QK1405
User´s Manual
Ref. 6299-030.3
Issue. B 01/2003

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The user should consider the possible consequences of the defects and should provide additional external installations for security so that, if necessary, the security of the system can be maintained especially during the initial installation and testing.
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Preface

The following is an introduction to the contents of the chapters in this manual, the adopted conventions, as well as a list of reference manuals for the products related to QK1405.

Description of this Manual

This manual describes the PROFIBUS DP slave QK1405 which allows the connection of ALTUS Programmable Controllers (PLCs) to PROFIBUS network as a master.

The interface QK1405 connects ALTUS QUARK QK801 and QK2000/MSP, AL-2002/MSP or AL-2003/MSP series Controllers as masters to PROFIBUS networks.

Acting as the master, the ALTUS PLCs can be used as to control I/O devices on the Network as valves, converters, remote I/O or other PROFIBUS DP devices.

The chapter **Introduction** introduces the QK1405 module and its basic characteristics.

The chapter **Technical Description** describes the architecture of the QK1405.

The chapter **Configuration** shows how the QK1405 is configured and its use by application programs of the PLC (function module F-1405.025).

The chapter **Installation** describes the installation of QK1405 into the PLC and PROFIBUS net.

The chapter **Maintenance** explains how to maintain the module, most common diagnostics and the LEDs behaviour of QK1405.

The appendix A, **GSD** displays a listing of the GSD definition file of the QK1405 as a PROFIBUS master.

The appendix B, **Application Example** shows an example for configuring the function module F-1405.

The appendix C, **Master Diagnostics** shows details of master diagnostic message fields.

The appendix D, **Device Diagnostics** shows details of device diagnostic message fields.

The appendix E, **Glossary** relates to the expressions and abbreviations used in this manual.

Related Manuals

In order to obtain additional information about using the PROFIBUS modules with ALTUS PLCs the following manuals can be consulted:

- PROFIBUS user´s manual
- QUARK series user´s manual
- AL-2002 user´s manual
- AL-2003 user´s manual
- AL-3830 and AL-3832 programming manual
- MASTERTOOL programming manual
- Technical characteristics manual.

Terminology

The following expressions are used frequently in the manuals text. Therefore it is necessary to be familiar with then in order to have a better understanding.

- **PLC**: Programmable Controller - understood as equipment made up of a CPU, input and output modules and a power supply.
- **CPU**: Central Processing Unit is the basic PLC module which carries out the data processing.
- **AL-3830**: identifies the ALTUS program for the standard IBM-PLC ® or compatible Personal Computers allowing the development of applications

for PLC's of series AL-600, AL-2000, AL-3000, PICCOLO and QUARK. Throughout the manual, this program will be referred to as "AL-3830 programmer".

- **AL-3832**: identifies the ALTUS program for standard IBM-PLC® or compatibles which allows the development of applications for PLCs of series AL-600, PICCOLO and CPUs, QK801 and QK600. Throughout the manual, this program will be referred to as "AL-3832 programmer".
- **MASTERTOOL**: identifies the ALTUS program for standard IBM-PLC ® or compatible, executable in the WINDOWS ® environment, which allows the development of applications for the PLCs of series PICCOLO, AL-2000, AL-3000 and QUARK. Throughout the manual, this program will be referred to as "MASTERTOOL programmer".

Other expressions can be found in appendix C - **Glossary**.

Conventions Used

Numbers used throughout this manual are decimal, except otherwise noted. Suffix **H** specifies an hexadecimal number, and **B** specifies a binary number.

The symbols used throughout this manual have the following meanings:

- This mark indicates a list of items or topics

SMALL CAPITAL letters indicate the names of keys, e.g. ENTER.

"KEY1 + KEY2" is used for keys to be pressed simultaneously. For example, the simultaneous pressing of keys CTRL and END is indicated by CTRL + END.

KEY1, KEY2 is used for keys to be pressed sequentially. For example, the message "Press ALT, F10" shows that the ALT key should be pressed and released and then the F10 key pressed and released.

LARGE CAPITAL LETTERS indicate the names of files and directories.

Italics indicate words and characters which are pressed on the keyboard or seen on the screen. For example, if you are asked to press A:AL-3830, then these characters should be pressed exactly as they appear in the manual.

BOLD TYPE is used for names of commands or options, or for emphasizing important parts of the text.

The warning messages take on the following format and significance:

DANGER:
The label DANGER indicates a risk to human life, of serious personal injury or substantial physical harm resulting from the necessary precautions not being taken.

WARNING:
The label WARNING indicates a risk to human life, of serious personal injury or substantial physical harm can be caused by the necessary precautions not being taken

CAUTION:
The label CAUTION indicates that personal injury or minimal physical harm cam be caused if the necessary precautions are not taken.

Contains important information about the product, its operation or a part of the text which should be paid attention to.

Technical Support

ALTUS EXPRESS: obtain relevant information by calling 55-51-337-3633.

INTERNET:

- WWW: http://www.altus.com.br
- E-MAIL: altus@altus.com.br

In case the equipment may be already installed it is advisable to provide the following information before getting in contact:

- equipment model used and installed system Configuration
- CPU serial number, equipment revision and executive software version, obtainable from labels on its side.
- information regarding CPU's mode of operation, available through the programmers AL-3830, AL-3832 or MASTERTOOL.

- application program contents (modules), available through AL-3830, AL-3832 or MASTERTOOL programmers.
- programmer used version.

Revisions of this Manual

The reference and revision code and the date of the present manual are shown on the cover. Revision changes can mean alterations to the performance specification or improvements in the manual.

The following report lists the corresponding alterations in each revision of this manual.

Revision A Date 03/98

First revision of the manual.

Introduction

Profibus

Serial fieldbuses are used today primarily as the communication system for exchange of information between automation systems and distributed field devices. Thousands of successful applications have provided impressive proof that use of fieldbus technology can save up to 40% in costs for cabling, commissioning and maintenance as opposed to conventional technology.
In fieldbuses only two wires are used to transmit all relevant information (i.e., input and output data, parameters, diagnostic data, programs and operating power for field devices). In the past, incompatible vendor-specific fieldbuses were frequently used. Virtually all systems in design today are open standard systems. The user is no longer tied to individual vendors and is able to select the best and most economical product from a wide variety of products.
PROFIBUS is the leading open fieldbus system in Europe and it enjoys world-wide acceptance. Areas of application include manufacturing, process and building automation.
PROFIBUS is an international, open fieldbus standard which was standardized in the European fieldbus standard EN 50170. This provides optimal protection of vendor and user investments and vendor-independence is ensured. Today, all leading manufacturers of automation technology offer PROFIBUS interfaces for their devices.

QK1405

The PROFIBUS DP slave QK1405 integrates an ALTUS products line for accessing fieldbuses. The interface QK1405 was planned to connect the ALTUS PLCs in the QUARK series, AL-2002/MSP and AL-2003/MSP to PROFIBUS DP as a master device for communication with PROFIBUS DP compatible I/O devices.

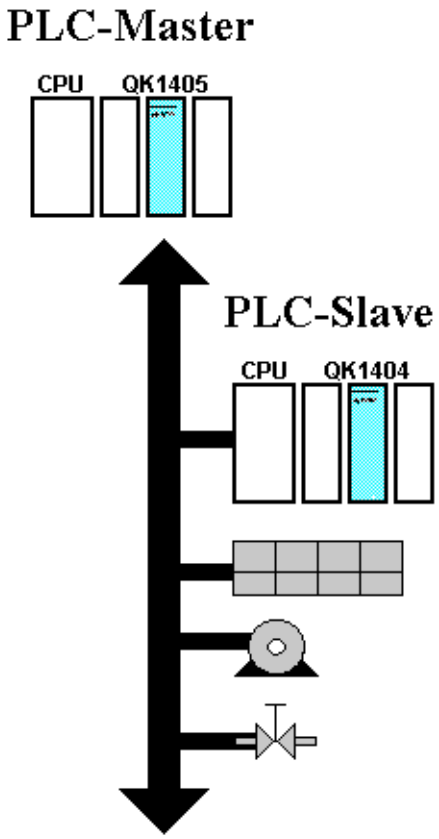


Figure 1-1 PROFIBUS-DP Network.

The QK1405 interface is an I/O module from the QUARK series of programmable controllers, having its own serial interfaces RS-485 and RS-232, and microprocessors, implementing the PROFIBUS DP master protocol, in accordance with EN 50170 standard.

QK1405 is used by application programs through the function F-1405.025. The function associates PLC operands to network devices and makes the data transfers between the network and PLC, making the PROFIBUS completely transparent for the application.

The basic characteristics of QK1405 are:

Characteristics	Description
Protocol	PROFIBUS DP master according standard EN 50170
PLC operand types accessed	A, M and TM
Size of datablock	Up to 512 bytes total input and 512 bytes total output
Multiprocessing interface	Independent processors for the network and for the PLC bus
Communication speed	Up to 12 Mbaud
Automatic testing and diagnostics	Built in the module.

Table 1-1 QK1405 Main Characteristics

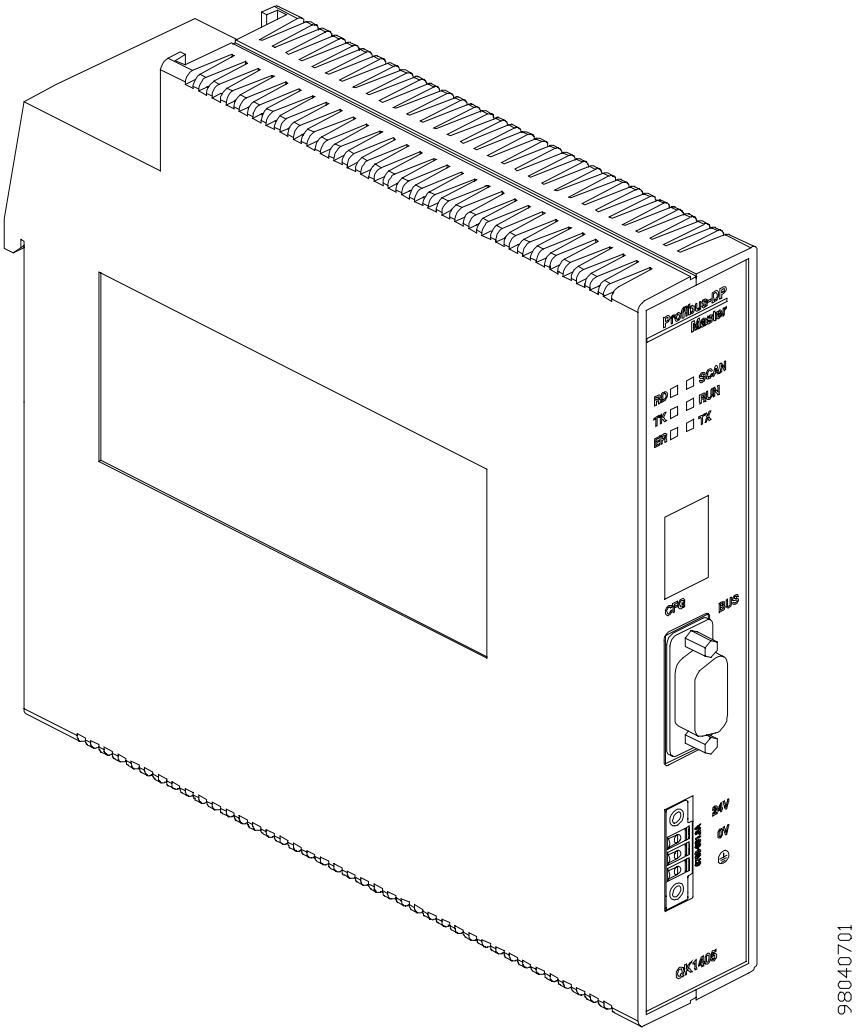


Figure 1-2 QK1405

Technical Description

QK1405 is a PROFIBUS master interface allowing a Programmable Controller to control I/O devices through PROFIBUS DP network, sending and receiving data to PLC operands of the types M, TM or A.

QK1405 is supported by CPUs QK801, QK2000/MSP, AL-2002/MSP and AL-2003/MSP, and is connected by the QUARK bus, exactly the same way as regular PLC I/O modules.

The use of the Interface for application is done through a special function module (F-1405.025) which configures and executes the PLC operand transfers for the network (c.f.ch. **Configuration**).

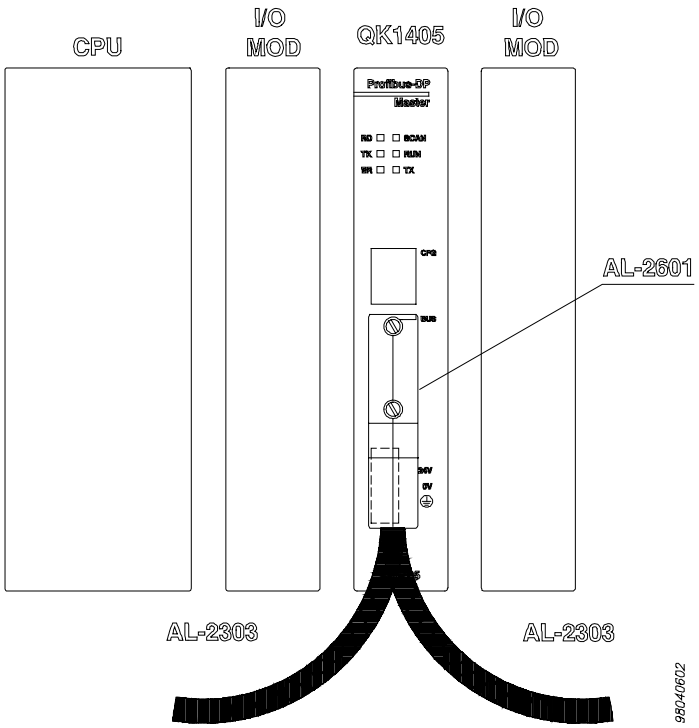


Figure 2-1 QK1405 Utilization

The QK1405 interface has two microprocessors: the first manages the interface with the QUARK bus, the second carries out the functions of the PROFIBUS DP slave. The microprocessors exchange data through a dual port memory.

The data is transferred during the execution of the function F-1405.025 which has to be included in the PLC's scanning. Various diagnoses are sent out through the F module to the PLC application program, and through the QK1405 to the master of the PROFIBUS, guiding the user during the installation and operation of the network (c.f.ch. **Configuration**). LEDs in the QK1405's panel help in recognizing the basic diagnostics and state of the interface (c.f.ch. **Maintenance**).

QK1405 needs a power supply which is fed externally with 24 Vdc. The power supply energizes the internal logic of the module and also supplies power to the PROFIBUS termination, through the nine pin connector.

The PROFIBUS is electrically isolated from the system ground by 500 Vdc, for reducing electrical interference.

QK1405 is connected to PROFIBUS network through a 9 pin D subminiature connector, in accordance with the standard EN 50170. The module does not have an internal termination but supplies the necessary power through the DB9 connector (c.f.ch. **Installation**). ALTUS offers two types of connectors, AL-2601 without termination and AL-2602 with termination.

Block Diagram

The following Figure shows the main block diagram of the QK1405.

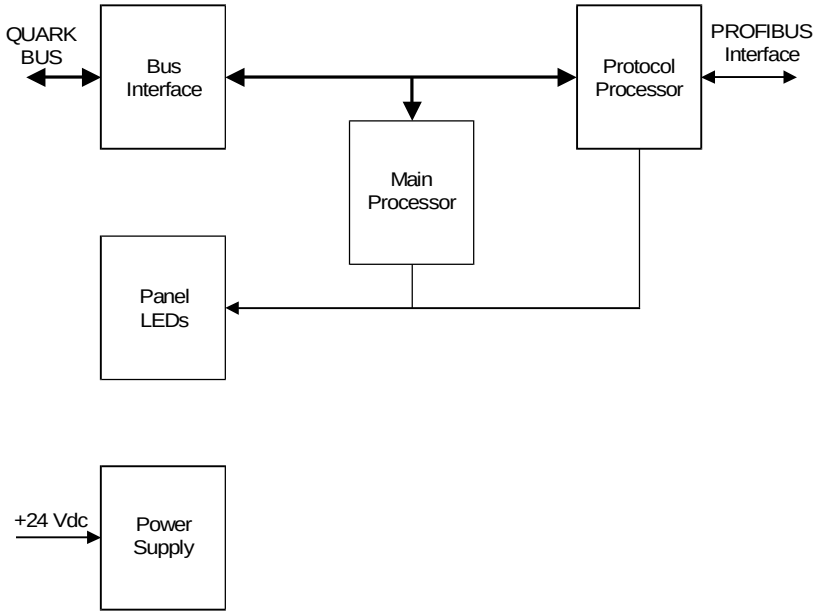


Figure 2-2 Block Diagram of the QK1405

Bus Interface

The bus interface contains the address decoder and the registers accessed through the CPU of the programmable controller. This is the communication media between the CPU and QK1405 module.

LEDs

The LEDs in the panel are controlled by the main processor of the Protocol, showing information about CPU access and network (c.f. ch 5, **Maintenance**).

Main Processor

The main processor of the QK1405 controls CPU access to the module and also manages data transfers with protocol's processor. The main processor is a 16 bit microcontroller (80C251) with 14 MHz clock. The executive software is stored in an 128 Kbytes EPROM.

Protocol Processor

The protocol's processor manages PROFIBUS, implementing all levels of the DP protocol, in accordance with standard EN 50170. The protocol processor uses the 80C188 microprocessor with 16 MHz clock. The data transfer between the main processor and the protocol processor is carried out through a 2 Kbytes two port memory.

The serial interface RS-485 is isolated by 500 Vdc from the rest of the card.

Power Supply

The power supply converts 24 Vdc voltage in 5 Vdc to supply card's logic. It has these characteristics:

- filtering circuits to suppress electrical noise
- power failure sensor: detects when primary power voltage reaches safe levels and generates signals for the correct operation of the card
- protection:
  - against short circuit with current limitation
  - against power failure through sensor that signals to processor before a complete power failure.

GSD File

All PROFIBUS devices have a file which defines their limits and possible Configurations. The file ALT_0735.GSD furnished with the module QK1405,

contains the required definitions to include the module in a PROFIBUS network.

The GSD files were conceived to facilitate PROFIBUS devices of different manufacturers interoperability. These files have device characteristics which has to be considered for its correct functioning in the network, such as the number and type of I/O modules, diagnostic messages, possible bus parameters, transmission rate and time-out.

Each device to be integrated in a PROFIBUS DP must have a GSD file supplied by its manufacturer. QK1405 is supplied with a file ALT_0735.GSD which has these parameters. (c.f. **Appendix A**).

The GSD files must be used to configure the network master, achieved with the help of a special program (Configurator) which loads the files and asks the user to enter appropriate module options required for its installation (c.f. Fig. 2-4). ALTUS supplies the program configurator PROFITool to configure the QK1405.

See the PROFIBUS user´s manual for more information about GSD files.

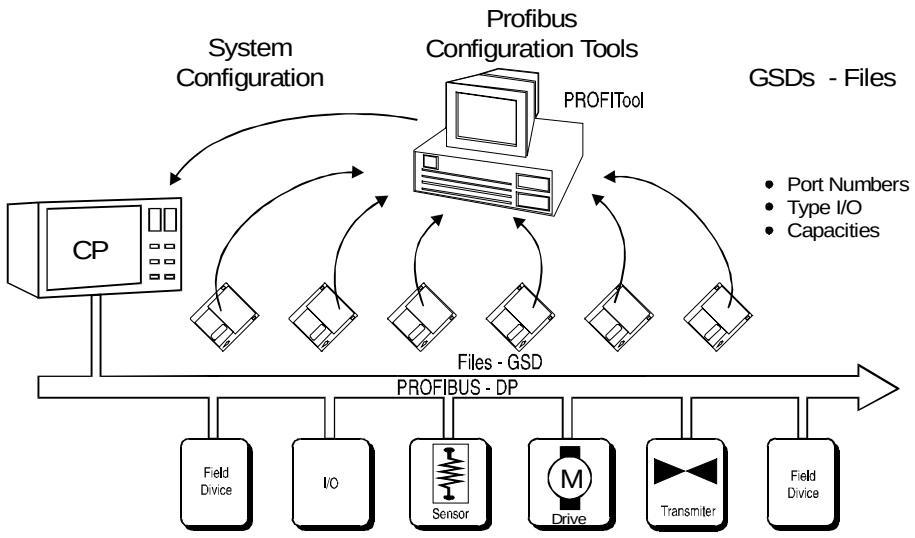


Figure 2-4 Configuration through the GSD Files.

Physical Composition of QK1405

The QK1405 is supplied with a 1.44 Mb floppy disk which contains the manual, the file ALT_0735.GSD and the function F-1405.025.

Connectors AL-2601, AL-2602 and AL-2303 PROFIBUS cable can be purchased separately. The AL-2601 is used to connect devices to the network with hot-swapping characteristic, as the cable goes in and out the connector. The AL-2602 must be used on network edges. This connector have the PROFIBUS termination. The AL-2303 cable is supplied by meter. The use of AL-2601, AL-2602 and AL-2303 c.f. chapter **Installation.**

QK1405 Characteristics

The QK1405 module has the following characteristics:

Basic Characteristic	Description
Protocol	PROFIBUS DP master According to EN 50170 standard
Multiprocessing interface	Independent processors for PROFIBUS and PLC bus
Communication speed	Up to 12 Mbaud
LEDs	4 LEDs for status indication
Automatic testing and diagnostics	Built in to the module
Operation temperature	O to 60ºC Exceeding IEC 1131 standard
Storage temperature	25 to 75ºC According to IEC 1131 standard
Operation relative humidity	5 to 95% without condensation According to IEC 1131 standard, level RH 2
Degree of protection	IP 20, against contact with live moving parts inside and no protection against water. According to IEC Pub. 144(1963) standard
Weight	Unshipped: 500g Shipped: 580g

Table 2-1 General Characteristics

Electrical characteristics	Description
External power supply	19 to 30 Vdc
Power consumption	50 mA @ 12 Vdc (bus) 300 mA @ 24 Vdc (external)
Module Dissipation	7 W
Dielectric strength	500 Vdc: PROFIBUS signals against bus and ground
Electrostatic discharge immunity (ESD)	According IEC 1131 standard, level 3
Damped oscillatory wave conducted noise immunity:	According IEC 1131 standard, level A
Fast transient conducted noise immunity:	According IEC 1131 standard, level B According IEC 801-4 standard, level 3
Radiated electromagnetic field immunity:	10 V/m @ 140 MHz According IEC 1131 standard

Table 2-2 Electrical Characteristics

Software Characteristics	Description
Communication	Through the PROFIBUS DP protocol
Configuration and programming	Through function module F-1405.025, integrated in the ladder diagram through MasterTool®
Types of operands accessed	A, M and TM
Maximum number of bytes transferred	512 inputs and 512 outputs

Table 2-3 Software Characteristics

Configuration

Module QK1405 Configuration must be carried out by PROFITool Programming Software, through QK1405 RS-232 serial port. Application Program on PLC accesses network devices through function module F-1405.025. An association table for F-1405 function must be initialized to carry out operand and network devices relations.

For QK1405 Configuration all connecting devices GSD files are needed, including QK1405 master. The GSD file for QK1405 accompanies the module in a floppy disk. **Appendix A** introduces a listing of that file.

PROFIBUS master communicates with slave devices only if Configurations in the master and in the slave are identical.

Network Configuration

PROFITool program is used to assemble master network configuration. The program runs on a PC computer and needs all device GSD files as input. The PROFITool compiles the files and helps the user in device parameterization, through windows.

For each device in network user can define sub-modules (in case of modular device) and physical and logical addresses. Physical addresses define the device on bus. Logical addresses define the octet (or byte) order along all devices on network. This ordering is important to make associations with PLC operands.

After configuration is defined, this information is downloaded in QK1405 through serial RS-232 port, and stored in Flash Memory, remaining there until a new configuration is made.

For additional information on QK1405 configuration consult PROFITool manual.

Module F-1405.025 Configuration

Programming of the PROFIBUS DP Master QK1405 on the PLC is carried out through the function F-1405.025.

Description

The function F-1405.025 is in charge of the communication between CPU and PROFIBUS DP Master Interface QK1405. This function manages all data transfers for the interface.

The F-1405.025 function works by operand bands association. This associations define declared PLC operands and PROFIBUS network addressing space relationships. The PROFIBUS addressing space is defined in Master through PROFITool program (consult PROFITool user's manual).

F-1405.025 function manages data transfers between PLC's CPU and network logical addressing space. This addressing space is divided in 4 areas (table 3-1)

Area	PLC operand type	Device type	Network Logical Address
0	TM, M or A	Digital input devices	000 - xxx
1	TM or M	Other input devices	xxx - 511
2	TM, M or A	Digital output devices	000 - yyy
3	TM, or M	Other output devices	yyy - 511

Table 3-1: Logical addressing areas on netwwork

Addressing areas 0 and 2 are reserved for digital input/output devices and can be associated with **TM, M** or **A** PLC operand types. Area size must be defined according to byte number used by digital devices.

Addressing areas 1 and 3 are reserved for other types of input/output devices (analog, etc.). These areas can be associated with **TM or M** PLC operand types. Area size must be defined according to byte number used the devices. See example in **Appendix B**.

After area sizes were defined, operand types and addresses are chosen to send/receive data to/from each one of the four areas, defining them in *association table* %TMXXXX.

QK1405 interface supports a maximum of 512 bytes input data and more 512 bytes output data.

"Input" and "output" concepts will be used in the description always referring to the Master, that is to say:
- input: data is read by the Master (data flow from Master to PLC).
- output: data is written by the Master (data flow from PLC to Master).

F-1405 function communicates with QK1405, PROFIBUS master, sending and receiving data to PLC associated operands and returning network *diagnostic*:

- Data (sent/received)
- Diagnostic

PROFIBUS net *diagnostic* is divided in two parts: *master diagnostic* and *device diagnostic* (slave diagnostic).

Master diagnostic informs master point of view of network general situation, including a landscape of active or in error stations. **Appendix C** shows the master diagnostic in detail.

Device (or slave) diagnostic shows slave error situation details. **Appendix D** shows the device diagnostic in detail.

F-1405 function maintains master diagnostic in PLC operands, and can access the diagnostic of one chosen device, by the order of application.

Parameters

Parameter defining master operation must be put in *association table* (%TMXXXX) indicated in the function call.

Function F-1405 interprets these parameters during execution, transferring data form/to defined operands in table. One special operand %MXXXX is used to inform function status.

%TMXXXX table must be initialized on PLC's first scan through CAB instruction. Reserved fields on table must be initialized by **zeros**.

Call to function F-1405.025

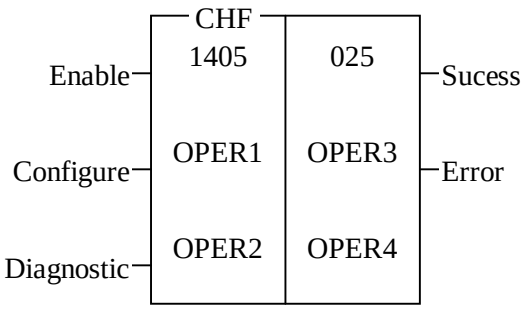


Figure 3-1 Call to Function F-1405.025

Operands

The cells of the CHF instruction used for the call to the function are programmed as follows:

Operand	Description
OPER 1	Number of parameters passed through the function in OPER 3: Must be obligatorily a memory constant with the value 2 (%KM + 00002)
OPER 2	Number of parameters passed in OPER 4: %KM + 00000, since OPER 4 is not used.
OPER 3	Parameters passed to the function, declared through a window seen in the programmer of PLCs AL-3830 or MasterTool, when the instruction CHF is edited. The number of editable parameters is specified in OPER 1, are two for this module: RXXXX - address of module QK1405 in PLC's bus. TMXXXX - address of association table
OPER 4	Not used.

Table 3-1 Operands

Function inputs and Outputs

The inputs of the CHF, called as F-1405.025 are:

Inputs	Description
Enable	When true, permits the function's execution. The operands are checked and communication with QK1405 is achieved.
Configure	When true, force module configuration parameters analysis. If false, the module performs only data transfers.
Diagnostic	When true, force device diagnostic request (c.f. **device diagnostic**).

Table 3-3 Function CHF Inputs

Function F-1405.025 outputs have the following behaviour:

Success	Error	Description
0	0	The module F-1405.025 is not executing (is not loaded into the PLC)
0	1	The module F-1405.025 is executing, but there are errors in function call parameters (%RXXXX, %TMXXXX, %MXXXX TM position 2 operand or parameter number).
1	1	Some error in F-1405.025 module exists (configuration parameters, %MXXXX TM position 3 memory), or in QK1405 module. The **error memory** contains the error code.
1	0	Both F-1405.025 and QK1405 are executing without errors.

Table 3-4 Function F-1405.025 outputs

Additional Parameters

The table %TMXXXX declared in OPER 3, called the **association table**, contains the parameter information for PROFIBUS master interface.

By convention
The corresponding information for each position of the TM table, used to configure the associations, are codified through the memory constants %KM+XXXXX.

Association table

The association table must have a size of 33 positions. The table format is to be followed:

Pos.	Parameter	Description
000 to 002	Reserved	Reserved positions for function own use
003	Error memory	Address position of the memory operand that will receive function error bits (c.f. table 3-10)
004	Invalid association memory	Address position of the memory operand that will receive the number of association in error
005 to 006	Master diagnostic pointer	Initial **M** or **TM** operand address that will receive master diagnostic data (c.f. table 3-11 and **Appendix C**)
007 to 008	Device (slave) diagnostic pointer	Initial **M** or **TM** operand address that will receive device diagnostic data (c.f. table 3-12 and **Appendix D**)
009 to 011	Area 0 association (Digital inputs)	Defines addressing area 0 in PLC (c.f. tables 3-8 and 3-9)
012 to 014	Area 1 association (Other inputs)	Defines addressing area 1 in PLC (c.f. tables 3-8 and 3-9)
015 to 017	Area 2 association (Digital outputs)	Defines addressing area 2 in PLC (c.f. tables 3-8 and 3-9)
018 to 020	Area 3 association (Other outputs)	Defines addressing area 3 in PLC (c.f. tables 3-8 and 3-9)
021 to 032	Reserved	Reserved positions for function own use

Table 3-5 Association Table

Error memory

Operand %MXXXX that receives F-1405 function error codes. See table 3-10 for function error codes.

Invalid association memory

Operand %MXXXX that contains the number of wrong operand association, in case that error exists. Number **1** indicates error in master diagnostic pointer, **2** indicates device diagnostic pointer error, and numbers **3** to **6** indicate errors in associations for areas **1** to **4**, respectively (c.f.table 3-6).

Assoc. number	Description
1	Master diagnostic pointer
2	Device diagnostic pointer
3	Digital input association
4	Other inputs association
5	Digital output association
6	Other outputs association

Table 3-6: Invalid Association Memory

Master and Device Diagnostics

These two areas will receive master diagnostic and diagnostic of one selected device in the network. These areas can be associated to **M** or **TM** operands. The pointer has the following format:

Pos.	digit 4	digit 3	digit 2	digit 1	digit 0
Xxx	-	Initial operand address			
Xxx+ 1	-	Oper type	Table initial position		

Table 3-7: diagnostic pointer

Initial Operand Address indicates the number of the first operand %MXXXX where diagnostic area will be, or the %TMXXXX table number in case the operand is a table. Operand type must be **0** for memory type, or **6** for table. If is a table also initial position must be given. Operands must be defined in PLC. If it is a table, the table must have the necessary positions to receive the data.

Master diagnostics occupies **21** positions (21 **M** operands or 21 table positions). Device diagnostics needs **101** positions (101 **M** operands or 101 table positions).

Consult tables 3-11 and 3-12 for diagnostic formats, and **Appendixes C and D**, respectively.

Operand Associations

The data transfer between the PROFIBUS master and the PLC is achieved by associations between blocks of operands of the PLC and logical address areas (areas 0 to 3).

Each association is described by 3 successive positions in the association table. The association is defined by 3 %KM+XXXXX constants. Observe the significance of each constant digit (c.f. table 3-8):

Pos.	digit 4	digit 3	digit 2	digit 1	digit 0
xxx	-	Initial operand address			
xxx+1	-	Oper type	Table initial position		
xxx+2	-	Number of operands in the area or number of table positions			

Table 3-8 Operand Association Format

Initial operand address

Specify the operand address according to declared in the PLC.

(E.g.: %M0010 has the address 10; %TM0000 has the address 0)

Operand Type

Choose the operand type to be associated with the addressing area. The accepted operands are **M**, **TM** or **A** for **0** or **2** areas, and **M** and **TM** for areas **1** and **3** (c.f. codes in table 3-9).

Initial Position for Tables

If the specified operand is to be a table (TM), the initial position for the transfer has to be specified in this field (0 to 254).

Number of Operands or Table Positions

On association third position one must specify the operand band size, in number of operands. E.g.: if we need 16 M operands beginning in 10, the defined band is %M0010 to %M0025. If there are 8 A operands beginning in 13, the defined band is %A0013 to %A0020. If the operand is “table”, this parameter defines the number of positions to be used.

Parameter	Description	
Initial operand address	First M, A or table TM operand address to be associated for address area	(Must be a valid operand in PLC configuration)
Operand Type	0 = M - memory 6 = TM - memory table	9 = A - auxiliary relays
Initial Position for Tables	This parameter indicates the transfer initial position, in case the operand is a table	(Must be between 0 and 254)
Number of Operands	Area size in number of operands	(Operand band must be defined on PLC configuration)

Table 3-9 Association Parameters

Function F-1405 errors

Function F-1405 error codes are listed in the chosen operand as “error memory”. In case that some error occurs, the F-1405 error output will be activated and the operand %MXXXX will contain the error code, according to table 3-10):

Bit	Error	Description
0	Module not declared	QK1405 is not declared in the PLC bus
1	Module non-existent	QK1405 is declared but is not present in the bus (or is defective)
2	Module occupied	QK1405 is occupied (should not be occupied for more than 1 sec in the case of Configuration)
3	Configuration	QK1405 was configured in this scan (is not an error)
4	Internal error	Communication error with the CPU (You may notify Support)
5	<reserved>z	
6	More than 512 bytes	Total byte number of input areas (0 and 1) or output (2 and 3) exceeds 512.
7	Invalid device physical address	Device physical address in diagnostic request field is out of 1 to 126 band.
8	Memory operand for invalid associations	Operand for “invalid association memory” does not exists or is not an M type operand
9	Invalid parameter	The association parameter is negative, or the initial table position is greater than 254
10	Operand type invalid	Operand type defined in the association is different of indicated
11	Size error	Operand band size exceeds 512 bytes (or 256 words), or number of table positions exceeds table size.
12	Association errors with operands %MXXXX	Operand address does not exists or is out of declared limits in PLC
13	Association errors with table operands	The table defined in the association is not declared in PLC, or its initial position is out of the table
14	Association errors with Aux operands	The address of auxiliary relay operand specified exceeds the PLC limits for this type of operand (consult PLC CPU user’s manual)
15	Any error	Indicates the existence of any errors.

Table 3-10 Function Error Codes

Bit 15 of the status memory is active when any error occurs. Also function output 1 is true, indicating whatever error.

Bit 2 (occupied) does not show an error, but an operation in progress in QK1405. It can occur in case of very short application programs that executes in less than 50 ms. The function does not execute as long as the module is occupied, waiting to execute in another PLC scan.

Bit 3 is on when module is configured. The module is configured when PLC initiates the first scan, or under application request (function input 1 active). During Configuration, data transfer is not done.

Bit 4 (internal error) should never occur in normal situations. It indicates a loss of synchronism between the CPU and QK1405. In such an event, ALTUS Support should be contacted.

Bits 8 to 14 indicate association table parameter errors, and occurs only during Configuration of F-1405.

Bit 7 error only occurs if device diagnostic was requested (function input 2 is active).

Bit 6 is activated when input or output area byte number exceed 512.

Master Diagnostic

Master diagnostic area contains relevant information about network behavior. The 5 initial positions show network conditions. Positions 5 to 20 show the status of each slave device on the network. The status is a two bit indication, one bit for *active device* and other for *message available.*

Position 0 shows *global error* bits. Position 1 shows master actual state. Position 2 shows the physical address of error device, and position 3 shows the corresponding error number (c.f. **Appendix C**). Position 4 is an total error counter, used to evaluate network quality.

See details about master diagnostic in **Appendix C**

Position	Description
0	Global Errors
1	Actual Master state
2	Remote Address in error
3	Error code
4	Error Count
5-20	Device state and diagnostic maps

Table 3-11 Master Diagnostic

Device Diagnostic

Device diagnostic is delivered from the Master by order of PLC application program. To order device diagnostic, the application program must set the physical address of desired slave in position 0 of diagnostic area, and activate the function input 2. The diagnostic will be copied into the respective area. The actualization number is incremented each time a new diagnostic is copied.

To obtain the device diagnostic, proceed:

- Set a physical address of desired device in diagnostic area position 0 (address must be between 1 and 126)
- Active F-1405 function input 1 (diagnostic), to enable diagnostic reading..
- Position 1 receives a "actualization number" which is incremented circularly, between 0 and 32767, at each new diagnostic readed.
- Examine the diagnostic, available in area positions 2 to 100. (c.f. **Appendix D**)

Position	Description
0	Physical address for device that diagnostic is to be readed (1 to 126)
1	Diagnostic actualization number
2	Status 1 (c.f. Appendix D)
3	Status 2 (c.f. Appendix D)
4	Status 3 (c.f. Appendix D)
5	Status 4: Master physical address for this device
6	Device identification (ID number)
7-100	Extended diagnostic (c.f. Appendix D)

Table 3-12 Device diagnostic

Use

This function should be used with QK801, QK2000/MSP, AL-2002/MSP and AL-2003/MSP CPUs.

Working Characteristics

The execution of multiple calls to the function F-1405.025 is allowed but will unnecessarily reduce the PLC scan speed, without significantly improving the PROFIBUS's performance.

This function cannot be used in interruption modules(E-.018 type).

The function is associated to a physical module. It is possible to have more than one QK1405 module in the PLC's bus. In this case, each QK1405 module must have a particular F-1405.025 function call.

The function execution time varies with data block size transferred:

CPUs QK2000 e QK801	85µs / byte
CPU AL-2002	105µs / byte
CPU AL-2003	95µs / byte

More 2 miliseconds must be additioned to compensate internal function inicialization

Example: for a total data block size of 128 bytes (inputs, outputs and diagnostics) the execution time will be 14 ms for a AL-2003 CPU.

The master diagnostics is only transferred when is changed. The Device diagnostic is transfered when application asks it, and when is avaiable at the interface.

Installation

This chapter introduces the procedures for the physical installation of PROFIBUS QK1405.

Installation on PLC Bus

QK1405 mounting is done in rails, together with CPU or QK2512 power supply and other I/O modules.

The module has a gap in the rear section so that its possible to fix it to the rail, trough engaging. For details concerning the mounting and the removal of the module on the rail, consult the QK2000/MSP CPU User´s manual.

Before mounting the module in the rail, the bus PLC address must be defined through the existing straps accessible through a side window on the casing. The module's address should be the same as that configured in the application program by the MASTERTOOL® or AL-3830 programmers, in its bus declaration (you can consult the user´s manual).

After defining the address, the module is inserted into the bus and connected by the communication cable with a CPU (flat cable). For details of addressing and module connection to the bus, consult the CPU QK2000/MSP user´s manual.

The module must be powered by 24 Vdc (19 a 30 Vdc) through the 3 pin connector in the front panel, as depicted in Figure 4-1.

Installation on PROFIBUS Network

General Information

QK1405 module installation on PROFIBUS must to be in accordance with the EN 50170 standard. The cable and the connectors used in the installation can be furnished by ALTUS:

- AL-2601: PROFIBUS tapping connector
- AL-2602: PROFIBUS termination connector
- AL-2303: PROFIBUS cable

Consult the PROFIBUS user´s manual for details of QK1405 installation on the network.

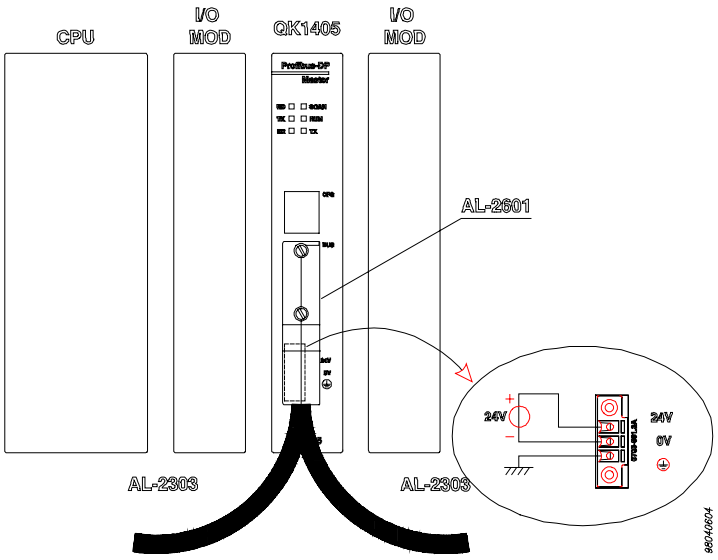


Figure 4-1 QK1405 PROFIBUS Installation

Maintenance

This chapter deals with the maintenance of the system. It contains information regarding the general care, the protective devices and the procedures for the operator in the case of errors.

The sections which follow introduce the most common problems encountered by the operator and the procedures to be implement in such cases.

Most Common Problems

If the QK1405 does not turn on (does not light any LED) the following verifications should be carried out:

- Check if the external power supply of 24 Vdc is active (19 Vdc to 30 Vdc, ripple included).
- Check the connections and supply voltage for the QK1405. In case of connection problems, repair them and reconnect the system.
- In case an over voltage problem was occurred, the QK1405 supply protection system might be activated and internal components have to be replaced. In this case, ALTUS Support Service has to be contacted.
- If the QK1405 module is correctly power supplied and no LED lights up, the module is defective and needs to be replaced.

Panel Diagnostics

QK1405 has LEDs in its front panel which show the most common diagnostics.

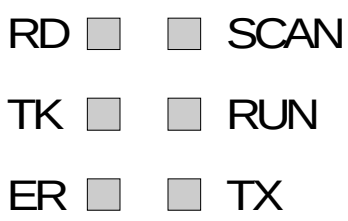


Figure 5-1 Panel LEDs

The following explains the meaning of the LEDs:

- **Scan:** this LED shows that the module is being accessed by the CPU. It should flash quickly while the F-1405 module is executed. If the LED SCAN is not lighting the module is not being accessed by the CPU, for one or more possible causes:

  - The module address in the bus is incorrect.
  - The bus cable is disconnected or badly connected.
  - The CPU is not in execution mode.
  - The QK1405 module was not defined in the bus by the programmer.
  - The F-1405 module is not loaded into the CPU's memory.
  - The F-1405 module is not executing or there is errors in its parameters.

In the event of the LED SCAN remaining statically lit, the QK1405 is defective and should be replace. The normal behaviour of the LED SCAN is to light for a moment during power up, switch off, and immediately after beginning to flash, indicating accesses by the CPU.

- **RD (READY):** this LED indicates that the module is ready for communicating. The LED READY is always switched on. In case it isn't, the possible reasons are:
  - Failure in the external power of 24 Vdc (all the LEDs off).
  - Internal failure or configuration error in the module (READY flashes).
- **RUN:** shows that the module is communicating with PROFIBUS and PLC is also communicating with QK1405 board.
  Possible errors:
  - RUN flashing: error in PROFIBUS, with a disconnected cable, wrong termination, CPU in programming state, QK1405 module not defined in PLC bus, F-1405.025 function module not executing.
  - RUN unlit: failure in the 24 Vdc supply or in the module.
- **X:** indicates transmission.

- **TK (HTOKEN):** hold token - indicates transmission in progress. If it is unlit, it indicates a failure in PROFIBUS (cable, connector or termination).
- **ER (ERROR):** lights when there is a retransmission of message in the network.

QK1405 GSD File

This appendix introduces the file ALT_0735 GSD which defines the Configuration of the QK1405 interface.

```
;*************************************************************************
**
;***
***
;***      Altus Sistemas de Informática S.A.
***
;***      PROFIBUS DP
***
;***      L. Gerbase
***
;***
***
;*************************************************************************
**
;***
***
;***      Filename: ALT_0735.GSD                  (c) 1997
***
;***
***
;*************************************************************************
**
;
;      ATTENTION:
;      ==========
;      Changes in this file can cause Configuration or communication
;      problems.
;      This file is compatible to the firmware of the device.
;
;      Changes
;      =======
;      ------------------------------------------------------------------
---
;      01.12.97   V1.000  F. Faehrmann (Hilscher GmbH)
;      -  created

#Profibus_DP

GSD_Revision        = 1
Vendor_Name         = "ALTUS Sistemas de Informatica"
Model_Name          = "QK1405"
Revision            = "V2.000"
```

```
Ident_Number        = 0x0735
Protocol_Ident      = 0
Station_Type        = 1
FMS_supp            = 0
Hardware_Release    = "V4.000"
Software_Release    = "V1.000"
9.6_supp            = 1
19.2_supp           = 1
93.75_supp          = 1
187.5_supp          = 1
500_supp            = 1
1.5M_supp           = 1
3M_supp             = 1
6M_supp             = 1
12M_supp            = 1
MaxTsdr_9.6         = 60
MaxTsdr_19.2        = 60
MaxTsdr_93.75       = 60
MaxTsdr_187.5       = 60
MaxTsdr_500         = 100
MaxTsdr_1.5M        = 150
MaxTsdr_3M          = 250
MaxTsdr_6M          = 450
MaxTsdr_12M         = 800
Trdy_9.6            = 11
Trdy_19.2           = 11
Trdy_93.75          = 11
Trdy_187.5          = 11
Trdy_500            = 11
Trdy_1.5M           = 11
Trdy_3M             = 11
Trdy_6M             = 11
Trdy_12M            = 11
Tsdi_9.6            = 70
Tsdi_19.2           = 70
Tsdi_93.75          = 70
Tsdi_187.5          = 70
Tsdi_500            = 150
Tsdi_1.5M           = 200
Tsdi_3M             = 250
Tsdi_6M             = 450
Tsdi_12M            = 800
Tset_9.6            = 1
Tset_19.2           = 1
Tset_93.75          = 1
Tset_187.5          = 1
Tset_500            = 1
Tset_1.5M           = 1
Tset_3M             = 4
Tset_6M             = 8
Tset_12M            = 16
Tqui_9.6            = 0
Tqui_19.2           = 0
Tqui_93.75          = 0
Tqui_187.5          = 0
Tqui_500            = 0
Tqui_1.5M           = 0
Tqui_3M             = 3
Tqui_6M             = 6
Tqui_12M            = 9
Redundancy          = 0
Repeater_Ctrl_Sig   = 0
```


```
24V_Pins            = 0
Max_MPS_Length      = 100
Max_Lsdu_MS         = 32
Max_Lsdu_MM         = 32
Min_Poll_Timeout    = 1
Las_Len             = 125
Max_Slaves_supp     = 125

Bitmap_Device = "ALTUSM_R"
Bitmap_Diag   = "ALTUSM_D"
Bitmap_SF     = "ALTUSM_S"


.
```

Application Examples

This appendix shows an example for configuring QK1405 interface.

Example 1

The example shows the use of QK1405 interface controlling a network composed by a modular device, with 5 sub-modules:

Modules	Description
MBM DI8	Digital input, 1 octet
MBM DO8/0.5A	Digital output, 1 octet
MBM AI4U	Analogic input, 4 words (16 bits)
MBM AI4U	Analogic input, 4 words (16 bits)
MBM AO4U	Analogic output, 4 words (16 bits)

Table B-1: Modulos used in Examples

Master Configuration

The Master must be configured by PROFITool program.

Using PROFITool program, we assemble the network, beginning with master, adding the 5 slave modules (c.f. PROFITool User's Manual).

The device logical addressing determines their relative positioning in PLC operands. For project beginning, is strongly recommended that device octet order is stabilised prior to making the Configuration. Use table B-2 as a starting point. Note that digital devices are ordered prior to analogue or other devices, which follow without any address discontinuity.

The logical addresses obtained from B-2 table must be utilised in the Configuration with PROFITool

After configuring, the network must have the following appearance (c.f. Figures B-1 and B-2):

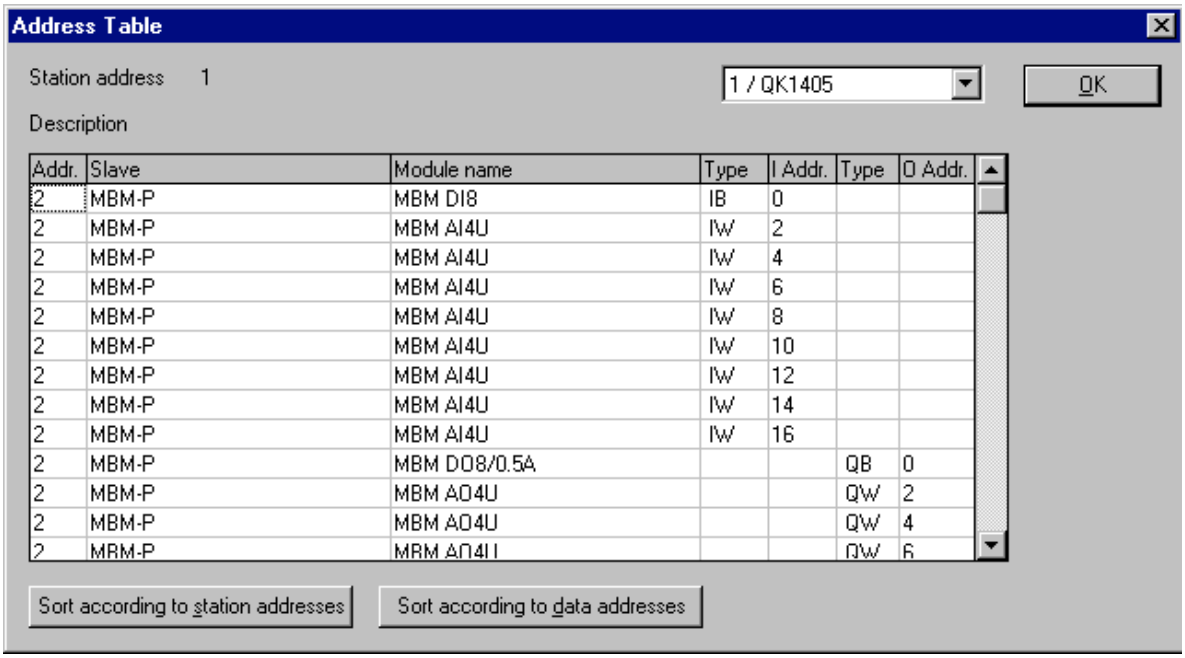


Figure B-1: Network Configuration (screen 1)

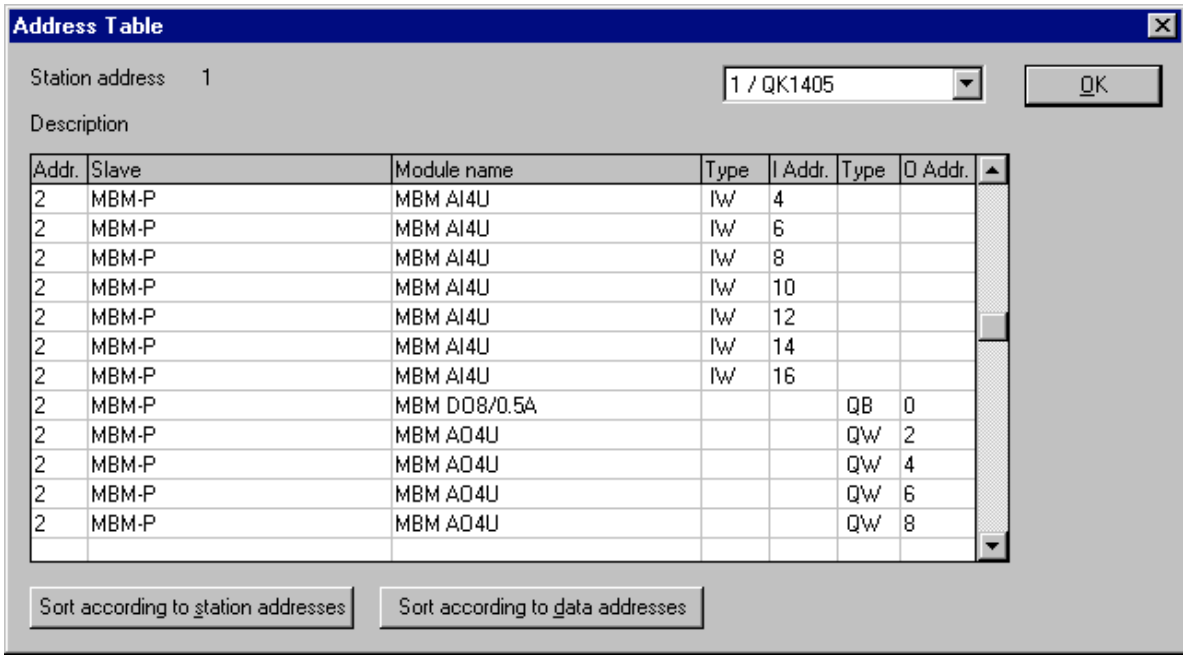


Figure B-2: Network Configuration (screen 2)

Observe that digital input has only one octet, but occupies two addresses, because PROFIBUS accepts only even byte addressing. Same occurs for digital output.

PLC Configuration

Association Table Data:

- Error Memory: %M0000
- Invalid association memory: %M0001
- Master diag area: %M0010 to %M0030 (21 operands)
- Slave diag area: %M0100 to %M0200 (101 operands)
- Digital input area: %A40-%A41 (even address)
- Analogic input area: %M0300 to %M0307
- Digital output area: %A50-%A51 (even address)
- Analogic output area: %M0400 to %M0403

Table B-2 shows how PROFIBUS network devices are mapped in the PLC

Digital input			Digital output		
Logical addresses (net)	**Operands**	**Octet**	**Logical addresses (net)**	**Operands**	**Octet**
0	%A0040	Digital in octet 0	0	%A0050	Digital out octet 0
1	%A0041	not used	1	%A0051	not used
	Analog Inputs		**Analog Outputs**		
Logical addresses (net)	**Operands**	**Octet**	**Logical addresses (net)**	**Operands**	**Octet**
2	%M0300	Analog.input 0	2	%M400	Analog. output 0
4	%M0301	Analog.input 1	4	%M401	Analog. output 1
6	%M0302	Analog.input 2	6	%M402	Analog. output 2
8	%M0303	Analog.input 3	8	%M403	Analog. output 3
10	%M0304	Analog.input 4	10		
12	%M0305	Analog.input 5			
14	%M0306	Analog.input 6			
16	%M0307	Analog.input 7			
18					

Table B-2: PROFIBUS Device Mapping in PLC for example 1

Association Table

The association table, to the example, must be assembled as shown in table B-3:

Pos.	Parameter	Value
000 to 002		
003	Error Memory	0 (%M0000)
004	Invalid association memory	1 (%M0001)
005 006	Master Diag	10 (%M0010 a %M0030) 0 (type M)
007 008	Slave Diag	100 (%M0100 a %M0200) 0 (type M)
009 010 0011	Digital input association	40 (%A40) 9000 (type A) 2 (%A40 to %A41)
012 013 014	Analog input association	300 (%M0300) 0 (type M) 8 (%M0300 to %M0307)
015 016 017	Digital output association	50 (%A50) 9000 (type A) 2 (%A50 to %A51)
018 019 020	Analog output association	400 (%M0400) 0 (type M) 4 (%M0400 to %M0403)
21 to 032	Reserved	

Table B-3: Association Table for example 1

Example 2

The second example shows the same PROFIBUS net form example 1 associated to PLC %TMXXXX operands

PLC Configuration

Association table data:

- Error Memory: %M0000
- Invalid association memory: %M0001
- Master diag area: %M0010 to %M0030 (21 operands)
- Slave diag area: %M0100 to %M0200 (101 operands)
- Digital input area: %TM0001, position 0
- Analogic input area: %TM0002, positions 0 to 7
- Digital output area: %TM0001, position 10
- Analogic output area: %TM0002, positions 10 to 13

Table B-4 shows how PROFIBUS network devices are mapped in the PLC

Digital input			Digital output		
Logical addresses (net)	**Operands**	**Octet**	**Logical addresses (net)**	**Operands**	**Octet**
0	%TM0001, pos 0, bits 0-7	Digital in octet 0	0	%TM0001, pos 10, bits 0-7	Digital out octet 0
1	%TM0001, pos 0, bits 8-15	not used	1	%TM0001, pos 10, bits 8-15	not used
	Analog Inputs		**Analog Outputs**		
Logical addresses (net)	**Operands**	**Octet**	**Logical addresses (net)**	**Operands**	**Octet**
2	%TM0001, pos 0	Analog.input 0	2	%TM0001, pos 10	Analog. output 0
4	%TM0001, pos 1	Analog.input 1	4	%TM0001, pos 11	Analog. output 1
6	%TM0001, pos 2	Analog.input 2	6	%TM0001, pos 12	Analog. output 2
8	%TM0001, pos 3	Analog.input 3	8	%TM0001, pos 13	Analog. output 3
10	%TM0001, pos 4	Analog.input 4	10		
12	%TM0001, pos 5	Analog.input 5			
14	%TM0001, pos 6	Analog.input 6			
16	%TM0001, pos 7	Analog.input 7			
18					

Table B-4: PROFIBUS Device Mapping in PLC for example 2

Note that when we associate **bytes** (digital input or output) to PLC **M** or **TM** operands, the even byte will occupy operand bits 0-7 and odd byte will occupy operand bits 7-15.

Association Table

The association table of example 2, must be filled as shown in table B-5:

Pos.	Parameter	Value
000 to 002		
003	Error Memory	0 (%M0000)
004	Invalid association memory	1 (%M0001)
005 006	Master Diag	10 (%M0010 a %M0030) 0 (type M)
007 008	Slave Diag	100 (%M0100 a %M0200) 0 (type M)
009 010 0011	Digital input association	1 (%TM001) 6000 (type TM, initial pos. 0) 1 (position 0)
012 013 014	Analog input association	2 (%TM002) 6000 (type TM, initial pos. 0) 8 (positions 0 to position 7)
015 016 017	Digital output association	1 (%TM001) 6010 (type TM, initial pos. 10) 1 (position 10)
018 019 020	Analog output association	2 (%TM002) 6010 (type TM, initial pos. 10) 4 (positions 10 to position 13)
21 to 32	Reserved	

Table B-5: Association Table for example 2

Master Diagnostic

Master diagnostic is always available on respective area defined in *association table*. This is a area of 21 table positions or 21 %MXXXX operands size.
Following is the master diagnostic format description:

Global Errors (position 0):

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	Ev	Fa	Nd	Ac	Ct

Bit 4: Ev (Event): indicates that a diagnostic have to be read in one of the devices

Bit 3: Fa (Fatal): indicates that heavy bus errors make communication impossible.

Bit 2: Nd (no Data): indicates that at least one slave device is not communicating or notifies heavy mistake

Bit 1: Ac (Auto Clear): master entered auto clear mode because of bus error (master must be operating in auto clear mode)

Bit 0: Ctrl (Parameterization error): Configuration in one device is different from master.

Master states (position 1):

00H: OFFLINE

40H: STOP

80H: CLEAR

C0H OPERATE

The meaning of master states can be seen in PROFIBUS user's manual

Device Address (position 2):

In this position the remote address of the faulty participant is placed, if an error occurs. If the source of error is determined inside the Master, the value 255 will come up.

Error Event (position 3):

This position shows the error number of the participant which address is in position 2

Error count (position 4):

This position counts heavy bus errors, for example bus short circuits.

Positions 5 to 20: Device State

Positions 5 to 20 of master diagnostic area contains two bit maps showing connected device state. The first 8 positions are the "state" and following 8 positions are the "diagnostic". En each map, a bit represents a station in network, in the physical corresponding position. The significance of the two bits (state and diagnostic) is:

	State = 0	State = 1
Diagnostic = 0	- No Data I/O Exchange between master and slave	- Slave is present on the bus - Data I/O Exchange exists between

	- Perhaps this slave is not configured or not responsive	master and slave
Diagnostic = 1	- The master and the corresponding slave do not exchange their I/O data - The master holds newly received diagnostic data in the internal diagnostic buffer	- Slave is present on the bus - The master and the corresponding slave do exchange their I/O data - The master holds newly received diagnostic data in the internal diagnostic buffer

Table C-1 Device state bits significance

The “state” bit turned on indicates that the device is communicating normally.

The “state” bit turned off indicates that device is not connected to the network or have some kind of error.

“Diagnostic” bit indicates that the slave has a diagnostic message available to be readed by the master. That message can be transferred to “Device diagnostic” area by request (c.f. **Appendix D**).

Following is the network devices state map format. The devices are represented by its physical address, that corresponds to bit position in table, as shown.

Position	**Device State** (bits) 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
5	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
6	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
7	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
8	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
9	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
10	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
11	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
12		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
	Device Diagnostic (bits) 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
13	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
14	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
15	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32
16	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
17	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64
18	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
19	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96
20		126	125	124	123	122	121	120	119	118	117	116	115	114	113	112

Table C-2 Device State Map

Error Codes

The following tables show Master Diagnostic position 3 error codes.

Table C-3 shows error numbers when device address is 255 (master errors). Table C-4 shows error numbers for devices (position 4 shows device physical address, different form 255).

Error Code	Description	Action
0	No errors	
50-53	Internal error	Contact Technical Support
54	Non existing master parameters	Repeat o Configuration “download”
55	Faulty parameter-value in the master parameter	Contact Technical Support
56	Non existing slave parameters	Revise configuring data and repeat “download”
57	Faulty parameter-value in a slave parameter datafile	Contact Technical Support
58	Double slave address	Revise configuring data and repeat “download”
59	Projected send process data offset address of a participant outside the allowable border of 0-255	Revise configuring data and repeat “download”
60	Projected received process data offset address of a participant outside the allowable border of 0-255	Revise configuring data and repeat “download”
61	Data areas of slaves area overlapping in the send process data	Revise configuring data and repeat “download”
62	Data areas of slaves area overlapping in the receive process data	Revise configuring data and repeat “download”
63-64	Internal error	Contact Technical Support
65	Faulty slave parameter data sets	Revise configuring data and repeat “download”
202	Internal error	Contact Technical Support
212	Faulty reading of a data base	Repeat “download”
213	Internal error	Contact Technical Support

Table C-3: Master Error Codes

Error Code	Description	Action
2	Station reports overflow	Check length of configured slave Configuration or parameter data
3	Request function of master is not activated in the station	Check if slave is PROFIBUS DP standard compatible
9	No answer-data, although the slave must response with data	Check Configuration data of the station and compare it with the physical I/O data length
17	No response of the station	Check bus cable, check bus address of slave
18	Master is not into the logical token ring	Check Master address or highest station Address of other master systems. Examine bus cabling to bus short circuits

Tabloe C-4: Device Error Codes

Device Diagnostic

This Appendix shows the format of device diagnostic data. The Positions refer to device diagnostic area as defined in F-1405.025 module.

Position 2 (Status 1):

Bit 7: Master_lock: Slave is parametrized by another master.

Bit 6: Parameter_fault: Last parameter telegram faulty

Bit 5: Invalid_Slave_Response: Implausible response of the slave

Bit 4: Not_Supported: Unknown command detected by the slave

Bit 3: Ext_diag: The slave has a extended diangostic message

Bit 2: Cfg_Fault: Slave is wrong parameterized

Bit 1: Station_Not_Ready: Slave is not ready

Bit 0: Station_non_Existent: Slave is not responding

Position 3 (Status 2):

Bit 7: Deactivated: Slave was declared inactive on parameterization

Bit 6: reserved

Bit 5: Sync_Mode: Turned on by slave when receiving Sync command

Bit 4: Freeze_mode: Turned on by slave when receiving Freeze command

Bit 3: Watchdog_On: Turned on by slave when your watchdog was activated

Bit 2: Always 1

Bit 1: Static_Diagnostic: Turned on by slave to signal that diagnostic must be readed by the master

Bit 0: Prm_Req: Turned on by slave to signal that the slave must be parameterized

Position 4 (Status 3):

Bit 7: Ext_Diag_Overflow: Turned on when extended diagnostic data exceeds field size declared on GSD file (Ext_Diag_Data)

Bits 0 to 6: reserved

Position 5 (Status 4)

Master_Add: This byte contains the physical address of the master which has done the parameterization of the slave. If the slave is not parameterized, this byte has the value 255

Position 6 (Status 5/6)

Ident_Number: Identification number of the slave device

Positions 7-100: Extended Diagnostic:

The following bytes describe the detailed situation of the slave. If the slave sends the extended diagnostic, the Ext_Diag bit is turned on.

Extended diagnostic has 3 types:

- Device related diagnostic
- Identifier related diagnostic
- Channel related diagnostic

One slave can have sub-modules, and each module can have channels or I/O points.

Device related diagnostic

7	6	5	4	3	2	1	0	Header
0	0	<----size---->						

Size: block length in bytes, including header

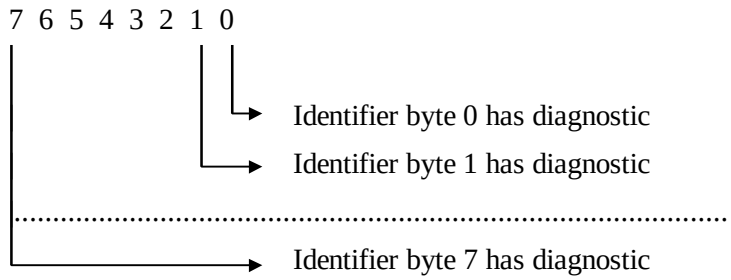
Follow bytes that identifies device situation. The format of these bytes are unique for each device (c.f. device manual)

Identifier related diagnostic

7	6	5	4	3	2	1	0	Header
0	1	<----size---->						

Size: block length in bytes, including header

Follow bytes that identifies identifier situation:



Channel related diagnostic

Each channel enters channel number and error reason

Each entry has 3 bytes

Byte 1:

7 6 5 4 3 2 1 0 Identifier

1 0 <-- ident --->

Ident: is the module number, from 0 to 63

Byte 2:

7 6 5 4 3 2 1 0 Channel number

<I/O> <--channel-->

I/O::

00 - reserved

01 - input

10 - output

11 - input and output

Channel: channel number

Byte 3:

7 6 5 4 3 2 1 0 Diagnostic type

<ch. typ> < err type>

Error type and channel type: c.f. tables D-1 and D-2.

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

111	reserved

Table D-1: Channel type

Error type:	Description
0	reserved
1	short circuit
2	undervoltage
3	overvoltage
4	overload
5	overtemperature
6	line break
7	upper limit value exceeded
8	lower limit value exceeded
9	error
10	reserved
------	--------
15	reserved
16	manufacture specific
------	--------
31	manufacture specific

Table D-2: Error type

Glossary

This appendix contains a glossary of words and abbreviations frequently used in this manual.

- **Active CPU**: In a redundant system, it is a CPU which has control of the system, reading the values of the input points, executing the application program and updating the output values.
- **Algorithm**: Finite sequence of well defined instructions objectifying the resolution of problems.
- **Application program**: Control algorithm, usually programmed in relay diagram language, which specifies the command of a specific machine for the CP.
- **Arrest**: Protective device against lightning carrying inert gas.
- **Assembly Language**: Programming language for microprocessor. Also known by machine language.
- **Auto-clear**: PROFIBUS parameter which when activated changes the status of the master to clear from an error in the network.
- **Backoff**: Time that one point of the network waits before returning to transmit data after a collision has occurred in the physical environment.
- **Baud rate (transmission rate)**: Rate at which the bits of information are transmitted through a serial interface or communication network.
- **Bit map**: form of digital coding of the images.
- **Bit**: Basic unit of information. It can have the status of 0 or 1.
- **Bridge**: Equipment for connection of two communication networks within the same protocol.
- **Broadcast**: Simultaneous sending an information to all the interconnected nodes of a communications network.

- **Bus**: Collection of electrical signals logically grouped with a function to transfer information and control between different elements of a subsystem.
- **Byte**: Unit of information composed of eight bits.
- **Clear**: Status of PROFIBUS network when the outputs are protected.
- **Command**: Instruction given by the user which tells the equipment or program which task is to be executed.
- **Communication network**: Set of equipment (nodes) interconnected through communication channels.
- **Configuration Module (Module C)**: Single module in a program of the Programmable Controller which contains several parameters necessary for the functioning of the controller, such as a number of operands and the arrangement of the I/0 modules in the bus.
- **Configuration**: Preparation for putting the product into operation.
- **Connector**: Mechanical component which allows the connection or separation of two or more components or electrical circuits.
- **CPU**: Central processing unit. Controls the flow of information, interprets and executes the program instructions and monitors the devices of the system.
- **CSMA/CD**: Discipline for access to the physical environment. It consists of: monitoring the line of data to verify the possibility of access when it is free. Access to the line can be achieved for various stations. The detection of conflict when two nodes use a line simultaneously.
- **Data Sheet**: Technical data or specifications for a device.
- **Database**: Databank
- **Debugging**: Tests to determine the correct performance of the product and the picking up and correction of errors.
- **Default**: Pre-defined value for a variable, used in case where there are no definitions.
- **Deterministic communication network**: Communication network where the maximum time of transmission and reception of information between the different nodes of which it is made is guaranteed under certain conditions through the protocol which supports it.
- **Diagnostic**: Procedure used to detect and isolate faults. It is also all the data used for such determination which helps to analyse and correct problems.
- **Download**: Programs or Configuration load into the modules.

- **EIA RS-485**: Industrial standard (physical level) for communicating data. Main characteristics are: possibility of communicating with various nodes; high level of immunity from electromagnetic interferences due to its differential voltage operation.
- **EN 50170**: Standard which defines the PROFIBUS network.
- **Encoder:** Transducer for measuring position.
- **Environment access**: Method used for all the nodes of a communications network to synchronise data transmissions and resolve possible conflicts of simultaneous transmissions.
- **EPROM (Erasable Programmable Read Only Memory)**: Memory only for reading, erasable and programmable. It uses ultraviolet rays for erasing its contents, being able to be reprogrammed when necessary. It does not lose its contents when its power is off.
- **Execution module (Module E)**: Software modules which contain the application program of three possible types: E000, E001 and E018. Module E000 is executed only once in turning on the Programmable Controller or in changing from programming state to execution. Module E001 contains the main part of the program which is executed cyclically, where as module E018 is activated by time interruption.
- **Executive program**: Operating system of a programmable controller; manages controller the basic functions and executes the application programs.
- **Executive software**: Operating system of a programmable controller; manages controller the basic functions and executes the application programs.
- **E2PROM**: Non volatile memory electrically erasable.
- **Flash EPROM**: Non volatile memory electrically erasable.
- **Frame**: A unit of information transmitted in the network
- **Freeze**: Status of PROFIBUS network when the input data is frozen.
- **Function module (Module F)**: Module of a program in the Programmable Controller which is called from the main module (module E) or from another function module or procedure, with parameters passing and values returned, working as a sub-routine.
- **Gateway**: Equipment for connecting two communication networks with different protocols. The gateways AL-2400/S-C or QK2400 allows the interconnections of the ALNET/Network with the ALNET II network.

- **Hardkey**: Connector usually attached to parallel interface of microcomputer with the function of prevent the execution of illegal copies of software.
- **Hardware**: Physical equipment used in data processing where the programs (software) are usually executed.
- **Hot swapping**: Procedure for substitution of system modules without having to turn off the power. Normally used to change I/0 modules.
- **IEC Pub.144 (1963)**: Standard for protection against incidental access to equipments and sealing of water, dust or other equipment strange objects.
- **IEC 1131**: Generic standard for operation and use of Programmable Controllers.
- **IEC-536-1976**: Standard for protection against electric shock.
- **IEC-801-4**: Standard for tests of immunity from interference through pulse bursts.
- **IEEE C37.90.1 (SWC - Surge Withstand Capability)**: Standard for protection against oscillatory wave noise.
- **Inactive CPU**: CPU which is not in an active status (controlling the system), neither in a reserve status (supervising the active CPU) nor being able to take control of the system.
- **Installation**: Describes the mounting of hardware, cabling, power and other elements of the system.
- **Instruction**: Operation to be executes over a set of operands inside a program.
- **Integrated circui**t: Device which incorporates, into one encapsulation, all the elements and interconnections necessary for a complete miniaturised electrical circuit.
- **Interface**: Device which adapts electrically and/or logically the transfer of signals between two pieces of equipment.
- **Interruption**: Priority processing event which temporarily suspends program execution. The interruptions can be divided into two generic types: hardware and software. The first is caused by a signal coming from a peripheral device and the second is created by instructions of a program.
- **I/O (input/output)**: Input and/or output data devices of a system. In the case of PLCs, they correspond typically to digital or analog input or output modules, that monitor or active the control devices. In ALTUS PLCs relay language, they also correspond to operands E (input) and S (output),
- **I/0 Module**: Module belonging to an I/0 subsystem.

- **I/0 Subsystem**: Set of digital, analogue or interface I/0 modules which are available to compatibilize PLC and field logical signals. They have a modular form and are mounted in racks.
- **Kbytes**: Unity that represents the amount of memory. Each Kbytes represents 1024 bytes.
- **Language of Relays and Blocks**: Set of instructions and operands which allows the edition of an application program to be used in a Programmable Controller.
- **Laptop**: Portable microcomputer in a small suit case format.
- **LED (Light Emitting Diode)**: Type of semiconductor diode which emits light when electrically stimulated. Used as an illuminated indicator.
- **Logic**: Graphic matrix where are inserted the instructions of relay diagrams language which makes up an application program. One sequentially ordered set of logic makes up an program module.
- **Master-slave communication network**: Communication network where the transfer of information is initiated only by one node linked to the data bus (the network master). The rest of the network nodes (slaves) responds only when requested.
- **Master**: Communication network equipment which sends out requests for commands for other equipment in the network.
- **Menu**: Set of available options and screen displays for a program, to be selected by the user with the aim of activating or executing a determined task.
- **MIL-HBOK-217E**: American military standard for calculation of reliability.
- **Module address**: Address through which the PLC achieves accesses to a specific I/O module connected on the bus.
- **Module (when it refers to hardware)**: Basic element of a complete system which has well defined functions. Usually it is connected to the system through connectors which can be easily replaced.
- **Module (when it refers to software)**: Part of an application program capable of carrying out a specific function. It can be executed independently or in conjunction with other modules exchanging information through parameter passing.
- **Mono-master**: Network with only a master.
- **Multi-master communication network**: Communication network where information transfer is initiated by any node connected to the databus.

- **Multi-master**: Network with more than one master.
- **Multi-turn**: Encoder with code for more than one rotation.
- **Multicast**: Simultaneous sending of information to a determined group of interconnected nodes in a communications network.
- **Network Configuration Module**: Project routing module that contains the set of parameters of a specific Configuration of the network and the routing device.
- **Nibble**: Unit of information composed of four bits.
- **Node or nodule**: Any station in a network capable of communication using an established protocol.
- **Notebook**: Portable microcomputer in notebook format.
- **Octet**: Set of eight bits numbered 0 to 7.
- **Operands**: Elements on which the instructions act. They can represent constants, variables or set of variables.
- **Palm-Top**: Portable microcomputer in the form of a pocket calculator.
- **Peer to peer**: Is a type of communication where two partners exchange data and/or warnings.
- **PLC**: Abbreviation for Programmable Controller.
- **Plug and Play**: Configuration form which dispenses adaptations in the modules or software.
- **Points of Adjustment**: Key for selection of addresses where the Configuration, composed of straps in the circuit card and a small removable connector, used for the selection.
- **Power down**: Power supply generated signal which communicates a power failure to system CPU, guaranteeing safe shut down and ensuring retentive memory protection.
- **Procedure module (Module P)**: Module of a program in the Programmable Controller which is called from the main module (module E) or from another function module or procedure,, without parameters passing.
- **Programmable Controller**: Tool which has control under the command of an application program written in language of relays and blocks. It is made up of a CPU, power supply and input/output structure.
- **Programming Language**: A set of rules, conventions and syntax, used to prepare a program. A set of symbols used for representation and communication of information or data between people and machines.

- **Programming Logic**: Graphic matrix where are inserted the instructions of relay diagrams language which makes up an application program. One sequentially ordered set of logic makes up an program module.
- **Programming terminal**: A microcomputer executing a PLC software programmer like MASTERTOOL®, AL3830, AL3800 or AL3880.
- **Programming**: The act of preparing a program in all its stages for a computer or similar equipment.
- **Program**: Set of basic instructions ordered properly which instruct a certain machine to carry out operations on the data with the aim of achieving a result.
- **Protocol**: Rules of procedure and conventional formats which, by means of control signals, allow the establishment of data transmission and the recovery of errors in the equipment.
- **P2006_1000**: Relay diagram language programmed module in which manages the control of the redundancy and of the communication with the remote stations in CPU 1.
- **P2006_2000**: Relay diagram language programmed module in which manages the control of the redundancy and of the communication with the remote stations in CPU 2.
- **RAM**: Memory where all the addresses can be directly accessed at random and at the same speed. It is volatile, that is to say, its contents are lost when the power is turned off. Memory region where user data is stored for processing.
- **Redundant CPU**: Corresponds to other CPU of the system, in relation to which the manual's text is to be referred to. For example, the redundant CPU of CPU 2 is the CPU 1 and vice versa.
- **Redundant System**: System which contains reserved or duplicated elements for executing a certain task, which can tolerate certain types of failure without compromising task execution.
- **Remote station**: Equipment which is able to read and write points of input and output of the controlled process, communicating its values with an active CPU.
- **Reserve CPU**: In a redundant system, it is a CPU which supervises the active CPU, not having control of the system, being ready to assume control in case of failure in the active CPU.
- **Ripple**: Undulation present in DC voltage.

- **Router device**: Equipment which carries out the interconnection of two networks ALNET II (bridge) or between one subnetwork ALNET I and another subnetwork ALNET II (gateway).
- **Safe**: Protected status of outputs.
- **Scan cycle**: A complete execution of the executive program and of the application program of a programmable controller.
- **Serial channel**: Device which permits the connection and communication of data between two or more pieces of equipment through a common standard.
- **Series**: Set of modules which have the same code AL, QK, FT or PL and the same first numerical character. E.g.: the series AL2000 includes the controllers AL-2000/MSP-C and AL-2002/MSP.
- **Single tur**n: Encoder with code for only one rotation.
- **Slave**: Network communication device which responds to requests from commands coming from the master.
- **Slot**: Number associated with the address in the network of the module.
- **Socket**: Device in which the integrated circuits or other components are plugged, allowing them to be replaced and making the maintenance easy.
- **Software:** Computer programs, procedures and related rules of operation for a data processing system.
- **Start-up:** Control system final debugging procedure, when all CPUs and remote station programs are executed as a whole, after they were individually designed and verified
- **Status:** Status of module.
- **Sub network:** Segment of a communications network which interconnects a group of equipment (nodes) with the aim of isolating the local traffic or using different protocols or physical environment.
- **Supervision station:** Equipment connected to a communication network or instrument with the power to monitor or control variables of a process.
- **Sync:** Operation mode of PROFIBUS which synchronises the outputs.
- **System:** Set of equipment used for the control of a machine or process, made up of the CP's, CPU, I/O, Modules, Microcomputer and user-machine interfaces.
- **Tag:** Name associated with an operand or logic which permits a summarised list of its contents.

- **Time-out:** Pre-established maximum time for a communication to be completed which if it is exceeded, cause the occurrence of a communication error.
- **Toggle:** Element which has two stable states changing alternatively for each activation.
- **Token:** Is a mark which indicates the master of the bus at the moment.
- **Upload:** Reading of program or Configuration of the modules.
- **Varistor:** Protective device against voltage surges.
- **Watchdog circuit:** Electrical circuit dedicated to verifying the integrity in the functioning of a piece of equipment.
- **Word:** Unit of information made up of sixteen bits.

Abbreviations Used:

- BAT Battery
- BT Battery Test
- CARAC. Characteristics
- Develop Developing
- CPU Central Processing Unit
- -DP Decentralised Periphery
- EEPROM Electric Erasable Programmable Read Only Memory:
- EPROM Erasable Programmable Read Only Memory
- ER Error
- ESD Electrostatic Discharge
- EX Execution
- E2PROM Electric Erasable Programmable Read Only Memory
- FC Force
- Flash EPROM Flash Erase Programmable Read Only Memory
- FMS Fieldbus Message System
- GSD The German wording for device date base files (“Geräte Stammdaten Datei” in German)
- I/O Inputs and Outputs
- INTERF. Interface
- ISOL. Isolated, Isolation
- LED Light Emitting Diode
- LLI. Lower Level Interface
- MAC. Media Access control
- Max Maximum
- Min Minimum
- Obs Observation or observations

- PAs Points of Adjustment
- PG Programming
- PID Proportional, Integral and Derivative control
- PLC Programmable Controller
- RAM Randon Access Memory
- ref. Reference
- RXD Serial Reception
- RX Serial Reception
- SELEC Selectable
- SWC Surge Withstand Capability
- THUMB. Keys of type thumbwheel
- TXD Serial transmission
- TX Serial transmission
- UTIL Utilizing
- VFD Virtual Field Device
- WD Watchdog

Remissive Index