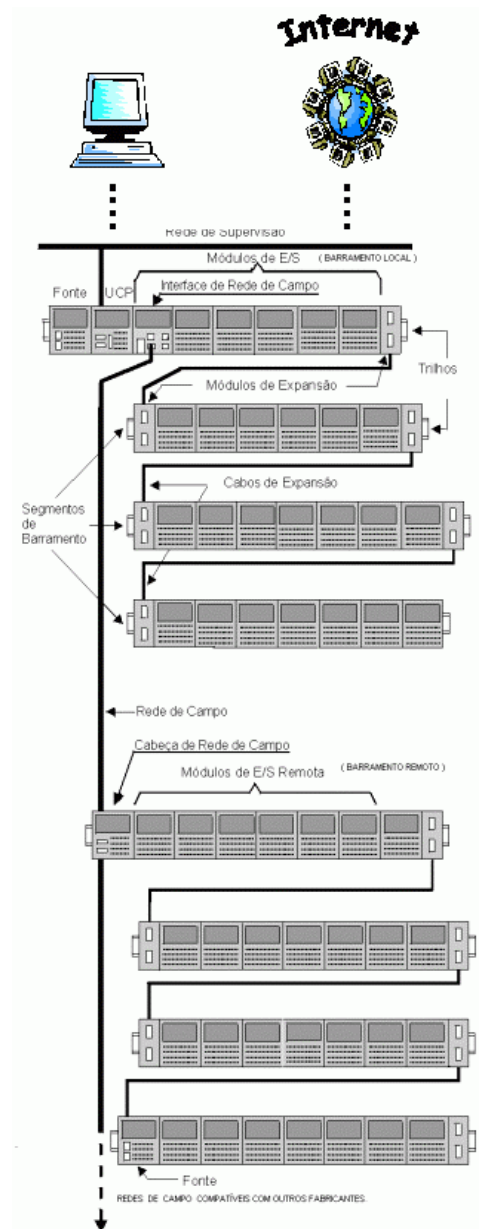
Table 2-1 PROFIBUS Head characteristics

The PROFIBUS head connects to the Altus CPUs QK801, QK2000/MSP, AL-2002/MSP or AL-2003 with the QK1405 master PROFIBUS Interface, or to any PROFIBUS master accordingly to the EN 50170 norm.

The network master configures and parameterizes the PROFIBUS head through its specific configuration program. The ProfiTool is the configuration program for the Altus PLCs. The head GSD file generates the configuration and contains the information for all the Ponto Series IO modules (please see chapter 5, **Parameterization**).

The modules send the diagnoses to the head that forwards to the network master. This will help the user to install and utilize the network (please see chapter 5, **Parameterization**). The PROFIBUS head frontal panel LEDs help recognizing the main head and diagnosis status (see chapter 7, **Maintenance**).

The PROFIBUS head has a power supply fed by an external 24 VDC. The power supply feeds the head and at most twelve Ponto Series modules distributed in up to two segments. Such a limit may be exceeded when using the MT6000- MasterTool ProPonto software because it calculates the exact current consumption for each module.



F
i
g

Figure 2-1 Ponto Series Architecture

You should start a new segment when the maximum number of modules is exceeded. The PO8085 should occupy the first position on the new segment (instead of the PO7078 Bus Expander – please consult the Ponto Series Utilization Manual).

In order to reduce electrical interferences, there is a 1500 VAC isolation between the PROFIBUS network input and the system ground.

The connection of the PROFIBUS head to the network is done through the PO6500 base terminal blocks. The network cable should be connected to any of the two terminal blocks with three available connections. If a derivation to another remote bus is required, then please the other output terminal block (please see chapter 3, **Installation**). The head base has a termination that must be on if the head is in the last PROFIBUS network physical position. The base also contains two hexadecimal switches in order to configure the PROFIBUS network head address.

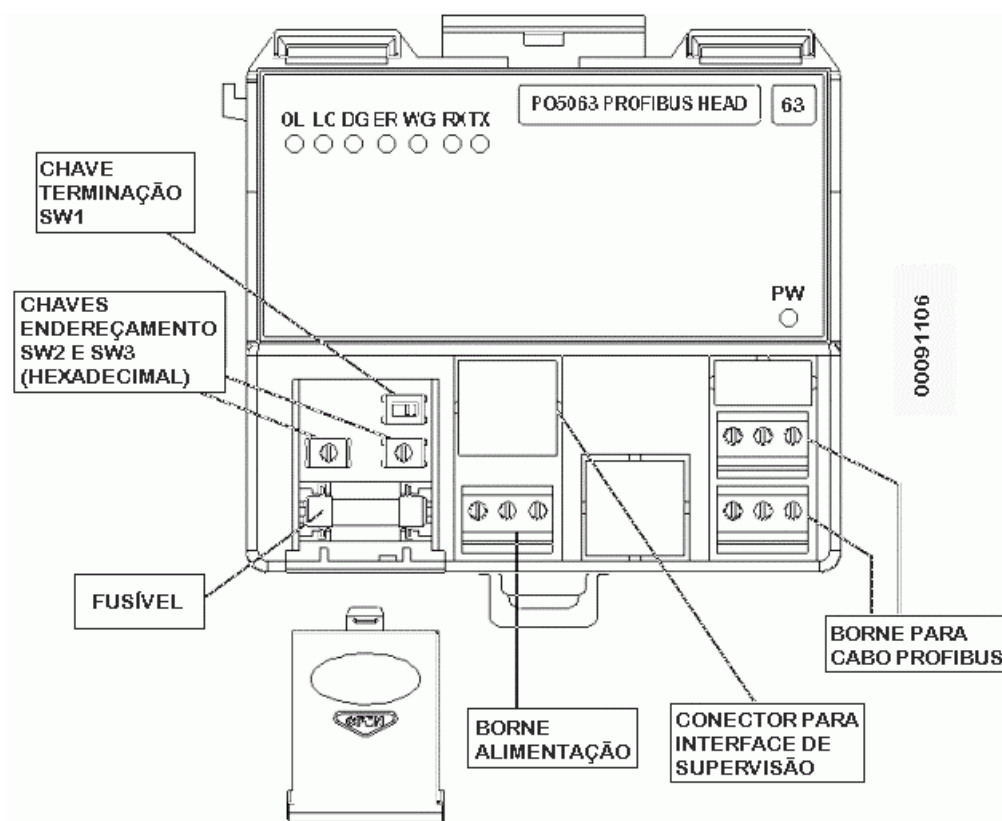


Figure 2-2 PO6500 Base Connections

Product Packaging

The product package contains:

- PO5063 Module
- Installation Guide

Product Code

Please use following product code when ordering the product:

Code	Descriptions
PO5063	PROFIBUS-DP Field Network Head

Related Products

Depending on your system requirements, the following products might be ordered along with the PO5063. Please check with your sales representative if you have any questions.

Code	Description
PO6500	PROFIBUS Head Base, Modbus
PO6504	PROFIBUS Head Base with DB9 connector
PO8085	24 VDC Power Supply
AL-2601	Deriver connector, for PROFIBUS network
AL-2602	Terminator connector, for PROFIBUS network
AL-2303	PROFIBUS network cable, diameter 7.1 mm
AL-1715	RJ45-CFDB9 cable
AL-1719	RJ45-CMDB9 RS232 cable
AL-1720	RJ45-CMDB9 RS232 / RS485 cable
MT6000	MasterTool ProPonto
PO8510	10 Sheets with 14 labels of 14 tags for printer

Table 2-2 PROFIBUS Head Related Products

Notes

PO6500: this base has terminal blocks to connect to the PROFIBUS cable, thus eliminating the need for DB9 connector from AL2601 and AL2602 type.

PO6504: this base has a Type DB9 PROFIBUS connector, thus requiring the AL2601 or AL2602 connectors.

AL-1715: this cable has a RJ45 serial connector and a DB9 RS232 female IBM/PC standard. It may be used for:

- Interconnection of MMIs with IBM/PC standard connectors for local supervision
- Interconnection to a IBM/PC compatible computer with supervision software
- Interconnection to a IBM/PC compatible computer with MasterTool for monitoring and local forcing.

AL-1719: this cable has a RJ45 serial connector and a DB9 RS232 male with Altus standard pins. It may be used for:

- Interconnection to a MMI type Foton 5 or Foton 10

AL-1720: this cable has a RJ45 serial connector and a DB9 RS232/ RS485 male with Altus standard pins. It may be used for:

- Interconnection to a MMI type Foton 1

MT6000 –MasterTool ProPonto

The MasterTool ProPonto software is designed to configure the Ponto Series modules. The software is not required for configuration of a PROFIBUS head, on the other hand it offers many functions that facilitates the system project:

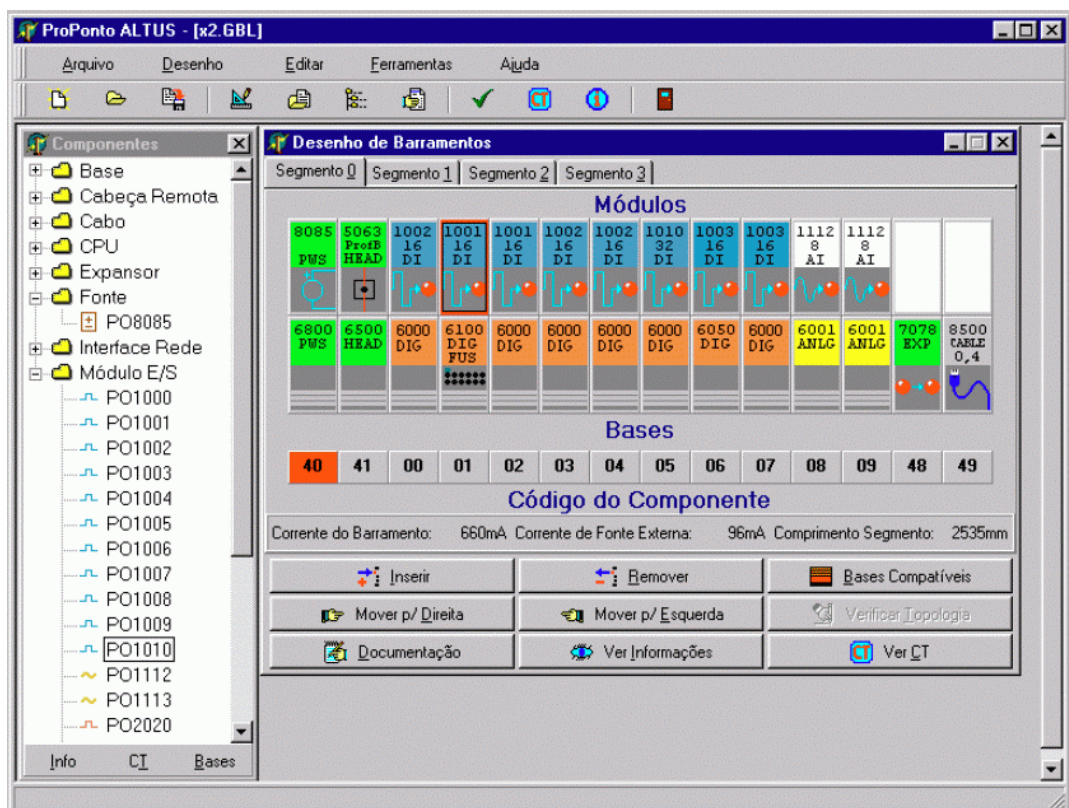


Figure 2-3 MasterTool ProPonto Screen shot

- Project and bus visualization in a graphical format
- Verifies the configuration validation, checking items like: consumption, compatible bases and project limits
- Tags attribution for system IOs. Labels generation for module identification
- Bill of materials

The software runs on Windows 32 bits.

GSD Files

The files ALT_059A.GSD and ALT_059A.GSP are available at <http://www.altus.com.br> or along with the MasterTool ProPonto software.

The image files *.DIB also belong to the GSD files. These files help identify the PROFIBUS slave when building the network.

Blocks Diagram

The PROFIBUS head has one microprocessor and two intelligent controllers: the first executes the interface protocol to the Ponto bus; the second executes the PROFIBUS-DP slave protocol functions. The microprocessor administers the data transfer.

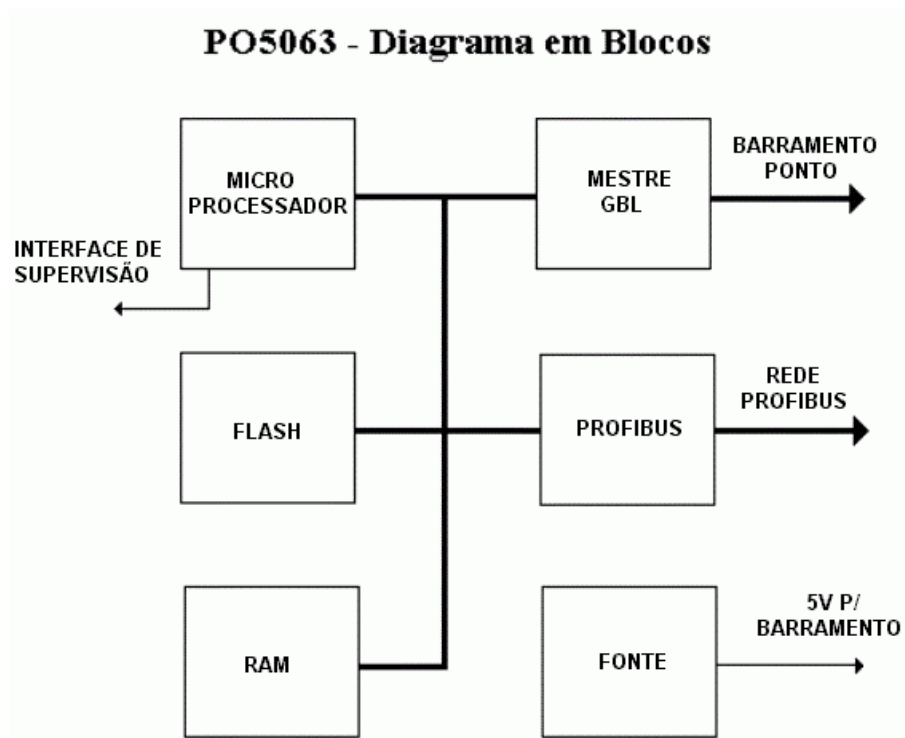


Figure 2-4 PROFIBUS head block diagram

Microprocessor

The PROFIBUS head microprocessor controls the Ponto bus modules and implements the communication protocol to the PROFIBUS network.

The MasterTool uses the supervision interface for monitoring and forcing the bus IOs and diagnoses reading.

GBL Master

The Ponto bus master controller - GBL Master – is responsible for polling and bus control. The master interfaces with the microprocessor through a double port memory that works as a Ponto bus mirror.

PROFIBUS

The PROFIBUS interface implements the protocol levels 1 and 2 including the opto coupled isolated interface.

The PROFIBUS interface comes embedded with a network termination that is activated by a switch on the PROFIBUS head base (please see chapter 3, **Installation**).

FLASH

The FLASH memory stores the software that runs on the microprocessor. Such software is pre-recorded by Altus.

RAM

The RAM memory stores the PROFIBUS inputs and outputs data, programmed configuration, parameters and internal control variables. This memory is volatile the information is erased when the power supply is shut down.

Power Supply

The power supply converts the input of +24VDC into +5VDC for the internal head logic and local bus. It has the following characteristics:

- Filtering circuits for electrical noise;
- Missing power sensor circuit: detects when power reaches safe limits and then generates signals for the proper board operation;
- Protections:
- Short circuit with current limit;
- Failure on power supply sensor circuit that alerts the processor before power runs out.

GSD File

Every PROFIBUS-DP device has a file that defines its limits and configuration possibilities. Altus provides the files ALT_059A.GSD and ALT_059A.GSP that carry the needed definitions to include the module into a PROFIBUS-DP network. The file ALT_059A.GSP is generated using the Portuguese language. Also related to the GSD files, there are three image files (*.DIB) that help identifying the slave during the PROFIBUS buildup network in the master configurator.

The files ALT_059A.GSD, ALT_059A.GSP, PO5063_S.DIB, PO5063_R.DIB and PO5063_D.DIB are available at <http://www.altus.com.br> and also come along with the MasterTool ProPonto software.

The GSD files facilitate the interoperability among PROFIBUS devices from different manufacturers. Those files have the device's characteristics that must be taking into consideration for its correct operation, like number and type of IO modules, diagnoses messages, bus parameters, baud rates and time out.

The GSD files must be utilized when configuring the network master, through a special program – Configurator. The Configurator imports the file and then asks the user to choose the modules as shown on figure 2-4.

Altus provides the ProfiTool in order to configure its PLCs.

Please consult the PROFIBUS Network Utilization Manual for further information about GSD files.

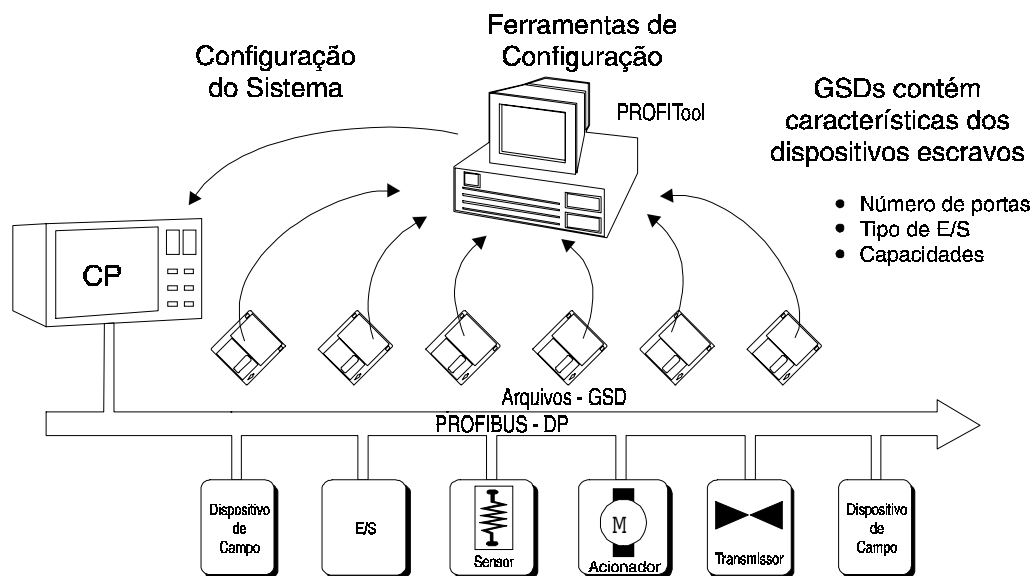


Figure 2-5 Configuration through the GSD files

Response Time for the PROFIBUS Head

The response time is the time between the detection of an input change until the respective output responds.

The response time in a remote IO system depends on the internal delays of the network connecting to the master and the network controller program processing time.

The figure 2-5 shows the main components of the response time. Many of those components are polling operations. The polling adds a statistical factor because the response time in such system may take one or two interactions.

In order to calculate the maximum response time we will suppose it takes two interactions in each system.

General Formula:

Response Time =

Delay time for input module +
 n X Ponto bus polling cycle +
 inputs processing time
 2 X polling cycle for PROFIBUS network +
 2 X execution time for application program +
 2 X polling cycle for PROFIBUS network +
 outputs processing time
 n X Ponto bus polling cycle +
 delay time for output module

$n = \text{number of polls to access module} + 1.$

Components analysis:

Input and output modules delays: this time depends on the IO module and it is specified on their respective Technical Characteristics.

Ponto Bus Polling: the Ponto bus polls the modules in sequential order in a way that each module is accessed once each polling. Among the Ponto modules, there are some that are read in one poll and others that are read in more than one poll.

Example:

Input Type	Number of Inputs	Number of Channels	Number of polls	Access time
Digital	16		1	16μs
Digital	32		2	16μs
Analog		8	9	16μs
Block			1	73μs

Table 2-3 Ponto modules examples

The digital modules are read in one or two polls. The analog modules are read one channel per poll and another poll for parameterization. The block type modules transfer the data in one poll.

The Ponto bus poll time is the sum of the time to access each module.

The time to access a module may take one or more polls. For example, one digital module may be accessed in one or at most in two polls. A analog module with 8 channels is accessed in pools.

Example:

Bus with 5 modules and 16 inputs, two analog modules with 8 inputs and one block module:

$$T_v = 5 \times 16 + 2 \times 16 + 1 \times 73 = 185 \mu s$$

Maximum accessing times:

$$16 \text{ input modules: } 2 \times 185 = 370 \mu s$$

$$8 \text{ channels modules: } 9 \times 185 = 1665 \mu s$$

Minimum accessing times:

$$16 \text{ input modules: } 1 \times 185 = 185 \mu s$$

$$8 \text{ channels modules: } 9 \times 185 = 1665 \mu s$$

Inputs and Outputs Processing: the executive software of the PROFIBUS head processes the inputs and outputs. The process manages the inputs in the Ponto bus double-port memory, preparing the transmission buffers for the PROFIBUS network. The processing of outputs takes the reverse route.

Following is the formula to calculate this time:

Inputs:

$$T_e = T1 + n \times T2$$

being

$$T1 = 250 \mu s$$

$$T2 = 18 \mu s$$

n = total number of input octets

(The analog channels use 2 octets each).

Outputs:

$$T_s = T3 + m \times T4$$

being

$$T3 = 250 \mu s$$

$$T4 = 18 \mu s$$

m = total number of output octets

(The analog channels use 2 octets each).

PROFIBUS Polling and Application: the polling time for the PROFIBUS network must be evaluated by the network master. The polling time is function of the number of octets configured in the network.

The program processing time for the network master must be computed, including the application execution time and the master operating system.

Response Time Calculation Example

Being:

Application time for the master: 50 ms

PROFIBUS network polling time: 2 ms

Inputs and outputs processing time: 50 μ s

Input module delay time: 150 μ s

Output module delay time: 10 μ s

Ponto bus polling time: 185 μ s

Number of polls to access input module: 2

Number of polls to access output module: 1

Then:

$$TR_{\max} = 150 + 3 \times 185 + 50 + 2 \times 2000 + 2 \times 50000 + 2 \times 2000 + 50 + 2 \times 185 + 10$$

$$TR_{\max} = 105,0 \text{ ms}$$

Installation

This chapter features the procedures for the physical installation of PROFIBUS Head.

Mechanical Installation

Please consult the **Ponto Series Utilization Manual** for description about assembling the head and other modules that are part of the PROFIBUS remote.

The PO5063 head is assembled on DIN TS35 rails along with the Ponto Series IO modules. The base PO6500 or PO6504 (acquired separately) must be utilized along with the PROFIBUS head. The base connects the head to the PROFIBUS network, to the 24VDC power supply and to the Ponto Series modules.

Ponto Bus and Termination

The bus connection follows the Ponto Series Utilization Manual.

The Ponto bus has two terminations. The first one is at the head base and is always connected. The second one must be connected to the physical end of the Ponto bus.

The second termination comes along with the PO6500 base and it allows a normal bus operation. This termination must be removed from the base compartment and put on the last bus base (last base of the last segment). The termination must have the red mark on the front, as show on figure 3-1.

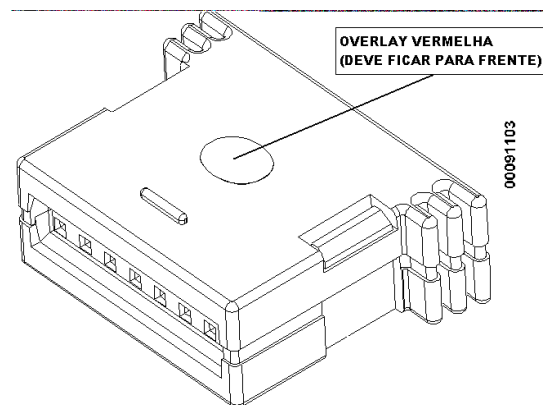


Figure 3-1 Ponto Bus Termination

Electrical Installation

24 VDC Power Supply

A 24VDC power supply (19 to 30VDC including ripple) feeds the head through the 3 connector terminal block, on the frontal panel, as shown on figure 3-2. The grounding cable connection is required.

The PROFIBUS head has a 2^A fuse in the base.

Please shut down the 24VDC power supply when connection the power cables or replacing fuses.

The following diagram shows the 24VDC power supply wiring and the PROFIBUS network cable with the PO5063 module on the PO6500 base.

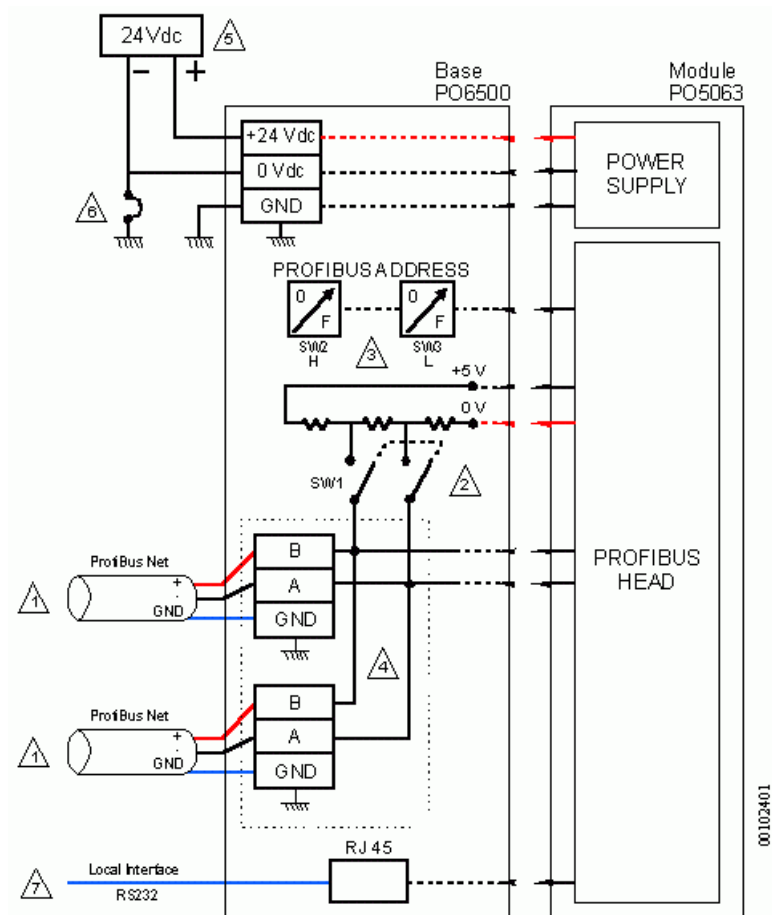


Figure 3-2 Connection Diagram of the PO5063 Module and the PO6500 Base

- 1 – The PROFIBUS network cables are directly connected to the terminal blocks identified by B and A and the shielding at GND.
- 2 – When the network head is the last element of a PROFIBUS network, then please set SW1 switch to On. Such procedure will add termination resistors required by the network.
- 3 – Two hexadecimal switches program the PROFIBUS address for the PO5063 module.
- 4 – The PO6500 base has terminal blocks to directly connect to the PROFIBUS cable and incorporates the impedance compensation circuit. Thus it will not need the AL-2601 and AL-2602 special connectors.

- 5 – The 24VDC power supply connects to the terminal blocks identified by " + 24 VDC ", " 0 VDC " and to " GND " grounding.
- 6 – The power supply common point to the modules powering (0V) may be connected to the electrical panel ground. This connection is not required but it is recommended in order to reduce electrical noise interference.
- 7- The RJ45-RS232 standard interface may connect a local MMI.

Network Installation

PROFIBUS Network

Please consult the PROFIBUS Network Utilization Manual for further details on the PROFIBUS network, cable type, connectors, speed and distances.

The PROFIBUS network is connected to the head base through three terminal blocks. The network cable that gets to the base must be connected to the first terminal block, while the cable that leaves the base is connected to the second one, as shown on figure 3-2 and 3-3.

The terminal blocks pins are:

Block	Signal
B	TxD/RxD-P
A	TxD/RxD -N
G	Cable shielding
B	TxD/RxD-P
A	TxD/RxD -N
G	Cable shielding

Table 3-1 PROFIBUS Terminal Block Pins

Address Switches

The head base has two address hexadecimal switches. The switches must be set to the desired PROFIBUS addresses (from 1 one 125). The first switch (SW2) programs the number for the most significant nibble (0 to 7) and the second one (SW3) program the least significant nibble (1 to 15).

The address follows the formula:

$$\text{Address} = \text{SW2} * 16 + \text{SW3}$$

Where: SW2: 0 to 7

SW3: 0 to 15 (0 to F in hexadecimal)

The address switches positions are shown on figure 3-3.

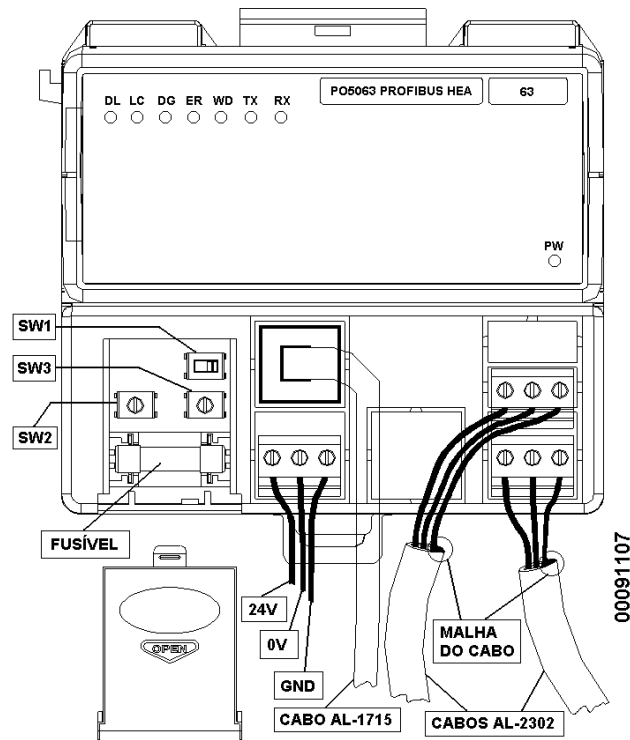


Figure 3-3 Powering connection and PROFIBUS cable

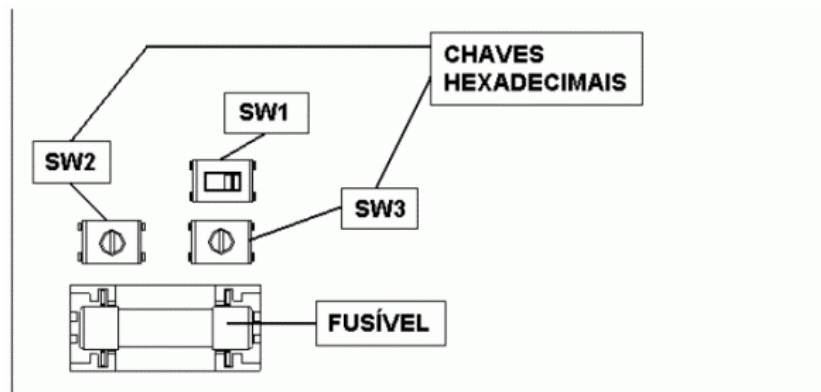


Figure 3-4 Termination Switches (SW1) and Address (SW2 e SW3)

PROFIBUS Termination Switch

The SW1 switch the the head base activates the PROFIBUS termination. The termination is required when the base head is at the physical ends of the network. In such cases, the SW1-1 and SW1-2 switches must be set to On. If the base is in a intermediate position please set the switches to Off.

The termination switch position is shown on figure 3-3 and 3-4.

Configuration

This chapter covers how to define the required products to build a remote IO system with PROFIBUS-DP protocol.

The MT6000 MasterTool ProPonto facilitates the configuration and also guarantees that all specifications will be met. It also provides a complete bill of materials to put the system together and finally it may print the tag labels for the IOs.

PROFIBUS Head

The table 4-10 shows some Ponto Series IO modules and the basic information required for the configuration steps 1 and 2.

Module	Description	Compatible Bases	Number of Bytes for Input Data	Number of Bytes for Output Data
PO1010	32 DI 24 VDC Opto	PO6000	4	-
PO1112	8 AI Isolated Universal	PO6001-PO6101	16	-
PO2020	16 DO 24VDC Isolated	PO6002	-	2
PO2022	16 DO Relay	PO6000-PO6002-PO6100-PO6102	-	2

Table 4-1 Ponto Bases

Please follow these steps when configuring a remote IO system:

Step 1

Determine the required input and output modules. You must consider:

- Number of needed IOs in the PROFIBUS head in light of the controlled process
- Grouping the inputs accordingly to their characteristics: dry contact outputs, isolated analog signals, etc
- Choosing the modules types
- Determine the number of each type module to cover needed IOs
- Verify the PROFIBUS head capacity based on following values:
 - Maximum number of real modules: 20.
 - Maximum number of virtual modules: 7 of each type.
 - Total number of declared modules: 32
 - Maximum number of bytes to be transmitted to the network: 200 input bytes and 200 output bytes.

Example 1:

IO number: 76 AI, 153 DI 24VDC, 59 DO.

Input characteristics: analog inputs with common and isolation.

- Digital inputs with common and isolation.
- Dry contact digital outputs.

Modules selection:

- PO1112 - 8 EA Universal Isolated
- PO1010 - 32 ED 24Vdc Opto
- PO2022 - 16 DO relay

Determine the number of modules:

- 10 PO1112 modules
- 5 PO1010 modules
- 4 PO2022 modules

Check the maximum number of modules per head:

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	10	16 E	160 (= 10 x 16)	-
PO1010	5	4 E	20 (= 5 x 4)	-
PO2022	4	2 S	-	8 (= 4 x 2)
TOTAL	19 ✓		180 ✓	8 ✓

Table 4-2 Maximum Number of Modules for Example 1

(*) This data is available in the ALT_059A.GSD file.

Conclusion: ✓ This configuration is Ok because it complies with the specifications of maximum number of modules and data bytes.

Example 2:

IO number: 76 AI, 153 DI 24VDC, 59 DO.

Input characteristics: analog inputs with common and isolation.

- Digital inputs with common and isolation.
- Transistor digital outputs.

Modules selection:

- PO1112 - 8 EA Universal Isolated
- PO1010 - 32 ED 24Vdc Opto
- PO2020 - 16 DO 24VDC Opto

Determine the number of modules:

- 4 PO1112 modules
- 3 PO1010 modules
- 3 PO2020 modules

Check the maximum number of modules per head:

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	4	16 E	64 (= 4 x 16)	-
PO1010	3	4 E	12 (= 3 x 4)	-
PO2020	3	2 S	-	6 (= 3 x 2)
TOTALS	10 ✓		76 ✓	6 ✓

Table 4-3 Maximum Number of Modules for Example 2

(*) This data is available in the ALT_059A.GSD file.

Conclusion: ✓ This configuration is Ok because it complies with the specifications of maximum number of modules and data bytes.

Example 3:

IO number: 112 AI, 68 DI 24VDC, 15 DO.

Input characteristics: analog inputs with common and isolation.

- Digital inputs with common and isolation.
- Dry contact digital outputs.

Modules selection:

- PO1112 - 8 EA Universal Isolated
- PO1010 - 32 ED 24Vdc Opto
- PO2022 - 16 DO relay

Determine the number of modules:

- 14 PO1112 modules
- 3 PO1010 modules
- 1 PO2022 modules

Check the maximum number of modules per head:

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	14	16 E	224 (= 14 x 16)	-
PO1010	3	4 E	12 (= 3 x 4)	-
PO2022	1	2 S	-	2 (= 1 x 2)
TOTALS	19 ✓		236 ✗	2 ✓

Table 4-4 Maximum Number of Modules for Example 3

(*) This data is available in the ALT_059A.GSD file.

Conclusion : ✗ This configuration is not Ok because it does not comply with the total number of data bytes requirement. The IOs should be redistributed in other nearby heads.

Step 2

Determine the required bases for the IO modules.

Please check the Technical Characteristics (TCs) for each specific module selected. The Ponto Series have a wide selection of bases allowing many different module configurations.

For instance: dry contact output with common, fused protected outputs, protection fuses for sensors powering, spring and screw terminal blocks, etc.

The table 4-4 shows the options.

	Compatible Bases Types
PO1010 – 32 DI 24 VDC Opto	PO6000
PO1112 – 8 AI Universal Isolated	PO6001, PO6101
PO2020 – 16 DO 24 VDC Transistor Opto	PO6002
PO2022 – 16 DO Relay	PO6000, PO6002, PO6100, PO6102

Table 4-5 Bases Selection

Step 3

Determine the head and its base.

For the PROFIBUS-DP head, the head is the PO5063 module and the PO6500 is the respective base.

Step 4

Determine the number of bus segments. Please consider:

Maximum number of segments per head: 4

Maximum number of modules per segment: 10

Physical distribution within the panel.

These factors allow more than one configuration for the number of segments. Always use the smallest number of segments, but depending the available physical space you may use a bigger number of segments.

Example 1:

Possible configurations for a head with 19 IO modules.

Segment 0 with 10 modules and segment 1 with 9.

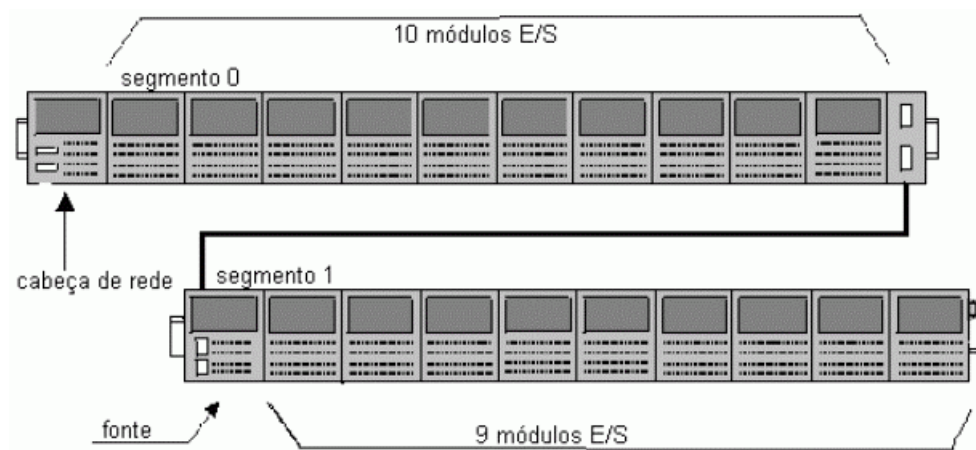


Figure 4-1 Example 1 with 2 segments

Segment 0 with 5 modules, segment 1 with 7 and segment 2 with 7.

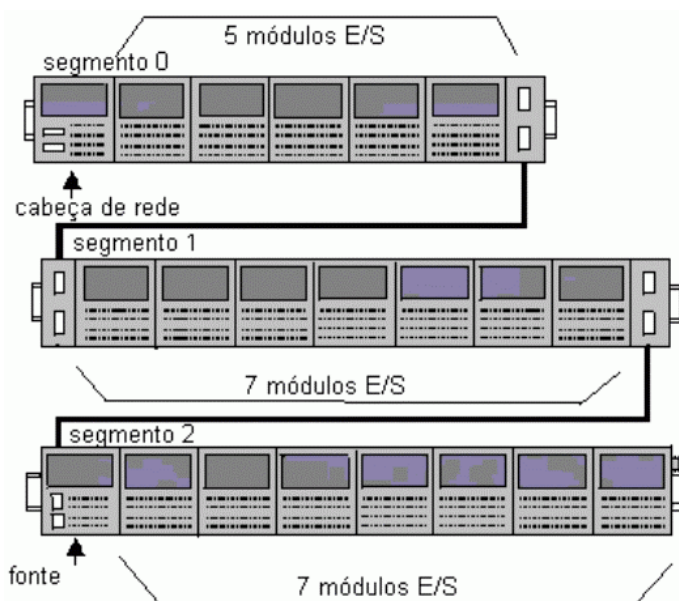


Figure 4-2 Example 1 with 3 segments

Example 2 :

Possible configurations with 10 IO modules.

Segment 0 with 5 modules and segment 1 with 5.

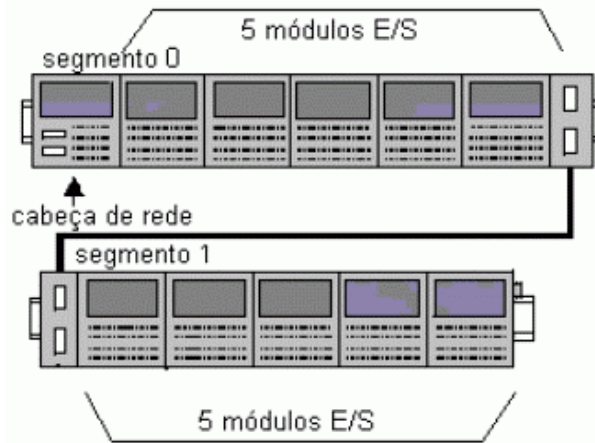


Figure 4-3 Example 2 with 2 segments

Segment 0 with 10 modules.

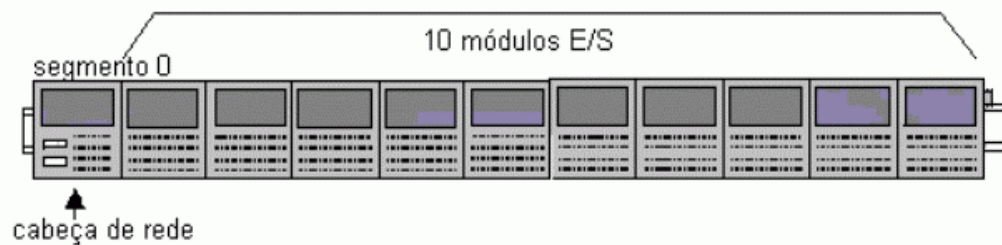


Figure 4-4 Example 2 with 1 segment

Note:

It is important to use the Ponto Series modular dimensions advantages to position the elements in a way to optimize the distribution on the rails.

Step 5

Determine the number of power supplies.

The PROFIBUS head or additional PO8085 power supplies feed the segments. Following is the rule to define the number of power supplies:

One power supply may feed at most 12 modules and at most 2 bus segments.

Examples :

Please observe on the figure 4-1 that the first bus segment (0) is fed directly from the field network head. The next segment (1) is fed by a power supply located on the first bus position.

In the figure 4-2, the segments 0 and 1 are fed directly from the field network head because the total number of modules is 12. In the segment 2 there is a power supply located on the first bus position.

Step 6

Determine the PO7078 bus expander modules and expander cables.

The expander modules and their cables connects the bus segments. Their position is directly related to the modules addresses, the communication logic bus and the power supply.

The following rules define the number and position for expander modules:

Each segment end needs a expander module and a PO8500 cable (0.4 meters) or PO8501 (1.4 meters). The last bus segment does not need the expander module.

Each segment beginning needs a expander module, except the ones beginning with a head or power supply.

The expander cable length depends on the panel assemble segments distribution. When defining such distribution, please be sure the expander cables will not be by the signal cables, thus avoiding electrical noises interference.

Examples:

The figure 4-1 shows the segment 0 with a expander module at its end; a expander cable and a power supply at the beginning of the segment 1. The PO8085 power supply feeds the modules in its bus and also has a base connector compatible with the expander module.

The figure 4-2 shows the expander modules assembled at the end and beginning of the segment, except the segments 0 and 2 that have a head and a power supply. Please observe there is no expander module after the last module on the segment 2. This position must have a bus terminator instead.

Attention :

It is important during the configuration phase to respect the correct bus segment assembly order. On the figure 4-1 and 4-2 the segment beginning is at the left side. That is where the bus head, power supply or expander module should be installed and connected to the previous segment. Such information will define what bus expander cable should be used.

The figures 4-5 to 4-8 show 2 correct ways and 2 incorrect ways to lay out the modules:

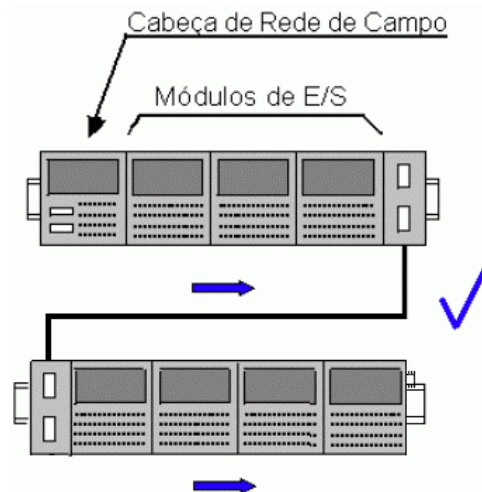


Figure 4-5 Correct Modules Distribution

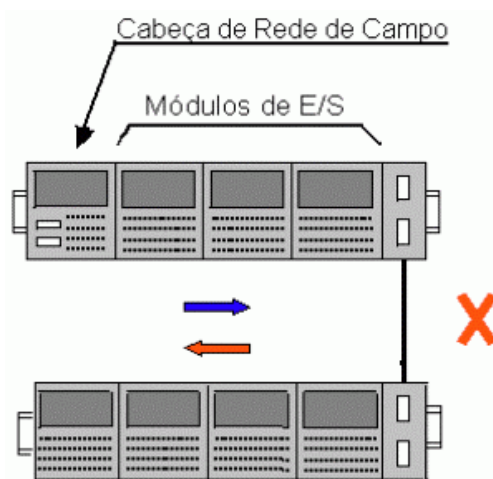


Figure 4-6 Incorrect Modules Distribution

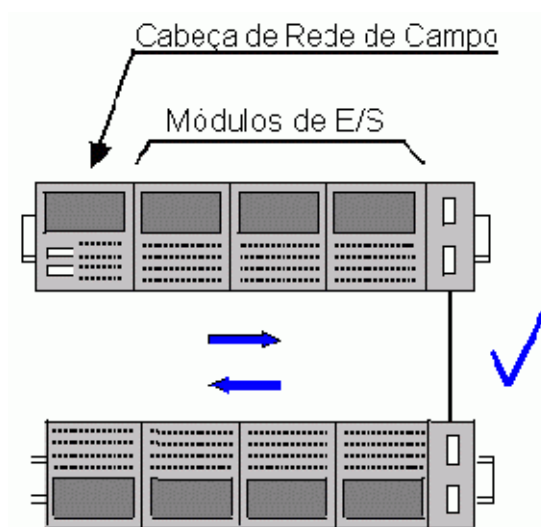


Figure 4-7 Correct Modules Distribution

Please observe the figure 4-7 has the modules inverted on the second bus. For such case the configuration is Ok.

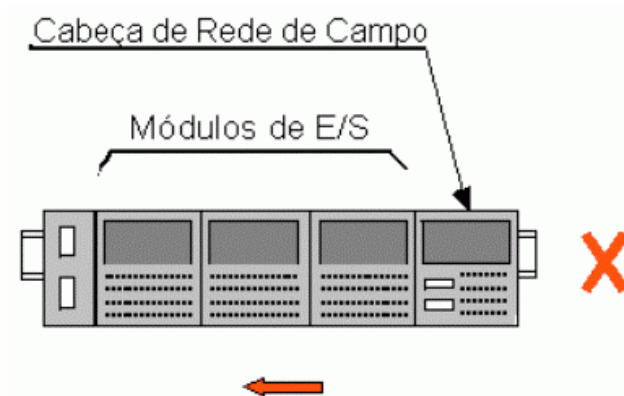


Figure 4-8 Incorrect Modules Distribution

Step 7

Power supply.

Define the 24 VDC external power supply current capacity in function of the loads :

- Field Network Head
- PO8085 power supply (defined on step 5).
- Modules with external 24VDC power.
- Input signals.
- Output signals.

We recommend to use a separated power supply to feed the field sensors (inputs and outputs). This will increase the system reliability in case of field short-circuits.

Please consider the following values:

	Operating Conditions	Current consumption @ 24 Vdc
PROFIBUS Head	Powering 12 IO modules	0,7 A
PO8085 Power Supply	Powering 12 IO modules	0,3 A
16 DO Relay PO2022	With all outputs on	0,19 A
8 AI Isolated PO1112	Normal operation	0,09 A

Table 4-6 Modules Consumption

For this application please use the following power supply:

	Power	Output
AL 1518	90 to 265 VAC	24 VDC - 5A

Table 4-7 24 VDC Power Supply

Other values may be calculated based on the IO signal configuration.

PROFIBUS Head with AL-2000

Ponto Series PROFIBUS Heads may be connected to the AL-2000 CPU Series accordingly to the figure 4-9. The Quark Series bridges the communication. This is an alternative for large systems configuration or to expand current systems.

Please use the components listed on the table 4-7 to implement such configuration. Also please check the AL-2000 Series Utilization Manual.

AL-2000 Series CPU	AL-2002 or AL-2003
Power Supply	AL-3511 or AL-3512
Rack	AL-3630, AL-3632 or AL-3634
Bus Interface	AL-3411
Local IO modules	Check Series characteristics to define IO
Supplementary Power Supply	QK2511 or QK2512
AL-3411 cable	AL-1367
Rail	QK1500/4, QK1500/8, or QK1500/16
PROFIBUS master interface	QK1405
Flat cable	QK1304, QK1308, or QK1316
Network Cable PROFIBUS Type A	AL-2303
Terminator or split connector, for PROFIBUS network	AL-2601, AL-2602
ProfiTool Software	AL-3865

Table 4-8 QK CPU Modules

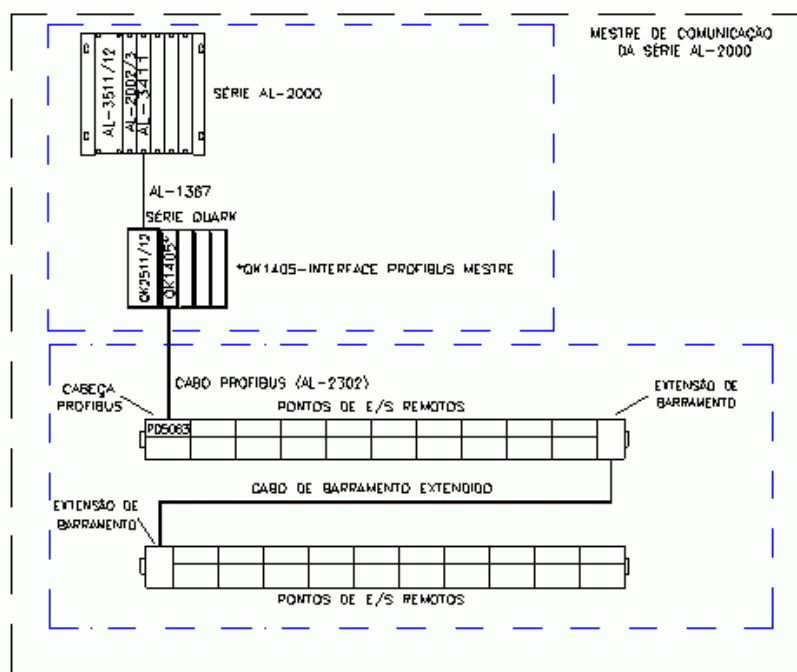


Figure 4-9 PROFIBUS Head with QK2000 PLC

ATTENTION:

Further details are available on the NAP 060 Application Notes - PROFIBUS-DP Network with Altus master and Ponto Series Head – at Altus website.

PROFIBUS Head with Quark CPUs

In this configuration, the Quark Series CPU communicates with one or more Ponto Series heads using a QK1405 module – PROFIBUS Master Interface.

Following are listed the available components for such implementation.

Please consult the Quark Series CPUs Utilization Manual.

Quark Series CPUs	QK800, QK801, or QK2000
Rail	QK1500/4, QK1500/8, or QK1500/16
Master PROFIBUS Interface	QK1405
Local IO Modules	Please check Series characteristics to define IOs
Flat cable	QK1304, QK1308, or QK1316
PROFIBUS Type A Network Cable	AL-2303
Terminator or split Connector for the PROFIBUS network	AL-2601, AL-2602
ProfiTool Software	AL-3865

Table 4-9 Quark Series Modules

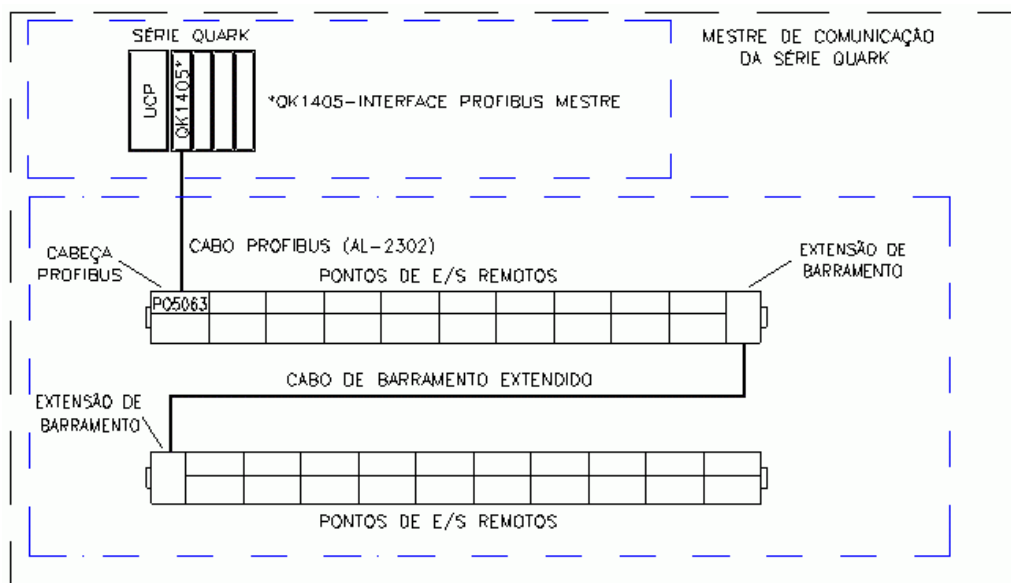


Figure 4-10 PROFIBUS Head connected to Quark Series

ATTENTION

Further details are available on the NAP 060 Application Notes - PROFIBUS-DP Network with Altus master and Ponto Series Head – at Altus website.

PROFIBUS Head with other CPUs

Other manufacturers master devices may connect to the Ponto Series, as long as they comply with the PROFIBUS-DP norm. The user must pay attention to required cables and connectors (see item 2.1). The figure 4-11 shows the schematic connection of one or more Ponto Series heads to another CPU (in this case a Siemens master).

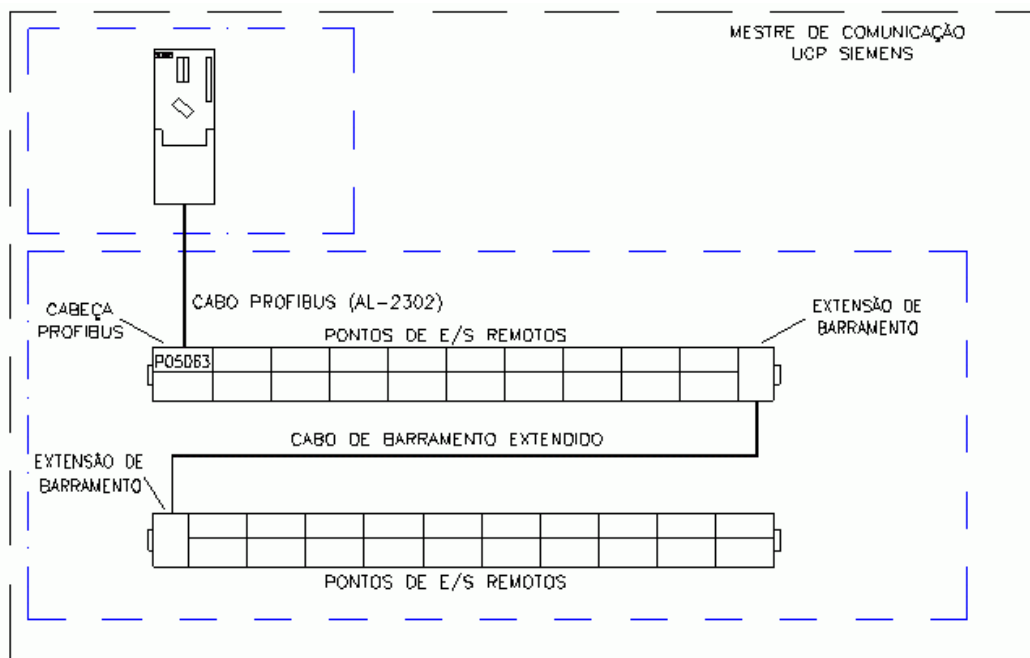


Figure 4-11 PROFIBUS Head connected to other PLCs

ATTENTION:

Further details are available on the NAP 050 Application Notes - PROFIBUS-DP Network with Siemens master and Ponto Series head – at Altus website.

PROFIBUS Head with Microcomputer

You may connect one or more heads to an IBM PC compatible. It will need a PCI PROFIBUS interface card. This configuration may be applied for small system based on PCs.

We recommend to use the Hilscher GmbH PROFIBUS master interface – manufacturer of equipment listed on table 4-9.

Please check Hilscher GmbH's site <http://www.hilscher.com> for further information.

	Application	Buffer in KBytes
CIF50 – PB	desktop (PCI)	7
CIF60 – PD	laptop (PCMCIA type2)	7
CIF30 – DPM	desktop (ISA)	1

Table 4-10 PROFIBUS boards for microcomputers

The provider also has a CIF_OPC communication driver compatible with Ladder programming or for supervision software.

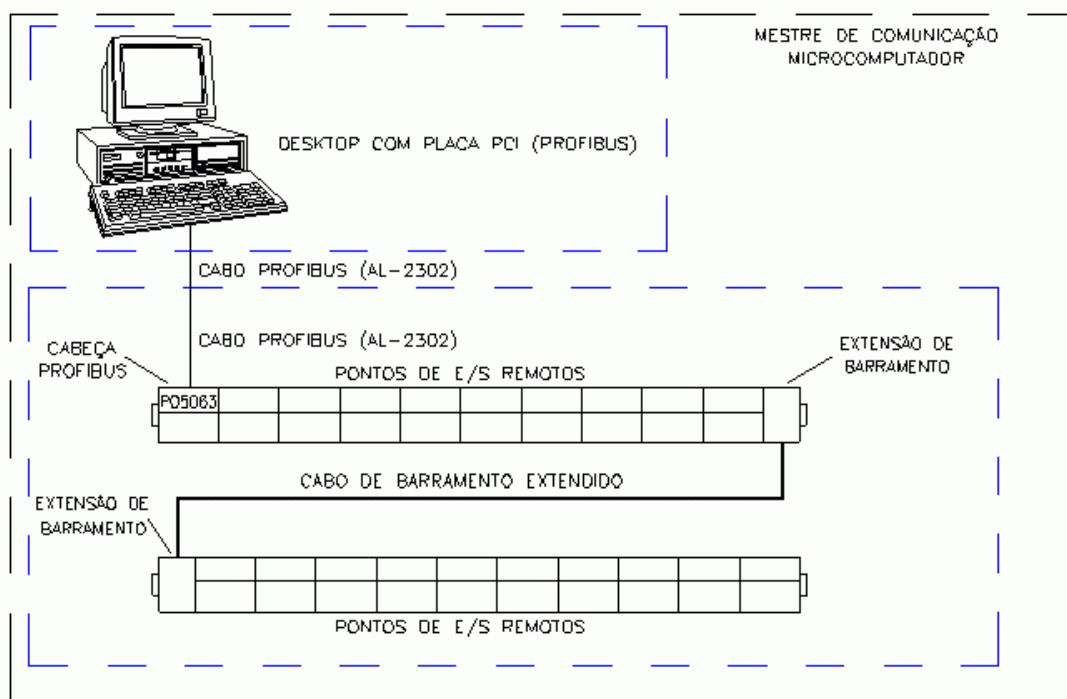


Figure 4-12 PROFIBUS Head connected to Microcomputer

Parameterization

Each PROFIBUS master has the parameters from its slaves. Such data comes from the GSD and is defined in the master programming software.

ATTENTION:

Each PROFIBUS master manufacturer provides the programming software and the slaves parameterization

This chapter shows what parameters defined in the master. We will use the ProfiTool software (QK1405 Altus PROFIBUS master) as an example.

The parameterization process takes two steps:

- Bus configuration
- Modules Parameterization

Bus Configuration

The modules are configured through the PROFIBUS head ALT_059A.GSD file and the master specific configuration. The GSD file has the type, geometry and parameterization of the Ponto Series modules.

The network master configuration tool does the bus configuration (the Altus master uses the ProfiTool software for such purpose as we are going to see in this chapter).

Modules Order

The configuration follows the Ponto bus modules **physical sequence**.

You should define, through the master configuration tool, the PROFIBUS head modules on the same sequence they are installed on the bus (see figure 5-1).

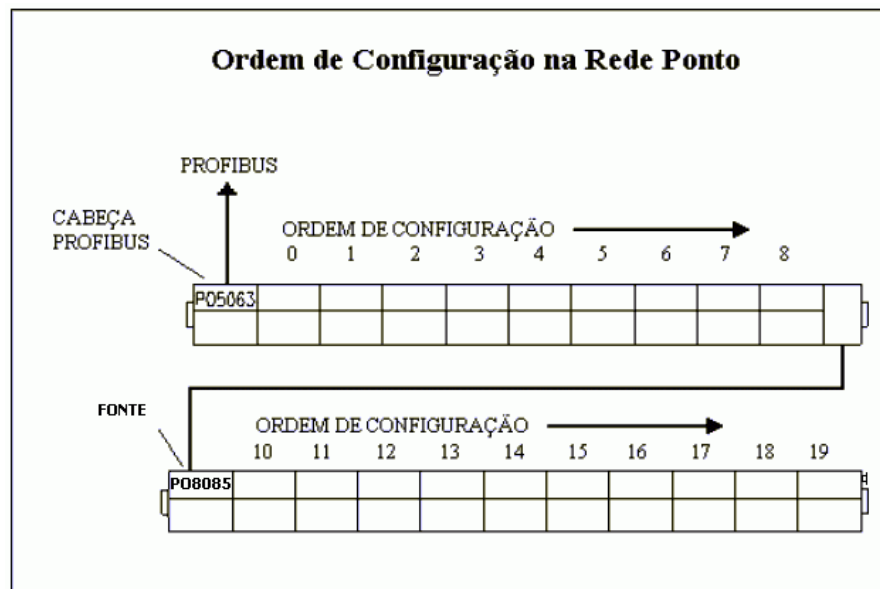


Figure 5-1 Configuration Order

After defining all the modules, you should attribute the address for each one. You must follow the network order that is going to be used by the master to read/write to the module.

The list may have IO and special modules. Please declare the special modules along with the IO ones but include the special characteristics:

PO9999 – Reserve module

PO7078 – Bus expander

PO9098 – Virtual module to use with MMIs

PO9999 – Reserve Module

With this module you may declare a position and/or address for future system expansion without needing to physically install the module.

Following are the available options:

- **PO9999 Dummy Module:** used for reserve base, this is a reserve module
- **PO9999 – 2 bytes Output:** reserve base and two output bytes in the network PROFIBUS addresses
- **PO9999 – 4 words Output:** reserve base and four output words (16 bits) in the network PROFIBUS addresses
- **PO9999 – 4 bytes Input:** reserve base and four input bytes in the network PROFIBUS addresses
- **PO9999 – 8 words Input:** reserve base and eight input words (16 bits) in the network PROFIBUS

The PO9999 modules reserve the configuration addresses for future modules. You should select them accordingly to the future module dimensions (input or output; two, four or eight; bytes or words).

When there is a physical module on the reserve module declared position the PROFIBUS head will not enable it and will signalize. Its behavior relates to the **System Set Up** parameter, seen in this chapter in the item **Modules Parameterization**.

PO7078 – Bus Expander

The Ponto Series bus is divided in **segments**. The PO7078 module - Bus Expander - gives logic continuity to a segment, and it also have to appear on the master configuration.

PO9098 –Virtual Module to use with MMIs

The PO9098 module does not represent a bus physical module. It allocates PROFIBUS network addresses for exchange of data between the master a MMI.

ATTENTION:
This module must be declared at the end of the bus.

Please see chapter 6 **MMI Configuration** for further information.

Example:

The figure 5-2 shows the result of a PROFIBUS head configuration with the modules described on the table 5-1.

Local	Bus Position	Module
Segment 0	0	PO2022
	1	PO2022
	2	PO2022
	3	PO9999 – 2 bytes Output
	4	PO2020
	5	PO7078
Segment 1	10	PO1112
	11	PO1112
	12	PO9999
	13	PO1010
	14	PO1010
Virtual Modules	-	PO9098 – 8 words OUT
	-	PO9098 – 8 words IN

Table 5-1 Configuration Example

In this example we used five positions in the 0 Ponto bus segment, leaving the position 3 reserved for future expansions (PO9999 – 2 bytes Output is a module that reserves one position with two output bytes, where there is a base with no module). The PO7078 ends the 0 segment. The remaining five modules are at the 1 segment.

Please observe the PO9999 reserve module, declared on the position 3, reserves a position with two output bytes addresses for future PO2022 modules expansions. The PO9999 reserve module, declared in the position 12, just reserves the base.

Even though there are two PO9098 virtual modules, they only serve as PROFIBUS addresses to exchange data between the master and a MMI.

End.	Slot	Ind.	Dispositivo	Módulo	Nome do	Tipo E	End. E	Tamar	Tipo S	End. S	Taman.
3	0	1	PO5063	PO2022 16DO NO Dry	Module1				QB	0	2
3	1	1		PO2022 16DO NO Dry	Module2				QB	2	2
3	2	1		PO2022 16DO NO Dry	Module3				QB	4	2
3	3	1		PO9999 - 2 bytes	Module4				QB	6	2
3	4	1		PO2020 16DO	Module5				QB	8	2
3	5	1		PO7078 Bus Extension	Module6						
3	6	1		PO1112 8AI Universal	Module7	Iw	0	8			
3	7	1		PO1112 8AI Universal	Module8	Iw	16	8			
3	8	1		PO9999 Dummy	Module9						
3	9	1		PO1010 32DI 24 Vdc	Module10	IB	32	4			
3	10	1		PO1010 32DI 24 Vdc	Module11	IB	36	4			
3	11	1		PO9098 - 8 words OUT	Module12				Qw	10	8
3	12	1		PO9098 - 8 words IN	Module13	Iw	40	8			

Figure 5-2 PROFIBUS Master Configuration

Modules Parameterization

The Ponto Series modules may require configuration parameters that define their operation. There are PROFIBUS head parameters and IO modules parameters.

The parameters are defined in the master configurator.

ATTENTION:

The parameterization menus in the programmers provide an easy interface to select the options. This is the case for the majority of the PROFIBUS master configuration software. But please see the item Parameter Bytes Assembly in this chapter if you need to build them.

Head Parameters

The PROFIBUS head has the following parameters:

- System Start Up
- Disable Outputs
- Diagnosis status
- Module activation delay

System Start Up

The PROFIBUS head may start up with three different configurations:

- Hot swap disabled

All the declared modules must be present on the bus.

When the PROFIBUS head detects a module status as:

- Not in the bus
- In a wrong position
- Not configured for current position
- Not declared for current bus
- Defect

Then it gets into an error status, disables the outputs and generates a diagnosis, see chapter 7 Maintenance.

- Hot swap enabled and with start up consistency

It checks if all the declared modules are present in the bus during the system start up.

The system start up happens the first time the PROFIBUS head gets into the ON LINE status after being powered.

When the PROFIBUS head detects a module status as:

- Not in the bus
- In a wrong position
- Not configured for current position
- Not declared for current bus
- Defect

During the system start up, the PROFIBUS head gets into an error status, disables the outputs and generates a diagnosis.

After the system start up, if a module gets into any situation described before, the system continues to work and generates a diagnosis.

If a power supply failure occurs, even temporarily, and if there is a missing module, then the head will get into an error status because the head consider this as a system start up situation.

This “System Start up” parameter option is the most recommended because it guarantees the system integrity during the system start up, and also allows the module swap while the system is operating.

- Hot swap enables with no start up consistency

It allows the system to run event upon one of the following situations:

- Not in the bus
- In a wrong position
- Not configured for current position
- Not declared for current bus
- Defect

All these situations are signalized through the diagnosis feature.

This option is recommended during the system implementation because it allows exchange of modules without powering the system down and without needing all the modules configured.

Disable Outputs

This parameter allows to physically disable the outputs through the supervision serial channel.

There are two possible values:

- Disable

Inhibit the command

- Enable

Allow the command execution

ATTENTION:

The PROFIBUS head have to receive the ALNET I output disable command through the serial channel in order to execute this operation.

ATTENTION:

The MasterTool ProPonto or MasterTool may execute the output disable command.

Diagnosis Status

Through the PROFIBUS diagnosis the PROFIBUS head may present information about problems related to modules and system status.

This parameter programs the diagnosis generation behavior that is defined as follow:

- Disabled

The diagnosis generation only occurs when there is a variation in the modules information.

- Enabled

The diagnosis generation occurs when there is any variation in the information from the modules and system status.

The need to enable or not the transmission of diagnosis status occurs because some PROFIBUS master devices consider any diagnosis as an error.

The master will not indicate the head has a problem when this option is disabled. The Siemens master is an example of device we recommend to set this option to disabled.

Modules Parameters

The modules parameters are specified in their respective Technical Characteristics. Please check them out.

If there are more than one module of the same type, they should be configured individually. I mean, each module must have its own parameters set.

ATTENTION:

The parameterization menus in the programmers provide an easy interface to select the modules parameters. This is the case for the majority of the PROFIBUS master configuration software. But please see the item Parameter Bytes Assembly in this chapter if you need to build them.

The number of module parameters varies but can not exceed ten bytes. The TC may present some bytes or bits as constants, such values must be copied literally in order to guarantee the correct parameterization.

When available, the first two bytes are module general parameters. The remaining bytes are channel parameters as shown on table 5-3.

Bytes	Description
0	Module general parameter
1	Module general parameter
2	General parameter for channel 0
3	General parameter for channel 1
4	General parameter for channel 2
5	General parameter for channel 3
6	General parameter for channel 4
7	General parameter for channel 5
8	General parameter for channel 6
9	General parameter for channel 7

Table 5-2 Module Parameters Format

Example:

The figure 5-3 shows the parameters for the PO1112 module as an example. The ProfiTool software window shows the module parameters in the first 3 lines (temperature range, update time and RTD curve standard) and in the remaining ones the channel parameters (analog variables range definition and associated filters). In this case, the parameters 1 to 3 are not used.

The figure 5-3 shows only the parameters that may be modified. The figure 5-4 shows the edition of a **Channel 1 Type** editing.

ATTENTION:

This manual does not cover the PO1112 module parameters meaning. For such, please consult its Technical Characteristics.

ATTENTION:

This manual does not cover the ProfiTool programmer utilization. For such, please consult the ProfiTool Utilization Manual.

Byte	Descrição	Valor
1	Unidade de temperatura	C
1	Tempo de atualizacao	100 ms
1	Curva RTD	Padrao Americano
2	Tipo do canal 0	Corrente 0 a 20 mA
2	Filtro do canal 0	2ms
3	Tipo do canal 1	Corrente 0 a 20 mA
3	Filtro do canal 1	2ms
4	Tipo do canal 2	Corrente 0 a 20 mA
4	Filtro do canal 2	2ms
5	Tipo do canal 3	Corrente 0 a 20 mA
5	Filtro do canal 3	2ms
6	Tipo do canal 4	Corrente 0 a 20 mA
6	Filtro do canal 4	2ms

Figure 5-3 PO1112 Module Parameters

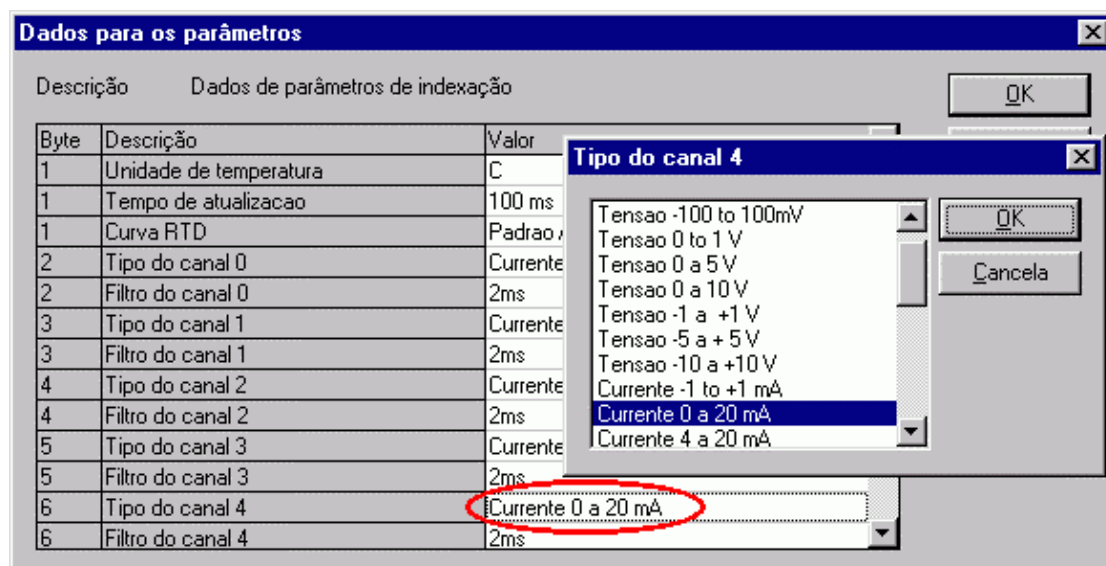


Figure 5-4 Parameters selection for PO1112 module

Parameters Bytes Assembly

For programming software that does not have an user friendly interface, you may have to assemble the bytes sequence that represent the modules parameters.

The bytes are composed by two consecutive areas:

- Head parameters
- Modules parameters

The head parameters bytes are described on the table 5-2. The table 5-3 has the bits organization for each byte.

Byte	Description
0	Constant 00
1	Bytes number for the head parameters
2	Head general parameters
3	Reserved
4	Constant 14h

Table 5-3 Head Parameters Bytes

ATTENTION:

For configurators that do not have parameterization menus, the use should use the table 5-3 to get the bits and bytes to define the PROFIBUS head behavior:

Byte 0 – Constant 00								Description
7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	Always 0
Byte 1 – # of Parameters								Description
7	6	5	4	3	2	1	0	
0	0	0	0	0	1	0	0	Constant value in 04
Byte 2 - General Parameters								Description
7	6	5	4	3	2	1	0	
						0	0	Disable hot swap
						0	1	Invalid value
						1	0	Enables hot swap with no start up consistency
						1	1	Enables hot swap with start up consistency
					0	0		Always zeros
			0					Do not allow outputs disable
			1					Allow outputs disable
		0						Sent system diagnosis status
		1						Sent just error diagnosis
0	0							Always 0
Byte 3 - Reserved								Description
7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	Always 0
Byte 4 – Delay for enabling modules								Description
7	6	5	4	3	2	1	0	
0	0	0	1	0	1	0	0	Constant value in 14h

Table 5-4 Head Parameters

Following are the modules parameters.

Each declared module (except the PO7078 bus expander modules) has a parameter register that may have three types:

No parameters module: the module parameter register only has one byte and it is constant 00 – indicating this module has no parameters;

Module with command word: the register has only one byte, this byte has the low nibble set to 1 and the high nibble is transferred to the bus module;

Module with command word and parameters: the register varies between 2 and 10 bytes, the low nibble is 0, it has the parameters number (in bytes) to be transferred to the module. All the bytes should be transferred from the byte 0 up to the number of declared bytes. The high nibble should be transferred to the GBL command word specified in the module.

The table 5-4 shows the parameters bytes sequence referent to the example in the table 5-1.

Module	Byte	Hexa Value	Description
System parameters	0	00h	Constant 00
	1	04h	Number of bytes of the head parameters
	2	03h	Head general parameters . System start up: hot swap enabled <u>with</u> start up consistency . Outputs disable: disabled . Diagnosis status: enabled
	3	00h	Reserved
	4	14h	Constant 14h
Parameters PO2022	5	00h	PO2022 does not have parameters Receives value 00
Parameters PO2022	6	00h	
Parameters PO2022	7	00h	
Parameters PO9999 – 2 bytes output	8	00h	PO7078 does not have parameters Receives value 00
Parameters PO2020	9	01h	The PO1112 module has 1 parameter byte The bytes meaning are described in the TC.
Parameters PO1112	10	0Ah	The module PO1112 has 10 parameters bytes. The bytes meaning are described in the TC.
	11	00h	
	12	09h	
	13	09h	
	14	09h	
	15	09h	
	16	09h	
	17	09h	
	18	09h	
	19	09h	
Parameters PO1112	20	0Ah	The module PO1112 has 10 parameters bytes. The bytes meaning are described in the TC.
	21	00h	
	22	09h	
	23	09h	
	24	09h	
	25	09h	
	26	09h	
	27	09h	
	28	09h	
	29	09h	
Parameters PO9999	30	00h	PO9999 does not have parameters Receives value 00
Parameters PO1010	31	02h	The module PO1010 has 2 parameters bytes. The bytes meaning are described in the TC.
	32	01h	
Parameters PO1010	33	02h	The module PO1010 has 2 parameters bytes. The bytes meaning are described in the TC.
	34	01h	
Parameters PO9098	35	00h	PO9098 does not have parameters Receives value 00
Parameters PO9098	36	00h	does not have parameters Receives value 00

MMI Configuration

As a unique characteristic this head has a serial interface that may connect to MMIs, thus creating a powerful local interface in the PROFIBUS head.

The MMI may read or write in local or virtual modules, thus allowing interaction with master controlled variables.

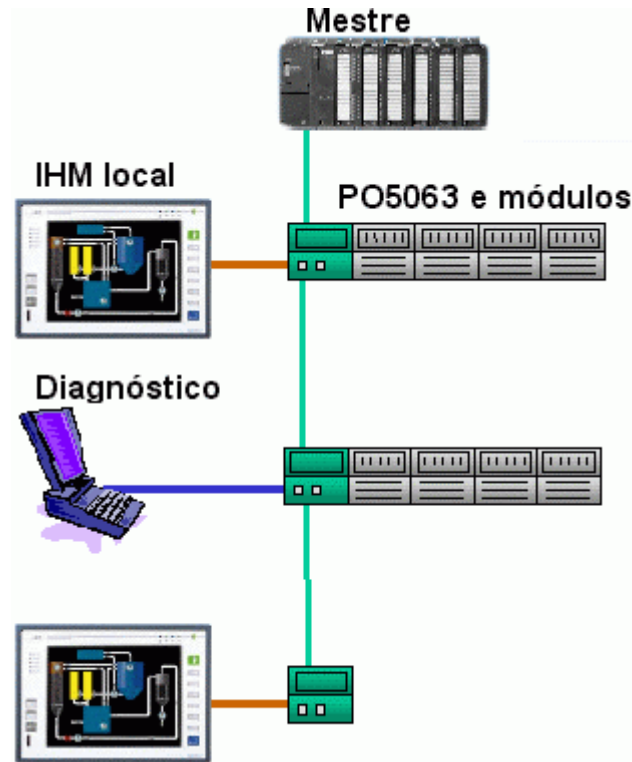


Figure 6-1 Local MMI

In order to use a MMI in the PROFIBUS head you will need to declare in the PROFIBUS master the MMI virtual modules. Those are the PO9098 modules are not physical, but they use PROFIBUS addresses in order to exchange data between the master and the MMI.

These modules should be declared at the end of the bus because they have no physical position.

There are four types of PO9098 modules, these types determine the data format and direction (byte or word, input or output).

In the PROFIBUS master may be allocated up to seven PO9098 for each type.

The table 4-1 shows the modules types, their data allocations and equivalent types of operands.

The operands are required representations for the MMIs to access the PROFIBUS head.

Module Type	Data Type	Operand Type
PO9098 - 8 bytes IN (MMI)	Digital Inputs	%E
PO9098 - 8 bytes OUT (MMI)	Digital Outputs	%S
PO9098 - 8 words IN (MMI)	16 bits Inputs	%M
PO9098 - 8 words OUT (MMI)	16 Bits Outputs	%M

Table 6-1 Virtual Modules Types

The operands that are monitored or written by the MMI are in a specific range of virtual modules. The table 4-2 shows the virtual operands for each type of module:

Module Type	Operands Addresses
PO9098 - 8 bytes IN (MMI)	%E200 - %E255
PO9098 - 8 bytes OUT (MMI)	%S456- %S511
PO9098 - 8 words IN (MMI)	%M200 - %M255
PO9098 - 8 words OUT (MMI)	%M456- %M511

Table 6-2 Virtual Operands Areas

The MMI must have a master ALNET I v2.0 in order to connect to a PROFIBUS head. In these same conditions, a supervisory software may also be connected to a head as it was a MMI.

Utilization Example

This example shows the procedures and equivalence among operands and PROFIBUS addresses to configure the MMIs.

In an architecture with the following characteristics (configured in the PROFIBUS master):

Local	Bus Position	Module
Segment 0	0	PO2022
	1	PO1010
	2	PO1112
Virtual Modules	-	PO9098 – 8 words IN (MMI)
	-	PO9098 – 8 words OUT (MMI)

Table 6-3 Architecture Example

The modules configuration related to the MMI are the PO9098, even though it is permitted only one MMI, there are two module declarations. This occurs because the MMI may be accessed by many data areas.

There is an area of eight words for input and eight words for output to declare the PO9098 modules. The operands allocated for the MMI are as follow:

%M456 .. %M471 –16 bits outputs (data visualized on the MMI)

%M200 .. %M207 –16 bits inputs (data entered or forced on the MMI)

The figure 6-2 shows the PROFIBUS head configuration and the network addresses. These are equivalent to the MMI operands showed on the table 6-3.

End.	Slot	Ind.	Dispositivo	Módulo	Nome do	Tipo E	End. E	Tamar	Tipo S	End. S	Taman.
5	0	1	PO5063	PO2022 16DO NO Dry Contact	Module1	IB	0	4	QB	0	2
5	1	1		PO1010 32DI 24 Vdc Opto	Module2						
5	2	1		PO1112 8AI Universal Isolated	Module3	IW	4	8			
5	3	1		PO9098 - 8 words IN (MMI)	Module4	IW	20	8			
5	4	1		PO9098 - 8 words OUT (MMI)	Module5				QW	2	8

Figure 6-2 MMI declaration in the PROFIBUS network

The figure 6-2 shows the ProfiTool programmer as an example of master configurator.

Module	MMI Operands	PROFIBUS network addresses	
		Input	Output
PO9098 - 8 words IN (MMI)	%M200	20	
	%M201	22	
	%M202	24	
	%M203	26	
	%M204	28	
	%M205	30	
	%M206	32	
PO9098 - 8 words OUT (MMI)	%M207	34	
	%M456		2
	%M457		4
	%M458		6
	%M459		8
	%M460		10
	%M461		12
	%M462		14
	%M463		16

Table 6-4 Virtual Operands Areas

ATTENTION:

For each PO9098 module added to the project, the following operands are allocated in each module type range. It is not possible to declare more than seven modules for each type.

Using the Foton Series

Following are the Altus small size MMIs:

- FT1 and FT3: simple MMIs where the identification and processing of the keys are processed by the master CPU. These MMIs have a performance influenced by the PROFIBUS network polling time where the head is connected.
- FT5 and FT10: MMIs that process internally their keyboard thus have more flexibility and performance does not depends on the network polling time.

The Foton Series must have the screen parameters (output) and keyboard (input) programmed accordingly to the PROFIBUS configurator declaration.

As an example, following is the Foton 3 configuration through its ProFoton programmer. Please consult the Foto Series Utilization Manual for further information.

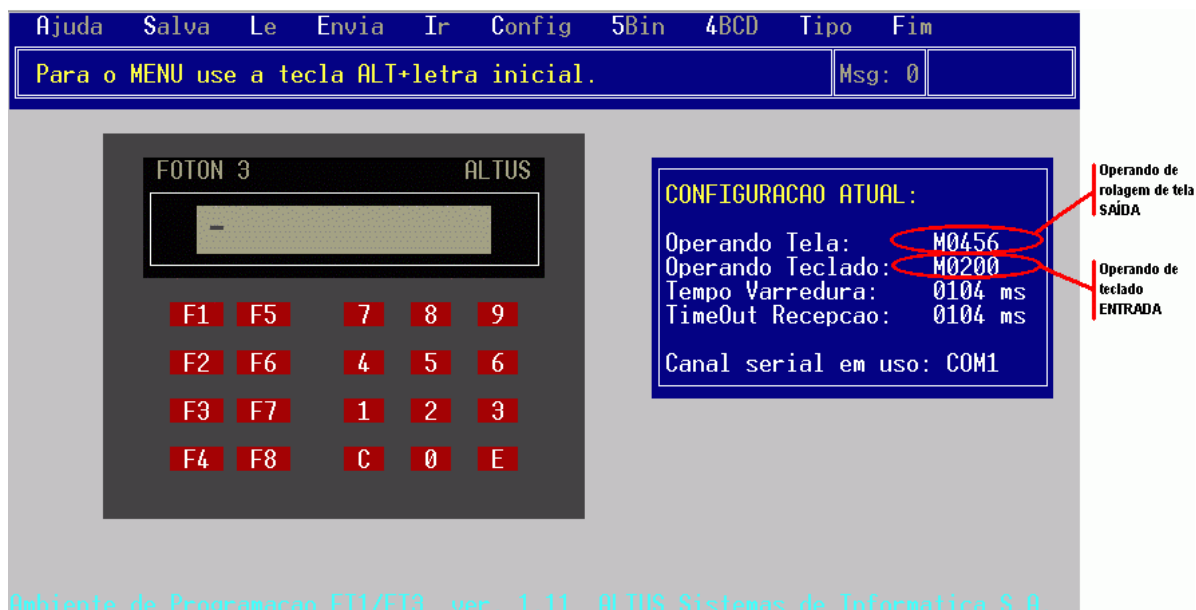


Figure 6-3 Example of Foton 3 with PROFOTON configuration

The figure 6-3 shows as example of keyboard and screen configuration for the correct operation with the Foton 3 MMI.

The figure 6-4 shows two output area operands to be monitored by the MMI. This operand has the PROFIBUS address defined in the head configuration and may be modified by the master.



Figure 6-4 Example of Foton 3 with PROFOTON configuration

Maintenance

This chapter covers system maintenance. It will describe general care, protection devices and operator procedures in case of errors.

Following are the most common problems and procedures to be taken to fix them up.

Most Common Problems

If the PROFIBUS Head does not power up (no LED goes on) when power is turned on, then follow these instructions:

- Check if the 24VDC power supply is active (19 VDC to 30 VDC including ripple).
- Check the connections and PROFIBUS Head power supply. If you find connection problems, please fix them up and power the system again.
- If you found over-voltage on the power supply, then the PROFIBUS Head protection system may have been actuated and some internal components should be replaced. In such cases, please contact Altus Technical Support and sent the equipment for repair.
- If the PROFIBUS Head is properly powered and no LED goes on, then it is damaged and must be substituted.

Diagnoses LEDs

The PROFIBUS head indicates the diagnoses through LEDs in the front panel as shown on figure 7-1. The table 7-1 describes the LED status and indications.

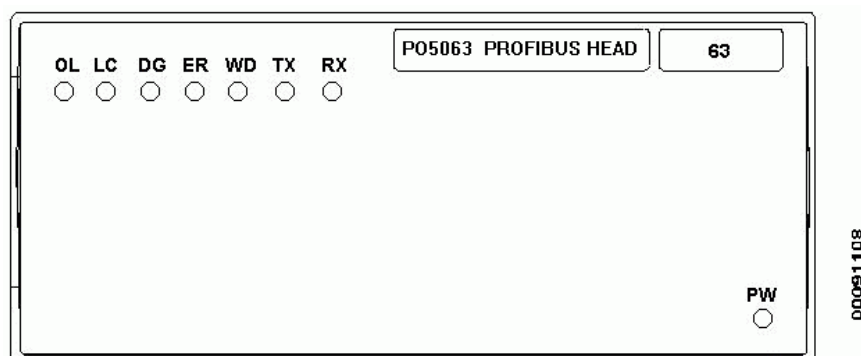


Figure 7-1 Frontal Panel

The **OL**, **LC** and **ER** LEDs indicate the head status. The **DG** LED indicates diagnoses and it may be on or blinking 4 times accordingly to the indication

LED	Meaning	Description	
OL	On Line	On	On Line
		Off	Off Line
DG	Diagnosis	On	No diagnosis
		Blinking	In diagnosis (see tables 7-3, 7-4 and 7-5)
ER	Error	Head errors (see DG LED)	
LC	Local	The system is executing internal operations	
WD	Watchdog	Watchdog activated, it indicates hardware or software error	
TX	Transmit	Transmitting on the maintenance serial channel	
RX	Receive	Receiving on the maintenance serial channel	

Table 7-1 PROFIBUS Head LEDs meanings

Operating Status

The head may get into one of the three operating status. The table 7-2 describes the status and LEDs indications.

Status	LEDs OL, PG and ER	Description
On Line	OL: On PG: Off ER: Off	Occurs when the PROFIBUS head is configured and communicating with master.
Off Line	OL: Off PG: Off ER: Off	The PROFIBUS head is not communicating with the master. The reason is indicated in the DG LED
Error	OL: Off PG: Off ER: On	Indicates problems with the PROFIBUS head or network. The DG LED indicates the error. Once head gets into an error status, please fix the problem and then turn the head off and on again in order to reset it. In such status the software will need to be reset. Ex: missing Ponto bus termination.

Table 7-2 Operating status

On Line Status Diagnoses

There is no diagnoses when the PROFIBUS Head DG LED is on. On the other hand, there is diagnosis when that LED is blinking, and the identification of the diagnosis is based on the other LEDs.

The table 7-3 describes the meaning of the DG LED when the PROFIBUS head is *On Line* (OL LED on).

DG LED	Meaning	Possible causes
Blinks 1X	Existing diagnosis in modules	Some module is generating diagnoses
Blinks 2X	Forced IO or channel	There is one or more forced IO/channel
Blinks 3X	Disabled outputs	Disabled bus outputs
Blinks 4X	Missing module / different / not declared / with parameters error	One or more modules are in one of the following situations: <ul style="list-style-type: none"> - Missing in the bus - Different from declaration - Non declared in the bus - Too many or missing parameters

Table 7-3 On Line DG LED Meanings

Off Line Status Diagnoses

The table 7-4 describes the meaning of the DG LED when the PROFIBUS head is *Off Line* (OL LED off).

LED DG	Meaning	Possible causes
Blinks 1X	No activity on PROFIBUS network	Network cable not connected
		Error at PROFIBUS termination
		Defected PROFIBUS network cable
		PROFIBUS master off
Blinks 2X	Parameterization missing	PROFIBUS master has not sent the configuration and parameterization yet
		PROFIBUS address is different from the address switches on the PROFIBUS head
Blinks 3X	Parameterization failure	Exceeded number of input or output bytes
		Number of real modules is larger than 20
		Number of virtual modules is larger than 7 per type of operand
		Virtual module in the middle of a bus
		Segment with more than 10 real modules
		Number of parameters is different from expected

Table 7-4 Off Line DG LED meanings

Error Status Diagnosis

The table 7-5 describes the DG LED meaning when the PROFIBUS head is in *Error* (ER LED on).

LED DG	Meaning	Possible causes
Blinks 1X	Missing or non declared module	Missing module with disabled hot swap.
		Non declared module with disabled hot swap.
		Module does not reply with disabled hot swap.
		Missing module on the start up with consistency
		There is a non declared module in the start up with consistency
Blinks 2X	Different module	Different module from declaration in the start up with consistency.
		Different module from declaration with disabled hot swap.
Blinks 3X	Ponto bus hardware failure	Missing termination at the Ponto bus.
		Defected bus extension cable.
		Defected bus extension or base.
Blinks 4X	Other errors	PROFIBUS address switch with invalid value.
		Module with no parameters, or module does not require parameters.
		PROFIBUS coprocessor memory error

Table 7-5 Error DG LED meanings

ATTENTION:

Some messages may appear simultaneously, in such case please consider first the one with the DG LED blinking more often. In order to identify the details of the diagnosis please consult the item **PROFIBUS Head Diagnoses: Byte 7 – system general status.**

Diagnoses Messages

The PROFIBUS head sends indication messages to the PROFIBUS master whenever diagnosis happens to the head of IO modules.

The PROFIBUS network provides a comprehensive device diagnoses functionality. The network master receives the diagnoses and may analyze them by the configuration or application software.

This chapter shows the diagnoses messages and also an example of how the ProfiTool programmer may present them.

The head diagnoses messages provide four different information:

- Head diagnoses
- Modules diagnoses
- PROFIBUS Head status
- Head parameters

Head Diagnoses

The messages shown on table 7-6 summarize the diagnoses situations that may occur simultaneously:

Message	Possible causes
Diagnosis present in the module	The modules are declared and present in the bus. But they have one or more diagnosis in one of the channels. In other words, there is a functional problem.
Disable outputs	There was an output deactivation via supervision serial port.
One or more wrong modules	There is one declared module in a position declared for another module.
One or more missing modules	There is a declared module not replying as active. Meaning it may be missing for hot swap, or without energy or defected.
One or more non declared modules	There is a non declared module in a position that was supposed to be free.
Module with parameters error	Wrong number of parameters sent to the module.

Table 7-Head diagnoses messages

The general status information indicates problems and may be visualized on the table 7-7.

Message	Motive	Possible causes
Network problems	It was not possible to detect PROFIBUS network activity	The PROFIBUS cable is not connected
		The PROFIBUS network terminations are incorrect
		The master is not connected to the network
		The master is not transmitting data to the network
Parameters missing	Parameters not received	PROFIBUS master has not sent configuration and parameterization yet
		Different PROFIBUS address configured from head address switches
Parameters error	Parameters received from master, but it has some inconsistencies that halt operation.	Wrong number of parameters.
		There are more or less modules parameters than the number of configured modules.
PROFIBUS interface error	Not possible to communicate with PROFIBUS interface	This is a internal PO5063 problem. Please send it for repairing.
Missing termination at bus	Periodically the Ponto bus termination is tested. This message occurs when it is not possible to check the termination presence.	Missing Ponto bus termination.
		Missing or broken bus extension cable.
		A base is not connected to the previous one.
		A base has problems and it is not forwarding the data to following base.
Illegal PROFIBUS address	The address switches are set to a wrong value.	The valid address range for PROFIBUS is 1 to 125 (01h and 7Dh).
PROFIBUS memory error	Not possible to communicate to the PROFIBUS data memory	This is a internal PO5063 problem. Please send it for repairing.
Non declared module	There is a module exceeded	There is a non declared module.
Missing module with hot swap	A module was removed	A declared module was not found. The system gets into error because the hot swap is disabled.
Wrong module without hot swap	A module is wrong	A declared module was not found, and a different module is in its position. The system gets into error because the hot swap is disabled.
Non declared module with consistency	A module is exceeded during the start up	There is a non declared module. The system gets into error because consistency is enabled.
Missing module with consistency	A module is missing during the start up	One declared module is missing during the start up. The system gets into error because consistency is enabled.
Wrong module with consistency	A module is wrong during the start up	There is a different module from the declared one during the start up. The system gets into error because consistency is enabled.
More than 20 real modules	Master declaration is wrong.	There were declared more than twenty input and output modules.
More than 10 module per segment	Master declaration is wrong	There were declared more than ten modules in the same segment.

Number of IO bytes exceeded	Wrong master declaration.	The total input or output bytes exceeded 200.
Virtual module before termination	Wrong master declaration.	There was a virtual module declared before the bus termination. All the virtual module should come after the real ones.
Number of virtual modules larger than 7	Wrong master declaration.	There were declared more than seven modules from one of the four types of virtual modules (ex: PO9098 – MMI)
Other errors	Non predicted errors	This message should not occur. If so, most likely the software version is outdated.

Table 7-7 Head diagnoses messages

Modules diagnoses

When a module is deactivated the following message is shown:

- Missing or wrong module XX.

Where XX is the declared position in the PROFIBUS master configurator.

The modules may provide other diagnosis messages depending to the situation. They are called channel diagnoses.

A channel is a input or output unit. As for instance, the PO2132 has four analog outputs.

Some modules have the capacity to generate such messages depending on their characteristics. Other modules do not have such capacity. Such information is described in the respective TCs.

Most of the modules have the diagnosis channels 31 and 32. Those channels are not physical, but general information channels that indicate failure on external power supply and parameters errors.

The modules have their own diagnoses messages. You find those messages described on the respective module TC.

The chapter 9, **Diagnoses via Serial** lists the possible errors for channels and respective PROFIBUS codes.

PROFIBUS Head Status

It shows the operating status:

- OFF LINE
- ON LINE
- ERROR

Head Parameters

They are presented in the format of diagnoses messages. The presented information may be:

- Allows IO forcing
- Allows to disable outputs
- Disabled hot swap, hot swap with no consistency or hot swap with consistency.
- Delay for module activation

These messages are just visualized when programmed.

PROFIBUS Diagnosis

This chapter describes the format of the PROFIBUS diagnosis register, accordingly to the EN 50170 norm.

You will only need to read this chapter in the following situations:

- If your PROFIBUS master programmer is not capable of interpreting the diagnosis messages through the GSD file.
- If the application program requires the diagnosis bits for some of its processing.

It is not necessary to read this chapter if the PROFIBUS master program can interpret the diagnosis messages and show them visually.

Following is the general diagnosis format:

Byte	Meaning
0	Status 1
1	Status 2
2	Status 3
3	Status 4
4	Status 5
5	Status 6
6 – 127	Extended Diagnosis

Table 8-1 Frame format for the PROFIBUS Diagnosis

Standard Diagnosis

The standard diagnosis has 6 bytes, as defined by the norm and it is always present in the diagnosis.

Following are the diagnosis bits and their meaning:

Byte 0 – Status 1								Description
7	6	5	4	3	2	1	0	
							1	Station_non_Existent: slave not found on the network
						1		Station_Not_Ready: slave is not ready for communication
					1			Cfg_Fault: slave configuration is different from master configuration
				1				Ext_diag: slave has available a extended diagnosis message to the master
			1					Not_Supported: slave received a non-supported commanded.
		1						Invalid_Slave_Response: slave answer to the master was not recognized
	1							Parameter_fault: error when transmitting parameters to slave
Byte 1 – Status 2								Description
7	6	5	4	3	2	1	0	
							1	Deactivated: slave set to inactive by parameterization
					1			Sync_Mode: set on by slave when receiving Sync command
				1				Freeze_mode: set on by slave when receiving Freeze command
			1					Watchdog_On: set on by slave when what-dog-timer is set
		1						Always set to on by slave
	1							Static_Diagnostic: set on by slave in order to indicate diagnosis is available to master
1								Prm_Req: set on by slave to indicate parameterization and configuration
							x	Reserved
Byte 2 – Status 3								Description
7	6	5	4	3	2	1	0	
1								Ext_Diag_Overflow: set on when slave extended diagnosis data surpasses size defined in GSD (Ext_Diag_Data)
	x	x	x	x	x	x	x	Reserved
Byte 3 – Status 4 - Master_Add								Address to the master that parameterized slave. If no master has parameterized slave, then value is set to 255
Byte 4 e 5 – Status 5/6 - Ident_Number								Slave identifier (device number, accordingly to PROFIBUS Committee registers)

Table 8-2 Frame Fields for PROFIBUS Diagnosis

Extended Diagnosis

The bytes following the standard diagnosis describe the details about the slave status. If slave transmits the extended diagnosis, then the Ext_Diag bit is set to on.

The extended diagnosis has 3 types:

- Diagnosis related to the device
- Diagnosis related to the module
- Diagnosis related to the channel

The 8-3 table shows a extended diagnosis example:

Extended Diagnosis										
7	6	5	4	3	2	1	0			
0	0	0	0	0	1	0	0	Bits meaning is defined by manufacturer.	System diagnosis	
Divide Specific										
Field										
Size 3										
0	1	0	0	0	1	0	1	Module diagnosis		
							1			Module with 0 diagnosis
			1							Module with 12 diagnosis
					1					Module with 18 diagnosis
1	0	0	0	0	0	0	0	Module 0	Channel diagnosis	
0	0	0	0	0	0	1	0	Channel 2		
0	0	1	0	0	1	0	0	Overload (bit)		
1	0	0	0	1	1	0	0	Module 0		
0	0	0	0	0	1	1	0	Channel 2		
1	0	1	0	0	1	1	1	Exceeded upper limit (word)		

Table 8-3 Extended diagnosis example

Diagnosis related to the divide

7	6	5	4	3	2	1	0	
0	0	Size						Header

Size: bytes block size including the header

Following are the bytes that identify the device status. The format is specific for each device (please see in this chapter **PROFIBUS Header Extended Diagnosis**)

Diagnosis related to the module

7	6	5	4	3	2	1	0	
0	1	Size						Header

Size: bytes block size including the header

Following are the bytes that identify the device status

7	6	5	4	3	2	1	0	
Module 7	Module 6	Module 5	Module 4	Module 3	Module 2	Module 1	Module 0	Module with diagnosis

Diagnosis related to the channel

Each channel puts its identifier and error cause. Each input has 3 bytes

7	6	5	4	3	2	1	0		
1	0	Ident						Ident : diagnosis module number	Byte 0
7	6	5	4	3	2	1	0		
E/S		Channel						E/S: 00 – reserved 01 – input 10 – output 11 – input and output Channel: channel number	Byte 1
7	6	5	4	3	2	1	0		
Channel Type		Diagnosis Type						Channel type: see table 8-4 Diagnosis type: see table 8-5	Byte 2

Channel Type	Description
000	reserved
001	1 bit
010	2 bits
011	4 bits
100	1 byte
101	1 word
110	2 words
111	reserved

Table 8-4 Channel Type

Error Type	Description
0	reserved
1	Short circuit
2	Under voltage
3	Over voltage
4	Overload
5	Over temperature
6	Open loop
7	Exceeded upper limit
8	Exceeded lower limit
9	Error
10	Reserved
-----	.
15	Reserved
16	Manufacturer specific
-----	...
31	Manufacturer specific

Table 8-5 Error type

ATTENTION:

Please consult norm EN 50170 for further details about the device diagnosis.

PROFIBUS Head Extended Diagnosis

The table 8-6 shows the **extended diagnosis bytes** and the table 8-7 shows all the diagnosis messages from the PROFIBUS head, including the binary interpretation, the bit position or the byte value.

Byte	Description
0	Number of diagnosis bytes
1	Programmed parameters
2	Reserved
3	Module initialization time after hot swap
4	Head current status
5	General diagnosis
6	Reserved
7	System general status
8	Module 0 .. 7 status
9	Modules 8 .. 15 status
10	Modules 16 .. 19 status
11	Address switch value

Table 8-6 PROFIBUS head diagnosis

Byte 0 – Number of diagnosis bytes								Description
7	6	5	4	3	2	1	0	
0	0	0	0	1	0	1	1	Number of diagnosis bytes for system 11
Byte 1 – Programmed Parameters								Description
7	6	5	4	3	2	1	0	
						0	0	How swap unable
						0	1	Invalid value
						1	0	Enable hot swap with no start up consistency
						1	1	Enable hot swap with start up consistency
					0	0		Always zeros
			0					Do not allow outputs set to off
			1					Allow outputs set to off
		0						Transmit system status on diagnosis
		1						Transmit just error diagnosis
x	x							Reserved
Byte 2 – Reserved								Description
7	6	5	4	3	2	1	0	
x	x	x	x	x	x	x	x	Reserved

Byte 3 – Delay for module start up								Description
7	6	5	4	3	2	1	0	
0	0	0	1	0	1	0	0	Value always set to 20
Byte 4 – PROFIBUS head status								Description
7	6	5	4	3	2	1	0	
					0	0	0	OFF LINE status
					0	0	1	ON LINE status
					0	1	0	LOCAL status
					0	1	1	ERROR status
x	x	x	x	x				Reserved
Byte 5 – General Diagnosis								Description
7	6	5	4	3	2	1	0	
							0	OK
							1	Modules with diagnosis
					0			Disabled outputs
					1			Enabled outputs
				0				Modules are Ok
				1				Some modules are not Ok
			0					There is no missing modules
			1					There are some missing modules
		0						All modules declared
		1						There are some modules not declared
	0							No modules with parameters errors
	1							There are some modules with parameters errors
x						x		Reserved
Byte 6 – Reserved								Description
7	6	5	4	3	2	1	0	
x	x	x	x	x	x	x	x	Reserved

Byte 7 – System general status								Description
7	6	5	4	3	2	1	0	
			0	0	0	0	0	Normal operation
			0	0	0	0	1	No network activity
			0	0	0	1	0	Missing parameterization
			0	0	0	1	1	Parameterization failure
			0	0	1	0	0	Hardware failure on PROFIBUS interface
			0	0	1	0	1	No termination on Ponto bus
			0	0	1	1	0	PROFIBUS address switches with invalid value
			0	0	1	1	1	PROFIBUS coprocessor memory error
			0	1	0	0	0	Non declared module with hot swap disabled
			0	1	0	0	1	Missing module with hot swap disabled
			0	1	0	1	0	Module different from declaration with hot swap disabled
			0	1	0	1	1	Module non declared in the start up with consistency
			0	1	1	0	0	Missing module in the start up with consistency
			0	1	1	0	1	Module different from start up declaration w consistency
			0	1	1	1	0	Number of real module larger than 20
			0	1	1	1	1	Segment with more than 10 real modules
			1	0	0	0	0	Exceeded number of input or output bytes
			1	0	0	0	1	Declared virtual module in the middle of the bus
			1	0	0	1	0	Virtual module number larger than 7 per oper type
			1	0	0	1	1	PROFIBUS configuration format error
			1	0	1	0	0	Configuration buffer size error
			1	0	1	0	1	There is a module with parameter errors
			1	1	1	1	1	Hardware error
x	x	x						Reserved
Byte 8 – Modules 0 .. 7 status								Description
7	6	5	4	3	2	1	0	
							0	Module 00 present in the bus
							1	Module 00 declared was not found in the bus
							0	Module 01 present in the bus
							1	Module 01 declared was not found in the bus
						0		Module 02 present in the bus
						1		Module 02 declared was not found in the bus
					0			Module 03 present in the bus
					1			Module 03 declared was not found in the bus
			0					Module 04 present in the bus
			1					Module 04 declared was not found in the bus
		0						Module 05 present in the bus
		1						Module 05 declared was not found in the bus
	0							Module 06 present in the bus
	1							Module 06 declared was not found in the bus
0								Module 07 present in the bus
1								Module 07 declared was not found in the bus

Byte 9 – Modules 8 .. 15 status								Description
7	6	5	4	3	2	1	0	
							0	Module 08 present in the bus
							1	Module 08 declared was not found in the bus
							0	Module 09 present in the bus
							1	Module 09 declared was not found in the bus
							0	Module 10 present in the bus
							1	Module 10 declared was not found in the bus
							0	Module 11 present in the bus
							1	Module 11 declared was not found in the bus
							0	Module 12 present in the bus
							1	Module 12 declared was not found in the bus
							0	Module 13 present in the bus
							1	Module 13 declared was not found in the bus
							0	Module 14 present in the bus
							1	Module 14 declared was not found in the bus
							0	Module 15 present in the bus
							1	Module 15 declared was not found in the bus
Byte 10 – Modules 16 .. 23 status								Description
7	6	5	4	3	2	1	0	
							0	Module 16 present in the bus
							1	Module 16 declared was not found in the bus
							0	Module 17 present in the bus
							1	Module 17 declared was not found in the bus
							0	Module 18 present in the bus
							1	Module 18 declared was not found in the bus
							0	Module 19 present in the bus
							1	Module 19 declared was not found in the bus
							0	Module 20 present in the bus
							1	Module 20 declared was not found in the bus
							0	Module 21 present in the bus
							1	Module 21 declared was not found in the bus
							0	Module 22 present in the bus
							1	Module 22 declared was not found in the bus
							0	Module 23 present in the bus
							1	Module 23 declared was not found in the bus
Byte 11 – Switches address								Description
7	6	5	4	3	2	1	0	
x	x	x	x	x	x	x	x	Value read from the base address switches

Table 8-7 PROFIBUS head diagnosis messages

The channel diagnosis codes generated by the modules are described on the tables 9-4, 9-5 and 9-6 at chapter 9, **Serial Diagnosis**.

Diagnosis via Serial

The PROFIBUS head has a RS232 serial interface with RJ45 connector for monitoring locally the system diagnosis. This allows the diagnosis without the need to access the network master.

To use this connection, the PROFIBUS head must be connected to a microcomputer through the cable AL-1327 or AL-1715. And the MasterTool is the diagnosis monitoring software.

Diagnosis Operands

The head diagnosis operands area is divided in different areas. The first area refers to the system diagnosis and has 20 bytes. The following areas refer to the modules diagnosis and have 10 bytes each. The modules areas are defined by the module position within the GBL bus. Such operands may be accessed by the MasterTool or any other software or divide that talks master ALNET I protocol (for instance, a MMI):

Area	Meaning
%M512 .. %M521	System diagnosis
%M522 .. %M526	Module diagnosis in position 0
%M527 .. %M531	Module diagnosis in position 1
%M532 .. %M536	Module diagnosis in position 2
%M537 .. %M541	Module diagnosis in position 3
...	
...	
...	
%M697 .. %M701	Module diagnosis in position 35
%M702 .. %M706	Module diagnosis in position 36
%M707 .. %M711	Module diagnosis in position 37
%M712 .. %M716	Module diagnosis in position 38
%M717 .. %M721	Module diagnosis in position 39

Table 9-1 Diagnosis operands division in modules

ATTENTION:

The serial communication with the head must occur at a 9600 baud rate and the ALNET I address must be 0.

System Diagnosis

The system diagnosis bytes are divided as following (%M512 .. %M521):

Byte	Description	Operand
0	Number of diagnosis bytes	%M512 byte HIGH
1	Programmed parameters	%M512 byte LOW
2	Reserved	%M513 byte HIGH
3	Constant value	%M513 byte LOW
4	Head current status	%M514 byte HIGH
5	General diagnosis	%M514 byte LOW
6	Reserved	%M515 byte HIGH
7	System general status	%M515 byte LOW
8	Modules 0 .. 7 status	%M516 byte HIGH
9	Modules 8 .. 15 status	%M516 byte LOW
10	Modules 16 .. 19 status	%M517 byte HIGH

Table 9-2 System Diagnosis

These bytes have the same meaning of the bytes from Chapter 8, **PROFIBUS Diagnosis** in the item **PROFIBUS Head Extended Diagnosis**.

For better operands visualization, it is possible to monitor the operands bytes individually, as for example:

%M512b0 – byte LOW from %M512 operand

%M514b1 – byte HIGH from %M514 operand

ATTENTION

The byte 7 – System general status may be seen through MasterTool or by a MMI requesting the monitoring of %M515 memory operand.

Modules Diagnosis

The modules diagnoses are defined individually. In other words, each module type has a different structure that is found on the Technical Characteristics.

Even though the diagnoses have different formats, the diagnosis header has a defined general format:

Byte	Meaning	PROFIBUS Channel
0	Module general diagnosis	Channel 31
1	Module general diagnosis	Channel 32
2	Diagnosis of channel 0	Channel 0
3	Diagnosis of channel 1	Channel 1
4	Diagnosis of channel 2	Channel 2
5	Diagnosis of channel 3	Channel 3
6	Diagnosis of channel 4	Channel 4
7	Diagnosis of channel 5	Channel 5
8	Diagnosis of channel 6	Channel 6
9	Diagnosis of channel 7	Channel 7

Table 9-3 Modules diagnoses

The channels 31 and 32 represent module general diagnoses, while the channels 0 to 7 represent specific situation for the data physical channels.

Following is a table with the meaning for the diagnoses generated by the modules:

Byte 0 – Module general diagnosis								PROFIBUS Message
7	6	5	4	3	2	1	0	
						1		Code 09 – Error
				1				Code 31 – Non parameterized module
			1					Code 05 – Temperature
		1						Code 01 – IO error
	1							Code 02 – Missing external power supply
1								Code 30 – Burned fuse
					x		x	Not used

Table 9-4 Diagnosis for Channel 31 Modules

Byte 1 – Module general diagnosis								PROFIBUS Messages
7	6	5	4	3	2	1	0	
							1	Code 24
						1		Code 25
					1			Code 26
				1				Code 27
			1					Code 28
		1						Code 29
x	x							Not used

Table 9-5 Diagnosis for Channel 32 Modules

The channels diagnoses are described as follow.

Bytes 2 a 9 – Channel diagnosis								PROFIBUS Message
7	6	5	4	3	2	1	0	
							1	Code 16
							1	Code 17
					1			Code 18
				1				Code 19
			1					Code 20
		1						Code 21
	1							Code 22
1								Code 23

Table 9-6 Module diagnosis for Channels 0 to 7

Addendum A - 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.

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.

Adjustment jumps: switch to set addresses or configuration. It is made with pins located on a circuit board and a small connector to connect them.

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.

Assembly language: microprocessor programming language, it is also known as machine language.

Auto-clear: PROFIBUS parameter that switches the master status into Clear when there is a network error.

Backoff: time that a node in a CSMA/CD network takes before transmitting data after a collision has occurred.

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.

Base: component where the IO modules are inserted, CPUs, power supplies and remaining Ponto Series modules.

Baud rate: rate that the information bits are transmitted through a serial interface or communication network (measured in Bits/second)

BGL Bus Address (or bus physical position) : define to the CPU the absolute address of a IO module in order to execute the data exchange through the serial channel. For the Ponto Series such address is automatic and user transparent.

Bit map: image digital codification form.

Bit: information basic unit, it may be at 1 or 0 status.

Bridge: equipment to connect two communication networks with the same protocol.

Broadcast: simultaneous communication to all the nodes in a communication network.

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 be divided into four segments.

Bus termination: component that must be connected to the last module in a bus.

Byte: information unit composed by eight bits.

Clear: PROFIBUS network status when the outputs are protected.

Command: user entered instruction that indicates what task to run by the equipment or program.

Commercial Code: it is the product code, formed by the letters PO and followed by four digits.

Communication network: set of equipment (nodes) interconnected by communication channels.

Connector: mechanical element that allows to connect or separate two or more components or electrical circuits.

Configuration: preparation to put the product in operation through the integration of hardware and software.

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.

CSMA/CD. Type of access to the physical media based on data collisions. It is used for Ethernet networks.

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.

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.

EIA RS-485: industrial standard (physical level) for data communication.

EN 50170: norm defining the PROFIBUS field network

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.

Expander Power Supply: power supply to add extra power to a bus segment.

Expansion cable: cable that connects bus expanders.

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 Head: slave module of a field network. It is responsible for the exchange of data between the modules and the field network master.

Field Network Interface: master module for the field networks, located in the local bus and performs the communication with the field network heads.

Flash EPROM: non volatile memory that may be erased by electricity.

Frame: information until transmitted in the network.

Freeze: PROFIBUS network status where input data is frozen.

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.

Gateway: equipment to connect two communication networks with different protocols. The AL 2400/S-C or QK2400 gateways allow interconnection of ALNET I and ALNET II networks.

GBL: high speed data transmission bus with auto addressing features and used on local and remote Ponto Series buses. Altus' patent pending.

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.

Installation: description for assembly of hardware, cabling, power supplies and other system elements.

Instructions: operation executed over a set of operands within a program.

Integrated Circuit: device combining under the same casing all the elements and interconnections needed to a whole miniaturized electronic circuit.**E2PROM** - Electric Erasable Programmable Read Only Memory

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 later 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.

Local Bus: set IO modules connected to a CPU.

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.

Logic Programming: 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.

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.

Mechanical Switch Code: two decimal digits defined by the base programmable mechanical switches with the goal of blocking the assembly of incompatible modules. Thus avoiding potential damages caused by assembly and/or maintenance operations.

Media access: method used by all nodes in a network to synchronize data transmission and resolve possible conflicts in simultaneous transmissions.

Menu: set of available options for a program, they may be selected by the user in order to activate or execute a specific task.

MIL-HBDK-217E. American military norm for reliability calculation.

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.

Mono-master: PROFIBUS network with only one master.

Multi-master: PROFIBUS network with more than one master.

Multi-master communication network: communication network where the data transfer are initiated by any node connected to the data bus.

Multi-turn: encoder with code for more than one rotation.

Multicast: simultaneous communication with a group of nodes connected to a network.

Network Configuration Module: router project module carrying the configuration parameters specific to the network and routing for a router.

Nibble: information unit composed by four bits.

Node: any station in a network with the capacity to communicate using a established network.

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.

P 2006_1.000: module programmed in relay diagram language. It performs the control of redundancy and communication with remote stations on CPU 1.

P 2006_2.000. module programmed in relay diagram language. It performs the control of redundancy and communication with remote stations on CPU 2.

PC: Programmable Controller

Peer to peer: type of communication where two partners exchange data without relying on the master.

Power down: signal generated by the power supply to inform the CPU about energy failure, thus guaranteeing a secure system shutting down and protection of retentive memories.

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.

Product Commercial Description: way to briefly and clearly describe the main product characteristics.

Program: a collection of instructions that tell the computer what to do.

Programmable Controller: equipment controlling a system under the command of an application program written in relay and block language. It is made of a CPU, power supply and IO subsystem.

Programming: preparation of a program in all its steps for a computer or similar equipment.

Programming language: it is a set of rules, conventions and syntaxes utilized when building a program.

Programming Terminal: microcomputer executing a software to program PLCs, like AL 3830, AL 3800, AL 3880, AL-3832 or MasterTool.

Protocol: rules of procedures and formats that, under control signals, allow the establishment of data transmission and error recovery among equipment.

Rail: metallic element with normalized shape accordingly to the DIN50032 norm. It is also called TS35 rail.

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.

Remote Bus: set of IO modules connected to a Field Network Head.

Remote Station: equipment reading and writing the controlled process IO, communicating such values to the CPU.

Ripple: undulation present in continuous voltages.

Router: equipment that interconnects two ALNET II (bridge) sub-networks or between a ALNET I sub-network and a ALNET II (gateway) sub-network.

Safe: output protected status.

Serial Channel/Canal: equipment interface that transfer data in the serial mode.

Series: set of modules that have the same code AL, QK, FT or PL and the same first character. For instance, AL 2000 Series covers all controllers AL-2000/MSP-C and AL-2002/MSP.

Scanning cycle: a complex execution of the PLC application program.

Single turn: encoder with code for one single rotation.

Slave: equipment connected to a communication network that only transmits upon the master requests.

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: set of equipment utilized to control a machinery or process. It is composed by a PLC CPU, IO modules, microcomputer and MMIs.

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.

Supervision Station: equipment connected to a PLC network with the goal of monitoring and controlling the process variables.

Sync: PROFIBUS operation mode that synchronizes the outputs.

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.

Tag: name associated to a operand or to a logic that identifies its content.

Time-out: maximum preset time to a communication to take place. When exceeded then an error is generated.

Toggle: element with two stable states that are switchable at each activation.

Token: it is a mark that indicates who is the bus master in a moment.

Upload: program reading or module configuration.

Varistor: protection device against voltage spikes.

Watchdog timer: electronic circuit that checks the equipment operation integrity.

Word: information unit composed by sixteen bits.

Acronyms

BAT - battery

BT – battery test

CARAC.: characteristics

CPU: central processing unit

Desenvolv.: development

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

FC: Forcing

Flash EPROM: Flash Erase Programmable Read Only Memory

FMS: Fieldbus Message System

INTERF: Interface

IO – inputs and outputs

ISOL: Isolation

LED –light emitting diode

LLI: Lower Level Interface

MAC: Media access control

Max: maximum

Min: minimum

Obs: notes

PAs – adjustment jumps

PA: Process Automation

PG - programming

PID – proportional, integrated and derivate control

PLCS: programmable logic controller

RAM - random access memory

ref: reference

RX – serial receiving

SELEC: selectable

SWC: Surge Withstand Capability

THUMB.: thumbwheel switch

TX – serial transmitting

TXD: serial transmission

UTIL: utilization

VFD: Virtual field Device

WD - watchdog timer