PO5064 PROFIBUS Head and PO5065 Redundant PROFIBUS Head Utilization Manual

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The user must analyze all the possible consequences of such defects and he/she must add security safeguards to protect system security as well as human lives. We strongly encourage reinforcing such procedures on initial installations and tests when problems are more likely to happen.

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Summary

Preface

Following we describe this document contents, conventions, as well as a list of manuals for products related to the PO5064/PO5065 PROFIBUS field head.

Manual Description

This manual describes the PO5064 and PO5065 - PROFIBUS Field Network Head – that connects the Ponto Series to a PROFIBUS network.

Chapter 1, **Introduction,** contains a description of the PROFIBUS protocol, the redundant network system and the main caracteristics of PO5064 and PO5065 PROFIBUS heads.

Chapter 2, **Technical Description,** describes the PO5064 and PO5065 PROFIBUS heads.

Chapter 3, **Installation,** describes the mechanical, electrical and network installation of the PO5064, PO5065 PROFIBUS heads.

Chapter 4, **Configuration,** describes the physical configuration for the PO5064 and 5065 PROFIBUS heads and Ponto modules.

Chapter 5, **Parameterization,** describes how the PO5064 and PO5065 PROFIBUS heads are 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 PO5064 and PO5065 PROFIBUS head serial ports.

Chapter 7, **Maintenance,** explains the maintenance, most common diagnoses and LEDs for the PO5064 and PO5065 PROFIBUS Heads.

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

Chapter 9, **Diagnoses via Serial**, explains how to get diagnoses from PO5064 and PO5064 PROFIBUS heads via serial and its format.

Chapter 10, **DPV1 communication diagnosis**, shows the diagnosis registers format for DPV1 communication.

Chapter 11, **Diagnosis via MMI**, explains how to get diagnosis from PO5064 and PO5065 PROFIBUS heads via MMI that communicate using ALNET I 2.0. For more information about how to use MMI please refer do http://www.altus.com.br

Chapter 12, **PO5065 redundancy**, eplains carecteristics that are exclusive to PO5065 PROFIBUS head.

Chapter 13, **Network architercture**, explains different architecture types where PO5064 and PO5065 PROFIBUS heads are used.

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 (technical characteristics and manuals). You may find such documents at www.altus.com.br

Each product has its specific Technical Characteristics (CT) document, where the technical details of the product are described in details. Some products also have its own specific utilization manual (in such cases the CT lists the respective manual code).

For further information please consult following manuals:

- Technical characteristics of each Ponto series product
- CT109000 – General characteristics of Ponto Series
- CT109511 – PROFIBUS DPV1 PO5064/65 Field Netowrk head
- CT104701 – AL-2601/2602 PROFIBUS connector
- CT104705 – AL-2605 Terminator with source diagnostics
- MU299026 – PROFIBUS network utilization manual
- MU203026 – AL-23865 ProfiTool utilization Manual
- MU202610 – AL-3406 Utilization Manual
- MU299604 – MasterTool XE – MT8000 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.
- **MMI:** Man Machine Interface
- **MasterTool XE**: identifies the ALTUS applications to run on IBM-PC^{tm} or compatible computers using Windows. The MasterTool allows the application development for the PLCs of the Ponto series, PICCOLO, AL-2000, AL-3000, PX, QUARK and GRANO. Throughout this document, MasterTool will be referred by its acronym or by "MasterTool programmer".
- **Browser**: interface to visualize HTML pages via the HTTP protocol.
- **SwitchOver**: State change between PO5065 redundant heads.

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
    - This marker indicates a second intems list
        - This marker indicates a third intems list

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.

Notes have the following format and meaning:

Notes indicate information that deserve some highlight or attention but do not offer any risk of personal or material damage.

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 3589 9500 in São Leopoldo, 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, 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.

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.

Using Ponto series redundant field network heads in conjunction with redundant CPUs it is possible to bring the redundancy concept to process control systems offering greater security to automated systems.

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 par 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 area. It covers applications such manufacturing, process control and building automation. It was also developed in a way to permit the use of redundancy when it is necessary. It also permits the use of maximum transmission rates of 12Mbaud.

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. This norm specifies PROFIBUS SPECIFICATION SLAVE REDUNDANCE wich defines PROFIBUS slaves redundancy.

For further information, please refer to PROFUBUS network Utilization manual, or visit www.profibus.com.

Redundant System

The redundancy concept became more and more important in the recent years when related to automation industry. This systems have a higher availability offering more security to the industrial process.

Through extensive research and investments, ALTUS developed Ponto Series equipments that employ the redundancy concept.

Figure 1-2 show networks system with and without redundancy. It is simples to note that the redundant system offers more security even if there are failure in one of the heads, the CPU or the network.

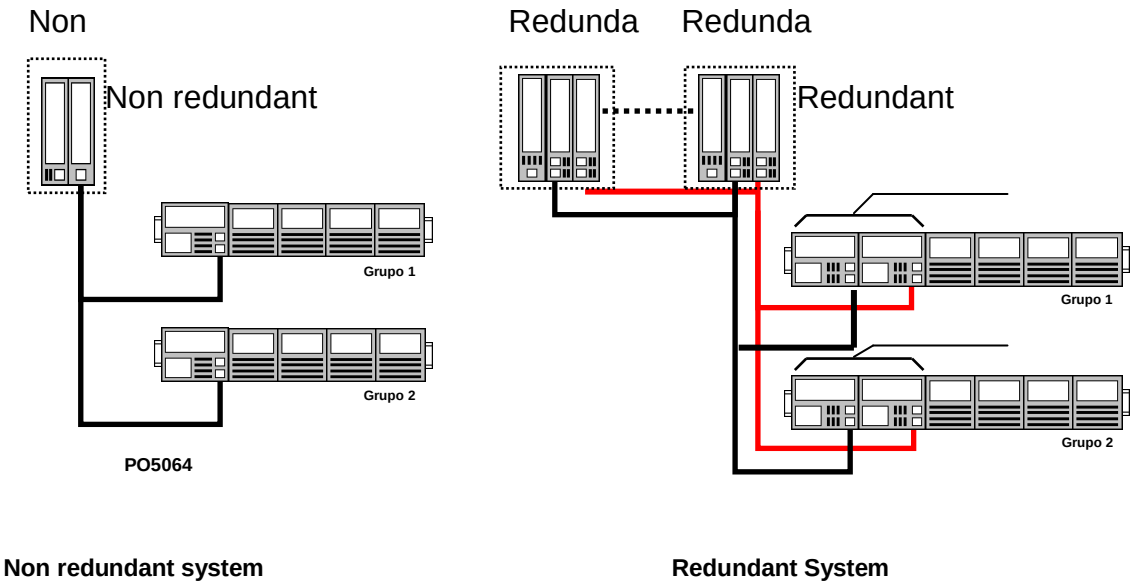

Figure 1-2. Some examples of a system network

Redundancy level

A redundant system can be divided in four levels:

- **CPU redundancy**: It's main caracteristic is the presence of redundant CPUs. In the case of failure of one of the CPUs the system can still work normally.
- **Master redundancy**: It is characterized by the presence of redundant Mater devices. In the case of failure of one Master, the system can still work normally.
- **Slave redundancy**: It is characterized by the presence of redundant heads. In the case of failure of one of the heads, the I/O devices can still work normally.
- **Physical layer redundancy:** It is characterized by the presence of two independent PROFIBUS networks. In the case of failure of one of the transmission line sets, teh system can still work normally.

The presence of redundancy of all the levels on an architecture is called Complete Redundant System. Please refer to the chapter – **Network Architectures** for a better understanding.

PO5064/PO5065

Figure 1-3. PO5064 and PO5065

The PO5064 and PO5065 PROFIBUS Field Network Head are modular slave devices that belong to the Ponto Series Remote Inputs/Outputs. The PROFIBUS head allows access using PROFIBUS-DP network.

PO6064 and PO5065 are mechanically identicall. They are differentiated by the information on the top label of the modules.

The main characteristic that differentiates the two heads is the presence of redundancy on PO5065. Using two PO5065 it is possible to offer higher degree of security in any automation system.

The Figure 1-4 shows the Ponto Series modules connection to the PROFIBUS network using a configuration with redundant Master and non redundant slaves. The CPU is an Altus CP PX2004 with PX3406 Master PROFIBUS interface offering a complete redundant system for the PO5065 heads.

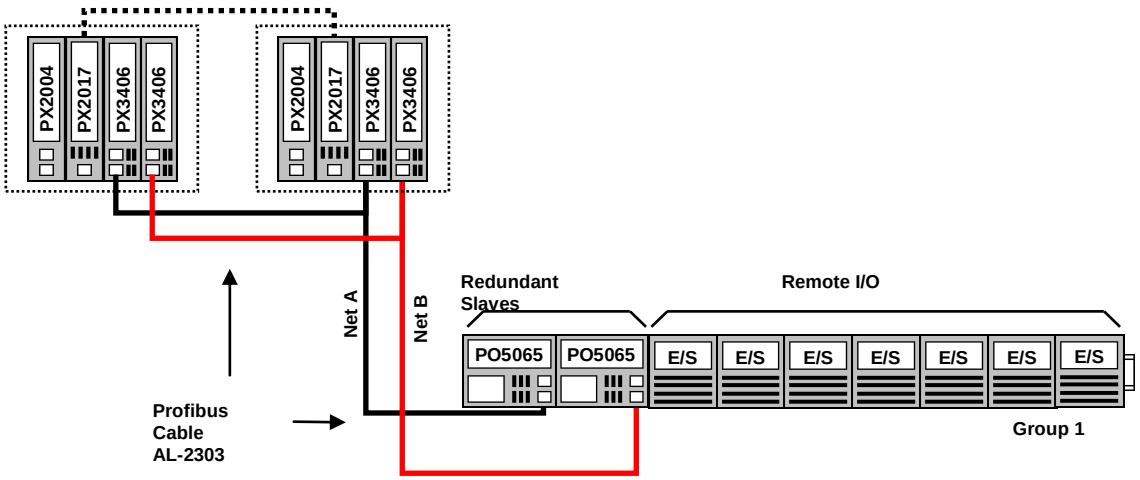

Figure 1-4. Ponto Series in the PROFIBUS Network

Relation between the PROFIBUS heads

The PO5064 head can replace the PO5063 and PO5063V1 heads but it is necessary modify the configuration project and replace the ALT_059A.GSD file from ALT_0BAF.GSD since this file contains characteristics and compatible modules of the PO5064 head. The PO5064 head has all the caracteristics of the PO5063/PO5063V1 and performs acyclic communications.

The PO5065 redundant head can replace PO5063V4 and PO5063V5 but it is also necessary to modify the configuration project and replace ALT_059A.GSD file from ALT_0BB0.GSD since this file contains characteristics and compatible modules of the PO5065 head. The PO5065 head has all the caracteristics of the PO5063V4/PO5063V5 and performs acyclic communications.

Technical Description

Table 2-1 and Table 2-2 show common and particular technical characteristics of PROFIBUS Field Head PO5064 and PO5065.

Table 2-1 Comom characteristics for PO5064 and PO6065 PROFIBUS Heads

	Comom characteristics of PO5064 and PO5065
Communication protocol	PROFIBUS-DPV1, 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
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
State indication	OL, LC, DG, ER, WD, TX, RX, PW LEDs
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 ^{o}C
Dimensions	100 x 52 x 84 mm
Supervision interface	RS232C in RJ45 – AL-1715 cable to interconnect through RS232 IBM-PC standard
Communication protocol to the supervision interface	ALNET I V 2.0
Compatible bases	PO6500: PROFIBUS field network head base

Table 2-2 Specific characteristics for PO5064 and PO6065 PROFIBUS Heads

	PO5064	PO5065
Module type	PROFIBUS-DPV1 field network head	Redundant PROFIBUS-DPV1 field network head
Inputs capacity	200 bytes	200 bytes: 198 data bytes + 2 status bytes for redundancy
Outputs capacity	200 bytes	200 bytes: 198 data bytes + 2 status bytes for redundancy
Diagnosis indication	LED DG multifunctional with indication for Ok module, no configuration, module with diagnosis, forcing on output modules or internal bus error	LED DG multifunctional with indication for Ok module, output retentions state, no configuration, module with diagnosis, forcing on output modules or internal bus error
Hot swap	Yes for IO modules	Yes for IO modules Yes for PO5065 module with external power on
Norms	PROFIBUS norm, European EN 50170 IEC 61131	PROFIBUS norm, European EN 50170 PROFIBUS GUIDE-LINE ORDER no. 2.212-PROFIBUS ESPECIFICATION SLAVE REDUNDANCE versão 1.0 IEC 61131

The PO5064 and PO5065 PROFIBUS heads connects to the Altus CPUs through ALTUS PROFIBUS master interface. The two heads can be connected 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 configuration is stored in a GSD wich contains the configuration and information for all the Ponto Series IO modules (please see chapter 5, **Parameterization**).

The modules send the diagnoses to the heads and the heads forward them to the network master. This will help the user to install and utilize the network (please see chapter 5, **Parameterization**). The PO5064 and PO5065 PROFIBUS heads 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 up to twelve Ponto Series modules distributed in up to two segments in the Ponto Serie Bus. Such a limit may be exceeded when using the MT6000- MasterTool ProPonto software because it calculates the exact current consumption for each module.

When the maximum number of modules is exceded, a new bus segment with a new PO8085 power supply on the first position must be created. Normally the first position is occupied by the PO7078 - bus expansion module (please refer to Ponto series Utilization manual – MU20900).

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 heads is made using the terminal blocks of the PO6500 base. When using the PO6500 base, the network cable is connected to any of the two terminal blocks avalible. If it's necessary to connect other remote network, the other terminal block can be used (please see chapter 3, **installation**). The PO6500 base has an installation key SW1, wich must be ON if the head is located on the last physical position of the PROFIBUS network. The base have two hexadecimal keys (SW2 and SW3) for configuring the head address on the PROFIBUS network.

Figure 2-1 shows a PO5065 head installed on a PO6500 base.

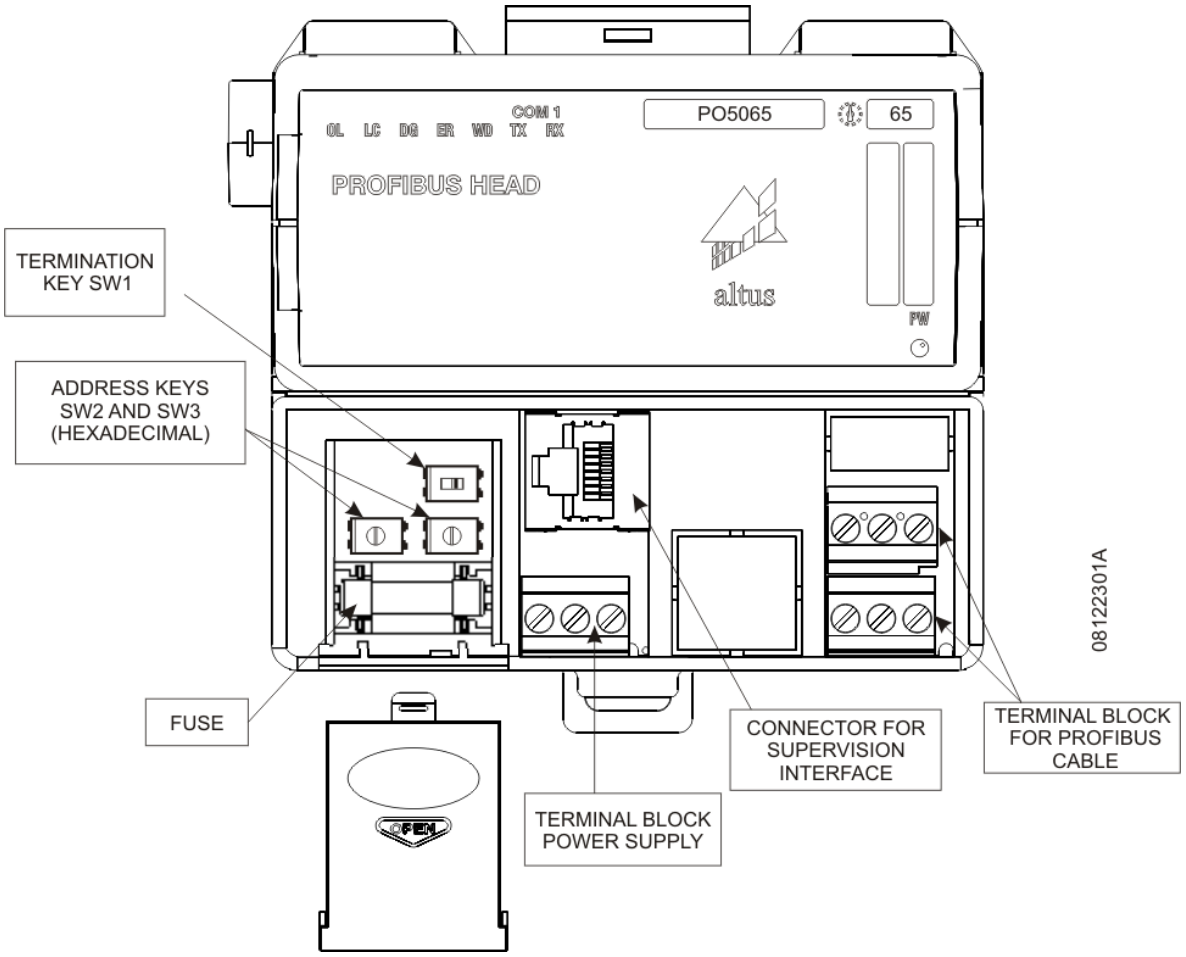

Figure 2-1. Conecting a PO5065 to the PO6500 base

Product Packaging

The product package contains:

- PO5064 or PO5065 Module
- Installation Guide

Product Code

Please use following product code when ordering the product:

Code	Descriptions
PO5064	PROFIBUS-DPV1 Field Network Head
PO5065	PROFIBUS-DPV1 Redundant Field Network Head

Related Products

Depending on your system requirements, the following products might be ordered along with the PO5064 or PO5065. Please check with your sales representative if you have any questions.

Table 2-3 PROFIBUS Head Related Products

Code	Description
PO6500	PROFIBUS Head Base, Modbus
PO8085	24 VDC Power Supply
AL-2601	Deriver connector, for PROFIBUS network
AL-2602	Terminator connector, for PROFIBUS network
AL-2605	Power supply diagnistics terminator
AL-2303	PROFIBUS network cable, diameter 7.1 mm
AL-1715	RJ45-CFDB9 cable
AL-1719	RJ45-CMDB9 RS232C cable
AL-1720	RJ45-CMDB9 RS232C / RS485 cable
MT6000	MasterTool ProPonto
PO8510	10 Sheets with 14 labels of 14 tags for printer

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

AL-1715: this cable has a RJ45 serial connector and a DB9 RS232C 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 RS232C male with Altus standard pins. It may be used for:

- Interconnection to a MMI

AL-2601: This is a DB9 connector used as derivator that conforms to the EN50170 norm and has no termination. It is ideal to connect PROFIBUS devices that are not mounted on the extremities of the PROFIBUS network. This connector has an input and an output in order to allow disconnection without interrupting physical continuity of the network.

AL-2602: This is a DB9 connector used as derivator that conforms to the EN50170 norm and has termination. It is ideal to connect PROFIBUS devices that are mounted on the extremities of the PROFIBUS network.

AL-2605: This terminator with power supply diagnostics is used on the extremities of redundant networks when it is necessary to replace devices of the network without losing the terminations.

AL-2303: PROFIBUS network data communication cable.

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:

- 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.

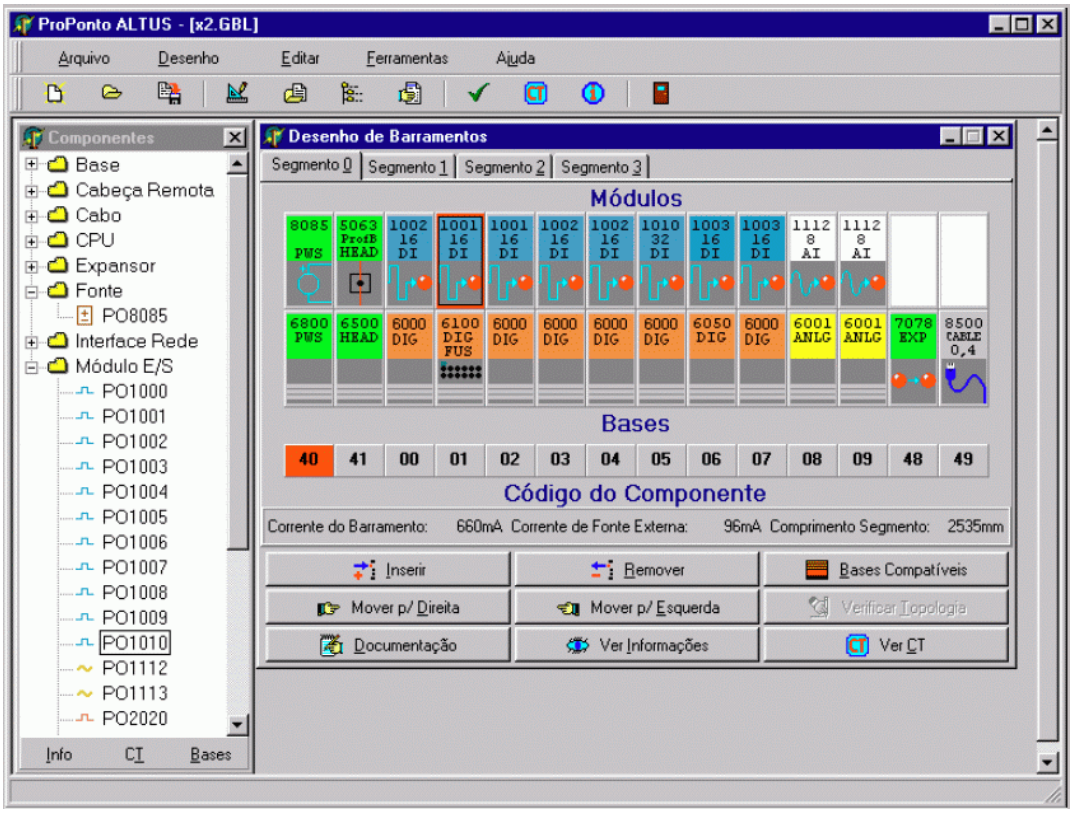

Figure 2-2. MasterTool ProPonto Screen shot

Block Diagram

The PO5064 and PO5065 PROFIBUS heads has one microprocessor and two intelligent controllers: the first executes the interface protocol to the Ponto bus; the second executes the PROFIBUS-DP and PROFIBUS-DPV1 slave protocol functions. The PO5065 head also has a dedicated block that controls redundancy, the redundancy channel REDCOM.

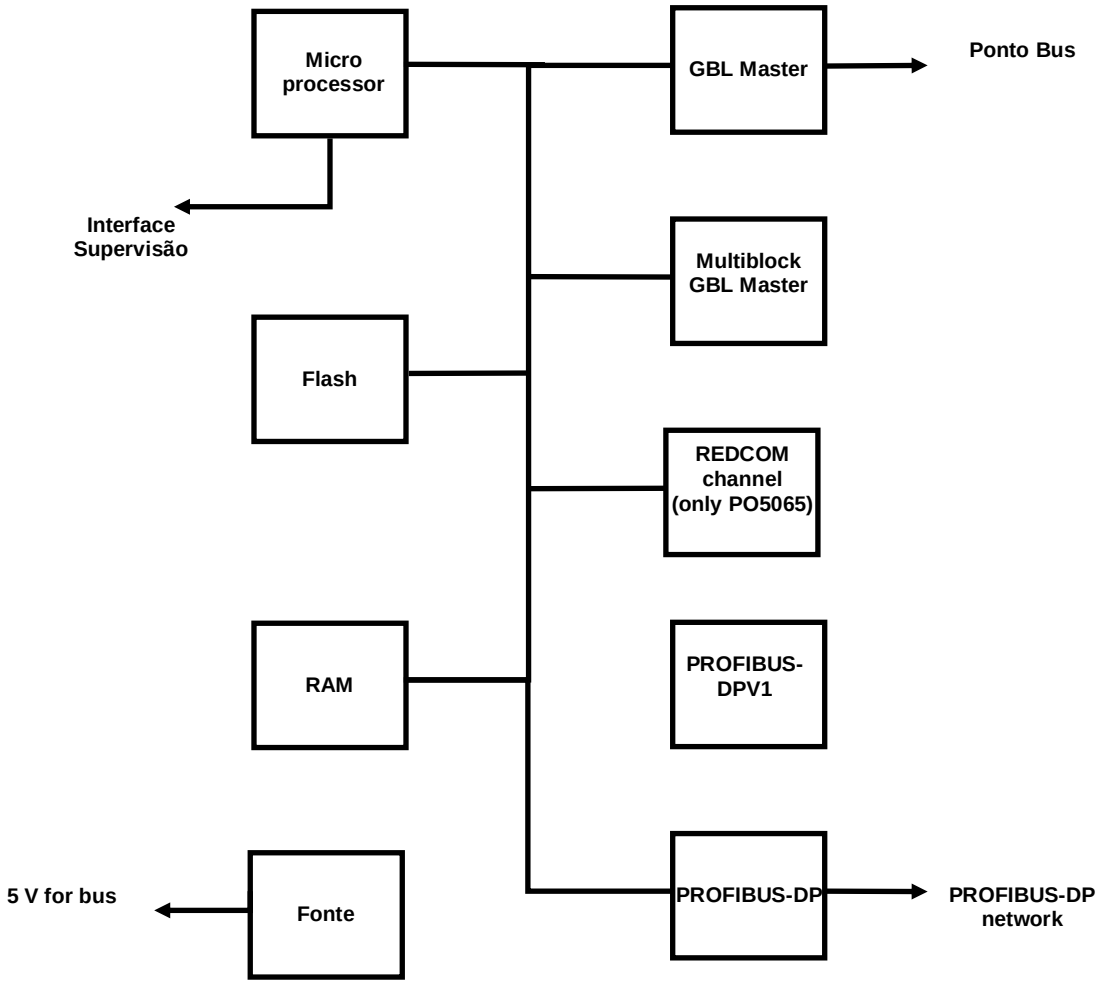

Figure 2-3. PROFIBUS head block diagram

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 dual port memory that works as a Ponto bus mirror.

Multi Block GBL Master

The Multi Block GBL Master executes acyclic read and write comands for message exchange with modules present on the bus and that also have this capacity.

PROFIBUS-DP

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**).

PROFIBUS-DPV1

The PROFIBUS-DPV1 is a PROFIBUS-DP extension that permit the execution of acyclic commands using class 1 and class 2 masters. Levels 1 and 2 of the protocol are also implemented in hardware.

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;
- circuit that alerts the processor before power runs out in case of failure on power supply sensor.

REDCOM communication channel (only for PO5065)

The REDCOM communication channel is implemented on the Ponto Bus and it's purpose is to implement the communication between redundand PROFIBUS heads.

The communication via REDCOM permits the solicitation of SwitchOver and identify problems with redundant heads (please refer to chapter 11, PO5065 redundancy).

This block is described in PROFIBUS UIDE-LINE ORDER no. 2.212-PROFIBUS SPECIFICATION SLAVE REDUNDANCE.

PROFIBUS head states

It is important to know the state in winch the PO5064 and PO6065 PROFIBUS heads are in is important to understand their functioning in an application. Each state is activated in distinct manner and possesses distinct characteristics.

PO5064 head states

A PO5064 can operate in one of the following states:

- Offline state
- OnLine state
- Error State

OffLine state

In this state, the head doesn't exchange data with the Master, does'nt actuates on the I/O devices and does'nt monitor the Ponto Bus.
This state occurs between the power on of the module and the recepction of the paramters and configuration sent by the master. This state also ocurrs when there's no communication with the master.
The head changes state to OnLine state when it receives que parameterization and configuration from the Master. The module can also change to Error state when there's an abnormal situation on the system.

OnLine State

In this state, the head exchange data with the Master, actuates on the I/O devices and monitors the Ponto Bus.
The head can change to OffLine state when it looses communication with the Master. The module can also change to Error state when there's an abnormal situation on the system.

Error State

In this state, the head looses read and write access the ponto bus and does'nt monitor the Master outputs.

Occurs when there's an abnormal situation on the system. Via dignostics, the head informs the error occurred (please refer to chapter 7, **Maintenance**).

The only way to change state from this state is issuing a power off of the head.

PO5065 head states

A PO5065 can operate in one of the following states:

- Offline state
- Primary OnLine state
- Reserve OnLine state
- Output Retention state
- Error State

OffLine state

In this state, the head does not exchange data with the Master, does not actuates on the I/O devices and does not monitor the Ponto Bus.
This state occurs between the power on of the module and the recepction of the paramters and configuration sent by the master. This state also ocurrs when there is no communication with the master.
The head changes state to OnLine state when it receives que parameterization and configuration from the Master. The module can also change to Error state when there is an abnormal situation on the system.

Primary OnLine State

In this state, the head has exclusive access to the bus and can exchange data with the Master, actuate on the I/O devices and monitors the Ponto Bus. This is the head that sends valid data to the Master.
The head can change to Reserve OnLine State in the case of a SwitchOver or to the Error State when there is an abnormal situation on the system. If the redundand slave looses communication with the Master, it changes to Output Retention State or to OffLine State if the Output Retention State is disabled.

Reserve OnLine State

In this state, the head does not have read and write access to the Ponto Bus. Although it is receiving and sending data from the Master via PROFIBUS network and monitoring failures on the primary head.
The redundant head indicates through the virtual redundancy module PO9100 that data is not valid and must not be considered valid for the application (please refer to chapter 11, **PO5065 redundancy**).
The head can change to Primary OnLine state in the case of a SwitchOver, to Output Retention State or to OffLine State (in case of Ouptut Retention State is disabled) when the redundant slave looses communication with the Master. The head can also change to the Error State when there is an abnormal situation on the system.

Output Retention State

In this state, the head maintains the input devices reading enabled but freezes the outputs remaining the last valid value received when there was communication with the Master.
The head enter this state when the redundant slave looses communication with the Master. To enter this state, a head needs to be in Primary OnLine State. If two head are in OnLine state before loosing the communication with the Master, the last head that looses communication will enter this state and the other one will enter OffLine state.
The Output Retention state is designed to avoid discontinuity of application processing in the caso of Master SwithOver.
The time that the head stays in Output Retention State is programmable through the parameter Sustentation Time without Master (please refer to chapter 4, **configuration**).
The head can enter Error State if there's abnormal situation on the system. The OnLine state is entered if the communication with the Master is restablished before the end of the sustentation time otherwise the head will enter OffLine state.

Error State

In this state, the head looses read and write access the ponto bus and does'nt monitor the Master outputs.

Occurs when there is an abnormal situation on the system. Via dignostics, the head informs the error occurred (please refer to chapter 7, **Maintenance**).

The only way to change state from this state is issuing a power off of the head.

Hot Swap

It is possible to replace the modules even when the bus is powered. This feature facilitates maintenance in case of failures of equipments.

I/O modules hot swap

The models PO5064 and PO5065 permit hot swap of it's I/O modules. Please refer Ponto Series Utilization manual (MU209000).

PO5065 hot swap

It is possible to hot swap of a redundant PO5065 when there is a redundant slave. In order to achieve this, the head that remains on the bus must be on Primary OnLine state. Doing this it is possible to replace a module without powering off the bus and affecting the I/O devices.

If the two PO5065 heads are removed, the last information sent by the Master to de input/output devices will be used.

PO5064 hot swap

It is not possible to hot swap the PO5064 head. In the case of removal of the PO5064 head, the input/output devices will be powered off.

If the PO5064 head is removed, the last information sent by the Master to de input/output devices will be used.

GSD File

Every PROFIBUS-DP device has a file that defines its limits and configuration possibilities. PO5064 and PO5065 use different configuration files. Altus provides the files ALT_0BAF.GSD and ALT_0BB0.GSD for PO5064 and PO5065 respectively. This files contain deinfitions needed to include the module into a PROFIBUS-DP network. This files are generated in English 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.

ATTENTION: Please use the GSD file (ALT_0BAF.GSD) revision 1.00 or superior with PO5064 and GSD file (ALT_0BB0.GSD) revision 1.00 or superior with PO5065.

The files ALT_0BAF.GSD, PO5064_S.DIB, PO5064_R.DIB and PO5064_D.DIB used with PO5064 and files ALT_0BB0.GSD, PO5065_S.DIB, PO5065_R.DIB and PO5065_D.DIB used with PO5065 are available at http://www.altus.com.br.

The GSD files facilitate the interoperability among PROFIBUS devices from different manufacturers. Those files have the devices 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.

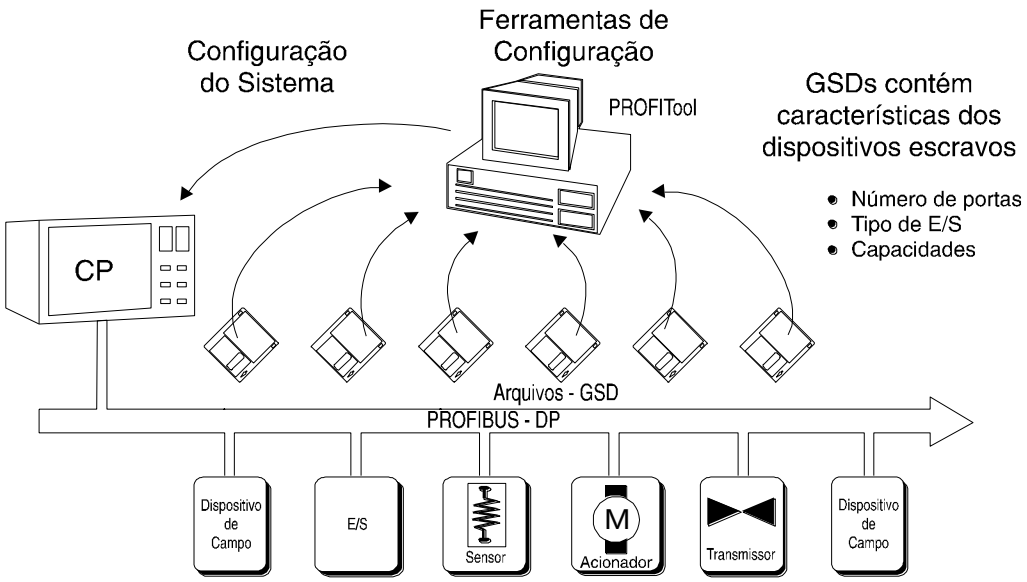

Figure 2-4. Configuration through the GSD files

Verifiyng the GSD version

Can be made in two ways: visualization with programmer software or by reading the GSD file.

Bellow are presented the steps needed to verify the version using MasterTool programming tool:

- On the menu bar select Tools> GSD Viewer.
- Select the device GSD file. In the case of PO5064 the file is ALT_0BAF.GSD and for the PO5065 the file is ALT_0BB0.GSD.
- Verify version on item device Revision

Bellow are steps needed to verify version of GSD using GSD file:

- Open the GSD file using any file editor software. In the case of PO5064 the file is ALT_0BAF.GSD and for the PO5065 the file is ALT_0BB0.GSD.
- Verify version on item Revision.

Response Time for the PROFIBUS Head

The response time is the time between the detection of an input change until the respective output responds. There is no difference of the response time of PO5064 and PO5065. Care must be taken to take in account the response time of the redundant module PO9100 when calculating the response time.

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.

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 +

m 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 = number of polls to access input module + 1.

m = number of polls to access output 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 poll 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:

Table 2-4 Ponto modules examples

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

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. An analog module with 8 channels is accessed in 9 pools.

Example:

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

$\mathbf{T_v}$ = 5 X 16 + 2 X 16 + 1 X 73 = 185 μs

Maximum accessing times:

16 input modules: 2 X 185 = 370 μs

8 channels modules: 9 X 185 = 1665 μs

Minimum accessing times:

16 input modules: 1 X 185 = 185 μs

8 channels modules: 9 X 185 = 1665 μs

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:

$\mathbf{T_e}$ = T1 + n X T2

where

T1 = 250 μs

T2 = 18 μs

n = total number of input octets

(The analog channels use 2 octets each).

Outputs:

$\mathbf{T_s}$ = T3 + m X T4

where

T3 = 250 μs

T4 = 18 μs

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 Masters operating system.

ATTENTION:
When using PO5065 redundant head, the PO9100 virtual module for redundancys delay must be taken into account. This module consumes 2 bytes for outputs and 2 bytes for inputs.

Response Time Calculation Example

where:

Application time for the master: 50 ms

PROFIBUS network polling time: 2 ms

Inputs and outputs processing time: 50 µs

Input module delay time: 150 µs

Output module delay time: 10 µs

Ponto bus polling time: 185 µs

Number of polls to access input module: 2

Number of polls to access output module: 1

Then:

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

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

ATTENTION:
There is no formula to calculate the response time for DPV1 communication since this communications are acyclic dificulting the calculation of the response time.

Installation

This chapter features the procedures for the physical installation of PO5064 and PO5065 PROFIBUS Heads. Because these heads are physically identical and coupled on the same base, both have identical mechanical, electrical and networking installation.

Mechanical Installation

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

The PO5064 and PO5065 heads are assembled on DIN TS35 rails along with the Ponto Series IO modules. The base PO6500 (acquired separately) must be utilized along with the PROFIBUS heads. The base connects the head to the PROFIBUS network, to the 24VDC power supply and to the Ponto Series modules.

ATTENTION: Both redundant heads must have theirs bases connected to 24 VDC power supply. Even if both are powered up, the capacity of modules on Ponto bus is not changed.

Ponto Bus and Termination

The bus connection follows the Ponto Series Utilization Manual.

The heads must to be installed obligatorily on the first two Ponto bus positions.

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.

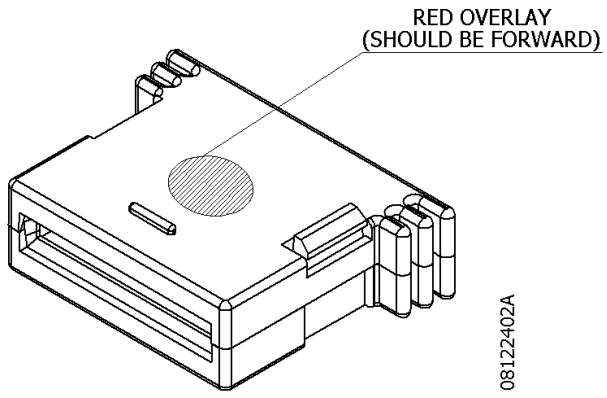

Figure 3-1. Ponto Bus Termination

Electrical Installation

24 VDC Power Supply

The PO5064 and PO5065 heads have the same power characteristics. They are connected at the same base type and use the same link type. A 24VDC power supply (19 to 30VDC including ripple) feeds the head through the 3 connector terminal block, on the frontal panel. The grounding cable connection is required.

The PROFIBUS heads have a 2 A fuse in the base where they were installed, protecting electronic circuit against current.

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 PO5064 or PO5065 module on the PO6500 base.

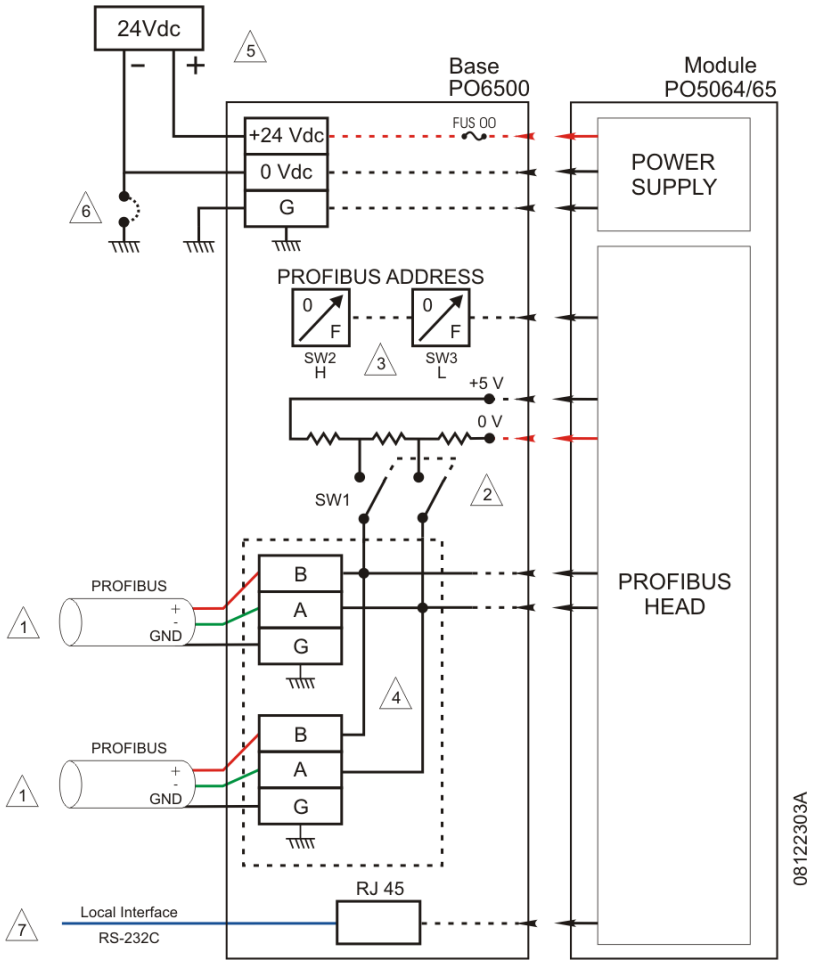

Figure 3-2. Connection Diagram Using the PO6500 Base

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, SW2 and SW3, program the PROFIBUS address for the PO5064 and PO5065 modules. The SW2 switch is the most significant bit.

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.

Redundant PO5065 Head Installation

It is necessary to take some providences about module physical installation, when the PO5065 Head with redundant characteristics is used:

- Install the power wiring. Two power supply can be used, but they must be connected together, instead of one for each Head. The output of each power supply must have a diode with power to support the supply maximum current. Besides, the output of each power supply can be linked to digital input module to generate diagnostic when a fault occurs.

ATTENTION: The backup Head does not execute received PROFIBUS frames. In case of fault, the backup Head will act like primary head and it will communicate with the network.

ATTENTION: LEDs indicates when a Head has not 24 VDC input nominal current. The two Heads must not be linked to two distinct supplies.

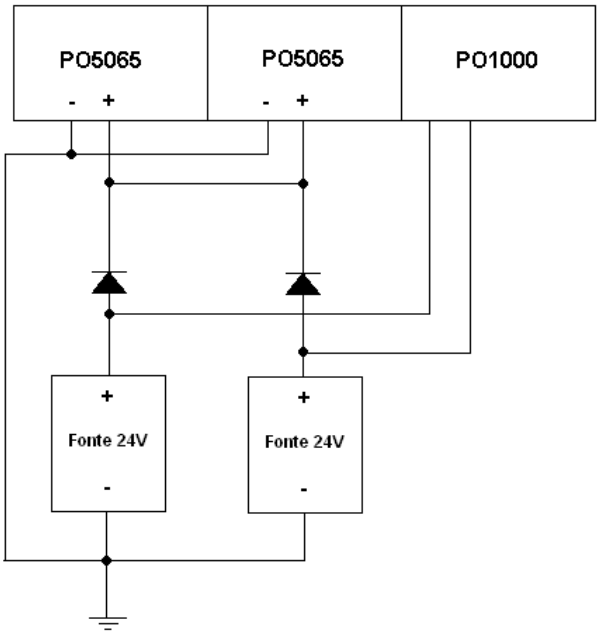

Figure 3-3. Connection Diagram Using Redudant PO5065 Heads

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, using the PO6500 base. There is not obligation to input and output cables, both one and other can be used like terminal.

Table 3-1 shows the terminal input configuration:

Table 3-1 PROFIBUS Terminal Configurations

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

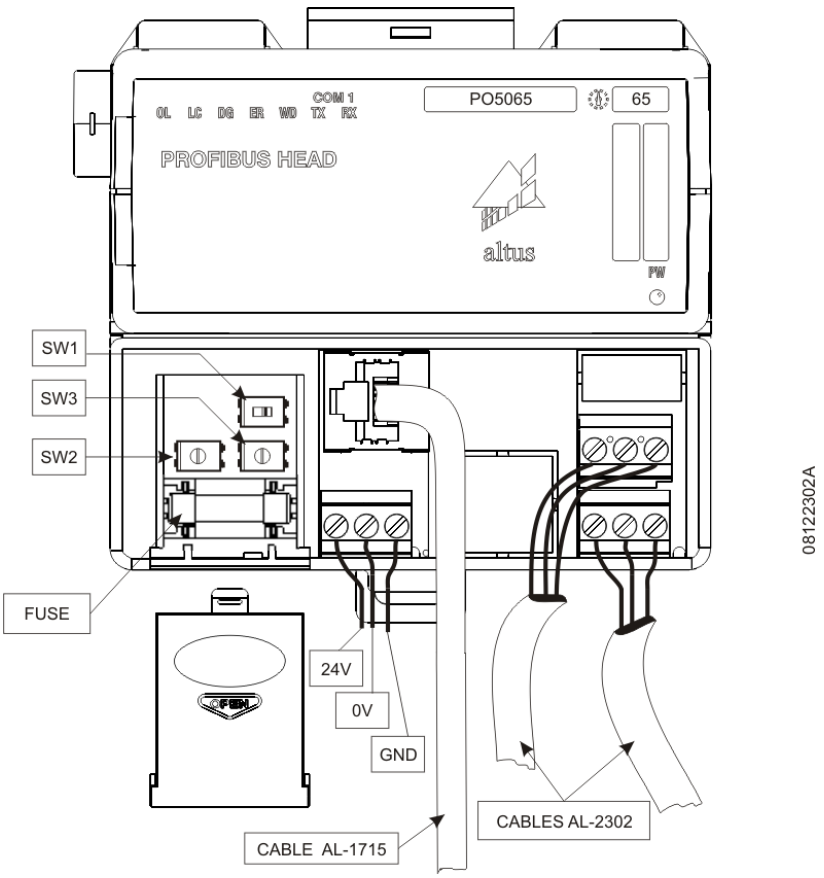

Figure 3-4. Powering Connection and PROFIBUS Cable Using PO6500 Base

Address Switches

PO5064 and PO5065 head bases have two address hexadecimal switches. The switches must be set to the desired PROFIBUS addresses (from 1 to 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:

Address = SW2 * 16 + SW3

Where: SW2: 0 to 7

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

The address switches positions are shown on Figure 3-5.

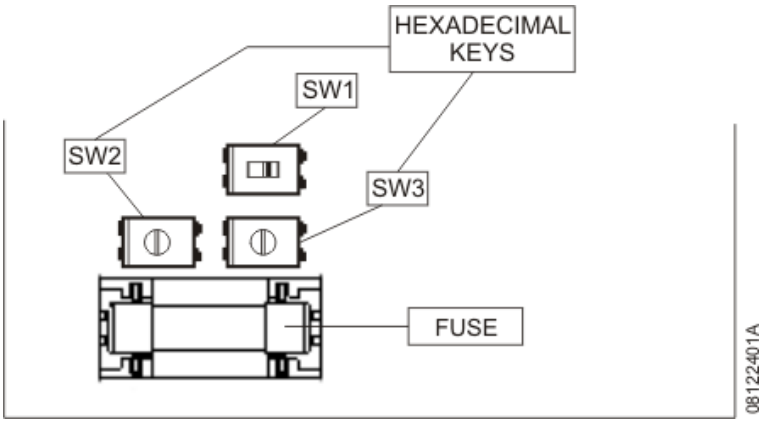

Figure 3-5. Termination Switches (SW1) and Address (SW2 and SW3) from PO6500 Base

It is necessary to adjust correctly the PO5065 head address according to network architecture (please consult chapter 12, **Network Architecture**)

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.

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.

Table 4-1 Ponto Series IO Modules shows some Ponto Series IO modules and the basic information required to do the configuration.

Table 4-1 Ponto Series IO Modules

Module	Description	Compatible Bases	Input Data Number of Bytes	Output Data Number of Bytes
PO1000	16 ED 24Vdc Opto	PO6000	2	
PO1001 / 2	16 ED 110/220 Vac	PO6003	2	
PO1003	16 ED 48 Vdc Opto	PO6000	2	
PO1004	16 ED 125 Vdc Opto	PO6000	2	
PO1006	8 ED 24 Vdc	PO6000	2	
PO1010	32 ED 24 Vdc Opto	PO6000	4	
PO1112	8 AI Isolated Universal	PO6001-PO6101	16	
PO1113	8 AI Voltage and Current	PO6001-PO6101	16	
PO1114	8 AI Current Module with Hart	PO6001	16	
PO1212	8 AI Isolated Universal	PO6001-PO6101	16	
PO1213	1 a 8 AI Isolated Voltage and Current	PO6001 - PO6101	16	
PO2020	16 Isolated 24Vdc DO	PO6002		2
PO2022	16 Relay DO	PO6000-PO6002-PO6100-PO6102		2
PO2025	8 DO 24 Vdc with Isolation Barrier	PO6002		2
PO2132	4 AO Voltage and Current	PO6001		8
PO2134	4 AO Current Module with Hart	PO6001		8

In this chapter, possible architectures are shown using PO5064 and PO5065 heads, for further information about architectures, check chapter 13, **Network Architectures**.

PO5064/PO5065

Configuration of PO5064 and PO5065 heads is composed by seven steps that must be followed for the correct system configuration. In some steps, practical examples are presented in order to help comprehension.

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 IO points.
- Verify the PROFIBUS head capacity based on following values:

  Maximum number of real modules: 20.
  Maximum number of virtual modules: 4 of each PO9098 type.
  Total number of declared modules: 32
  Maximum number of bytes to be transmitted over the network:
  PO5064: 200 input bytes and 200 output bytes.
  PO5065: 198 input bytes + 2 redundancy status bytes and 198 output bytes + 2 redundancy status bytes.

Example 1:

- Number of Points:

  85 Analog Input channels (AI).
  190 Digital Input points (DI) 24Vdc.
  48 Digital Output points (DO).

- Input characteristics:

  Analog inputs with common, but requires isolation.
  Digital inputs with common, but requires isolation.
  Dry contact digital outputs.

- Modules selection:

  PO1112 - 8 AI Universal Isolated
  PO1010 - 32 DI 24Vdc Opto
  PO2022 - 16 DO Relay

- Number of modules:

  11 PO1112 modules
  6 PO1010 modules
  3 PO2022 modules

- Check the maximum number of modules per head:

Table 4-2 Maximum Number of Modules for Example 1

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	11	16 I	176 (= 11 x 16)	-
PO1010	6	4 I	24 (= 6 x 4)	-
PO2022	3	2 O	-	6 (= 3 x 2)
TOTAL	19 ✔		200 ✘	06 ✔

(*) These data are available in ALT_0BAF.GSD and ALT_0BB0.GSD files.

- Conclusion:

  ✔ This configuration fits for PO5064 head, because it complies with the specifications of maximum number of modules and data bytes.

  ✘ This configuration does not fit for PO5065 head, because it overtakes the 198 input bytes maximum limit.

Example 2:

- Number of Points:

  76 Analog Input channels (AI).
  153 Digital Input points (DI) 24Vdc.
  59 Digital Output points (DO).

- Input characteristics:

  Analog inputs with common, but requires isolation.
  Digital inputs with common, but requires isolation.
  Transistor digital outputs.

- Modules selection:

  PO1112 - 08 AI Universal Isolated
  PO1010 - 32 DI 24Vdc Opto
  PO2022 - 16 DO 24Vdc Opto

- Number of modules:

  04 PO1112 modules
  03 PO1010 modules
  03 PO2022 modules

- Check the maximum number of modules per head:

Table 4-3 Maximum Number of Modules for Example 2

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	4	16 I	64 (= 4 x 16)	-
PO1010	3	4 I	12 (= 3 x 4)	-
PO2020	3	2 O	-	6 (= 3 x 2)
TOTALS	10 ✔		76 ✔	06 ✔

(*) These data are available in ALT_0BAF.GSD and ALT_0BB0.GSD files.

- Conclusion:

  ✔ This configuration fits for PO5064 head, because it complies with the specifications of maximum number of modules and data bytes.

Example 3:

- Number of Points:

  112 Analog Input channels (AI).
  68 Digital Input points (DI) 24Vdc.
  15 Digital Output points (DO).

- Input characteristics:

  Analog inputs with common, but requires isolation.
  Digital inputs with common contact, but requires isolation.
  Dry contact digital outputs.

- Modules selection:

  PO1112 - 8 AI Universal Isolated
  PO1010 - 32 DI 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:

Table 4-4 Maximum Number of Modules for Example 3

Modules Types	Number of Modules	Number of Bytes (*) Information / Module	Total Number of Input Bytes	Total Number of Output Bytes
PO1112	14	16 I	224 (= 14 x 16)	-
PO1010	3	4 I	12 (= 3 x 4)	-
PO2022	1	2 O	-	2 (= 1 x 2)
TOTALS	19 ✔		236 ✘	02 ✔

(*) This data is available in ALT_0BAF.GSD and ALT_0BB0.GSD files.

- Conclusion:

  ✘ This configuration does not fit for PO5064 and PO5065 heads, it does not comply with the total number of data bytes requirement. The IOs should be redistributed in other nearby heads and configuration must be made once more.

ATTENTION:
To configurate a remote IO system with PROFIBUS protocol, the PROFIBUS Master device used capacity bounds must be checked.

Step 2

Determine the required bases for the IO modules.

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

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

Table 4-3 shows the options.

Table 4-5 Bases for Ponto Series Modules

Input and Output Modules	Compatible Bases Types
PO1000 – 16 DI 12 Vdc Opto	PO6000
PO1001 – 16 DI 110 Vac Opto	PO6003, PO6103
PO1002 – 16 DI 220 Vac Opto	PO6003, PO6103
PO1003 – 16 DI 48 Vac Opto	PO6000
PO1004 – 16 DI 125 Vdc Opto	PO6000
PO1006 – 8 DI 24 Vdc	PO6000
PO1010 – 32 DI 24 Vdc Opto	PO6000
PO1112 – 8 AI Universal Isolated	PO6001, PO6101
PO1113 – 8 AI Voltage and CUrrent	PO6001, PO6101
PO1114 – 8 AI Current with Hart	PO6001
PO1212 – 8 AI Universal Isolated	PO6001, PO6101
PO1213 –1 a 8 IA Isolated Voltage and Current	PO6001, PO6101
PO2020 – 16 DO 24 Vdc Transist .Opto	PO6002
PO2022 – 16 DO Relay	PO6000, PO6002, PO6100, PO6102,
PO2025 – 8 DO 24 Vdc with Isolation Barrier	PO6002
PO2132 – 4 AO Voltage and Current	PO6001
PO2134 – 4 AO Current with Hart	PO6001

Step 3

Determine the head and its base.

For a PROFIBUS-DP head without redundancy one may use PO5064 head and for a PROFIBUS-DP head with redundancy one should use PO5065 head.

Step 4

Determine the number of bus segments. For this step, please consider:

- Maximum number of segments per head: 04
- 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.

Next, two examples of configurations are shown, each one presenting two distinct alternatives for system assembly. These examples are used to help comprehension of steps 5 and 6.

Example 1:

Two possible configurations for a head with 19 IO modules.

- Segment 1 with 9 input and output modules and PO7078 extender at the end of segment.
- Segment 2 with 10 input and output modules and an auxiliary PO8085 power supply of Ponto Series at the start of segment.

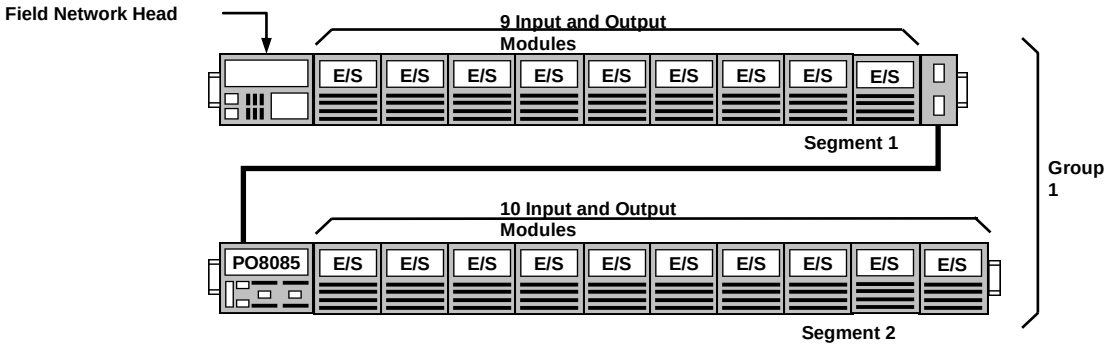

Figure 4-1. Example 1 with two segments

- Segment 1 with five input and output modules and PO7078 extender in the end of segment
- Segment 2 with seven input and output modules and two PO7078 extenders, one at the start of segment and the other one at the end of segment.
- Segment 3 with seven input and output modules and an auxiliary PO8085 power supply at the start of segment.

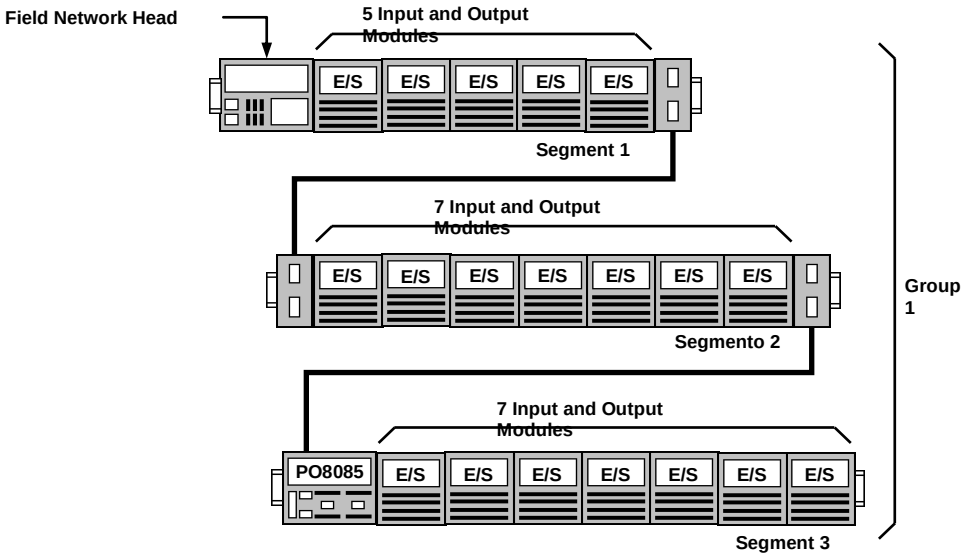

Figure 4-2. Example 1 with three segments

Example 2 :

Two possible configurations with one head and 10 IO modules.

- Segment 1 with five input and output modules and PO7078 extender in the end of segment.
- Segment 2 with five input and output modules and an auxiliary PO8085 power supply at the start of segment.

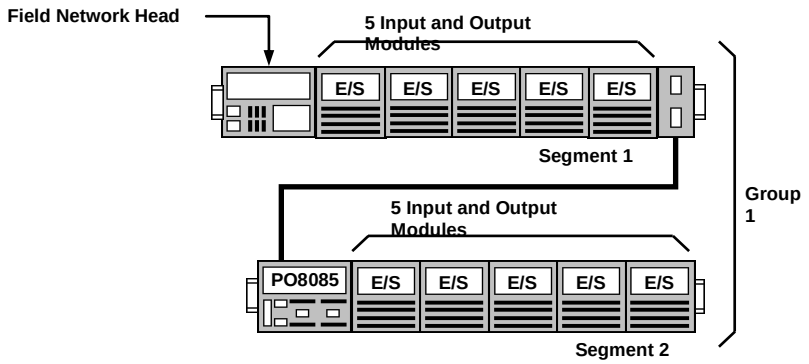

Figure 4-3. Example 2 with two segments

- Segment 1 with 10 modules.

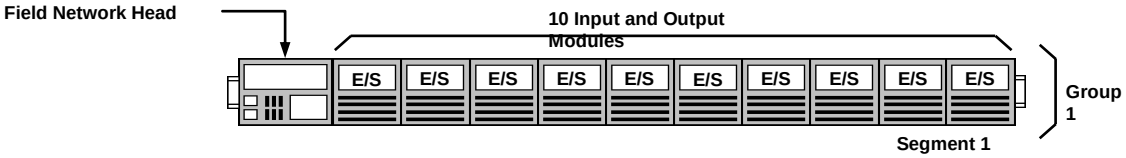

Figure 4-4. Example 2 with one segment

ATTENTION: 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.

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 Table 4-1 that the first bus segment (1) is fed directly from the field network head and the last segment (2) is fed by a power supply located on the first bus position.

In Table 4-3, the segments 1 and 2 are fed directly from the field network head because the total number of modules is 12. In the segment 3 there is a power supply located on the first bus position because the specified limit was exceeded

In Table 4-4 and Table 4-5 it is not necessary to make use of an additional power supply, because the mumber of modules is lower than 12.

.

Step 6

Determine the number of 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 1 with a expander module at its end; a expander cable and a power supply at the beginning of the segment 2.

In Figure 4-2 should be observed that segments 1 and 2 has expander modules, it is not necessary in segment 3, since exists an auxiliary PO8085 power supply.

The Figure 4-3 shows the expander modules assembled at the end of segment 1and beginning of segment 2. Please observe there is no expander module after the last input and output module on the segment 2, this position must have a bus terminator instead.

In Figure 4-4, there is no expander module because all modules are directly connected to head and only one segment is used.

Attention : It is important during the configuration phase to respect the correct bus segment assembly order. Notice that the segment beginning is at the left side, where the bus head, power supply or expander module should be installed and connected to the previous segment

Next figures show distinct forms of module arrangement using PO5064 and PO5065 heads.

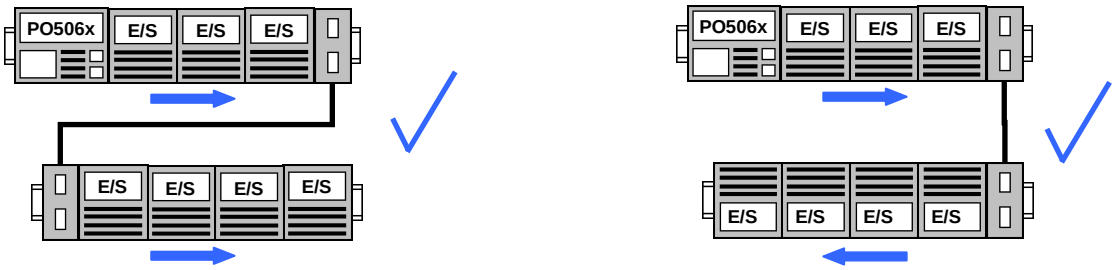

Figure 4-5. Correct Modules Distribution Using PO5064

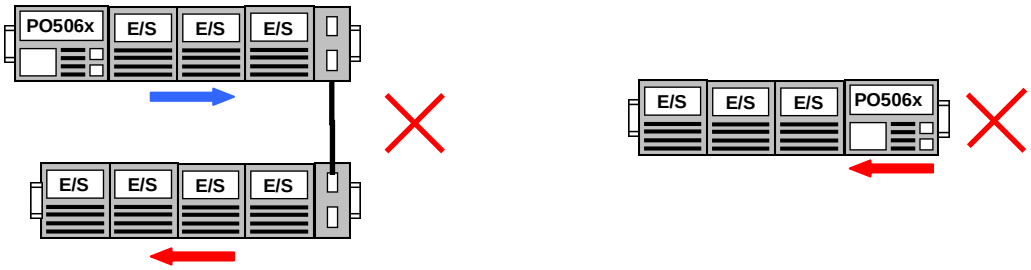

Figure 4-6. Incorrect Modules Distribution using PO5064

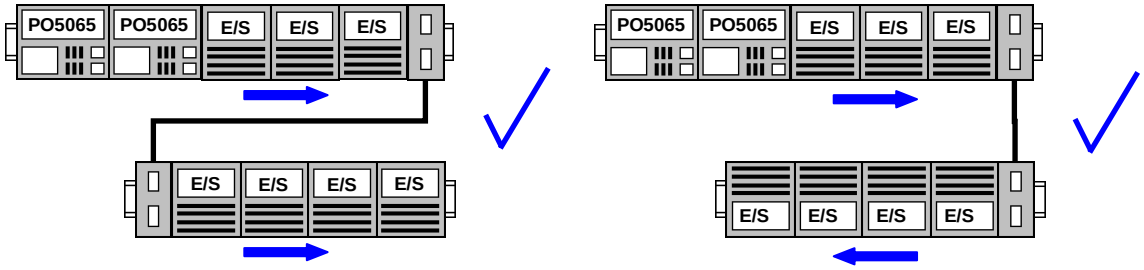

Figure 4-7. Correct Modules Distribution using PO5065

Figure 4-8. Incorrect Modules Distribution

Step 7

Dertermine Power supply. Current capacity of +24 VDC must be defined depending on the following charges:

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.

ATTENTION: The existency of power supply redundancy when one uses PO5065 head does not increase bus module capacity.

Please consider the following values, presented in Table 4-6:

Table 4-6 Modules Consumption

	Operating Conditions	Current consumption @ 24 Vdc
PROFIBUS Heads	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

For this application please use the following power supply, presented in Table 4-7:

Table 4-7 Modules Consumption

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

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

Master PROFIBUS-DP Interfaces

Altus availls some Master PROFIBUS Interfaces, like PX3406 and PO4053.

PX3406 is a Master which implemments communication fucntions with slaves over a PROFIBUS-DP network. Any slave compatible with PROFIBUS EN50170 Standard may be connected to these Masters. The PX3406 internally has redundancy control for PO5065 slaves, making easy redundant systems installation and optimizing the implementation (check Chapter 12, **Network Architecture**).

The master PROFIBUS-DP network interface PO4053 allows to connect PROFIBUS-DP networks to Ponto Series CPUs. Any slave compatible with PROFIBUS EN50170 Standard may be connected to this Master. In a redundant configuration, to mix redundant slaves devices and no redundant ones is not accepted.

We recommend to read PX3406 Utilization Manual (MU212000) and PO4053 Utilization Manual (MU209903).

PROFIBUS Heads with PX and Ponto Series CPUs

Tabla 4-8 presents the available devices to implement this configuration. We recommend consulting Ponto Series CPUs Utilization Manual, PX Series and their respective technical features.

Table 4-8 UCP AL Series Modules

Equipment	Model
PX Series CPU	PX2004
Power supply	PX3511 or PX3512
Shelter	PX3631, PX3634, PX3635, PX3640
Bus interface	AL-3411
Local IO modules	Consult the Series features to define IO
PROFIBUS-DP Master Interface	PX3406
PROFIBUS Network Cable Type A	AL-2303
Derivator ou terminator connector for PROFIBUS network	AL-2601, AL-2602
ProfiTool Software	AL-3865

Figure 4-9 shows a complete redundant system using redundant PLCs and slaves connected through independent networks. Each PLC is composed by a PX2004 CPU and a pair of PROFIBUS PX3406 Redundant Master Interfaces. Redundant slaves control input and output devices.

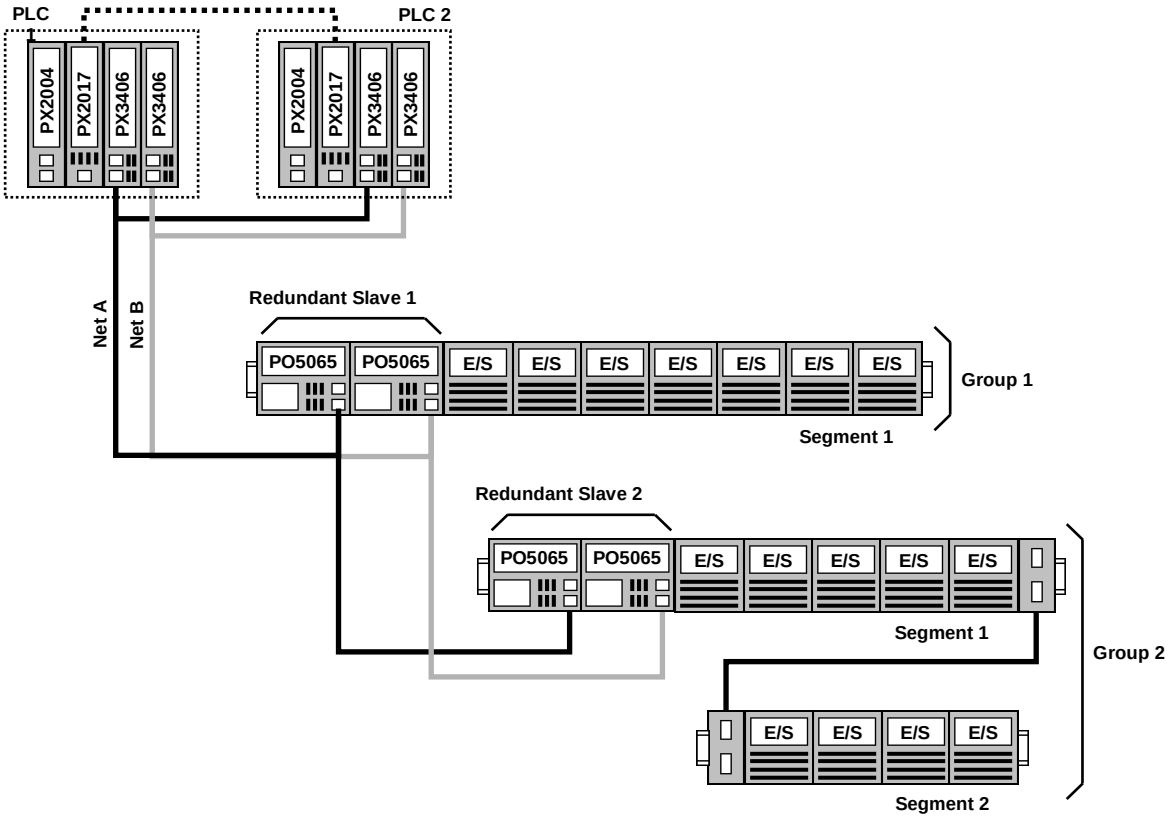

Figure 4-9. PO5065 Head and AL Series

Figure 4-10 presents a system which makes use of PO5064 heads. The PLC is composed by a PX2004 CPU and a PROFIBUS PX3406 Master Interface.

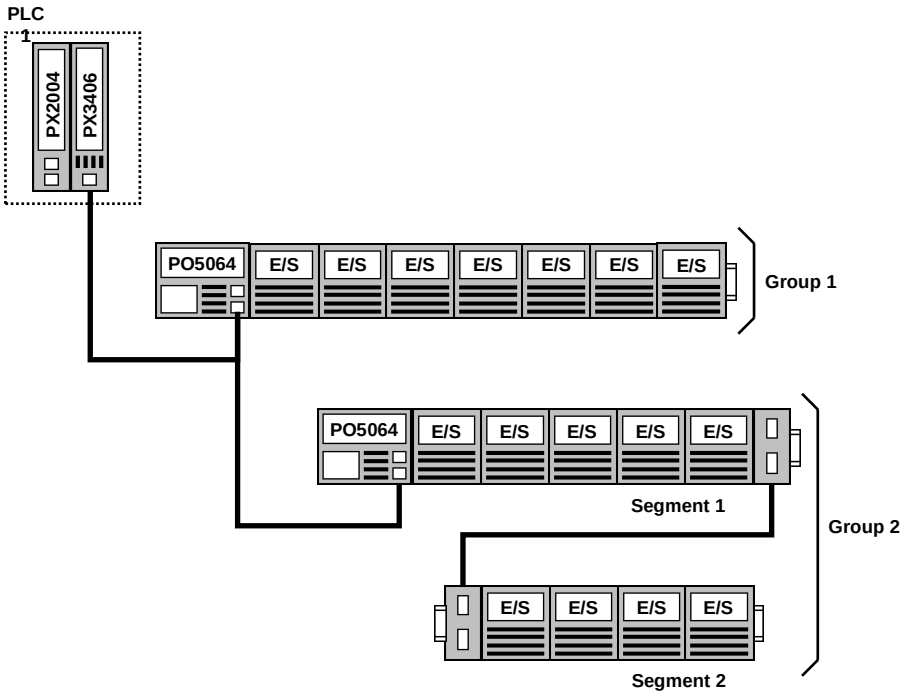

Figure 4-10 PO5064 Head and AL Series

It is also possible to make use of hybrid systems that PO5064 and PO5065 heads are used combined with same Master.

For information about systems configuration and parameterization check chapter 12, **Network Architectures**.

PROFIBUS Heads with Ponto Series CPUs

Table 4-9 displays the available devices to implment this configuration. We recommend consulting Ponto Series CPUs Utilization Manual and their respective technical features.

Table 4-9 Quark Series Modules

Equipment	Model
Ponto Series CPU	PO3242, PO3342, PO3147, PO3247
Trail	QK1500/4, QK1500/8, or QK1500/16
PROFIBUS Master Interface	PO4053
Local IO modules	Consult the Series features to define IO
PROFIBUS Network Cable Type A	AL-2303
Derivator ou terminator connector for PROFIBUS network	AL-2601, AL-2602
ProfiTool Sofware	AL-3865

Figure 4-11 presents a redundant system at head level, physical layer and Master. The PLC is composed by a PO3342 CPU and a pair of PROFIBUS PO4053 Master Interfaces. Redundant slaves control input and output devices.

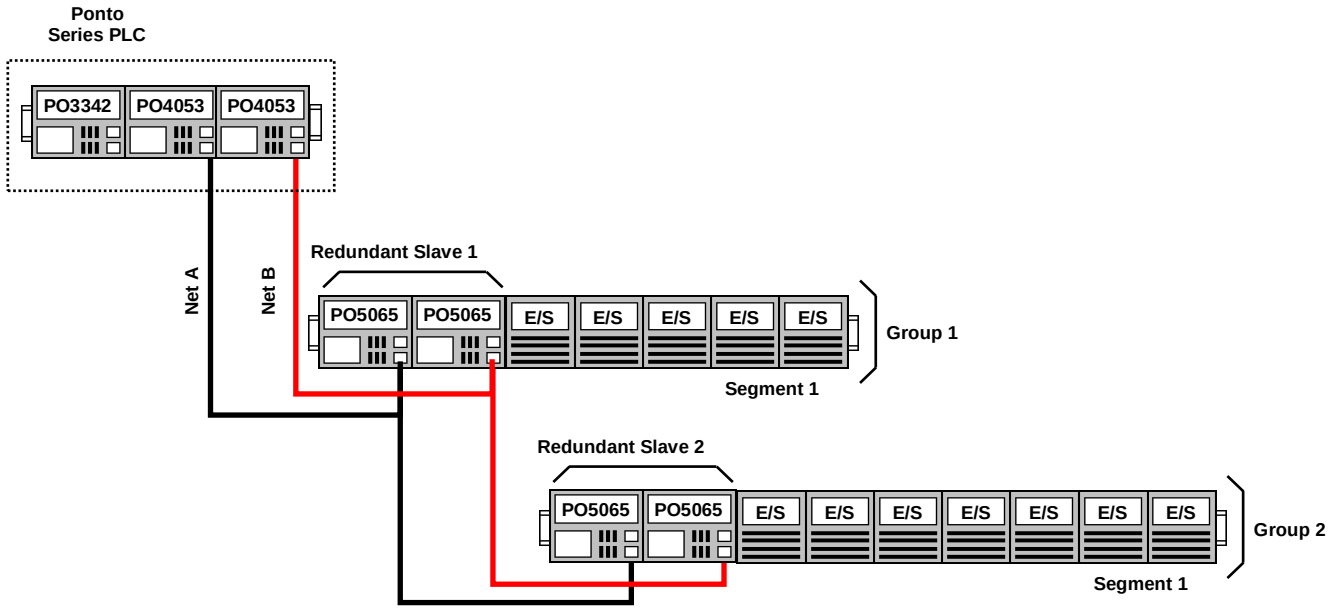

Figure 4-11. PO5065 Head and Ponto Series PLC

Figure 4-12 presents a system using PO5064 heads. PLC is composed by a PO3342 CPU and a PROFIBUS PO4053 Master Interface.

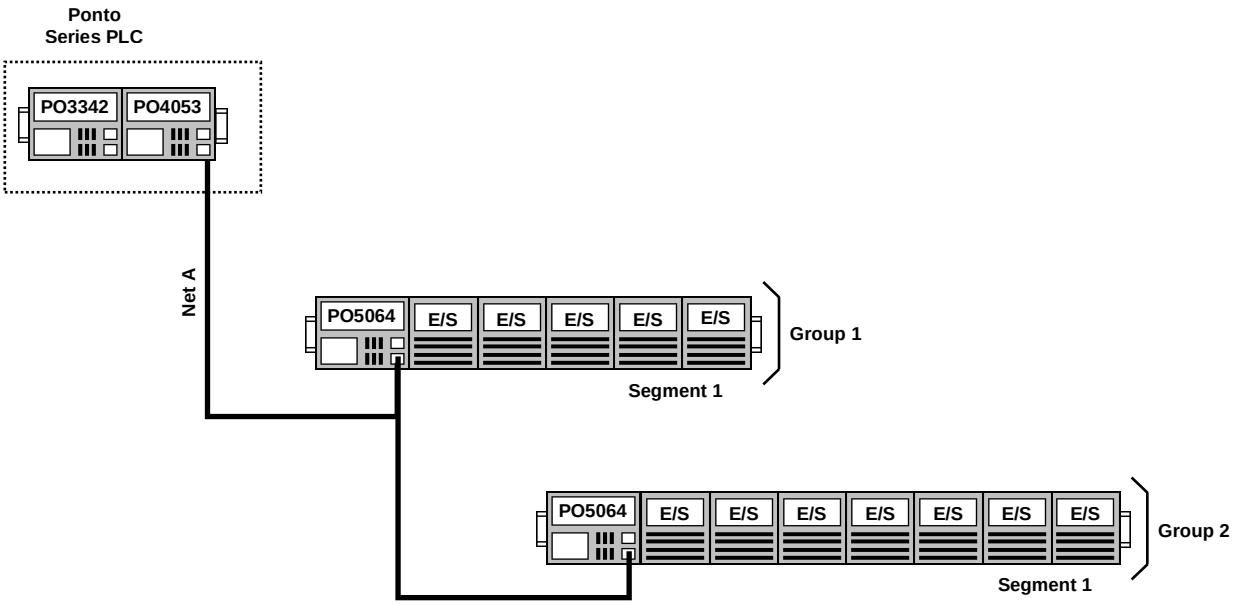

Figure 4-12 PO5064 Head

It is also possible to make use of hybrid systems that PO5064 and PO5065 heads are used combined with same Master.

For information about systems configuration and parameterization check chapter 12, **Network Architectures**.

PROFIBUS Head with other CPUs

Other manufacturers master devices may connect to Ponto Series heads, as long as they comply with PROFIBUS-DP communication standard. The user must pay attention to required cables and connectors, information found at the respective Master manuals.

Figure 4-13 shows a system with PO5064 heads and a Siemens communication Master.

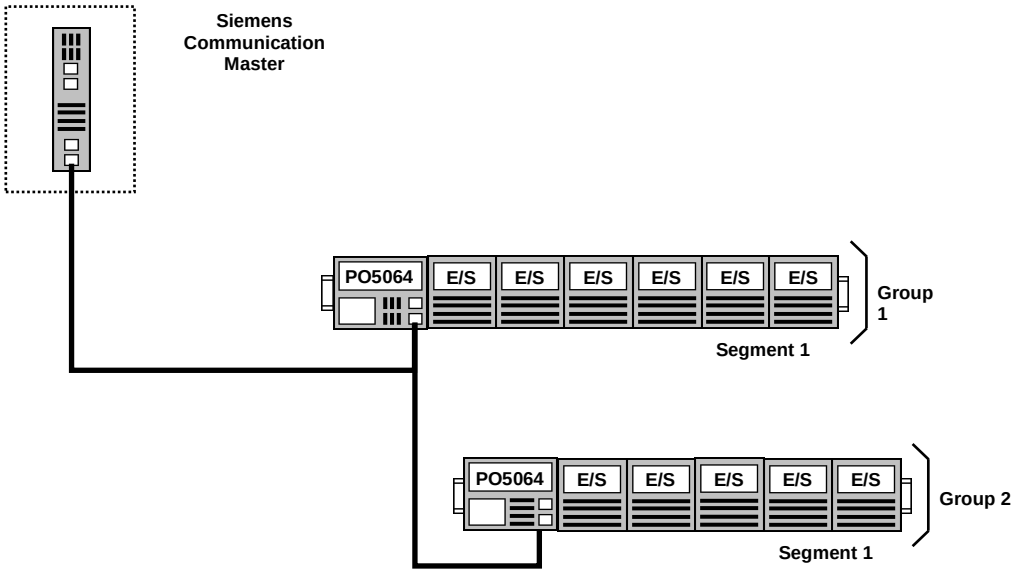

Figure 4-13. PROFIBUS Heads and Siemens Master

PROFIBUS Head with Microcomputer

You may connect one or more heads to na 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 4-10.

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

Table 4-10 PROFIBUS boards for microcomputers

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

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

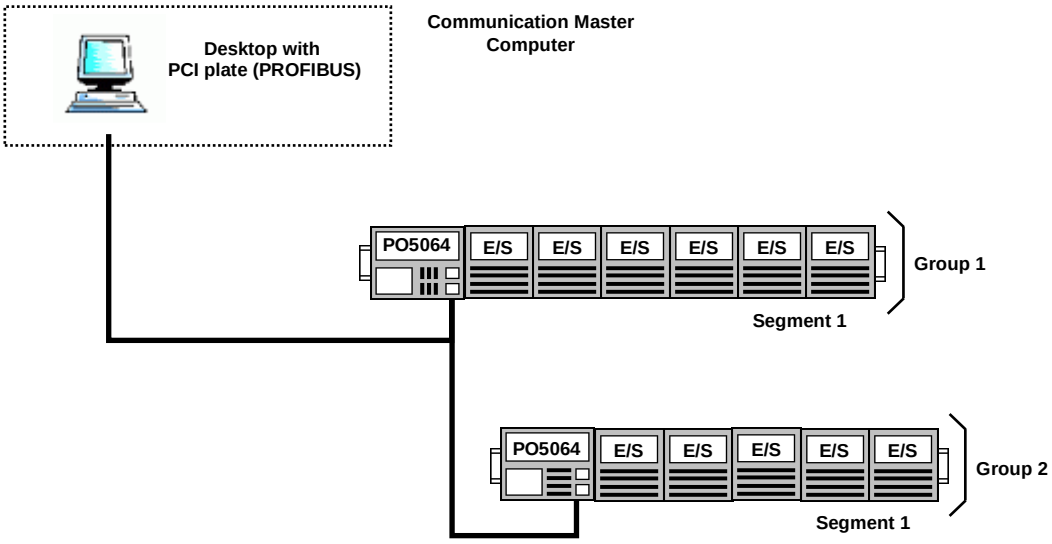

Figure 4-14. PROFIBUS Head and Microcomputer

Parameterization

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

ATTENTION:
Each PROFIBUS master manufacturer provides the programming software for network assembly and slave parameterization.

This chapter shows what parameters defined in the master for PO5064 and PO5065 head parameterization.

PO5064 and PO5065 heads use different GSD files. Take care to use the correspondent GSD files. We will use, as an example, the ProfiTool software, that is Altus PROFIBUS network programmer.

The parameterization process takes two steps:

- Bus configuration
- Modules Parameterization

It is recommendable to read and consult the Profitool Utilization Manual.

Utilize the ALT_0BB0.GSD file revision 1.00 or upper for PO5065 parameterization. And utilize the GSD ALT_0BAF.GSD file revision 1.00 or upper for PO5064 parameterization.

Bus Configuration

The modules are configured through the ALT_0BAF.GSD or ALT_0BB0.GSD file, according to the PROFIBUS head, and through 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).

ATTENTION: Although heads are installed physically on bus initial positions, they have not local bus address used by I/O modules. Thus, the module placed on this side has zero address position.

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).

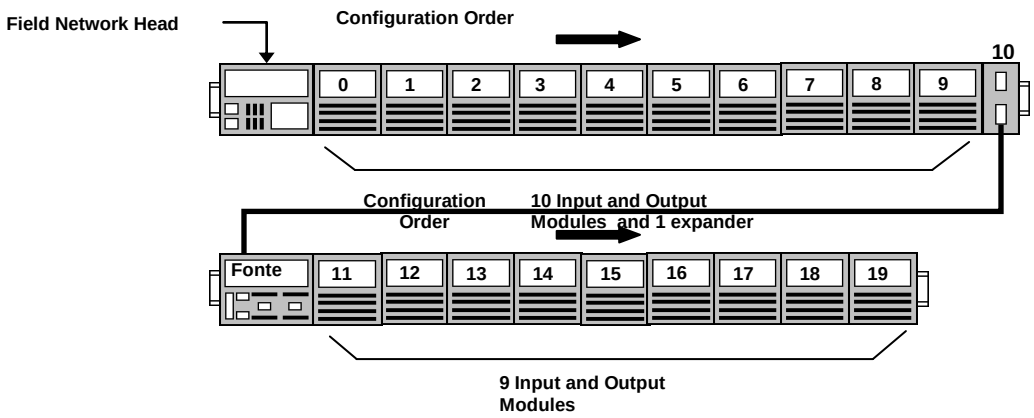

Figure 5-1. Configuration Order

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 I/O and special modules. Please declare the special modules along with the I/O ones but include the special characteristics:

PO7078 – Bus expander.

PO9098 – Virtual module to use with MMIs.

PO9100 – Virtual module to Redundant Heads (only PO5065).

PO9999 – Reserve module.

Special modules, except PO9999 module, do not influence on the maximum capacity of 20 modules suported by PO5064 and PO5065 heads.

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 (if there is PO9100 module, before it).

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

PO9100 – Virtual module to Redundant Heads

The PO9100 module does not represent a bus physical module. It enables redundancy between PROFIBUS heads and allocates PROFIBUS network addresses for exchange of data between the head and the master.

This module is declared to PO5065 heads only, and not PO5064 head.

PO9100 module must be obligatorily declared at the bus last position for correct working of the system (Please see chapter 12, **PO5065 Redundancy**)

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 in the network PROFIBUS addresses.
- PO9999 – 2 bytes Input: base and two input bytes 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 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.

Example 1:

Below it shows the result of a PO5065 PROFIBUS head configuration with the modules described on the Table 5-1.

Table 5-1 Configuration Example

Local	Bus Position	Module
Segment 1	0	PO2022
	1	PO2022
	2	PO2022
	3	PO9999 – 2 bytes Output
	4	PO1114
	5	PO7078
Segment 2	10	PO1112
	11	PO1112
	12	PO9999
	13	PO2134
	14	PO2134
Virtual Modules	-	PO9098 – 8 words OUT
	-	PO9098 – 8 words IN
	-	PO9100 – 2 bytes IN / 2 bytes OUT

In this example we used six positions in the 1 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 1 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.

The virtual module for PO9100 head redundancy is always the last module declared on Ponto bus. It must be declared only for PO5065 heads when they work as redundant slaves.

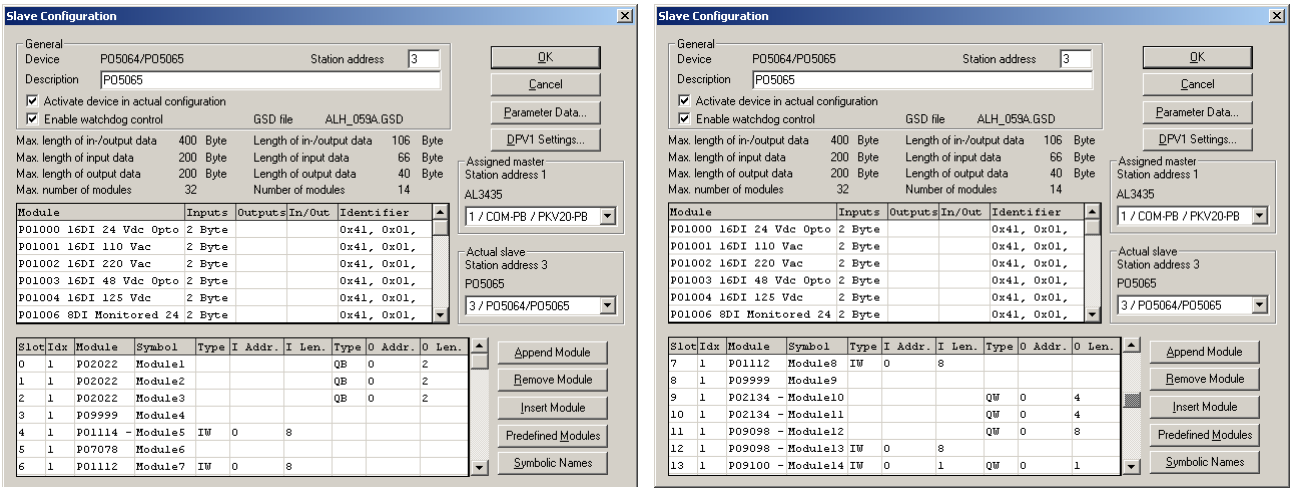

Figure 5-2. PROFIBUS-DP Configuration

DPV1 Communication Configuration

Complex slave devices need to increase PROFIBUS-DP communication features. This includes acyclic data exchange, models of alarms and complex data type introduction. Adding features to slave devices, PO5064 and PO5065 heads can be configured to realize PROFIBUS-DPV1 communications. PROFIBUS-DPV1 communications are acyclic communications and do not interfere with PROFIBUS-DP communication working.

In order to configure PO5064 and PO5065 heads, the PROFIBUS master configuration software must be used as well as the correspondent GSD file according head configured. The PO5064 head GSD file is ALT_0BAF.GSD and to the PO5065 head is ALT_0BB0.GSD.

PROFIBUS-DPV1 communication can be enabled and its options can be configured throught master configuration software. PROFITool is the ALTUS master configuration software and it is used as example to configure communication PO5064 and PO5065 heads. “DPV1 Settings...” button shows the DPV1 configuration window, see Figure 5-3.

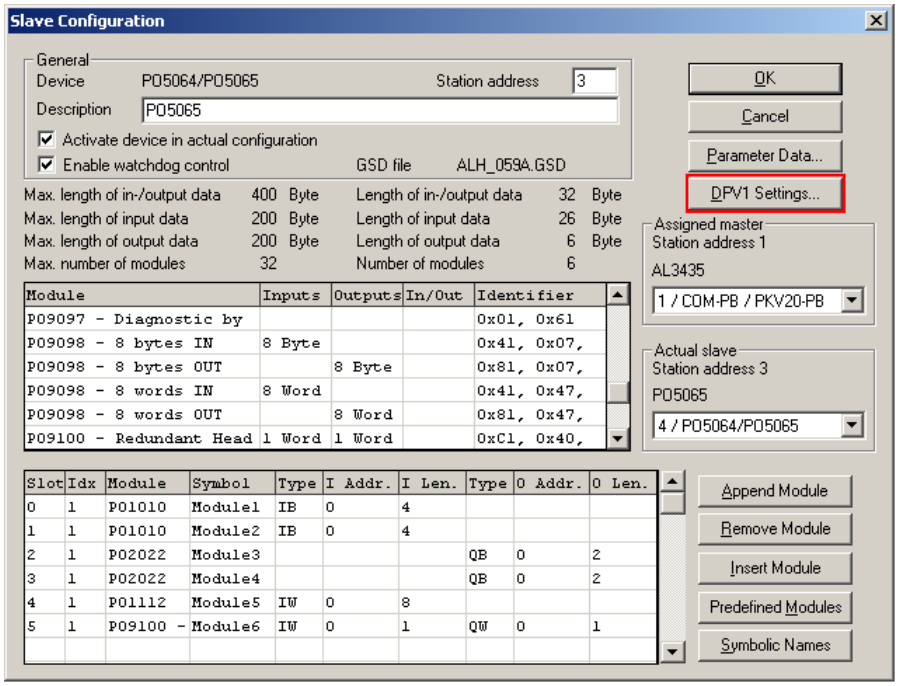

Figure 5-3. Access to the PROFIBUS-DPV1 Configuration Window

The GSD file of each PO5064 and PO5065 heads is standard in order to enable DPV1 communication.

At the DPV1 communication configuration window, “*DPV1 activated*” field must be set in order to enable DPV1 communication. The “*Maximum Channel Data Length*” field denotes how many data will be used in DVP1 communications. This number can be vary from 4 to 244 bytes. Also at the DPV1 communication configuration window, at the *“Fail Safe Suport*” field , the “*0 Data is sent in CLEAR mode*” option must be set instead of other option. Figure 5-4 shows described fields. With this configuration, it is possible to realize DPV1 communications with class 1 and 2 PROFIBUS-DPV1 master.

Note:
The configuration described above is used to perform PROFIBUS-DPV1 communication through a PROFIBUS master class 1, which must be enabled in the parameter of comunication DPV1.
When is used a PROFIBUS master class 2, it is not necessary enable the configuration parameters of a master class 1 to perform the communication PROFIBUS-DPV1. Once that the state machine of a master class 2 is targeted to perform aciclic communications, being possible to exchange messages PROFIBUS-DPV1 normaly with the Head PO5064/65.

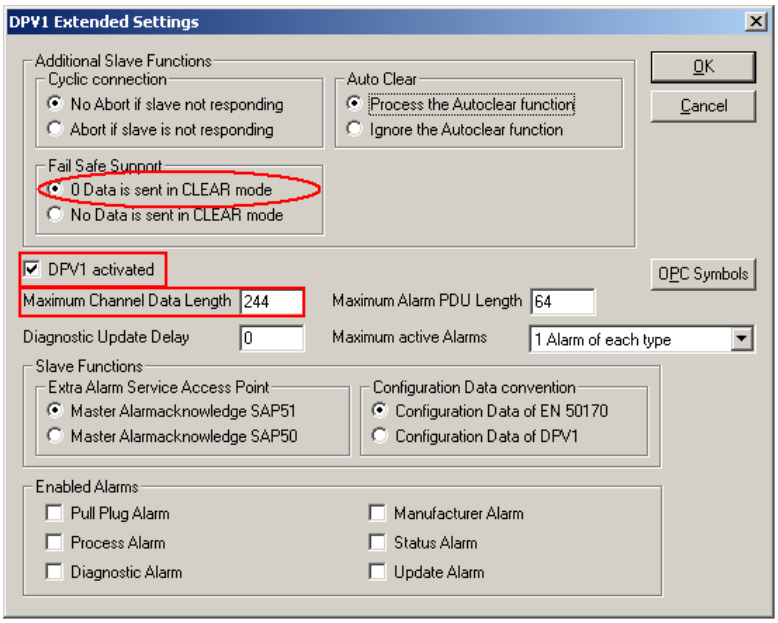

Figure 5-4. PROFIBUS-DPV1 Configuration Window

The configurations referential to alarms, slave functions, are not implemented on PO5064 and PO5065 heads. Thus, if these data are included in the configuration, they is not handled.

PO5064 and PO5065 heads can be configured to realize PROFIBUS-DPV1. Even if the master communicates only PROFIBUS-DP, there is no problem for PROFIBUS-DP network.

Modules Parameterization

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

PO5064 and PO5065 heads parameters are identical, but there are parameters which must be used with PO5065 only. These parameters must be disabled in PO5064 head. 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 PO5064 and PO5065 PROFIBUS heads has the following parameters:

- System Start Up
- Disable outputs
- Diagnosis Status
- Allowance to Manual Switch Over
- Channel Diagnostic
- Sustaining Time without Master

System Start Up

Start up is considered the first time when the PROFIBUS head gets into On-Line state, after be supplied. Or, if there are two heads working as slave redundadant heads, start up is considered the moment when one of them gets into Primary On-Line state. The PROFIBUS head may start up with three different configurations: hot swap disabled, swap enabled and with start up consistency, and swap enabled and without start up consistency.

- Hot swap disabled

All the declared modules must be always present on the bus.

The PROFIBUS head gets into Error State when detects a module status as:

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

- 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 head gets into Error State when detects a module status as:

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

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.

For two PO5065 heads working as slave redundant heads, the test of consistence occurs at start up. Even if SwitchOver command is active, the test does not occur again.

- 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.

Dissabling this option, the master does not indicate if the head has a error. It is advisable to disable this option on the Siemens Master, for example.

- Allowance to Manual Switch Over

Allowance to Manual Switch Over (only PO5065)

This parameter allows that the redundant head accepts the SwitchOver request from PROFIBUS Master and changes its operating state.

Possible values are two:

Disabled: The redundant head does not accept the SwitchOver request from Master and stays in its operating state.

Enabled: The redundant head accepts the SwitchOver request from Master and changes its operating state always that the Master to send this command.

This parameter must be disabled to a PO5064 head. For more informations, please see chapter 12, **PO5065 Redundancy.**

Sustaining Time without Master (only PO5065)

This parameter allows to program the Outputs Retention State time of the slave redundant head when communication lost with master occurs (please see chapter 2, **Technical Description**)

This parameter may be:

Disabled: After communication lost with Master, the head gets into Off-line state.

Enabled: After communication lost with Master, the slave redundant head gets into Outputs Retention State and stays in it during indeterminate time. It is possible to select following times: 10ms, 30ms, 50ms, 100ms, 300ms, 500ms, 1s, 3s, 5s, 10s. To each one of selected times, 1.1s must be added. Thus, if the selected time is 10s, the time with addition will be 11.1s. And if the selected time is 100ms, the time with addition will be 1.2s.

The outputs are freezed while the Sustaining Time without Master.

After the Sustaining Time without Master, if no head to re-establish communication with master, the slave redundant head gets into Off-line state.

The choice of the sustaining time value depends from application used. The sustaining time must be bigger than the PLC SwitchOver time, when used in a PLC redundant system.

ATTENTION:
To customize the PO5064 head the parameters exclusive of PO5065 must be always disabled (with a value zero). The not observance of this point prevent that the head into in operation.

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. It means, each module must have its own parameters set.

ATTENTION:
The parameterization menus in the programmers provide na 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 tem bytes. The CT 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 5-2.

Table 5-2 Module Parameters Format

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

Example:

The Figure 5-5 shows the parameters for the PO1112 module as na 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.

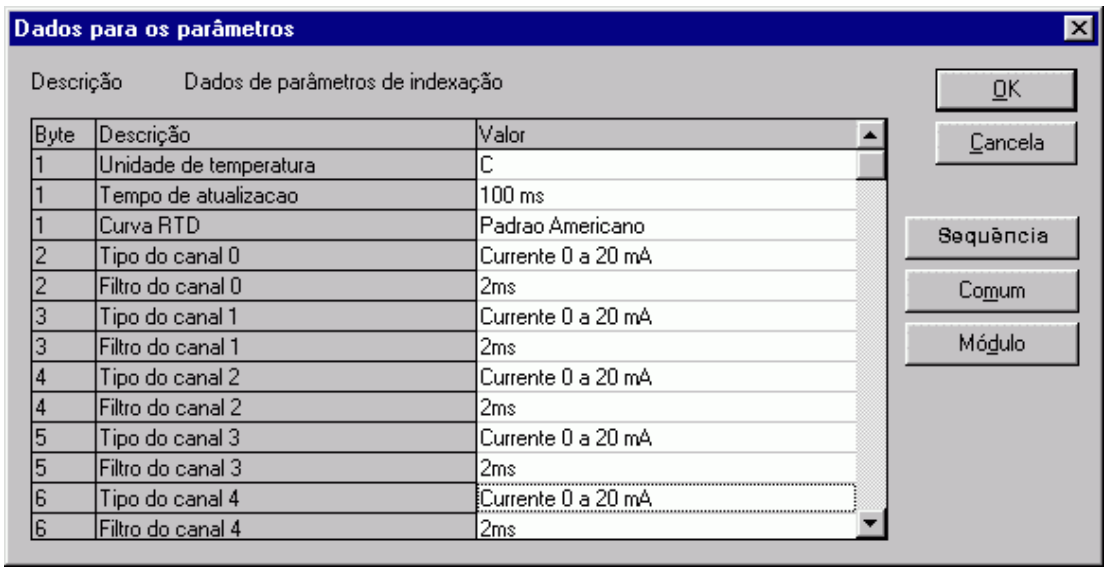

Figure 5-5. PO1112 Module Parameters

The Figure 5-6 shows the edition of a *Channel 1 Type* parameter**.**

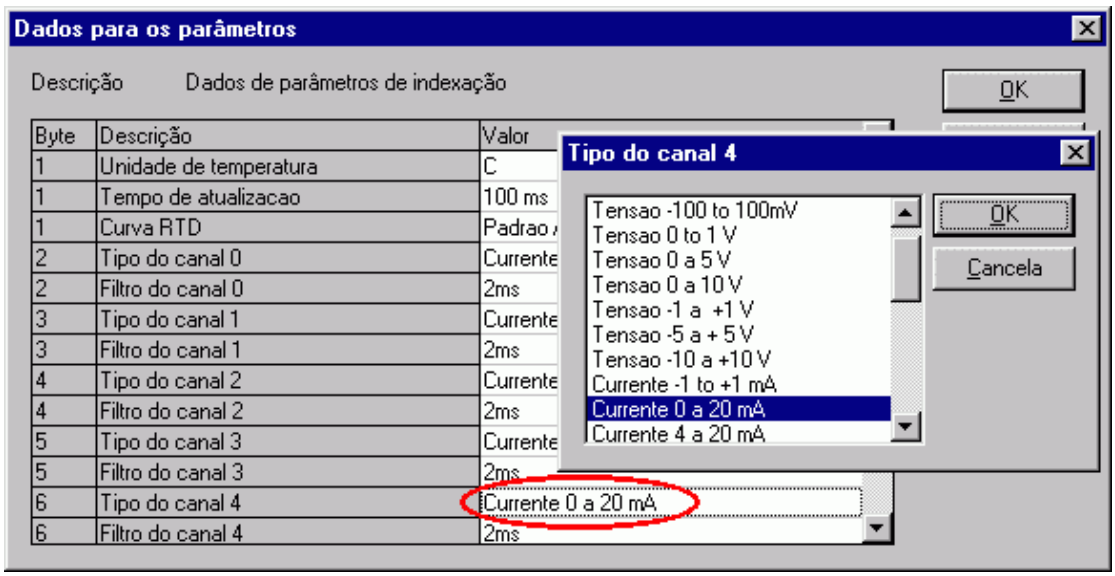

Figure 5-6. Parameters selection for PO1112 module

ATTENTION:
This manual does not cover the PO1112 module parameters meaning. For such, please consult its Technical Characteristics (CT).

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

Parameters Bytes Assembly

For programming software that does not have na 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 5-3. The Table 5-4 has the bits organization for each byte.

Table 5-3 Head Parameters Bytes

Byte	Descrição
0	DPV1 Configuration 1
1	DPV1 Configuration 2
2	DPV1 Configuration 3
3	Constant 00
4	Bytes number for the head parameters
5	Head general parameters
6	Sustaining Time without Master
7	Constant 14h

ATTENTION:
For configurators that do not have parameterization menus, the use should use Table 5-3 and Table 5-4 to get the bits and bytes to define the PROFIBUS head behavior:

Table 5-4 Head Parameters

Byte								Description
7	6	5	4	3	2	1	0	
Byte 0 – DPV1 Status 1								
1								Enable DPV1 communication
0								Disable DPV1 communication
	1							Enable Fail Safe
	0							Disable Fail Safe
		1						Enable Publisher
		0						Disable Publisher
			0	0				Reserved
					1			Enable Base WD
					0			Disable Base WD
						1		Enable Dis Stop Control
						0		Disable Dis Stop Control
							1	Enable Dis Start Control
							0	Disable Dis Start Control
Byte 1 – DPV1 Status 2								
1								Enable Pull Plug Alarm
0								Disable Pull Plug Alarm
	1							Enable Process Alarm
	0							Disable Process Alarm
		1						Enable Diagnostic Alarm
		0						Disable Diagnostic Alarm
			1					Enable Specific Manufacturer Alarm
			0					Disable Specific Manufacturer Alarm
				1				Enable Status Alarm
				0				Disable Status Alarm
					1			Enable Update Alarm
					0			Disable Update Alarm
						0		Always 0
							1	Enable Cfg Chk Mode
							0	Disable Cfg Chk Mode
Byte 2 – DPV1 Status 3								
1								PrmCmd
0								PrmCmd
	0	0						Always 0
			1					Enable Iso_Mod Req
			0					Disable Iso Mod Req
				1				Prm Structure
				0				Prm Structure
					x	x	x	Alarm mode
Byte 3 – Constant 00								
0	0	0	0	0	0	0	0	Always 0
Byte 4 – Number of parameters								
0	0	0	0	0	1	0	0	Constant value in 14h
Byte 5 – General parameters								
						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							Do not allow Manual Switch-Over *
	1							Allow Manual Switch-Over *
1								Enable Channel Diagnostic
0								Disable Channel Diagnostic
Byte 6 – Sustaining Time without Master *								
0	0	0	0	0	0	0	0	Disabled
	x	x	x	x	x	x	x	Sustaining Time Value without Master
0								Time base = 1 ms
1								Time base = 100 ms
Byte 7 – Delay for module enabling								
0	0	0	1	0	1	0	0	Constant value in 14h

(*) Theses parameters are exclusive from PO5065 redundant head and must receive null value when PO5064 head is used.

Sustaining Time without Master = decimal value from bits 0-6 x Time base (1ms or 100ms), varing

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 5-5 shows the parameters bytes sequence referent to the example in the Table 5-1 to a PO5065 redundant head.

Table 5-5 Head Parameters

Module	Byte	Hexa Value	Description
System parameters	0	80h	Configuration1 DPV1 - Enable DPV1 Communication
	1	00h	Configuration 2 DPV1
	2	00h	Configuration 3 DPV1
	3	00h	Constant 00
	4	04h	Number of bytes of the head parameters
	5	03h	Head general parameters: . System start up: hot swap enabled with start up consistency . Outputs disable: disabled . Diagnosis status: enabled
	6	00h	Reserved
	7	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 CE.
Parameters PO1112	10	0Ah	The module PO1112 has 10 parameters bytes. The bytes meaning are described in the CE.
	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 CE.
	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 CE.
	32	01h	
Parameters PO1010	33	02h	The module PO1010 has 2 parameters bytes. The bytes meaning are described in the CE.
	34	01h	
Parameters PO9098	35	00h	PO9098 does not have parameters Receives value 00
Parameters PO9098	36	00h	PO9098 does not have parameters Receives value 00
Parâmetros PO9100	37	00h	PO9100 does not have parameters Receives value 00

MMI Configuration

As a unique characteristic, PO5064 and PO5065 heads have a serial interface that may connect to MMIs, thus creating a powerful local interface in PROFIBUS head.

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

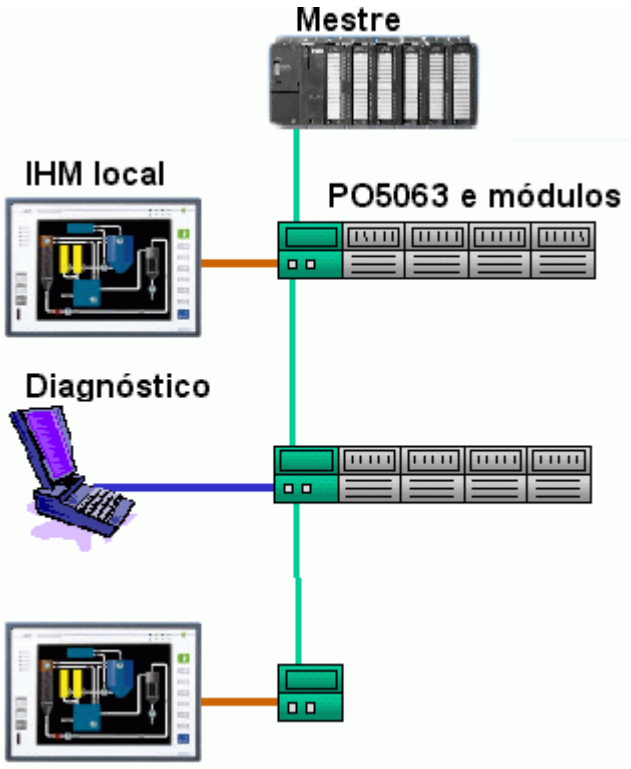

Figure 6-1. Local MMI

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 master and MMI.

These modules should be declared at the end of the bus because they have no physical position. For PO5065 heads the PO9098 module must be declared before the PO9100 module.

There are four types of PO9098 modules. These types determine the data format and direction, byte or word, and direction that data folow, input or output.

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

Table 6-1 Virtual Modules TypesTable 6-1 shows modules types, their data allocations and equivalent types of operands.

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

Table 6-1 Virtual Modules Types

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

The operands that are monitored or written by the MMI are in a specific range of virtual modules. Table 6-2 shows the virtual operands for each type of module:

Table 6-2 Virtual Operands Areas

Module Type	Operands Addresses
PO9098 - 8 bytes IN (MMI) x 4	%E200 - %E231
PO9098 - 8 bytes OUT (MMI) x 4	%S456- %S487
PO9098 - 8 words IN (MMI) x 4	%M200 - %M231
PO9098 - 8 words OUT (MMI) x 4	%M456- %M487

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.

Example:

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

Table 6-3 shows an architecture using a PO5064 head (configured in the PROFIBUS master):

Table 6-3 Architecture Example

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

Modules configuration related to the MMI is provided by PO9098. Even though it is permitted only one MMI, there are two module declarations. This occurs because the MMI may be access 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 MMI)
- %M200 .. %M207 –16 bits inputs (data entered or forced on MMI)

Figure 6-2 shows the PROFIBUS PO5064 head configuration and the network addresses using ProfiTool programmer. These are equivalent to the MMI operands depicted on Table 6-3.

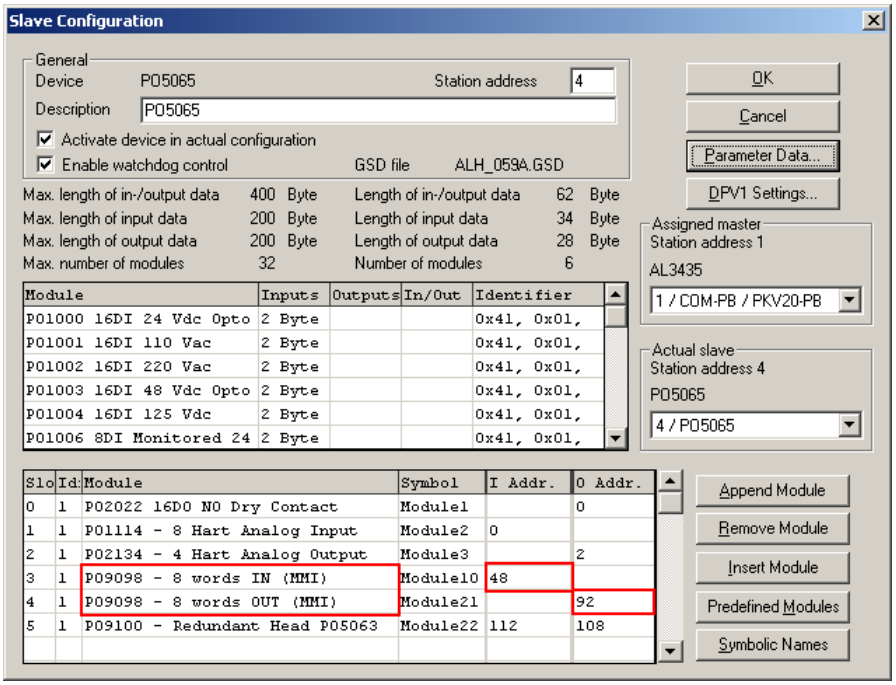

Figure 6-2. MMI declaration in the PROFIBUS network

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

Table 6-4 Virtual Operands Areas

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	
	%M207	34	
PO9098 - 8 words OUT (MMI)	%M456		2
	%M457		4
	%M458		6
	%M459		8
	%M460		10
	%M461		12
	%M462		14
	%M463		16

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 four modules for each type.

Maintenance

This chapter covers system and PROFIBUS PO5064 and PO5065 heads maintenance. It describes general care, protection devices and operator procedures in case of errors.

Following sections still presents encountered problems in case of no energization of heads, explication about diagonosis LEDs functioning and diagnosis messages displayed by PO5064 and PO5065 heads.

In case of reading this chapter and the heads defect stills without solution it is necessary to contact Technical Support.

- http://www.altus.com.br/
- E-mail: altus@altus.com.br

For further information check item **Technical Support** at the beginning of this manual..

Energization Problems

Case at system energization, the PROFIBUS head does not turn on (on LED goes on) one must check the following:

- Check if 24Vdc extern 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 this case, sent the equipment for repair. Contact o ALTUS Technical Support.
- If the PROFIBUS Head is properly powered and no LED goes on, then it is damaged and must be substituted.

It is important to stand out the necessary care with eletrical spinning and communication cables, always verifying the correct instalation and maintaining its connection firm, avoiding problems related to bad contacts.

Diagnosis LEDs

PROFIBUS PO5064 and PO5065 heads indicates the diagnoses through LEDs in the front panel.

PO5064 and PO5065 heads conduct as to LEDs indications are similar, existing only some differences in relation to indications relating to head status. Next diagnosis provided by LEDs from both heads and diagnosis of each head.

Table 7-1 depicts the used representation for description about head LEDs.

Table 7-1 Representation of LEDs status

Status	Representation
On	●
Blinking Intermittent	X
Blinking 1 time	1X
Blinking 2 times	2X
Blinking 3 times	3X
Blinking 4 times	4X
Off	○
Any State	–

Diagnosis LEDs for PO5064 and PO5065 Heads

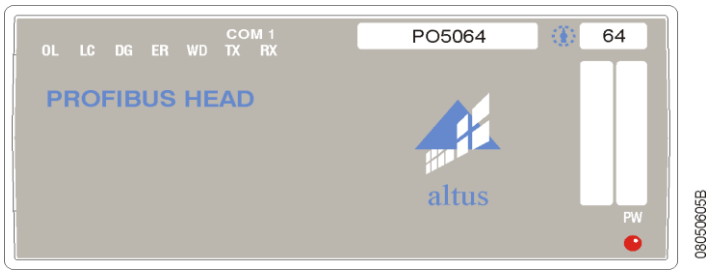

Figure 7-1 Frontal Panel of PO5064 Head

At PO5064 e PO5065 heads, **OL**, **LC** and **ER** LEDs indicate head status, **DG** LED indicates head diagnosis, LED **WD** indicates watchdog error, **TX** and **RX** LEDs indicate serial channel activity.

PO5064 and PO5065 Head Operation Status

PO5065 head may assume one of five distinct states. From these states only three may be assumed by PO5064 head. These states have the purpose of representing heads conduct. Table 7-2 presents the status and PO5064 and PO5065 head LEDs signalizing.

Table 7-2 PO5064 and PO5065 Heads Operation Status

Operação Status	OL	LC	DG	ER
Primary On-Line (or On-Line)	●	○	–	○
Standby On-Line (only PO5065)	●	●	○	○
Off-Line	○	○	–	○
Output Retaining State (only PO5065)	●	○	X	○
Error	○	○	–	●

PO5064 and PO5065 Heads Diagnosis

When LED DG is on, it informs that there is not diagnosis at PO5064 and PO5065 heads, in blinking it signals a diagnosis situation, which is related to heads operation status. Diagnosis informed by LEDs priority is according to quantity of blinkings, being the greater priority when blinks 1X and less priotity when blinks 4X.

Table 7-3 shows the meaning of PO5064 and PO5065 heads DG LED.

Table 7-3 Meaning of DG LED and P05064 and PO5065 Heads

Estado	OL	LC	DG	ER	Significado	Causa Provável
Primary On-Line (or On-Line)	●	○	1X	○	Existent Diagnosis at modules	Some module is generating diagnosis.
	●	○	2X	○	Forced point or channel	There is one or more forced point/channel.
	●	○	3X	○	Disabled outputs	Disabled bus outputs.
	●	○	4X	○	Missing module / different / not declared / with parameters error	One or more modules are in one of the following situations: - Missing in the bus - Different from declaration - Non declared in the bus - Too many or missing parameters
Off-Line	○	○	1X	○	No activity on PROFIBUS network	Network cable not connected.
						Defected PROFIBUS network cable.
						PROFIBUS master off.
	○	○	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.
						Error on PROFIBUS termination.
	○	○	3X	○	Parameterization failure	Exceeded number of input or output bytes.
						Number or real modules is larger than 20.
						Number of virtual modules is larger than 4 per type of operand.
						Virtual module in the middle of a bus.
						Error at redundant virtual module declaration.
						Error at virtual module declaration.
						Segment with more than 10 real modules.
						Number of parameters is different from expected.
Error	○	○	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.
	○	○	2X	●	Different module	Different module from declaration in the start up with consistency.
						Different module from declaration with disabled hot swap.
	○	○	3X	●	Ponto bus hardware failure	Missing termination at the Ponto bus.
						Defected bus extension cable.
						Failure at acess to Ponto bus
						Defected bus extension or base.
	○	○	4X	●	Other errors	PROFIBUS address switch with invalid value.
						Module with no parameters, or module does not require parameters.
						Invalid head position.
						PROFIBUS coprocessor memory error

Serial Channel Activity of PO5064 and PO5065 Heads

TX and RX LEDs describe the activity type when PO5064 and PO5065 heads serial supervision channel is used.

Table 7-4 shows the meaning of PROFIBUS TX and RX LEDs of PO5064 and PO5065 heads.

Table 7-4 Meaning of LEDs TX and RX of P05064 and PO5065 Heads

Atividade do Canal Serial	TX	RX
No activity in channel	O	O
PLC transmitting message	X	O
PLC receiving message	O	X
PLC transmitting and receiving message continuously	X	X

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.

Diagnosis Messages

Case exists diagnosis at PO5064 and PO5065 heads or IO modules, diagnosis messages are sent to the PROFIBUS Master connected to slave, indicating the reason.

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

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

PO5064 and PO5065 head diagnosis messages provide four different information types:

- Head diagnosis
- Modules diagnosis
- PROFIBUS Head status
- Head parameters

Head Diagnosis

The messages shown on Table 7-5 summarize the diagnoses situations that may occur simultaneously:

Table 7-5 Head diagnosis messages

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 and on that, there is an another type 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.

The general status information indicates problems and may be visualized on the Table 7-6.

Table 7-6 PO5064 and PO5065 Heads diagnosis messages

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.
		PO5064 head received exclusive PO5065 head parameters
PROFIBUS interface error	Not possible to communicate with PROFIBUS interface	This is an internal PO5064 and PO5065 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	Missing Ponto bus termination.
		Missing or broken bus extension cable.
		A base is not connected to the previous one.

	check the termination presence.	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 PO5064 and PO5065 problem. Please send it for repairing.
Non declared module	There is a module exceeded	There is a non declared module.
Missing module without hot swap	A module was removed	A declared module was not found. The system gets into error because 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	Master declaration is wrong.	The total input or output bytes exceeded 200.
Virtual module before termination	Master declaration is wrong.	There was a virtual module declared before the bus termination. All the virtual module should come after the real ones.
Number of PO9098 virtual modules larger than 4 for type	Master declaration is wrong.	There were declared more than four modules from one of the four PO9098 virtual module types.
Redundant module declaration error	Master declaration is wrong.	PO5064 – There is a PO9100 redundant virtual module declared. PO5065 – There is more than one or no PO9100 redundant virtual module declared .
Error at virtual module declaration	Master declaration is wrong.	There were declared more virtual modules with another virtual module which do not accepts this configuration.
Error at Ponto bus access	Head cannot read in Ponto bus	Failure at head or bus hardware.
Other errors	Non predicted errors	This message should not occur. If so, most likely the software version is outdated.

Modules diagnosis

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 diagnosis.

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 CTs.

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 CT.

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

PROFIBUS PO5064 and PO5065 Heads Status

It shows the states that PO5064 and PO5065 heads may have:

- Off-line
- On-line (only PO5064)
- Primary on-line (only PO5065)
- Standby on-line (only PO5065)
- Output retaining (only PO5065)
- Error

A more detailed description about PO5065 head status may be found at chapter 2, **Technical Description**.

PO5064 and PO5065 Head Parameters

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

- Allows IO forcing.
- Allows to disable outputs.
- Allows manual SwitchOver (only PO5065).
- Disabled hot swap, hot swap with no consistency or hot swap with consistency.
- Channel diagnosis.
- Time for sustentation with no Master (only PO5065).

These messages are just visualized when programmed.

PROFIBUS Heads Substitution

If it is necessary to substitute a PROFIBUS head, the PO5064 may substitute a PO5063V1 completely, while a PO5065 may substitute a PO5063V5 completely, but in both substitutions it is necessary to make changes at configurations.

When a PO5064 head substitutes a PO5063V1 head, it is needful to modify the configuration that is on PROFIBUS master for correct operation. For this one must substitute GSD file ALT_059a.GSD from PO5063V1 head by ALT_0BAF.GSD file that is the GSD file relative to PO5064 head. With GSD change, it is needful to make PO5064 head configuration through PROFIBUS Master configurator software. In case of substitution of a PO5063V5 head per a PO5065 head, it is also necessary to change GSD ALT_059a.GSD file by ALT_0BB0.GSD file that is the GSD file for PO5065 and configurate PO5065 head through PROFIBUS Master configurator software.

In case of a redundant system which makes use two PO5063V5 heads, it is not possible to change, in needs case, only one of them, by a PO5065, forming the redundant pair PO5063V5/PO5065.

PROFIBUS Diagnosis

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

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.
- Use of diagnosis by the control application program case the controller CLP have access to these bytes.

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

Following the general diagnosis format:

Table 8-1 Frame format for the PROFIBUS Diagnosis

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

Standard Diagnosis

Standard diagnosis has 6 bytes, as defined by the norm.

Following a Table 8-2 containing the diagnosis bits and their meaning:

Table 8-2 Frame Fields for PROFIBUS Diagnosis

Byte								Description
7	6	5	4	3	2	1	0	
Byte 0 – Status 1								
							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 an 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								
							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 mut be read by the master
1								Prm_Req: set on by slave to indicate parameterization and configuration
						x		Reserved
Byte 2 – Status 3								
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)

Extended Diagnosis

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

The extended diagnosis has 3 types:

- Diagnosis related to device.
- Diagnosis related to module.
- Diagnosis related to channel.

Table 8-3 shows an extended diagnosis example:

Table 8-3 Extended diagnosis example

Extended Diagnosis									
7	6	5	4	3	2	1	0		
0	0	0	0	0	1	0	0		System diagnosis
	Device Specific							Bits meaning is defined by manufacturer.	
	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)	

Diagnosis related to device

Table 8-4 presents diagnosis format related to device.

Table 8-4 Diagnosis format related to device

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 module

Table 8-5 shows diagnosis format related to module

Table 8-5 Diagnosis format related to module

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

Size: bytes block size including the header

Table 8-6 presents the bytes that identify the device status.

Table 8-6 Identification Bytes of Module 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 channel

Each channel puts its identifier and error cause. Each input has 3 bytes. Table 8-7 presents diagnosis format related to channel.

Table 8-7 Diagnosis Format Related to Channel

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

Table 8-8 shows channel type and its respective description.

Table 8-8 Channel Type

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 8-9 presents diagnosis type and its description.

Table 8-9 Diagnosis types

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	Moedule specific
…	...
23	Module specific
24	Reserved
…	
29	Reserved
30	Burned fuse
31	Non parameterized module

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

PROFIBUS Head Extended Diagnosis

Table 8-10 shows the extended diagnosis bytes and the

Table 8-11 shows all diagnosis messages from PROFIBUS PO5064 and PO5065 heads, including the binary interpretation, the bit position or the byte value.

Table 8-10 PO5064 and PO5065 head diagnosis

Byte	Description
0	Number of diagnosis bytes
1	Programmed parameters
2	Sustentation time with no Master
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 8-11 PO5064 and PO5065 head diagnosis messages

Byte								Description
7	6	5	4	3	2	1	0	
Byte 0 – Number of diagnosis bytes								
0	0	0	0	1	1	0	0	Number of diagnosis bytes for system 12
Byte 1 – Programmed Parameters								
						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

Byte								Description
				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
	0							Do not allow Manual SwitchOver (*)
	1							Allow Manual SwitchOver (*)
0								Enable channel diagnosis
1								Disable channel diagnosis
Byte 2 – Sustentaion time with no master (*)								
0	0	0	0	0	0	0	0	Disabled
	x	x	x	x	x	x	x	Sustentaion time with no master value
0								Time base = 1 ms
1								Time base = 100 ms
Byte 3 – Delay for module start up								
0	0	0	1	0	1	0	0	Constant value 20
Byte 4 –PROFIBUS PO5065 head status								
					0	0	0	Off-Line operating status (byte 4 only one time)
					0	0	1	Primary On-Line operating status
					0	1	0	Local operating status
					0	1	1	Error operating status
					1	0	0	Output retaining operating status
					1	0	1	Standby On-line operating status
x	x	x	x	x				Reserved
Byte 5 – General Diagnosis								
							0	Modules OK
							1	Modules with diagnosis
					0			Enabled outputs
					1			Disabled outputs
				0				There is not changed modules
				1				Some module is chenged
			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								
x	x	x	x	x	x	x	x	Reserved
Byte 7 – System general status								
			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

Byte								Description
			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 modules 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 4 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	0	1	1	0	Redundancy virtual module declaration error
			1	0	1	1	1	Virtual module declaration error
			1	1	0	0	0	Ponto bus access error
			1	1	0	0	1	Invalid head position
			1	1	1	1	1	Hardware error
x	x	x						Reserved
Byte 8 - Modules 0 .. 7 status								
							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								
							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								Description
Byte 10 - Modules 16 .. 23 status								
							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								
x	x	x	x	x	x	x	x	Value read from the base address switches

Sustaining time with no master = bits decimal value 0-6 x Time base (1ms or 100ms), with possible times between zero and 12.7 seconds.

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

Note:
Bytes 8, 9 and 10 which are for modules status must have their bits checked accordingly to the slot that modules occupy at configurator software. For instance, if there is a PO7078 module at bus, this one must be counted like a module when it is necessary to check modules diagnosis status.

Diagnosis via Serial

PROFIBUS heads have a RS232C serial interface with RJ45 connector for monitoring locally the system diagnosis. This allows the diagnosis without need to access the network master.

For maintaining through this port, PROFIBUS head is connected to a microcomputer or a MMI, making use of one of the cables AL-1327 or AL-1715.

Diagnosis monitoring software for computers is MasterTool. In case of a MMI, it is necessary to configure wanted diagnosis operands on MMI configuration software accordling with the following operands. Each head only can be monitored through its own serial port via ALNET I v2.0.

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. Table 9-1 shows diagnosis operands division in modules.

Table 9-1 Diagnosis operands division in modules

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

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

System Diagnosis

Table 9-2 presents system diagnosis bytes which are divided as following (%M512 .. %M521):

Table 9-2 System Diagnosis

Byte	Description	Operand
0	Number of diagnosis bytes	%M512 byte HIGH
1	Programmed parameters	%M512 byte LOW
2	Time sustentation with no Master	%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 .. 23 status	%M517 byte HIGH
11	Switches addresses	%M517 byte LOW

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

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

Even though the diagnosis have different formats, it was defined a general format for mounting head diagnosis. Table 9-3 shows module diagnosis general format.

Table 9-3 Modules diagnoses

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

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

Table 9-4 presents the meaning for the diagnosis generated by modules from channel 31.

Table 9-4 Diagnosis for Channel 31 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

ATTENTION:
In some PROFIBUS cnfigurators the message for code 01 – IO error is presented like a short circuit. When this message occurs, the problem may be a short circuit or a error in input or output at the indicated module.

Table 9-5 shows the meaning for the diagnosis generated by modules from channel 32.

Table 9-5 Diagnosis for Channel 32 Modules

Byte 1 – Module general diagnosis								PROFIBUS Message
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 9-6 presents channels diagnosis.

Table 9-6 Module diagnosis for Channels 0 to 7

Bytes 2 a 9 – Diagnóstico de canal								Mensagem PROFIBUS
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

Diagnosis via DPV1

PO5064 and PO5065 heads have DPV1 communication realizing acyclic communication. When this devices functions as Masters class 1 or class 2, they send requisitions through DPV1 specific commands. Some communication results generate diagnosis that are shown in the Table 10-1 bellow.

Four bytes can be verified when there is a DPV1 communication diagnosis generated by the heads or modules in the bus. These bytes are received by the PROFIBUS-DPV1 Master and are stored in the communication data area and are called FUNCTION_NUM, ERROR_DECODE, ERROR_CODE_1, and ERROR_CODE_2.

ERROR_DECODE contains information about the protocol that caused the error.

ERROR_CODE_X contains specific information about the diagnostic generated and depend on ERROR_DECODE value.

For grater details about DPV1 diagnosis please refer to PROFIBUS-DP Extensions to EN50170 (DPV1).

Table 10-1 shows the codes of negated communication for DPV1.

Table 10-1 Negated command received on data área DP-V1

Byte 0 – Diagnosis FUNCTION NUM								Negative response for a PROFIBUS DPV1 command
7	6	5	4	3	2	1	0	
1	1	0	1	1	1	1	1	Write command (0XDF)
1	1	0	1	1	1	1	0	Read command (0XDE)
1	1	0	1	0	1	1	1	Channel open command (0XD7)

Table 10-2 show the protocol that owns the generated diagnosis.

Table 10-2 Error Decode informs the protocol

Byte 1 – Diagnosis ERROR_DECODE								Protocol that generated the diagnosis PROFIBUS DPV1
7	6	5	4	3	2	1	0	
0	X	X	X	X	X	X	X	Reserved 0 – 127
1	0	0	0	0	0	0	0	DPV1 – 128
1	X	X	X	X	X	X	X	Reserved 129 – 253
1	1	1	1	1	1	1	0	Profibus FMS – 254
1	1	1	1	1	1	1	1	HART – 255

The diagnosis byte ERRO_CODE_1 is composed of a higher part and a lower part. The higher part shows the class of the diagnosis and the lower part shows the code that details the diagnosis.

Table 10-3 show the diagnosis codes separeted by class.

Table 10-3 Error Code_1 informs DPV1 diagnosis

Byte 2 – diagnosis ERROR_CODE_1 Hexadecimal values	Class (most significant bits)				Class meaning Hexadecimal values	Code (least significant bits)				Code meaning Hexadecimal values
	7	6	5	4		3	2	1	0	
XXh	x	x	x	x	0 até 9 reserved	X	X	X	X	X - Reserved
A0h	1	0	1	0	A – Application	0	0	0	0	0 – Read Error
A1h	1	0	1	0	A – Application	0	0	0	1	1 – Write error
A2h	1	0	1	0	A – Application	0	0	1	0	2 – Module Failure
Axh	1	0	1	0	A – Application	0	X	X	X	3 to 7 - Reserved
A8h	1	0	1	0	A – Application	1	0	0	0	8 – Version conflict
A9h	1	0	1	0	A – Application	1	0	0	1	9 – Not suported characteristic
Axh	1	0	1	0	A – Application	1	X	X	X	A to15 – User specific
B0h	1	0	1	1	B – Acess	0	0	0	0	0 – Ínvalid índex
B1h	1	0	1	1	B – Acess	0	0	0	1	1 – Wrong write size
B2h	1	0	1	1	B – Acess	0	0	1	0	2 – Invalid Slot
B3h	1	0	1	1	B – Acess	0	0	1	1	3 – Type Conflict
B4h	1	0	1	1	B – Acess	0	1	0	0	4 – Invalid área
B5h	1	0	1	1	B – Acess	0	1	0	1	5 – State conflict
B6h	1	0	1	1	B – Acess	0	1	1	0	6 – Acess denied
B7h	1	0	1	1	B – Acess	0	1	1	1	7 – Invalid size
B8h	1	0	1	1	B – Acess	1	0	0	0	8 – Invalid Parametr
B9h	1	0	1	1	B – Acess	1	0	0	1	9 – Invalid Type
BXh	1	0	1	1	B – Acess	1	X	X	X	A to F - User specific
BAh	1	0	1	1	B – Acess	1	0	1	0	A – Read/Write problema on Master B
BBh	1	0	1	1	B – Acess	1	0	1	1	B – Timeout on Master B
BCh	1	0	1	1	B – Acess	1	1	0	0	C – Communication backup PO5065
C0h	1	1	0	0	C – Resource	0	0	0	0	0 - Conflito de constrição de leitura
C1h	1	1	0	0	C – Resource	0	0	0	1	1 - Conflito de constrição de escrita
C2h	1	1	0	0	C – Resource	0	0	1	0	2 – Empty resource
C3h	1	1	0	0	C – Resource	0	0	1	1	3 – Unavailable resource
CXh	1	1	0	0	C – Resource	0	1	X	X	4 – 7 - Reserved
CXh	1	1	0	0	C – Resource	1	X	X	X	8 to F – User specific
XXh	1	1	X	X	D to F Specifics	X	X	X	X	Specifics

ERROR_CODE_2 parameters are specified and can be used to define other diagnosis codes defined by the manufacturer. PO5064 and PO5065 heads does not use ERROR_CODE_2 to inform diagnosis, default value of this bytes is zero “0”.

Diagnosis via MMI

PO5064 and PO5065 heads have an exclusive serial interface that can be used to InterConnect MMIs creating a powerfull local interface on the PROFIBUS head.

Through the MMI it is possible to visualize general dignosis and diagnosis related to the modules, incluind channel related informations.

The MMI required for this readings is an MMI compatible with ALNET 1 2.0 protocol. This MMIs are simple, low cost, easy handlig, and small size MMIs made by ALTUS. For more information please refer to HTTP://www.altus.com.br.

PROFIBUS redundant head PO5065 suports MMIs the same way that PO5064. Greater detalis about diagnosis via MMIs are treated on chapter 9, **Diagnosis via Serial**.

PO5065 Redundancy

This chapter describes the redundancy mechanism of the PO5065 head.

General Characteristic

A PROFIBUS I/O redundant remote is composed by two PO5065 redundant heads mounted side by side and charing the same signal I/O modules.

On redundant slave there is no specific order that indicates wich of the redundant heads will be on Primary or on secundary OnLine state. The alocation order of this states is randomic. But the software is implemented in a way that is not possible two heads on the same bus will be on Primary OnLine state.

The two heads operade in paralel, the head in Primary OnLine state is called Primary Head and the other one is called Reserve head. The Primary head is active, it commands the Input/Output devices, while the Reserve head is waiting to become active.

PO5065 Heads redundancy is possible because of the switchOver command. It changes teh state of the slave heads when there is a failure on the head that is on Primary OnLine state. This state change is made autonomously by the heads, software or operator intervantion is not necessary. It is possible to enable manual SwitchOver IF desired (please refer to chapter 05, **Parameterization**).

In order to use the PO5065 redundant heads it is necessary to declare the virtual redundancy module PO9100 on the last position of the bus. This is not a physical module and must be declared using the configuration software of the Master. For ALTUS Masters ProfiTool configuration tool is used.

The addresses of the PO5065 redundant heads on a same bus must be equal.

SwitchOver

It is necessary to permit the change between Primary OnLine and Reserve OnLine states in order to a redundant system to work. This state change is called SwitchOver.

This change can occur in the case of remotion, power off or failure in one of the heads turn impossible its normal functioning.

The redundant heads are able, in case of system failure to execute a SwitchOver and the application is also able to execute a SwitchOver.

In Table 12-1are listed the events that trigger a SwitchOver and the sequence of events and the states that each head will assume.

Table 12-1 SwitchOver events

Event	Action	Next state for Primary Head	Next State for Secondary Head
Connection loss between the primary head and the master	SwitchOver to Reserve Head	OffLine	Primary OnLine
Reserve head receives a SwitchOver command	SwitchOver command execution for the reserve head	Reserve OnLine	Primary OnLine
Primary head receives a SwitchOver command	SwitchOver command execution for the primary head	Reserve OnLine	Primary OnLine
Primary head perceives some failure that can interrupt netwrok functioning	SwitchOver command execution for the primary head	error	Primary OnLine.
Primary head looses Power due to failure on external or internal Power source	Reserve head perceives silence on bus and executes a SwitchOver	Power Off	Primary OnLine.
Primary head is removed for Hot Swap	Reserve head perceives silence on bus and executes a SwitchOver	Missing	Primary OnLine
Primary head enters watchdog	Reserve head perceives silence on bus and executes a SwitchOver	Watchdog	Primary OnLine

PO9100 Virtual Module

Virtual redundancy module PO9100 is responsible for informing the Master the redundant head state and to transmit SwitchOver commands.

This module must always be located on the last position of the bus. This should be configured by the Master configuration tool (please refer to chapter 5, **Parameterization**). Since it is a virtual module, it does not occupies a physical slot on the bus.

This module is composed by 2 input bytes and 2 output bytes. The input bytes contain information about the state of each head and the output bytes contain the SwitchOver command generated by the application.

Mor information about the SwitchOver can be obtained on PX3406 Utilization Manual on chapter 3, “SwitchOver”.

Redundancy algorythm

PX3406 and PO4053 PROFIBUS Field network interface Master has a software implementation of redundancy (MU212003 – Utilization Manual for PX3404 and MU209903 Utilization Manual for PO4053).

For applications using other master devices it is necessary to implement the redundancy algorythm. This algorythm receives data received from primary and reserve heads and select the valid ones aplying them to two PROFIBUS no redundant Masters.

Valid input data from non redundant PROFIBUS heads are shared by the PROFIBUS Master of a network. In this case there is no necessary the redundancy algorithm .

On a redundant system, the reserve head is continuosly sending invalid and diagnosis data to the master. The diagnosis contain information about the functioning of the head permiting preventive manutention, even if the head is on reserve state. It is up to the CPU to select valid and invalid data in a netowrk. The algorithm here in described has this function.

Each time the application program executes, the routine of the flux diagram of Figure 11-1 must be executed for each master.

On this flux diagram, “m” represents the number of virtual redundant modules declared. This number is the number of PO5065 redundant heads on the network. PO9900(n) represents the data coming from the virtual module head with the address on PROFIBUS network. The user must set the PROFIBUS input address in wich the virtual module PO9100 of each redundat head is located. By accessing the data of this virtual module, the master is able to identify if the PO5065 head is on Primary or reserve state. If this data is 1, then the head that is beeing accessed is on Primary mode and data sent by it is valid.

For each redundant system, the user must alocate in area for input operands of each PO5065 of the system. This area, called image, is an area reserved for valid data. In this area valid data of each head is stored.

This algorithm is also valid on a mixed network with two PROFIBUS masters witch have redundant slaves PROFIBUS heads and non redundant PROFIBUS heads simultaneously.

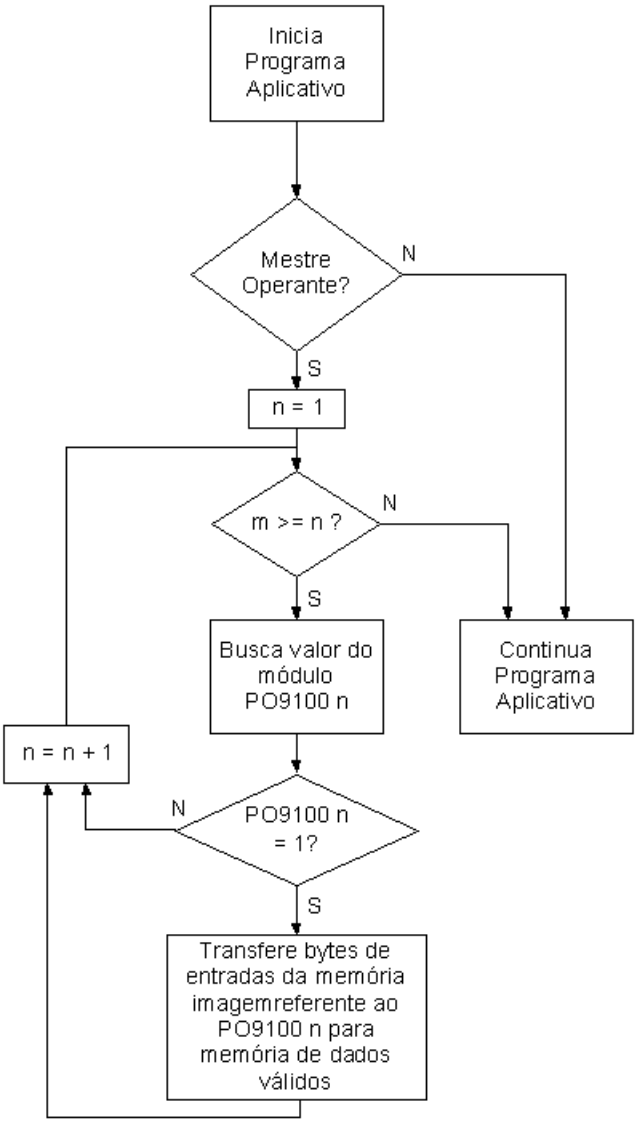

Figure 12.1 – Redundancy algorithm at Master device level

Network Architecture

The PO5064 and PO5065 head where developed to offer practical utilization conditions. But it is necessary to take some care specialy when mounting and configuring the system.

This chapter shows some examples of architectures using redundant and non redundant heads. This examples can serve as starting point solution for the user problems.

Three architectures will be show:

Non redundat sysntem

Physical layer redundant system

Complete redundant system

In this examples the connections, configurations made on PorfiTool programmer and some details of configuration and parameterization are show.

The modules used will be always the same in roder to facilitate the understaning and compare of the examples. Table 13-1 shows a list of input and output modules used on the examples.

Table 13-1 Lista of I/O modules

Módule	Description	Compaitble bases	Inpput data bytes	Output data bytes
PO1010	32 ED 24 Vdc Opto	PO6000	4	-
PO1112	8 EA Universal Isolated	PO6001, PO6101	16	-
PO2022	16 SD Relay	PO6000, PO6002, PO6100, PO6102	-	2

Non redundant system

Even without redundancy this system is an adequate solution in some industrial processes.

Figure 13-1 shows a non redundant system formed by a PO3342 CPU and a PO4053 PROFIBUS Master interface. A PO5064 head controls bus 1 and a PO5064 head controls bus 2.

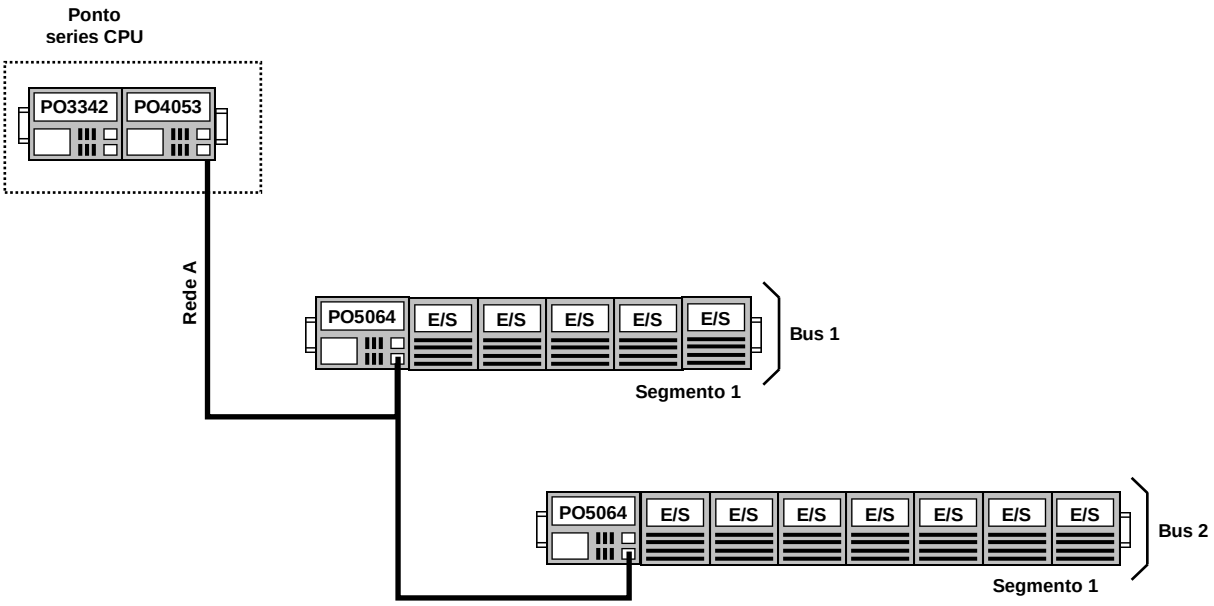

Figure 13-1 non redundant system

The termination key PO6500 must be activated (ON position) when the base is located on the end of the bus, in the example this occurs on bus 2.

The heads address must be diferent for each installed head..

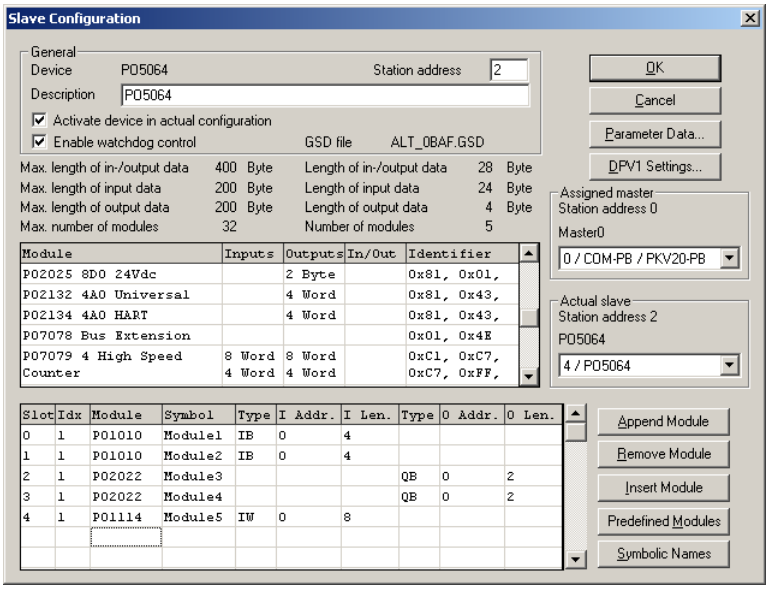

Figure 13-2 PO5064 cponfiguration for bus 1

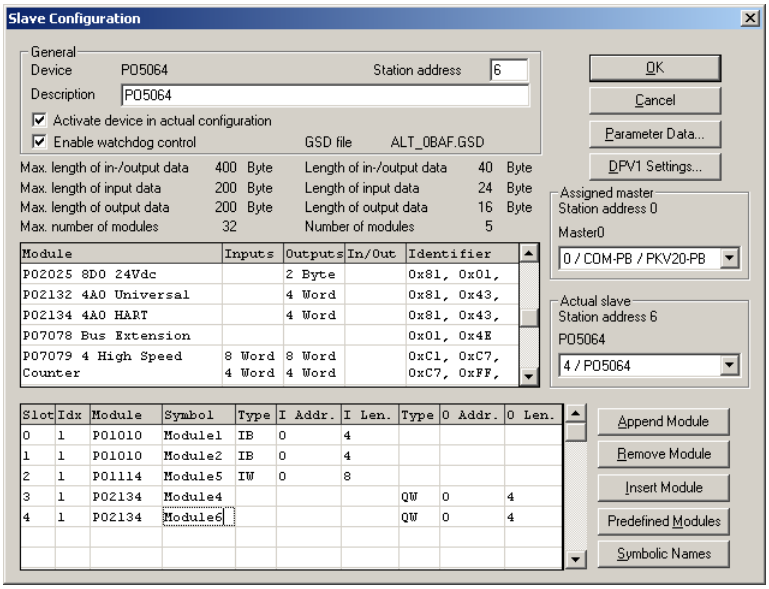

Figure 13-3 PO5064 configuration for bus 2

Figures 13-2 and 13-3 show the specific address for each head and the configuration of the input and output modules. This configuration was made on the programming tool for Masters PX3406 and PO4053. In this examples ProfiTool wsa used.

Figure 13-4 shows that redundancy parameters must be disabled for a correct funciotning of a non redundant system.

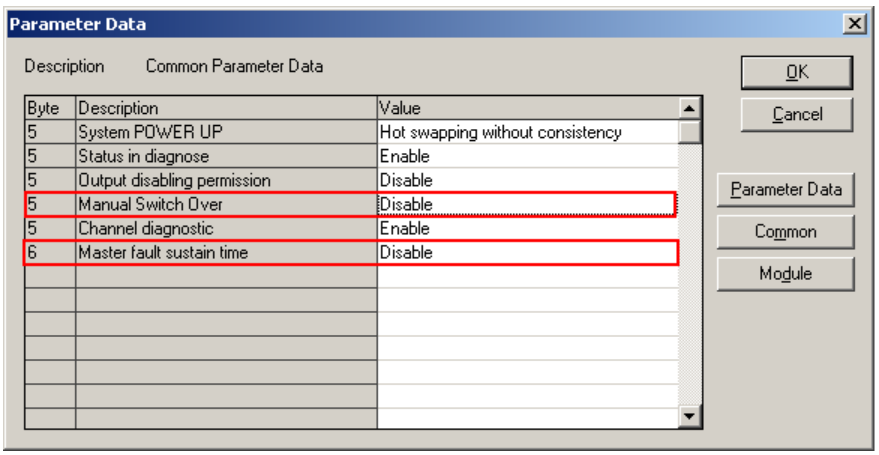

Figure 13-4 Head parameters

Physical layer redundant system

This type of architecture offer a greater security. The system can continue to work even if there is a failure in one of the redundant slave heads, interruption on transmission line or failure of the Master. This system is recomended in applications where a high degree of operation security is needed or where the enviroment can damage to the control system.

Each interface pair must be connected to a differente physical network and this must be connected to the same CPU.

Figure 13-5 shows a physical redundant system, the Master is a PX2004 CPU and the Master PROFIBUS interface is a PX3406. Two redundant slaves control the input output devices.

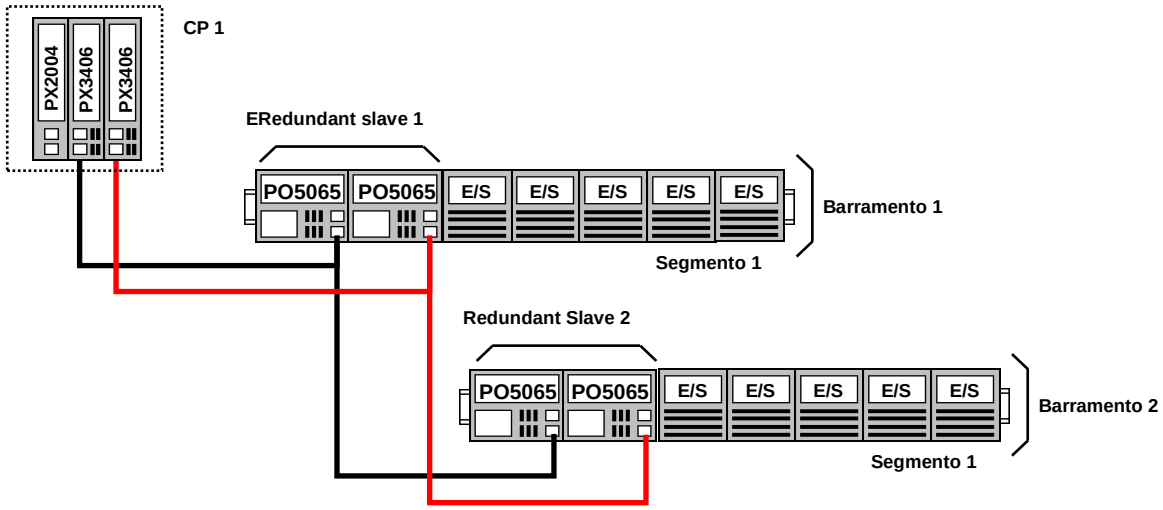

Figure 13-5 Physical layer redundant system using AL3406 master

In this type of architecture it is not necessary to develop any type of control algorithm for the heads, since the PX3406 Master Interface has the necessary redundancy controll characteristis.

It is important to activate the termination key, when using PO6500 bases. On Figure 13-6 this bases must be used on the two redundant slave heads and with PX3406 Master Interface because they are located at the extremities of the PROFIBUS network.

The redundant heads of a bus must use the same PROFIBUS addresses since they implement the same netowrk node for the Masters.

It is important to note that the slave heads are connected to two independent netowrks, so it is necessary to configure the two heads in identicall maner.

Figure 13-6 shows a system with redundat Masters, using PO4053.

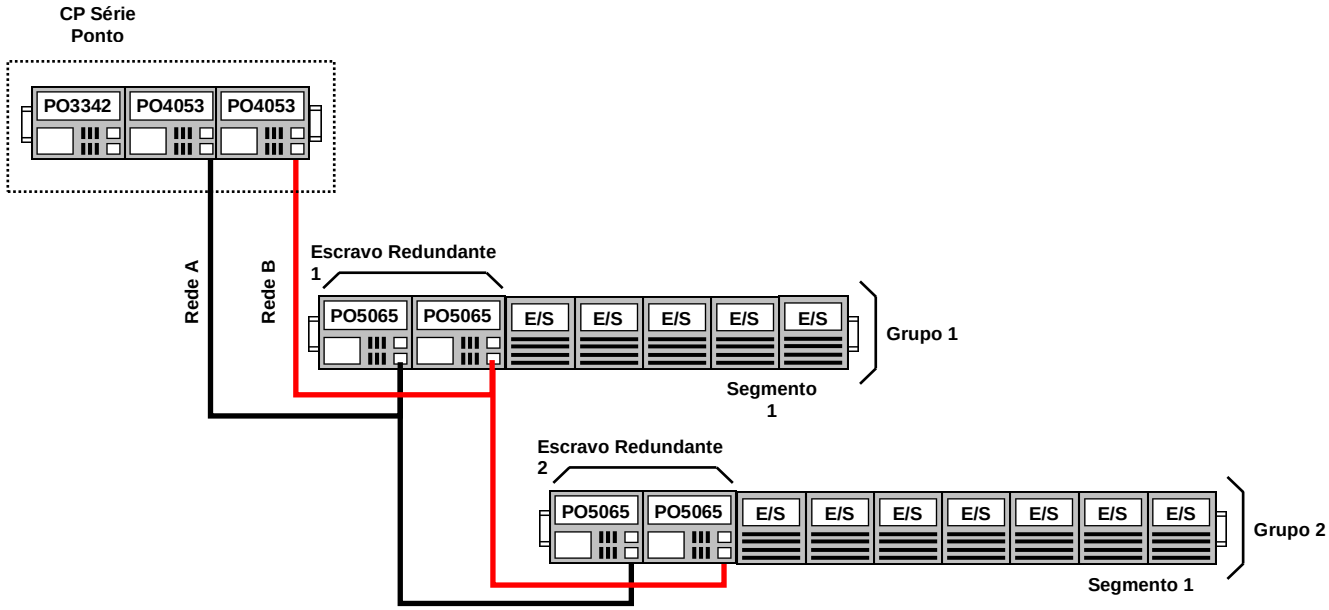

Figura 13-6 Physical layer and master redundant system using AL3406 master

Complete redundant system

Altus S.A. offers a complete and safe redundat control system for industrial instalations. The PO5065 PROFIBUS redundant Heads and the PX3406 and PO4053 PROFIBUS redundant Masters toghether with the Ponto Series offer a confiability of the Altus products. These products implement real time control with high degree of confiability. Real time system can garantee 100% of availabilty for equipment control variables sensing.

The Altus proposal for a real time system is a Complete Redundant System. Using a Complete Redundant System in industrial plants offers protection against failure of the heads, eletrical and optical lines, optical repeaters, Masters and CPUs. Any componente of the network can have a failure or can be hot swapped without inturrpting the avalibilty of commands. This can happen without human intervention in a totaly automatic manner.

With this system it is possible to guarantee contínuos monitoring of the input and ouput points even in the case of failure of the PROFIBUS heads, transmission lines, the Master or the CPU. This system is intended for applications where there is a need for a high degree of safeity and confiability.

Figure 13-7 shows a complete redundant System. This system uses redundant slaves conected by independent netwroks. Each CPU is composed by a PX2004 CPU and two PROFIBUS PX3406 Master interfaces. Two redundant slaves control the input output devices.

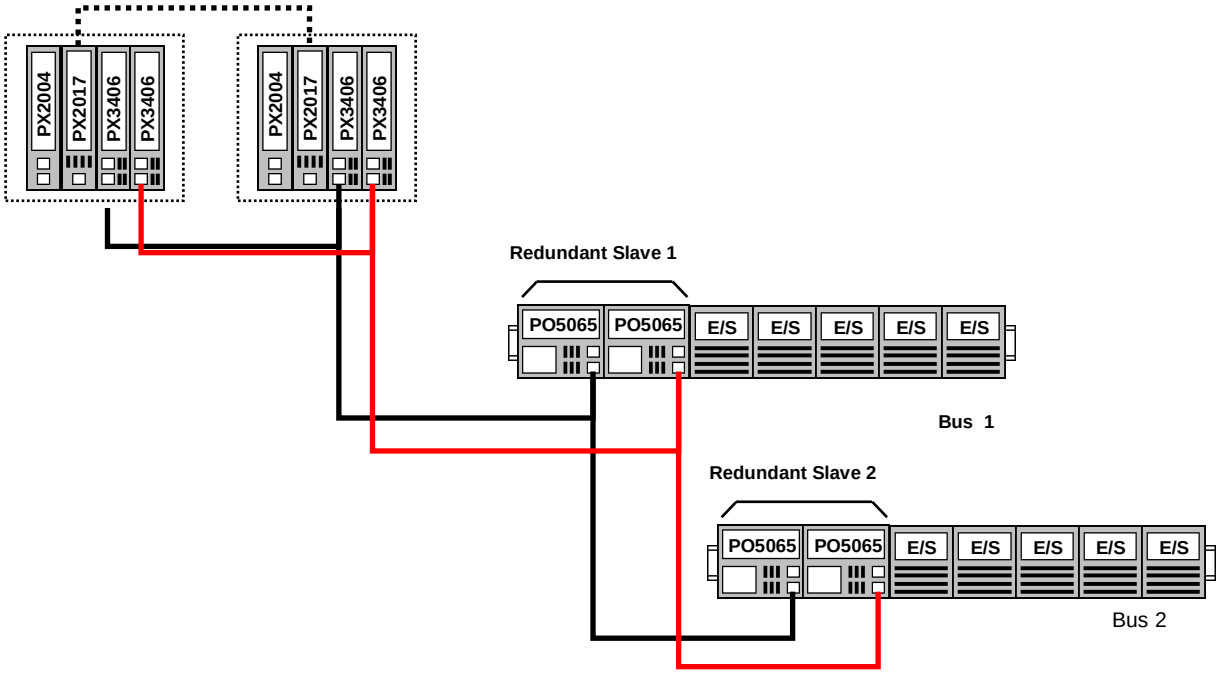

Figura 13-7 Complete redundant system

The addreesses of the heads on a bus must be the same. The same Project must be loaded for each master.

Configuration and parameterization is made the same way as show in the above examples. It is necessary to take care when selecting a suitable value for the retention time of the heads. This value depends on the application. The redundant system offers a high degree of security in process control. This system can work normally even in case of failures.

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 knows 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 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 or 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 loose 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 control 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 allows 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