ASCON TECNOLOGIC

COMPANY WITH QUALITY MANAGEMENT SYSTEM CERTIFIED BY DNV
= ISO 9001:2008 =

sigmadue microPAC MP-02

User Manual

S E R I E S

User Manual
M.U. microPAC MP-02-1/13.07
Code: ISTR-MU MP-02ENG01

Ascon Tecnologic srl

Headquarters:	via Indipendenza 56, *27029 Vigevano (PV)*
Phone:	+39 0381 69871
Fax:	+39 0381 698730
Internet Site:	www.ascontecnologic.com
E-mail address:	info@ascontecnologic.com

INDEX

Prerequisites

The products described in this manual should be installed, operated and maintained only by qualified application programmers and software engineers who are familiar with EN 61131-3 concepts of PLC programming, automation safety topics, and applicable national standards.

Using this manual

Specifications within the text of this manual are given in the International System of Units (SI), with non SI equivalents in parentheses.

Fully Capitalized words within the text indicate markings found on the equipment.

Words **in bold** style within the text indicate markings found in the Configuration Tools.

Warnings, Cautions and Notes are used to emphasize critical instructions:

DANGER!

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Caution

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Note: Highlights important information about an operating procedure or the equipment.

Current Documentation on the Internet

Make sure you are always working with the latest version of this document.

Ascon Tecnologic Srl reserves the right to make changes to its products in the name of technological advancement. New manual revisions, when published, and can be found online at:

http://www.ascontecnologic.com

Chapter 1
Hardware description

The system described in this User Manual is mainly composed of three main components:

- Ascon Tecnologic sigma**due** micro**PAC** MP-02 with 6 + 2 optional analogue inputs, up to 4 analogue outputs, 8 digital inputs and 8 digital outputs (ready to work with OpenPCS EN61131-3 compliant programming system);
- Ascon Tecnologic sigma**due** micro**PAC** I/O modules;
- Infoteam OpenPCS EN61131-3 compliant programming system.

micro**PAC** MP-02, is a powerful processing device, based on an ARM RISC processor, utilizing different types of memory, some onboard I/O and several communication ports.

micro**PAC** I/O is a complete family of I/O analogue and digital modules with special functions that can be connected to the MP-02 module through a dedicated bus.

Infoteam OpenPCS is a powerful and useful standard programming system for PLC applications.

It is a clearly structured, easily operated tool for editing, compiling, debugging, managing and printing PLC applications in all the development phases.

OpenPCS supports EN61131-3 programming under Windows server 2003, Windows XP SP2 or Windows Vista 32 bit.

The Ascon Tecnologic sigma**due** micro**PAC** line is based on the MP-02 module, combining its functionality with the capabilities of a PLC. "*Modular concept*" means that you can adapt the system to your requirements quickly and easily. This gives the sigma**due** automation system an especially economical price/ performance ratio.

This User Manual handbook introduces you to the micro**PAC** line and the Infoteam OpenPCS programming system.

It explains how to install the hardware and software, and how to start up the system. Information on maintenance, troubleshooting and service are also included.

1-1 Architecture

From the programmer's point of view, a complete system is made up as in "*Figure 1.1 - Programming the sigmadue microPAC Control Unit*" below:

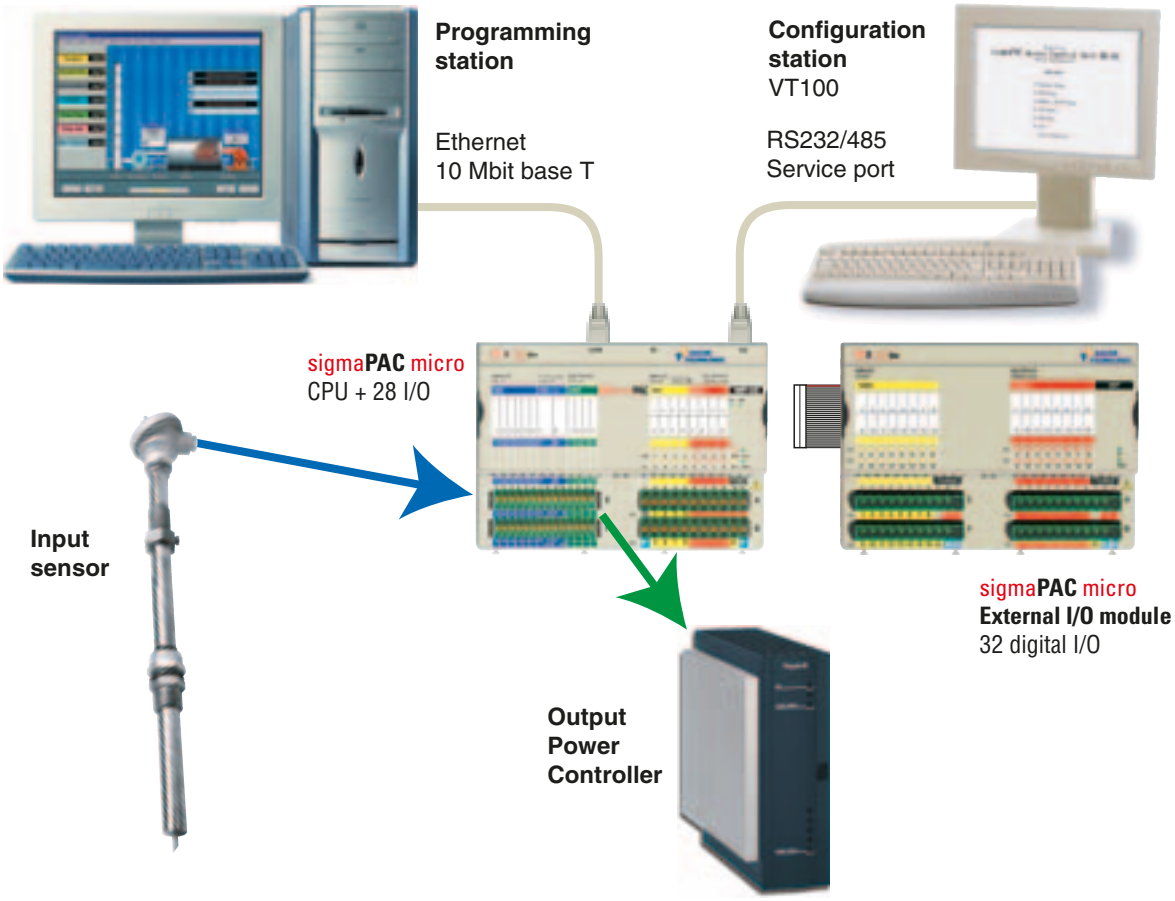


Figure 1.1 - Programming the sigmadue microPAC Control Unit

In "*Figure 1.1 - Programming the sigmadue microPAC Control Unit*" the configuration station (VT100 terminal) and the PC with OpenPCS are displayed as two different devices, but it is possible to use just one PC to run both OpenPCS and a VT100 emulator (e.g. HyperTerminal).

1-1-1 Communication ports

The CPU has 3 communication ports (*see* "*Control Unit I/O and Communication Ports on page 3*"):

- The Ethernet port (TCP/IP) will be used for the connection to the PC for:
  - CPU configuration using a telnet session;
  - Programming, debuging and commissioning;
  - Modbus TCP data exchange;
- The optional Service RS232/485 port (connector X0) will be used as:
  - Configuration port of the device with VT100 terminal;
  - Standard ASCII serial port;
  - Modbus RTU data exchange port.
- The optional RS485 port (connector X1) will be used as:
  - Modbus RTU data exchange port.

Pinout of all communication ports is described hereafter and in:
"*MP-02 Installation Manual*" **[9]**.

1-1-2 Integrated I/Os

The micro**PAC** base unit can house up to 28 I/O ports:

6 AI 6 analogue inputs configurable for mA, V (terminals E1... E6, F1... F6);

2 AI 2 optional universal or high level isolated analogue inputs configurable for (terminals E7... E10, F7... F10):
- Thermocouples (TC J, K, L ,N, R, S, T);
- RTD (PT100, PT1000);
- ±mA, ±V linear inputs;
- Potentiometers.

4 AO 4 optional high level analogue outputs (terminals E11... E14, F11... F14);

RS RUN/STOP program functionality (terminal A1);

8 DI General Purpose Digital Inputs (terminals A2... A5, B2... B5);

8 DO Isolated General Purpose Digital Outputs (terminals A6... A9, B6... B9).

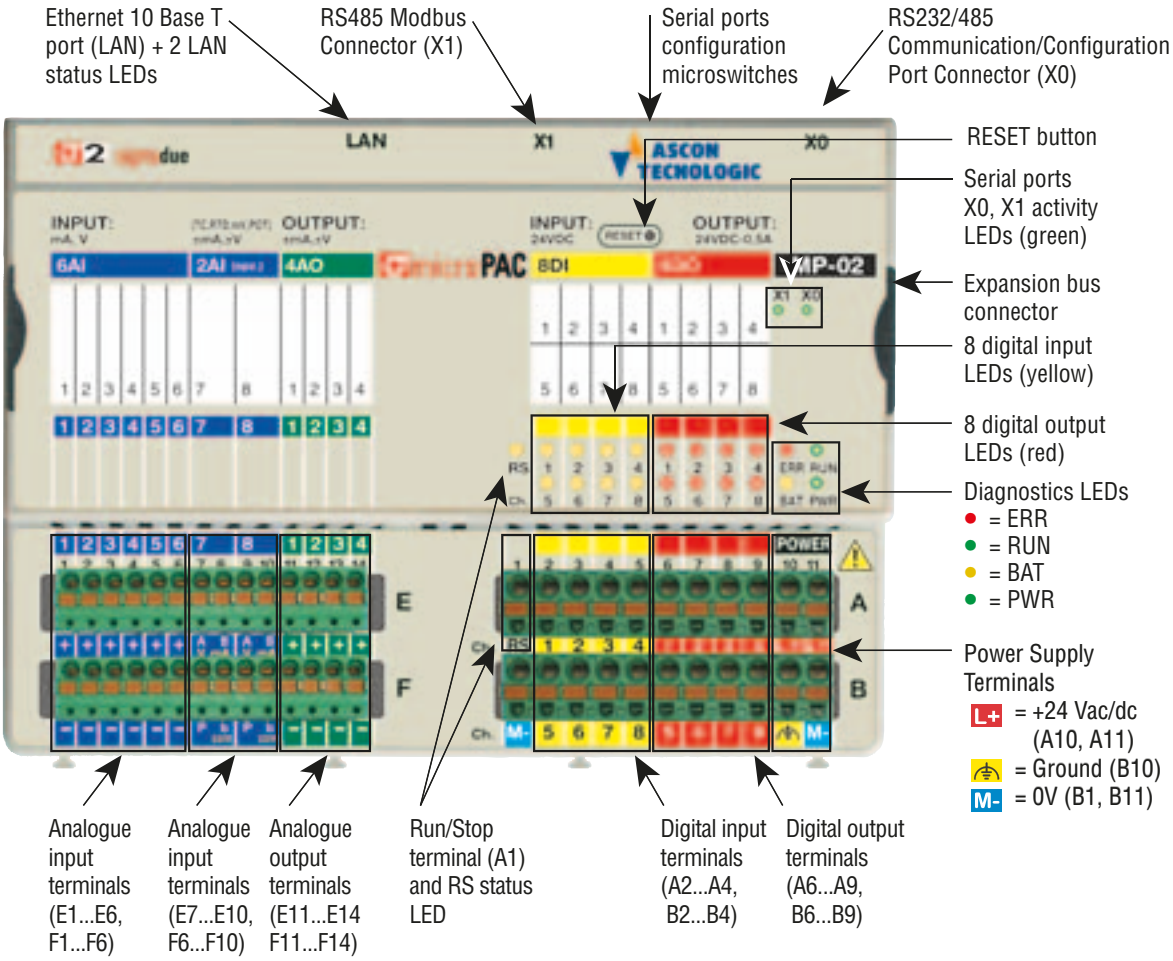


Figure 1.2 - Control Unit I/O and Communication Ports

WARNING

The **RESET** button **does not restart** the CPU or the 1131 application.
The RESET button ***resets all the stored setup parameters and restores the defaut parameters*** (as well as those set by the user).

1-1-3 Diagnostic LEDs

Referring to "*Figure 1.2 - Control Unit I/O and Communication Ports*" a description of the LEDs functions is given in the table below.

LED	Colour	Action (note 1)	Description
RS	Yellow	ON	RS input active (RUN program)
ERR	Red	Flickering (10Hz)	Checksum error in RETAIN data
		Single flash	CRC error in the configuration file, reset to default
		Double flash	Problem during file system mount
		Triple flash	Checksum VAR % RETAIN error (NOTE 2)
RUN	Green	ON	1131 program running
		OFF	1131 program stopped or not present
PWR	Green	ON	Power Supply present
BAT	Yellow	ON	Backup battery low

Table 1.1 - Diagnostics LEDs description

Notes: 1. As the ON/OFF sequence of the LEDs has a specific meaning, it is important that the user recognizes each LED status:

Sequence	Meaning
OFF	the LED is not lit
Steady ON	the LED is lit in a stable way
Blinking	the LED blinks at a frequence of 2.5 Hz (slow)
Flickering	the LED blinks at a frequence of 10 Hz (fast)
Single flash	the LED lits once for at least 200 ms
Double flash	the LED lits twice with pulses of 200 ms each
Triple flash	the LED lits three with pulses of 200 ms each

2. The first time some %M variable has been defined as RETAIN (see "*Retain Config Menu on page 14*"), the system needs to reboot in order to create the dedicated files. The error indication will disappear automatically.

Chapter 2
Installation

2-1 Mechanical installation

The sigma**due** micro**PAC** MP-02 Unit and the additional external expansion I/O units are designed to be installed on standard DIN rails.
As the MP-02 has only one expansion connector, it must be installed at the left end of the chain. Up to two additional external expansion I/O units can be connected in chain to the MP-02.

2-1-1 Installing and Removing the I/O expansion modules

A complete description on how the modules can be mounted on or removed from the system can be found in the "*MP-02 Installation Manual*" **[9]**.

2-2 Electrical installation

Refer to: "*Figure 1.2 - Control Unit I/O and Communication Ports*" and "*MP-02 Installation Manual*" **[9]** for details.

2-2-1 Connect the communication cables

RS232/485 Serial Service/ ModBus Port

X0 connector

The connector X0 on the MP-02 unit is an RJ45 type, with the following pinout:

Pin	1	2	3	4	5	6	7	8
Signal	D+ (RS485)	D- (RS485)	GND (RS485)	GND (RS232)	RX (RS232)	TX (RS232)	NC	NC

RS485 Modbus Port

X1 connector

The connector X1 on the MP-02 unit is an RJ45 type, with the following pinout:

Pin	1	2	3	4	5	6	7	8
Signal	D+ (RS485)	D- (RS485)	GND (RS485)	NC	NC	NC	NC	NC

LAN Ethernet 10baseT

LAN connector

The connector on the CPU module is an RJ45 type, with the following pinout:

Pin	1	2	3	4	5	6	7	8
Signal	TX+	TX-	RX+	NC	NC	RX-	NC	NC

2-2-2 Connector "A" connections

The "**A**" terminal block allows the connection of the +24V Power Supply, Run/Stop, 4 Digital Inputs and 4 Digital Outputs Signals.

The terminals are positioned as follows:

Pin	1	2	3	4	5	6	7	8	9	10	11
Label	RS	1	2	3	4	1	2	3	4	L+	L+
Function	Run/Stop	DI1	DI2	DI3	DI4	DO1	DO2	DO3	DO4	POWER	
Signal	INPUT	INPUT	INPUT	INPUT	INPUT	OUT	OUT	OUT	OUT	+24V	+24V

Run/Stop Digital Input — Digital Input — Digital Output — Power Supply

1 RS Run/Stop terminal, connecting this terminal to a 24V source, it is possible to launch or stop the execution of the 1131 program loaded in the CPU;

2...5 1...4 4 Digital Inputs terminals, connecting this terminal to a 24V source, it is possible to change the status of the input;

6...9 1...4 4 Digital Outputs terminals. Each source type (PNP) digital output can manage a 24V 0.5A load;

10...11 L+ 24Vdc power supply terminals.

2-2-3 Connector "B" connections

The "**B**" terminal block allows the connection of the 0V Power Supply, 4 Digital Inputs, 4 Digital Outputs Signals and the system hearth.

The terminals are positioned as follows:

Pin	1	2	3	4	5	6	7	8	9	10	11
Label	M-	5	6	7	8	5	6	7	8	⏚	M-
Function	POWER	DI1	DI2	DI3	DI4	DO1	DO2	DO3	DO4	Ground	POWER
Signal	0V	INPUT	INPUT	INPUT	INPUT	OUT	OUT	OUT	OUT	Ground	0V

Power supply — Digital Input — Digital Output — Frame ground — Power supply

1 M- 0V power supply terminal.

2...5 5...8 4 Digital Inputs terminals, connecting this terminal to a 24V source, it is possible to change the status of the input

6...9 5...8 4 Digital Outputs terminals. Each source type (PNP) digital output can manage a 24V 0.5A load.

10 ⏚ Frame ground.

11 M- 0V power supply terminal.

2-2-4 Connector "E" connections

The "**E**" terminal block allows the connection of 6 Analogue Inputs, 2 optional Analogue Inputs and 4 Analogue Outputs.

The terminals are positioned as follows:

Pin	1	2	3	4	5	6	7	8	9	10	11	9	10	11
Label	+	+	+	+	+	+	A V	B mA	A V	B mA	+	+	+	+
Function	AI1	AI2	AI3	AI4	AI5	AI6	Univ. AI1		Univ. AI2		AO1	AO2	AO3	AO4
Signal	IN	IN	IN	IN	IN	IN	IN		IN		OUT	OUT	OUT	OUT

Analogue input (mA, V) | Analogue input (±mA, ±V) | Analogue ouput (±mA, ±V)

1...6 **+** 6 configurable analogue (linear) input plus (+) poles. These inputs can be configured as mA or V. The minus (-) poles are on connector "**F**";

7...10 **A...B** 2 optional universal/high level analogue (linear) inputs (No. 7, 8) (see the "*MP-02 Installation Manual*" for details). The number (0... 2) and type of input can be identified with the order code. The other terminals of these 2 inputs are on connector "**F**";

11...14 **+** 4 optional analogue output plus (+) poles. The number of output (0... 4) is specified in the order code, the type of output is set during the **CPU setup phase** (see the "*MP-02 Installation Manual*" for details). The minus (-) poles are on connector "**F**".

2-2-5 Connector "F" connections

The connector labelled "**F**" has 14 terminals:

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Name	-	-	-	-	-	-	P	b com	P	b com	-	-	-	-
Function	AI1	AI2	AI3	AI4	AI5	AI6	Univ. AI1		Univ. AI2		AO1	AO2	AO3	AO4
Signal	IN	IN	IN	IN	IN	IN	IN		IN		OUT	OUT	OUT	OUT

Analogue input (mA, V) | Analogue input (±mA, ±V) | Analogue ouput (±mA, ±V)

1...6 **-** 6 configurable analogue (linear) input minus (-) poles;

7...10 **P...b** 2 optional universal/high level analogue (linear) inputs (No. 7, 8) (see the "*MP-02 Installation Manual*" for details);

11...14 **-** 4 optional analogue output minus (-) poles.

Chapter 3
CPU setup

At start-up, a configuration session is started to setup the system module and configure the system I/Os. Setup data can be inserted using a VT100 terminal or a Personal Computer with a Hyper Terminal program or a Telnet client.

3-1 Connect the Setup Terminal

There are 2 ports available on the CPU to enter the configuration session: the **X0** port for the serial RS232 connection or the LAN port for the ethernet connection. Depending on the setup method used, the user must:

- Set the **X0** or the LAN port (consult the "*MP-02 Installation Manual*" **[9]** for details);
- Provide the proper connection cable;
- Set the correct communications parameters;
- Run the communications program.

Caution

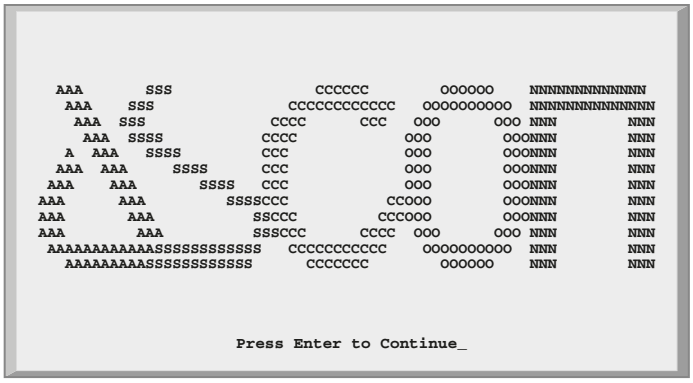
Appendix A describes connection and the setup details of the ports connection and configuration of the communication ports.

Once the setup terminal (VT100 or PC) is correctly connected to the MP-02 basic unit, the user can start the configuration session. In *Appendix C* is inserted the tree structure of the setup menus.

3-1-1 Starting the Setup Session

Accessing the Main Menu

To start the setup session, press the ENTER (the PC sends a CR, Carriage Return, character to the CPU) key on the setup terminal **while RUN and ERR LEDs are blinking on the Basic Unit at Power ON**. If the character CR is not sent before a predefined time (start-up timeout) the system ends the configuration session and starts the PLC application. In this chapter some templates of a configuration session are shown.
After the reception of the first CR character, the welcome screen appears as follows:



Press ENTER again to reach the configuration session Main Menu.
Please note that the system has a further timeout that controls the duration of the configuration session; this is the **inactivity** timeout. If the user does not work with the console for a time greater than this timeout, the configuration session will be ended automatically and the PLC application will be started.
Both the described timeouts can be set during the configuration. The user should not set too short timeouts, affecting the possibility to work with the configuration console. To select an item of a menu or to insert a value for a parameter, the user must type the corresponding number and than press ENTER.

3-2 CPU Main Menu

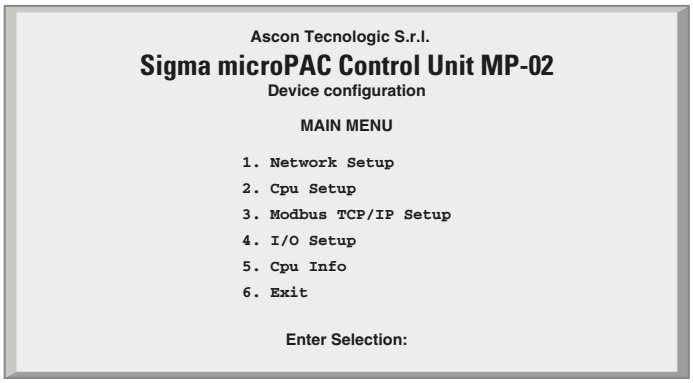


Figure 3.1 - Base Unit configuration Main Menu

The Main Menu (see Figure 3.1) has 6 different items:

Network Setup	All the communication ports settings of the CPU
CPU Setup	Specific CPU parameters
ModbusTCP/IP Setup	Modbus TCP/ IP Settings
I/O Setup	Onboard I/O Configuration
CPU Info	Firmware and hardware version
Exit	End the configuration session

3-2-1 Network Setup Menu

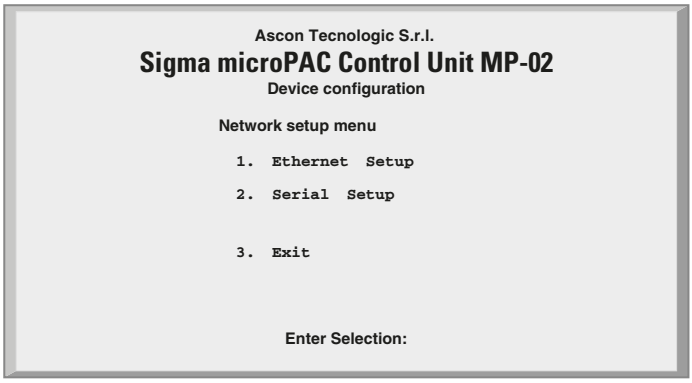


Figure 3.2 - Network Setup Menu

Ethernet Setup	Ethernet Setup Parameters
Serial Setup	Serial Setup Parameters
Exit	Return to previous menu

3-2-2 Ethernet Setup Menu

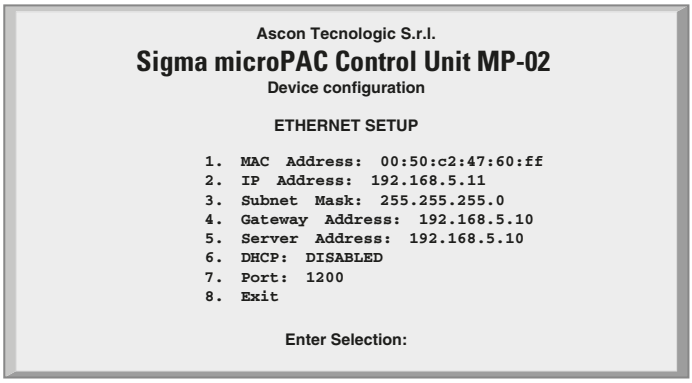


Figure 3.3 - Ethernet Setup Menu

MAC Address	Device Board MAC Address Display
IP Address	Device IP Address
Subnet Mask	Device subnet mask
Gateway Address	The Network Gateway Address
Server Address	The DHCP Server Address
DHCP	DHCP Protocol Enable
Port	OpenPCS Logic Port Number
Exit	Return to previous menu

3-2-3 Serial Setup Menu

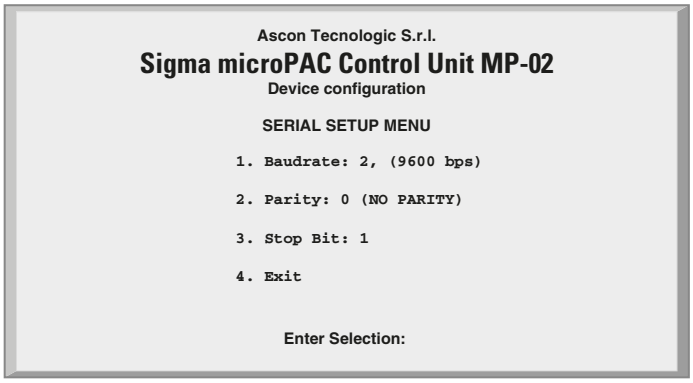


Figure 3.4 - Serial Setup Menu

Baudrate	**Serial Setup Connection Baudrate**	
	Possible Values	
	Value	**Baudrate**
	0	2400
	1	4800
	2	9600
	3	19200
	4	38400
	5	57600
	6	115200
Parity	**Serial Setup Connection Parity**	
	Possible Values	
	Value	**Parity**
	0	None
	1	Even
	2	Odd
Stop bit	Serial Setup Connection Stop bit: valid values are 1 or 2	
Exit	Return to previous menu	

3-2-4 CPU Setup Menu

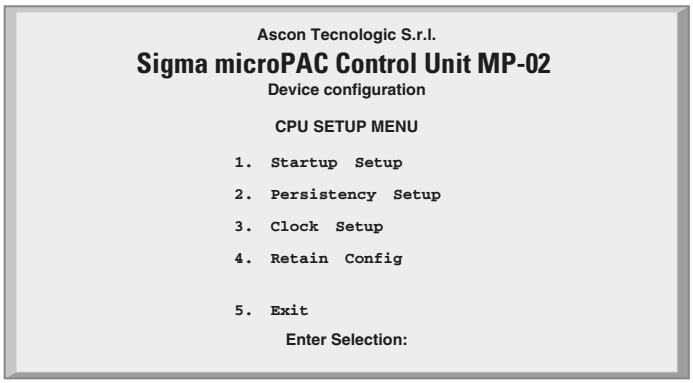


Figure 3.5 - CPU Setup Menu

Startup Timeout Setup	Timeout Setup Parameters
Persistency Setup	Persistency Parameters
Clock Setup	Real Time Clock Settings
Retain Config	Retentive Registers Configuration
Exit	Return to previous menu

3-2-5 Startup Setup Menu

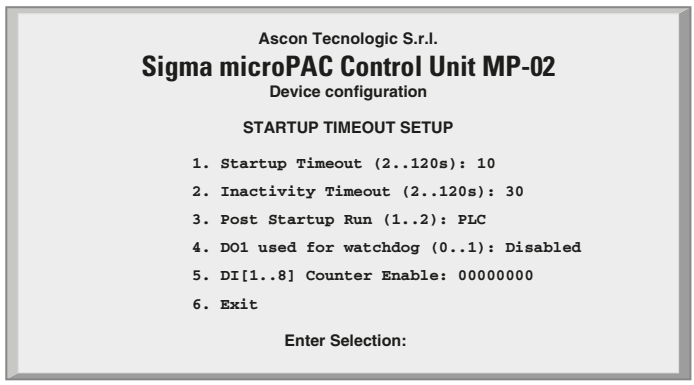


Figure 3.6 - Startup Setup Menu

Startup Timeout	The time available to enter in the startup session
Inactivity Timeout	Inactivity Timeout (please see *3-1-3* for details)
Post Startup Run	After the startup session could be run the PLC program or the I/O Watching window (1 = PLC, 2 = I/O Watch)
DO1 used by watchdog	If enabled, the digital output DO1 could be connected to a software function block to signal a watchdog event
DI[1...8] Counter Enable	A counter function can be enabled for each digital input (0 = counter disabled, 1 = counter enabled)
Exit	Return to previous menu

3-2-6 Persistency Setup Menu

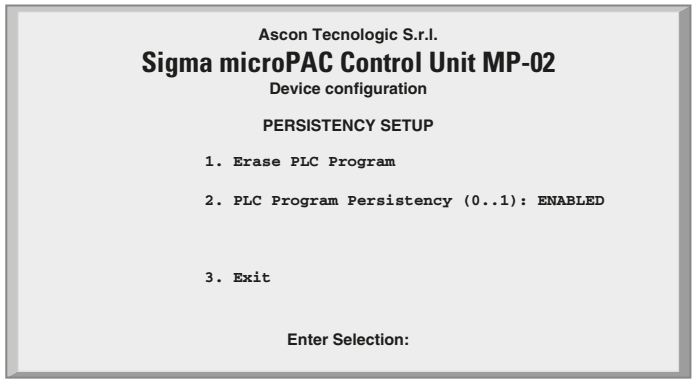


Figure 3.7 - Pesistency Setup Menu

Erase PLC Program	Command to erase the resident PLC program in the non volatile memory
PLC Program Persistency	If enabled every new download of a valid PLC program will be stored in the non volatile memory
Exit	Return to previous menu

The CPU is able to save a PLC program in persistent memory. This means that when PLC Program Persistency is ENABLED, the program will be automatically loaded and executed at start-up. Every time the user downloads a new program to the CPU (during the development activities), it is saved in the persistent memory and at next device start up, the last downloaded program will be executed. Saving a program in persistent memory is a time consuming activity. For that reason the user may want to disable the automatic program save to make development activities more efficient. It can be useful to prevent execution of any program at start-up. Selecting the item "*Erase PLC program*" the retentive memory area reserved to store PLC programs is erased. This activity take several seconds. When the "*Persistency setup menu*" screen reappears then the memory has been erased.

3-2-7 CLOCK Setup Menu

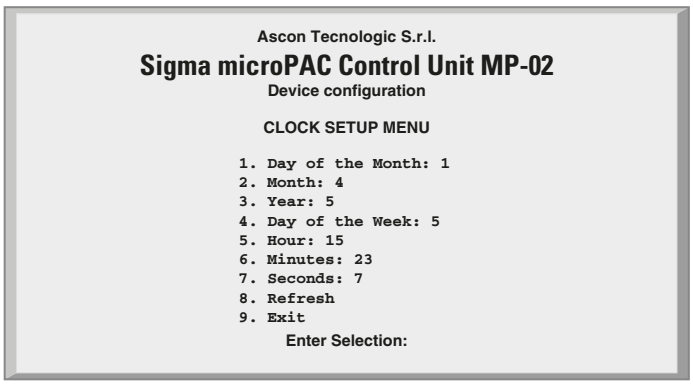


Figure 3.8 - Clock Setup

Day of the Month	Set the number of the day of the month
Month	Set the number of the month of the year
Year	Set the year
Day of the Week	Set the number of the day of the week
Hour	Set the Hour
Minutes	Set the Minutes
Seconds	Set the Seconds
Refresh	Command to refresh the clock values
Exit	Return to previous menu

Note: Clock values are not automatically updated on the screen, refresh the values to upate.

3-2-8 Retain Config

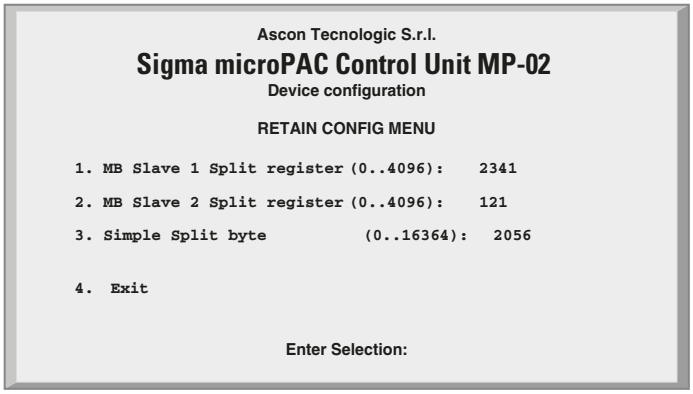


Figure 3.9 - Retain Config Menu

MB Slave 1 Split register	Slave 1 Modbus Memory Area (4096 registers)
MB Slave 2 Split register	Slave 2 Modbus Memory Area (4096 registers)
Simple Split byte	Marker Memory Area (16364 bytes)
Exit	Return to previous menu

Standard and Retentive memory management

The IEC 1131 programming tools allow to declare retentive variables using a specific syntax. These variables are saved and load from the retained memory which has a 32kB size (for security reasons, the memory is duplicated and refreshed during runtime operations). Differently from this automatic mechanism, it is possible to specify, during the boot-up configuration session, the amount of retained variables to be used in the percentage area.

The standard memory locations usable as retentive variables are accessible as registers, up to the maximum amount normally available for each Modbus agent (Slave 1 and Slave 2) and up to 16 kB in the marker area.

In particular, the range of registers available as retentive are:

Modbus Slave 1 : %MW1128.0... %MW9320.0
Modbus Slave 2 : %MW10128.0... %MW18320.0
Marker Area : %MB22000.0... %MB38363.0

Figure 3.10 - Percentage retentive areas

In the boot-up configuration session, by a specific dedicated menu, it is possibile to define the number of registers, for each areas, to be used as retentive.
From the main menu select "*CPU setup*" -> "*Retain Config*".

From the "*Retain Config*" menu it is possible to specify the split point between the retentive and the standard memory location.

Note: In case the **ENTIRE** memory will be defined as retentive, the cycle time of the application will be increased of around 12 ms.

In case of a "*Cold start*" command: the standard retentive variables will be reset or will assume the initialization value whereas the percentage retentive variables will be reset. In case of CRC error, the 2 areas are separately reset or initialized.

In case of a "*Warm Start*" command: both the standard and percentage retentive variables will be unaffected. In case of file corruption, the percentage retentive variables will be reset.

In case of a "*Hot start*" command: both the standard and percentage retentive variables will be unaffected.

At the moment it is possibile to upload or download both the retentive memory areas, for the standard and percentage variables, using a TFTP session. The timeframe window to perform this operation is available only during the boot-up phase before the configuration access. To upload or download the retentive memory files, please follow the procedure described at paragraph: "TFTP Protocol Access" on page 33

in chaper 6 paragraph6.1 The name of the files are:

Retentive standard : **/fs2/retain**

Retentive percentage: **/fs2/perc_ret**

Publishing I/O configuration data, Battery and Retain Memory status

During 1131 program execution is possible to recall some information present in certain particular addresses of the percentage memory. In particular:

%M0.0 : Battery satus (**1** low, **0** ok);
%M0.1 : Classic retain memory status at startup (**1** corrupted, **0** ok)
%M0.2 : Percentage retain memory status at startup (**1** corrupted, **0** ok).
%M0.3 : Error reading the Production Code.

The battery status is runtime calculated and updated at the beginning of each cycle. The remaining two flags are released at startup and the value remains unchanged after a warm or a cold startup.
The configuration of all the analogue I/O present in the CPU module are mapped, in byte, at addresses %MB10.0... MB21.0. Each byte represents a channel.
In particular:

%MB10.0... %MB15.0 : 6 AI HL (always present);
%MB16.0... %MB19.0 :4 AO (present/or absent in couples)
%MB20.0... % MB21.0 : 2 additional UL or HL optional channels

Using the conversion tables that follow, is possible to find the configuration type of the analogue I/Os.

Code	6 High Level Inputs (%MB10.0... %MB15.0)	2 optional High Level Inputs (%MB20.0... % MB21.0)	2 optional Universal Inputs (%MB20.0... % MB21.0)	4 optional Analogue Outputs (%MB16.0... % MB19.0)
0	0... 1 V	0... 1 V	-15... +15 mV	-10... +10 V
1	-	-1... +1 V	-35... +35 mV	-20... +20 mA
2	0... 5 V	0... 5 V	-50... +50 mV	0... +10 V
3	-	-5... +5 V	-100... +100 mV	0... +20 mA
4	1... 5 V	1... +5 V	-300... +300 mV	4... +20 mA
5	0... 10 V	0... 10 V	-1.25... +1.25 V	-
6	-	-10... +10 V	TC J	-
7	0... 20 mA	0... 20 mA	TC K	-
8	4... 20 mA	4... 20 mA	TC L	-
9	-	-20... +20 mA	TC N	-
10	-	-	TC R	-
11	-	-	TC S	-
12	-	-	TC T	-
13	-	-	Pt 100	-
14	-	-	Pt 1000	-
15	-	-	Potentiometer	-

When the analogue outputs or the optional expansion modules are not installed, at the correspondig missed channel is possible to read **0xFF** (255).

WARNING

At each warm/cold start, the I/O configuration codes are loaded/written in the marker percentage memory. If the same marker percentage memory areas are used to store user application data, pay extreme attention to the fact that at each warm/cold start these memories are written with the I/O configuration codes causing the destruction of the application data.

3-2-9 Modbus TCP/IP Setup

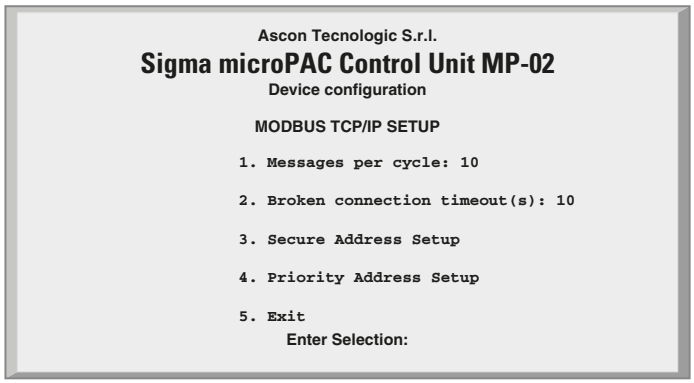


Figure 3.11 - Modbus TCP/IP Setup Menu

Messages per Cycle	Number of processed messages per cycle. Valid values from 1... 50
Broken Connection Timeout	Inactivity Timeout of a TCP/IP connection. Valid values from 10... 5400 s

Secure Address Setup	Secure Address Setup Menu
Priority Address Setup	Priority Address Setup Menu
Exit	Return to previous menu

To verify the connection state after a long period of inactivity, the TCP/IP "keep alive" protocol is used. The protocol performs the following steps sequentially:

1. At each received message the timeout is zeroed ;
2. In the event that the programmed timeout is reached, a "probe" message is sent in order to verify if the connection is still active;
3. If an answer to the "probe" is received, then the timeout is zeroed;
4. I no answer is received, the "probe" will be sent again three times, every 10 s;
5. After the fourth "probe" has received no answer the connection will be closed.

3-2-10 Modbus TC/IP Secure Address Table Menu

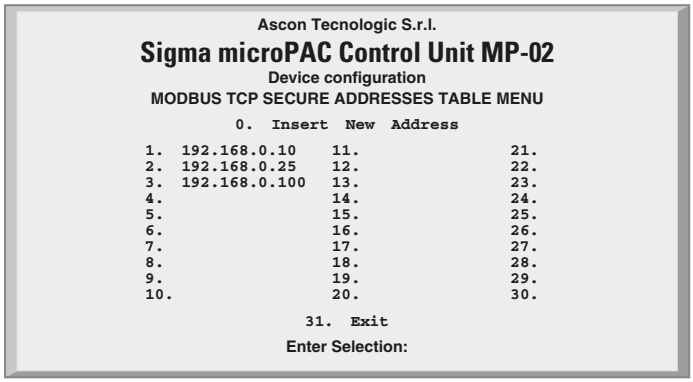


Figure 3.12 - Modbus TCP/IP Secure Address Table Menu

When the security functions are enabled (please see the "*Firmware Function Block Library Manual*"), the list of the addresses present in this menu will indicate the Modbus TCP/IP Clients that can access the CPU module.
To insert a new address, select "**0**", then type in the new address; it will be inserted in the first free position. To delete an address, select the number of the address you want to remove.

3-2-11 Modbus TC/IP Priority ADDRS Table Menu

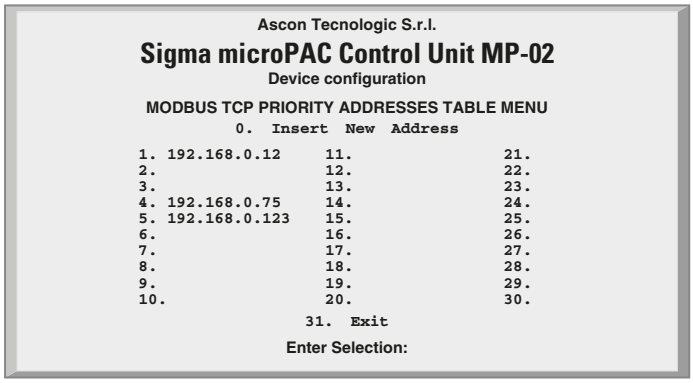


Figure 3.13 - Modbus TCP/IP Secure Address Table Menu

The insertion rules are the same as described for the "*Security address pool*". Addresses inserted in the "*Priority connection pool*" are managed by the system in a specific way. The Modbus TCP/IP server agent can maintain up to 10 TCP connections at the same time. When a new connection request is made and all available connections are utilized, the system will close one of the present active connections to satisfy the new request. Addresses not belonging to the "*Priority connection pool*" will be closed firs, followed by those which have been inactive longest

3-2-12 I/O Setup Menu

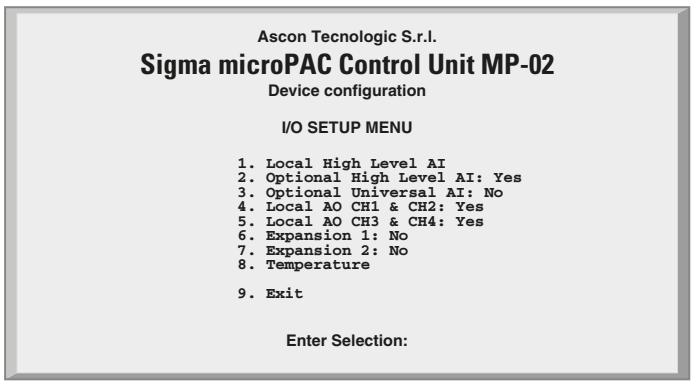


Figure 3.14 - I/O Setup Menu

Local High Level AI	High Level Analogue Inputs Configuration
Optional High Level AI	Optional High Level Analogue Inputs Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No*" **[note]**.
Optional Universal AI	Optional Universal Analogue Inputs Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No*" **[note]**.
Local AO CH1 & CH2	Analogue Outputs 1 and 2 Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No"*.
Local AO CH3 & CH4	Analogue Outputs 3 and 4 Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No*".
Expansion 1	First Expansion Unit Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No*".
Expansion 2	Second Expansion Unit Configuration. If this option is present the CPU inserts automatically the tag "*Yes"*. Otherwise the tag used is "*No*".
Temperature	Onboard Temperature measurement
Exit	Return to previous menu

Note: The presence/absence in the system of either 2 Optional High Level Analogue Inputs or 2 Optional Universal Inputs is determined by the order code.

3-2-13 Setting the Local I/O ports

Standard Local AI Menu

Select a Standard Local AI Channel

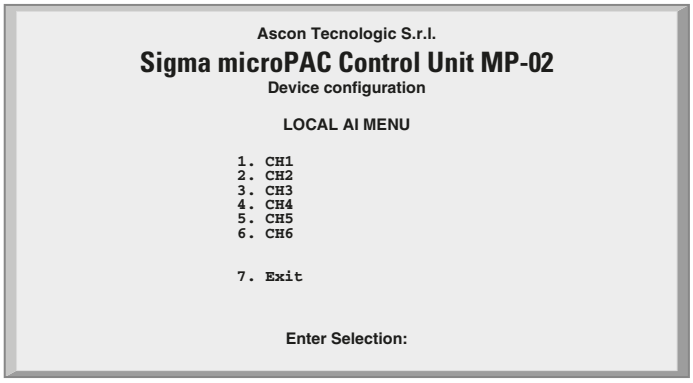


Figure 3.15 - Standard Local AI Selection Menu

Ch1	Analogue Input Channel 1 Configuration
Ch2	Analogue Input Channel 2 Configuration
Ch3	Analogue Input Channel 3 Configuration
Ch4	Analogue Input Channel 4 Configuration
Ch5	Analogue Input Channel 5 Configuration
Ch6	Analogue Input Channel 6 Configuration
Exit	Return to previous menu

Setup the Selected Local AI Channel

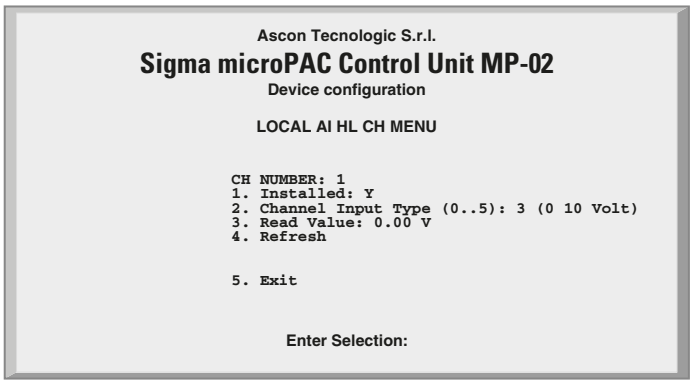


Figure 3.16 - Local Analogue Input High Level Setup Menu

CH Number	Chosen Analogue Input Channel (**Note**)	
Installed	For the high level analogue inputs this item is always "***Yes***"	
Channel Input Type	**Analogue Input Type**	
	Possible values:	
	Value	**Type**
	0	0...+1 V
	2	0... +5 V
	4	1...+5 V
	5	0...+10 V
	7	0...+20 mA
	8	4...+20 mA
Read Value	Input value read	
Refresh	Refresh command to update the "*Read Value*" item	
Exit	Return to previous menu	

Note: Please note that for all 6 high level input channels the setup menu is the same as described here.

Optional Local AI High Level Menu

Select an Optional Local AI HL Channel

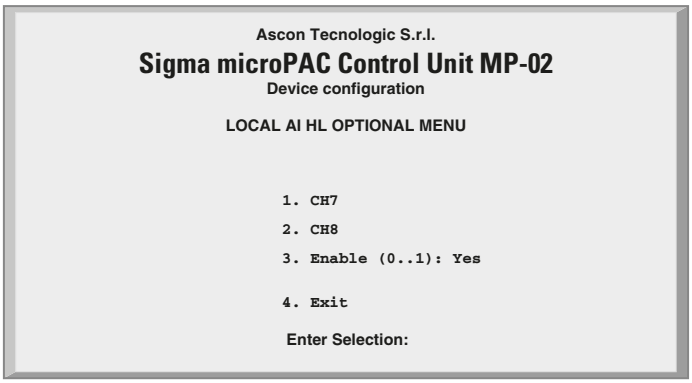


Figure 3.17 - Optional Local AI HL Selection Menu

Ch7	Analogue Input Channel 7 Configuration
Ch8	Analogue Input Channel 8 Configuration
Enable	"***YES***" if the High Level Analogue Inputs Option is present
Exit	Return to previous menu

Setup the Selected AI High Level Channel

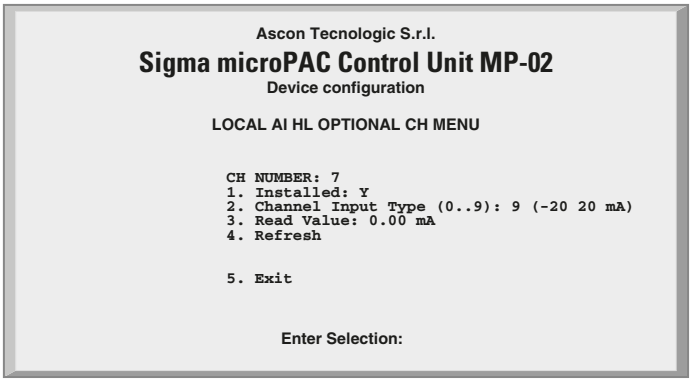


Figure 3.18 - Optional Local AI HL Setup Menu

CH Number	Chosen Analogue Input Channel (**Note**)	
Installed	"***Yes***" If the High Level Analogue Inputs Option is present	
Channel Input Type	**Analogue Input Type**	
	Possible values	
	Value	**Type**
	0	0...+1 V
	1	-1... +1 V
	2	0...+5 V
	3	-5...+5 V
	4	1...+5 V
	5	0...+10 V
	6	-10...+10 V
	7	0...+20 mA
	8	4...+20 mA
	9	-20...+20 mA
Read Value	Input value read	
Refresh	Refresh command to update the "*Read Value*" item	
Exit	Return to previous menu	

Note: Please note that for both optional high level input channels the setup menu is the same as described here.

Optional Local AI Universal Menu

Select an Optional Local AI Universal Channel

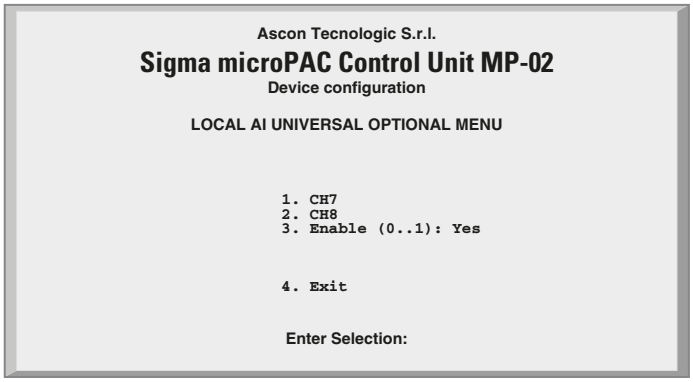


Figure 3.19 - Additional Local AI Universal Selection Menu

Ch7	Analogue Input Universal Channel 7 Configuration
Ch8	Analogue Input Universal Channel 8 Configuration
Enable	"*YES*" if the High Level Analogue Inputs Option is present
Exit	Return to previous menu

Setup the Selected AI Universal Channel

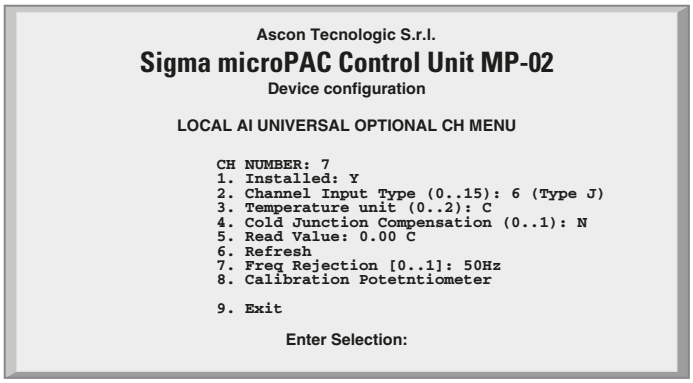


Figure 3.20 - Optional Local AI Universal Setup Menu

CH Number	Chosen Analogue Input Channel (**Note**)			
Installed	"*Yes*" If the Universal Analogue Inputs Option is present			
Channel Input Type	**Analogue Input Type**			
	Possible values:			
	Value	**Type**	**LO range**	**HI range**
	0	-15... +15 mV		
	1	-35... +35 mV		
	2	-50... +50 mV		
	3	-100... +100 mV		
	4	-300... +300 mV		
	5	-1.25... +1.25 V		
	6	Thermocouple J	-210°C (-346°F)(63K)	1200°C (2192°F)(1473K)
	7	Thermocouple K	-200°C (-328°F)(73K)	1372°C (2501°F)(1645K)
	8	Thermocouple L	-200°C (-328°F)(73K)	600°C (1112°F)(873K)
	9	Thermocouple N	0°C (32°F)(273K)	1300°C (2372°F)(1573K)
	10	Thermocouple R	0°C (32°F)(273K)	1600°C (2912°F)(1873K)
	11	Thermocouple S	0°C (32°F)(273K)	1760°C (3200°F)(2033K)
	12	Thermocouple T	-200°C (-328°F)(73K)	400°C (752°F)(673K)

Channel Input Type	13	Thermoresistance PT100	-200°C (-328°F)(73K)	1372°C (2501°F)(1645K)
	14	Thermoresistance PT1000	-200°C (-328°F)(73K)	850°C (1562°F)(1123K)
	15	Potentiometer	0.00	100.00
Temperature Unit	In case of temperature measurement this item allows the user to select the desired measurement unit			
	Possible values are:			
	Value	**Unit**		
	0	°C		
	1	°K		
	2	°F		
Cold Junction Compensation	In case of Thermocouple measurement this item allows the user to activate or deactivate the internal cold junction compensation			
	Possible values are:			
	Code	**Active compensation**		
	0	No		
	1	Yes		
Read Value	Input value read			
Refresh	Refresh command to update the “Read Value” item			
Frequency Rejection	Set the power rejection filter			
	Possible values are:			
	Code	**Rejection frequency**		
	0	50 Hz		
	1	60 Hz		
Calibration potentiometer	Potentiometer Calibration Menu			
Exit	Return to previous menu			

Note: Please note that for both optional universal input channels the setup menu is the same as described here.

3-2-14 Local AI Universal Pot Cal Menu

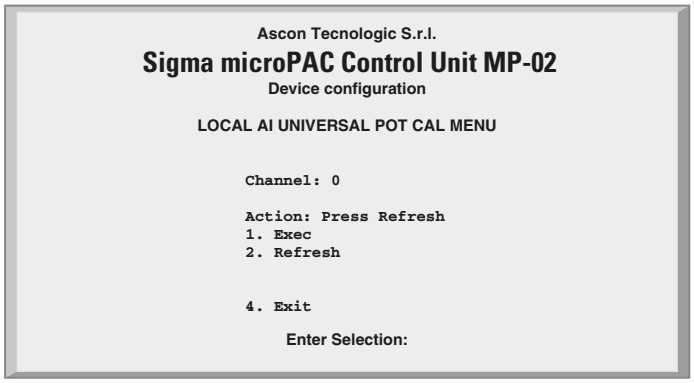


Figure 3.21 - Local AI Universal Pot Cal Menu

Due to the fact that the potentiometer input must be calibrated in the field, the necessary operations are performed using this menu. The following steps are required:

1. Enter in the menu of the channel where the potentiometer is connected (see *“Setup the Selected AI Universal Channel” on page 21*);
2. Select Channel Input Type as Potentiometer (value 15);
3. Enter in Calibration Potentiometer menu using the item 8;
4. Set a Refresh command using the item 2. The system will answer with “*Ready for cal hi*”;

5. Move the potentiometer to the "*Hi Value*";
6. Set the command by item 1;
7. Set a Refresh command using item 2. The system will answer with "*Ready for cal Lo*";
8. Move the potentiometer to the "*Lo Value*";
9. Set the command by item 1;
10. Set a Refresh command using item 2.
    The system will answer with "*Exit Calib*";
11. Set the command by item 1 to end the calibration.

Action	Next executable action
Exec	Command to execute the Action
Refresh	Go to next Calibration Step
Exit	Return to previous menu

3-2-15 Local AO Channel 1 & Channel 2 Menu

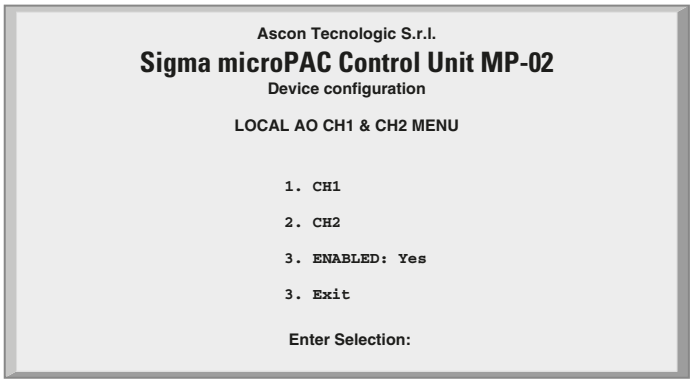


Figure 3.22 - Local AO Channel 1 & Channel 2 Menu

Ch1	Analogue Output Channel 1 Configuration
Ch2	Analogue Output Channel 2 Configuration
Enabled	"*Yes*" if the Optional Analogue Output Channel 1 and 2 are present
Exit	Return to previous menu

3-2-16 Local AO Channel 3 & Channel 4 Menu

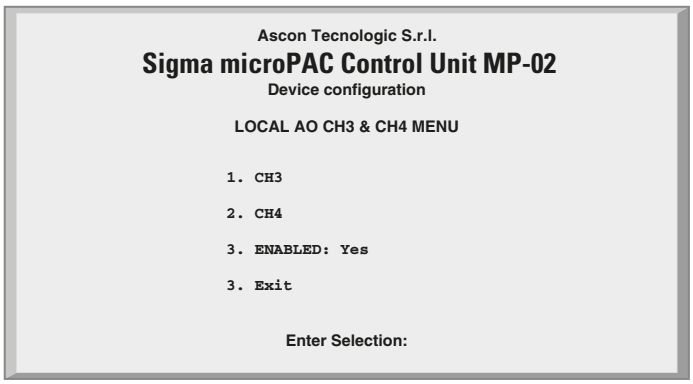


Figure 3.23 - Local AO Channel 3 & Channel 4 Menu

Ch3	Analogue Output Channel 3 Configuration
Ch4	Analogue Output Channel 4 Configuration
Enabled	"*Yes*" if the Optional Analogue Output Channel 3 and 4 are present
Exit	Return to previous menu

3-2-17 Local AO Ch Setup Menu

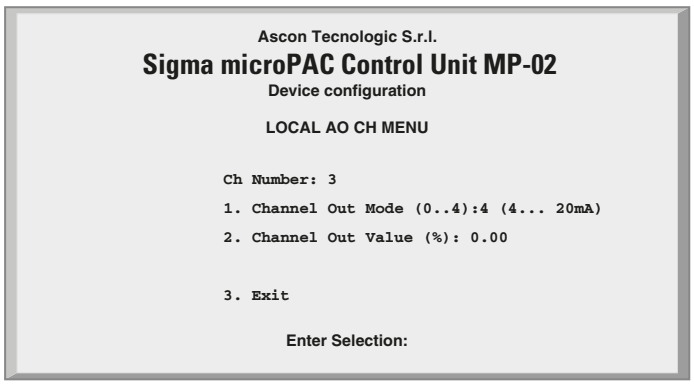


Figure 3.24 - Local AO Setup Menu

Ch	Chosen Analogue Output Channel (**Note**)	
Channel Out Mode	**Analogue Output Type**	
	Possible values are:	
	Value	**Type**
	0	-10...+10 V
	1	-20...+20 mA
	2	0...+10 V
	3	0...+20 mA
	4	4...+20 mA
Channel Out Value	Using this item the analogue output value can be set: please note that the range of the value is: -100.0...+100.0% for dual polarity signals 0...100% for single polarity signals	
Exit	Return to previous menu	

Note: Please note that for all 4 optional output channels the setup menu is the same as described here.

3-2-18 Temperature Menu

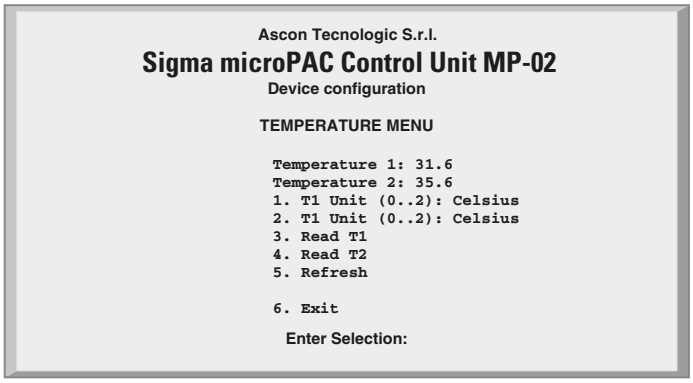


Figure 3.25 - Temperature Menu

Temperature 1 (Temp 1)	Measured temperature used to compensate the cold junction	
Temperature 2 (Temp 2)	Measured temperature of the internal electronic board	
T1 Unit	**Measure Unit used for T1**	
	Possible values are:	
	Value	**Type**
	0	Celsius
	1	Fahrenheit
	2	Kelvin
T2 Unit	**Measure Unit used for T2**	
	Possible values are:	
	Value	**Type**
	0	Celsius
	1	Fahrenheit
	2	Kelvin
Read T1	Command to read T1 value	
Read T2	Command to read T2 value	
Refresh	Refresh the displayed values T1 and T2	
Exit	Return to previous menu	

3-2-19 CPU Info Menu

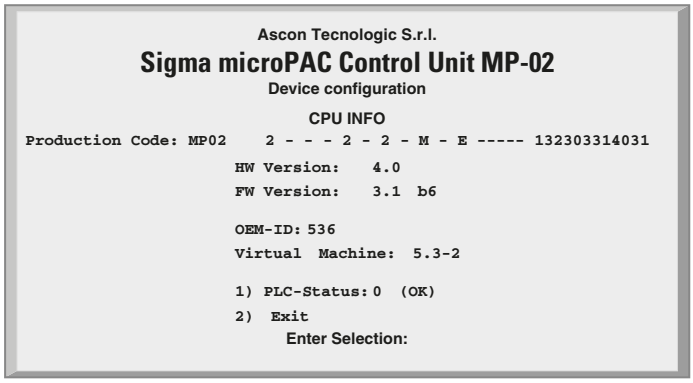


Figure 3.26 - CPU Info

Production Code (factory reserved information)	**Status**	**Message**
	OK	The system displays the production code (as shown)
	Error	The system displays the message: **Code Info Error - Invalid File** (note)
HW Version	Revision of the CPU hardware	
FW Version	Revision of the CPU firmware	
OEM-ID	Ascon Tecnologic CODE for the runtime software	
Virtual Machine	Version of the runtime software	
PLC-Status	CPU Status Indication, and acknowledge of the active alarms displayed	
	Possible Status Values are:	
	Value	**Type**
	0	Normal status
	1	Data Configuration Error (DCE)
	2	Retain Error(RE)
	3	DCE + RE
	4	Battery Low (BL)
	5	BL + DCE
	6	BL + RE
	7	BL + RE + DCE
Exit	Return to previous menu	

Note: The Production Code is registered in the file: */fs1/prodstr_file* and **must not be touched/modified** by the user (consult *"TFTP Protocol Access" on page 45*" for details).

Active alarms are acknowledged by entering **1** and the return key (displayed by "*CPU Info*" screen).

Chapter 4
CPU Diagnostic Tests

4-1 Entering the diagnostic mask

The MP-02 unit provides the user with a diagnostic mask in order to test the on-board I/Os. This mask can be activated from the STARTUP TIMEOUT MENU using the entry “Post Startup Run”.

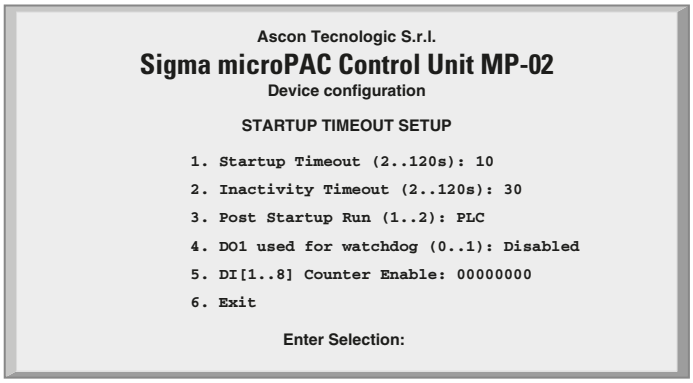


Figure 4.1 - Startup Setup Menu

To run the “*I/O Watch Window*”, the value “*I/O Watch*” must be set: insert the value “**3**” at the “**Enter selection**” input and use the value “**2**” to activate the diagnostic mask. The table that follows displays the possible values for the “*Post StartUp Run*” entry:

Value	Value displayed	Meaning
1	**PLC**	Exiting the configuration session the system runs the PLC 1131 application
2	**I/O Watch**	Exiting the configuration session the system runs the I/O Watch Window

When the user exits the configuration session, the system restarts running the specified program.

4-2 I/O Watch Window

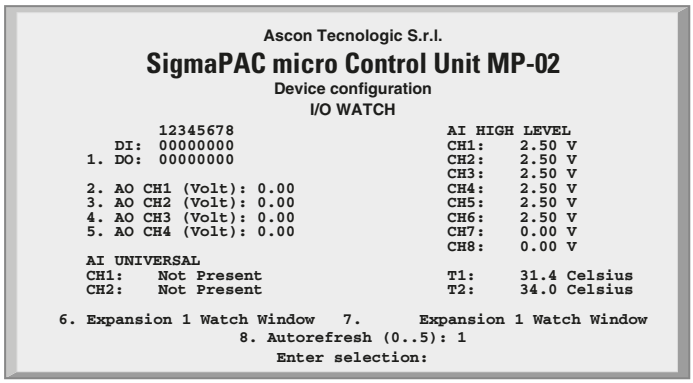


Figure 4.2 - I/O Watch Window

Using the "*I/O Watch Window*" the user can:

- Read the analogue inputs in engineering format;
- Read the digital inputs in binary format;
- Set the analogue output values in percentage (0...100);
- Set the digital outputs in binary format;
- Read the temperture values from the connectors (used for the cold junction compensation in case of TC input) and from the internal board (internal use only).

The window is updated continuously in order to allow the user to test the I/O connected to the unit. The refresh rate can be adjusted using the following table:

Value	Refresh rate
0	No refresh (static mask)
1...5	Time between 2 refresh sessions (1... 5 seconds)

To set an output value, the user must select the output number (1 for the digital, 2...5 for the analogue output) and then specify the desired value:

- A percentage (0...100%) for the analogue (without regard tor the output type);
- A digital value for the digital.

Examples: **Digital Output Channels**

Digital Output	DO 1	DO 2	DO 3	DO 4	DO 5	DO 6	DO 7	DO 8
Desired value	0	0	1	0	0	0	1	1
Enter selection	1							
Insert new value	00100011							

Analogue Output Channels

Ch1	**Output Type:**	0...10V
	Desired value:	7.00 V
	Enter selection:	2
	Insert new value:	70.00
Ch2	**Output Type:**	4... 20 mA
	Desired value:	12 mA
	Enter selection:	3
	Insert new value:	50.00

Chapter 5
Programming the CPU

5-1 Installing OpenPCS

5-1-1 Hardware and Software Requirements

OpenPCS requires a PC with at least:

- Pentium II, 1GHz;
- 512 MB RAM;
- 16 GB of free disk space;
- CD-ROM and 1024*768 resolution;
- Windows 2003, Windows XP SPII or Windows Vista 32bit.

5-1-2 Installation

OpenPCS is provided on CD-ROM. The CD auto-starts a screen where you can select the software you want to install. If auto-start is not activated or does not work, please start the last distributed OpenPCS programming tool version (e.g. `OpenPCS_Ver_631e.exe` file) available in `X:\SETUP\` folder ("**x**": is the letter assigned to the CD-ROM drive in your PC).
At the end of the installation, you will be asked if you want to install hardware drivers. If you received drivers with your PLC, enter the path to the hardware driver, otherwise select 'Quit'. If you received drivers for your PLC, you also received a licence key for OpenPCS. See Licence Editor for how to insert a licence key. If you do not have a hardware driver or a licence key, OpenPCS is still functional, but restricted to 'SIMULATION'.

Note: Installations to substituted drives are not supported by Windows XP.

5-1-3 Starting OpenPCS

Start Windows and choose:
Start → Programs → infoteam OpenPCS 2008 → infoteam OpenPCS 2008
in the start-menu to open the Framework.

5-1-4 Configuring OpenPCS

In order to work with the Ascon Tecnologic CPU target, you must install in OpenPCS a **cab** file. The file **Ascon_sigmadue_zzzz.cab** contains all the files describing Ascon Tecnologic sigma**due** Hardware, drivers, examples and utilities (**zzzz** are digits to identify the year of the software release).
In the OpenPCS "*Extras*" menu, select "*tools – Driver install…*". "*Select*" the desired cabinet (e.g. Ascon_sigmadue_2009.cab), then "*Install*".

Figure 5.1 - OpenPCS OEM Driver Installation

5-2 OpenPCS Setup

To connect the OpenPCS development system to the Ascon Tecnologic target, a new connection must be defined.
Select "*Connections...*" item in the "*PLC*" menu. In the window of *OpenPCS Connection Setup* select "*New*".
Now in the window "*Edit connection*" it is possible to set the new connection. In the field "*Name*" you can name the new connection.
By pushing the "*Select*" button you can pick the driver that manages the communication with the target: for Ascon Tecnologic CPU is TCP52.

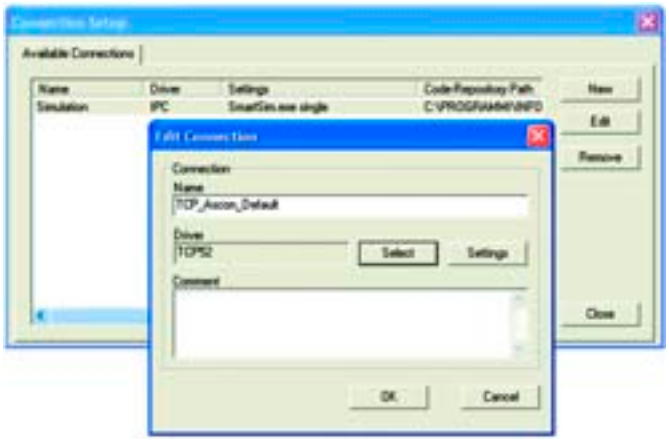


Figure 5.2 - OpenPCS Connection Setup

Now, click "*Settings*" button to set the communication parameters.

Figure 5.3 - TCP Settings

The Port number and IP address must be the same as those configured at the initial CPU configuration session. See the Ethernet setup menu, items 7 and 2. OpenPCS environment is now ready to communicate with the Ascon Tecnologic target.
The project must be set up in order to use the CPU.
Select the "*Resource Properties*" item in the PLC menu, select "*Ascon…*" in the "*Hardware Module*" field, then select the newly created TCP connection in the "*Network Connection*" field.

Figure 5.4 - OpenPCS resource Specifications

The code "*Optimization*" menu allows for three choices of compilation: "*Normal*" and "*Speed only*" refers to the NCC: Native Code Compilation, while "*Size only*" refers to the standard code.
Please note that the use of NCC does not permit the user to insert break points in debugging projects.

Setup Communication Timeout

There are several conditions that could make it necessary to set the Ethernet Port communication timeout to a value higher than the default value. This timeout checks the dialogue between OpenPCS and the target CPU. When dealing with large programs, it may be necessary to set a longer driver timeout. The default value of 20000ms can be increased by using the following register key:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\infoteam Software GmbH\
OpenPCS\6.x.x\Online\TcpDriverTimeout_ms]
```

Value = "20000" means a timeout of 20 seconds.

5-3 Communication Ports Protocols

sigma**due** MP-02 has various communication ports and protocols. The combinations of ports and protocols are shown below:

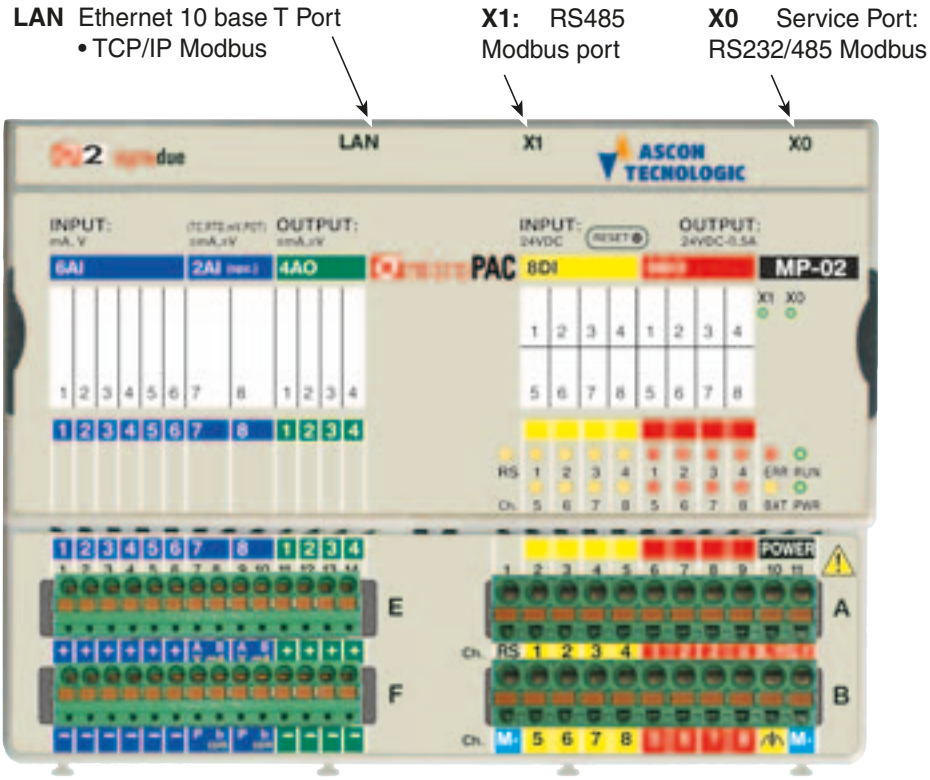


Figure 5.5 - Communication Ports and associated Protocols.

Notes: **1.** Modbus Master/Slave

2 Consult the Installation Guide to polarise and terminate the RS485 ports.

5-4 Watchdog Timer

Ascon Tecnologic MP-02contains a watchdog control, managed by 2 specific FBs. Watchdog is a down counter, decreased in 100ms. When the count value reaches zero, two different behaviors may be set:

- CPU keeps ON the program execution, it stores the event and forces the DO01 if enabled (please see *"3-2-5 Startup Setup Menu"* for details);
- CPU reset and the program restart.

Please note that the Watchdog timer is controlled by FBs and it runs independently of the PLC program. Therefore, if the program is stopped (e.g. during a debug session), the timer is still active, and behaves as programmed when the counter reaches zero.

For this reason, during the debug session it is advisable to disable Watchdog function.

Chapter 6
CPU TFTP File Access

6-1 TFTP Protocol Access

The MP01 unit allows the user to access to the device using the TFTP (Trivial File Transfer Protocol). With this protocol it is possible to upload or download device configuration, the IEC61131 program, the retained variables and error log files. For security reasons, the name and the number of the accessible files are limited and fixed. The following table lists the accessible files:

File Name	Description
/fs1/restore_file	Name of the IEC61131 program file
/fs1/sys_file	Name of the configuration file
/fs1/prodstr_file	Product identifcation file
/fs1/errlog_file	Name of the RUNTIME errors file
/fs2/retain	Name of the classic retained variable file
/fs2/perc_ret	Name of the % retained variable file
/fs2/stop_prg	Stops the PLC program (note 1)
/fs2/run_prg	Starts the PLC program (note 1)
/fs2/erase_prg	Erases the PLC program (note 1)
/fs2/ack_alm	Acknowledges the retentive variables file error alarm **ONLY** (note 2)
/fs2/reset	Reset command file (note 3)

Notes:
1. These TFTP commands do not have errors feedback because they do not establish any TFTP data exchange.
2. Because the Acknowledge command cannot be retained, it is not possible to use it for all the other alarm status. To acknowledge those ones you have to use the standard procedure as described in “CPU Info Menu” on page 32.
3. This TFTP command does not get any feedback answer from the CPU because it resets itself.

To connect the unit the user needs the IP address of the device (see *“Ethernet Setup Menu” on page 11* for details) and the logic port used, whic is always **69** for the TFTP. The TFTP protocol has only two different services:

- GET
- PUT

The GET service allows the user to upload a file from the MP01 unit, while the PUT service allows files to be downloaded.
Using the TFTP client present in the Windows installation (please see *C:\Windows\System32\tftp.exe*) the possible commands are:

- To GET a file from the MP01
  tftp –i <remote host address> get <remote file_name><local file name>
- To PUT a file to the MP01
  tftp –i <remote host address> put <local file name><remote file_name>

For example, if the user wants to GET the configuration file from the MP01 unit, and store it in a local file named "`configuration.bin`", the command is:

```
tftp -i 192.168.5.11 get /fs1/sys_file configuration.bin
```

where the IP address of the MP01 is 192.168.5.11.

If the user wants to PUT the IEC61131 program file to the MP01 unit, using the source file "*Resource.prs*", the command will be:

```
tftp -i 192.168.5.11 put Resource.prs /fs1/restore_file
```

Please note that the application binary file that contains the program compiled with OpenPCS is located in the project folder "`project_root/$GEN$/Resource`" and has always the name "Resource.prs".

6-2 IEC61131-3 OpenPCS Runtime Errors log file

In same cases, it is very useful to have a report of errors organized by date and time in order to understand the source of a possible problem in the application. For this reason it is now available inside the unit a file called `/fs1/errlog_file` that can be downloaded from MP-02. The file is in text mode (can be opened by Windows Notepad, for example) and it is organized in rows. The history goes back to maximum 10 events and it is organized as:

day of the week hh:mm:ss dd-mm-yy error code

Following an example:

Wed	16:37:28	23-04-08	2002
Wed	16:37:25	23-04-08	2002
Wed	16:36:36	23-04-08	2001
Thu	11:56:29	22-04-08	2002

The table of error codes is the following:

Error name	Error Code
kLzsModeConflict	1001
kLzsNoMem	1002
kLzsHardwareError	1003
kLzsInvalidPgm	1004
kLzsDwnldError	1005
kLzsConfigError	1006
kLzsInvalidModCfg	1007
kLzsInvalidPgmNr	1008
kLzsInvalidSegNr	1009
kLzsInvalidSegType	1010
kLzsSegDuplicate	1011
kLzsNoWatchTabEntry	1012
kLzsUnknownCmd	1013
kLzsModeErr	1014
kLzsNetError	1015
kLzsNetRecSizeError	1016
kLzsProcImgRdWrError	1017
kLzsTimerTaskError	1018

Error name	Error Code
kLzsNetInitError	1501
kLzsNetIoError	1502
kLzsNetInvalidNodeID	1503
kLzsNetVarCfgError	1504
kLzsNetNIOverflow	1505
kLzsStoreProgInFLash	2000
kLzsNoMemForRetain	2050
kLzsNoMemForPersist	2051
kIpDivisionByZero	2001
kIpArryIndexInvalid	2002
kIpOpcodeInvalid	2003
kIpOpcodeNotSupported	2004
kIpExtensionInvalid	2005
kIpTaskCmdInvalid	2006
kIpPflowNotAvailable	2007
kIpInvalidBitRef	2008

Error name	Error Code
kLzsIpVerError	111019
kLzsIpExecError	10101020
kLzsNcExecError	10101021
kLzsNoBkupMem	10101022
kLzsIOConfigError	111023
kLzsNoHDMem	1024
kLzsNotValidInRunState	1025
kLzsCycleLengthExceeded	1101
kLzsRtxBaseTimerLengthExceeded	1102
kLzsNetErrorLastSession	1103
kLzsUplErrorNotEnabled	1104
kLzsHistNoFreeEntry	1105
kLzsHistInvalidID	1106

Error name	Error Code
kIpErrorRestoreData	2009
kIpNoValidArrElementSize	2010
kIpInvalidStructSize	2011
kIecGeneralError	3001
kIecFBNotSupported	3002
kIecHardwareError	3003
kLzsStoreProgInFLash	9001
kLzsNoMemForRetain	9002
kLzsNoMemForPersist	9003
kLzsMemAccessAlignErr	9004
kLzsWatchdogReset	9005

The error 1103 it is not saved because it is generated every time the application restarts from a previous error situation. The errors log file is generated in FIFO mode (First In First Out).

Chapter 7
CPU I/O Data

The sigma**due** micro**PAC** MP-02 unit, has several onboard I/O points that can be easily accessed by the memory map area. The memory area is divided into different sections:

Central Unit	Digital Input Status
	Analogue Input Value
	I/O Diagnostic Status
	Onboard Temperature Values
	Digital Counters
	Digital Output Status
	Analogue Output Value
Expansion Unit	Expansion Units I/O Diagnostic Status
	Expansion Units Digital Input Status
	Expansion Units Digital Output Status

Caution
Please check the MP-02 order code to verify the available options on your device.

7-1 Central Unit Data

7-1-1 Digital Inputs Data

Addr	Size [byte]	Format	Data
%I100.0	1	WORD	Digital Inputs

7-1-2 Analogue Input Value

The first 6 High Level Analogue Inputs are always present on the device. The inputs configuration is performed using the CPU Setup Menu (see Chapter 3 for details). The value present in the memory map is expressed in engineering format (V or mA), using the floating point 32 bit format.

Addr	Size [byte]	Format	Data
%I112.0	4	REAL	AI High Level CH1
%I116.0	4	REAL	AI High Level CH2

Addr	Size [byte]	Format	Data
%I120.0	4	REAL	AI High Level CH3
%I124.0	4	REAL	AI High Level CH4
%I128.0	4	REAL	AI High Level CH5
%I132.0	4	REAL	AI High Level CH6

Analogue Inputs 7 and 8 are optional, and the possible configurations are:

- No Input
- High Level
- Universal

Space reserved for all the possible Input types in the map memory of the device.

In the map memory of the device it is reserved space for all the possible input types. For the Universal Input type the low level measure is also present (before the internal linearization), that could be [mV] in case of thermocouple, or [Ohm] in case of thermoresistor. If the selected input type is linear, the two values are the same.

Addr	Size [byte]	Format	Data
%I136.0	4	REAL	AI High Level CH7
%I140.0	4	REAL	AI High Level CH8
%I152.0	4	REAL	AI Universal CH7
%I156.0	4	REAL	AI Universal CH8
%I160.0	4	REAL	AI Universal CH7 mV
%I164.0	4	REAL	AI Universal CH8 mV

Caution

Please check the MP-02 order code to verify the options present on your device.

7-1-3 I/O Diagnostic Status

For each analogue channel (Input and Output), the MP-02 unit provides an indication about the status of the channel (even if this is not present because it is an option). The possible values of this indication are as follows:

Status Value	Description
0	The value is in the range of the signal
1	The value is under the low level of the signal
2	The value is over the high level of the signal
4	Channel not configured
8	No valid measure available

The memory map for the diagnostic indications:

Address	Size [byte]	Format	Data
%I170.0	1	BYTE	AI High Level CH1 Status
%I171.0	1	BYTE	AI High Level CH2 Status
%I172.0	1	BYTE	AI High Level CH3 Status
%I173.0	1	BYTE	AI High Level CH4 Status
%I174.0	1	BYTE	AI High Level CH5 Status
%I175.0	1	BYTE	AI High Level CH6 Status
%I176.0	1	BYTE	AI High Level CH7 Status

Address	Size [byte]	Format	Data
%I177.0	1	BYTE	AI High Level CH8 Status
%I178.0	1	BYTE	AI Universal CH7 Status
%I179.0	1	BYTE	AI Universal CH8 Status
%I180.0	1	BYTE	AO CH1 Status
%I181.0	1	BYTE	AO CH2 Status
%I182.0	1	BYTE	AO CH3 Status
%I183.0	1	BYTE	AO CH4 Status

7-1-4 Onboard Temperature Values

The MP-02 unit provides two indications about the internal temperature of the device:

Measure	Description
Cold Junction (Temp 1)	Temperature value presents at the thermocouple input, used for the internal cold junction compensation
Internal (Temp 2)	Device Internal Temperature

The data format used for the value present in the memory map is the floating point 32 bit and the unit used (°C, °F or °K). It is specified in the configuration menu (please see *"3-2-18 - Temperature Menu" on page 25* for details).

Address	Size [byte]	Format	Data
%I192.0	4	REAL	Temp 1
%I196.0	4	REAL	Temp 2

7-1-5 Digital Counters

In the configuration session (please see *"3-2-5 - Startup Setup Menu" on page 13* for details) it is possible to enable a counter matched to a digital input. In the memory map, there is a section with all the values for all the possible counters. The data format is unsigned 32 bit.

Address	Size [byte]	Format	Data
%I200.0	4	UDINT	Counter channel 1
%I204.0	4	UDINT	Counter channel 2
%I208.0	4	UDINT	Counter channel 3
%I212.0	4	UDINT	Counter channel 4
%I216.0	4	UDINT	Counter channel 5
%I220.0	4	UDINT	Counter channel 6
%I224.0	4	UDINT	Counter channel 7
%I228.0	4	UDINT	Counter channel 8

The value of each counter can be reset using a specific function block inside the program environment (please see the "*Ascon Tecnologic Firmware Function Block Library*" for details).

7-1-6 Digital Outputs Status

Address	Size [byte]	Format	Data
%Q100.0	1	WORD	Digital Outputs

7-1-7 Analogue Output Value

The four analogue output channels are optional, and the possible choices are:

- no analogue outputs;
- 2 analogue outputs;
- 4 analogue outputs.

In the memory map, is reserved for all the four channels, and the numerical format used is the 32 bit floating point; for the active channels, the user has to write the percentage value of the selected scale.

Address	Size [byte]	Format	Data
%Q112.0	4	REAL	AO CH1
%Q116.0	4	REAL	AO CH2
%Q120.0	4	REAL	AO CH3
%Q124.0	4	REAL	AO CH4

7-2 Expansion Unit

7-2-1 Expansion Units I/O Diagnostic Status

For each expansion unit the indication of the state of the module is available. As described in paragraph *"7-1-3 - I/O Diagnostic Status" on page 38* the possible values for the indication state are:

Status Value	Description
0	The value is in the range of the signal
4	Channel not configured
8	No valid measure available

Please note that values 1 and 2 are meaningless for digital modules.

Address	Size [byte]	Format	Data
%I236.0	2	UINT	Expansion Unit 1 Type (type: 1 = DM16TS, 2 = DM32TS)
%I238.0	2	UINT	Expansion Unit 2 Type (type: 1 = DM16TS, 2 = DM32TS)
%I240.0	1	USINT	Expansion Unit 1 Status
%I241.0	1	USINT	Expansion Unit 2 Status

7-2-2 Expansion Units Digital Inputs Status

In the memory map of the device space is reserved a for all the expansion units available (at the moment MP-D1/08-08 and MP-D1/16-16), and for all the possible positions (Pos1 and Pos2).

Address	Size [byte]	Format	Data
%I242.0	1	WORD	MP-D1/08-08 Pos1 Inputs
%I243.0	1	WORD	MP-D1/08-08 Pos2 Inputs
%I244.0	1	WORD	MP-D1/16-16 Pos1 Inputs 1...8
%I245.0	1	WORD	MP-D1/16-16 Pos1 Inputs 9...16
%I246.0	1	WORD	MP-D1/16-16 Pos2 Inputs 1...8
%I247.0	1	WORD	MP-D1/16-16 Pos2 Inputs 9...16

7-2-3 Expansion Units Digital Output Status

In the memory map of the device a space is reserved for all the expansion units available (at the moment MP-D1/08-08 and MP-D1/16-16), and for all the possible positions (Pos1 and Pos2).

Address	Size [byte]	Format	Data
%Q130.0	1	WORD	MP-D1/08-08 Pos1 Outputs
%Q131.0	1	WORD	MP-D1/08-08 Pos2 Outputs
%Q132.0	1	WORD	MP-D1/16-16 Pos1 Outputs 1...8
%Q133.0	1	WORD	MP-D1/16-16 Pos1 Outputs 9...16
%Q134.0	1	WORD	MP-D1/16-16 Pos2 Outputs 1...8
%Q135.0	1	WORD	MP-D1/16-16 Pos2 Outputs 9...16

7-3 Battery and Retentive Memory Status, I/O Configuration Information

7-3-1 Battery and Retentive Memory Status

Addr	Size [bit]	Format	Data
%M0.0	1	bit	Battery status (0: empty, 1: OK)
%M0.1	1	bit	Classic Retain Menory Startup Status (0: corrupted; 1: OK)
%M0.2	1	bit	Percentage Retain Menory Startup Status (0: corrupted; 1: OK)
%M0.3	1	bit	Production Code (0: Corrupted; 1: OK)

7-3-2 Production Code Management Variables

Model Code

Addr	Size [Bytes]	Data type	Data
%M100.0	1	BYTE	Model Code - Character_1
...	...	...	...
%M107.0	1	BYTE	Model Code - Character_8

Field Code

Addr	Size [Bytes]	Data type	Data
%M108.0	2	WORD	Field Code “A” - AI PRECONFIG.
%M110.0	2	WORD	Field Code “B” - RESERVED
%M112.0	2	WORD	Field Code "C" - RESERVED
%M114.0	2	WORD	Field Code "D" - RESERVED
%M116.0	2	WORD	Field Code "E" - OUT AO1..AO4
%M118.0	2	WORD	Field Code "F" - RESERVED
%M120.0	2	WORD	Field Code "G" - COM PORTS
%M122.0	2	WORD	Field Code "H" - COM2 PORT
%M124.0	2	WORD	Field Code "I" - TERMINALS
%M126.0	2	WORD	Field Code "J" - PACKAGING
%M128.0	2	WORD	Field Code "K" - INSTRUCTIONS

HW and SW versions

Addr	Size [Bytes]	Data type	Data
%M130.0	2	WORD	CUSTOMIZATION - HARDWARE
%M132.0	2	WORD	CUSTOMIZATION - SOFTWARE
%M134.0	2	WORD	SOFTWARE - SUB VERSION

Serial Number Code

Addr	Size [Bytes]	Data type	Data
%M136.0	1	BYTE	Serial Number - Character 1
...	...	...	...
%M143.0	1	BYTE	Serial Number - Character_8

HW and FW versions

Addr	Size [Bytes]	Data type	Data
%M144.0	2	WORD	Hardware code identifier
%M146.0	2	WORD	Firmware code identifier
%M148.0	2	WORD	ESERVED

7-3-3 I/O Configuration Information

High Level Inputs

Address	Size [byte]	Format	Data
%MB10.0	1	BYTE	High Level Input 1 configuration information
%MB11.0	1	BYTE	High Level Input 2 configuration information
%MB12.0	1	BYTE	High Level Input 3 configuration information
%MB13.0	1	BYTE	High Level Input 4 configuration information
%MB14.0	1	BYTE	High Level Input 5 configuration information
%MB15.0	1	BYTE	High Level Input 6 configuration information

Possible Values

Value	Type
0	0... +1 V
2	0... +5 V
4	1... +5 V
5	0... +10 V
7	0... +20 mA
8	4... +20 mA

Optional High Level or Universal Inputs

Address	Size [byte]	Format	Data
%MB20.0	1	BYTE	Optional High Level or Universal Input 7 configuration information
%MB21.0	1	BYTE	Optional High Level or Universal Input 8 configuration information

Possible Values

Value	High Level Type	Universal Type
0	0... 1 V	-15... +15 mV
1	-1... +1 V	-35... +35 mV
2	0... 5 V	-50... +50 mV
3	-5... +5 V	-100... +100 mV
4	1... +5 V	-300... +300 mV
5	0... 10 V	-1.25... +1.25 V
6	-10... +10 V	TC J
7	0... 20 mA	TC K
8	4... 20 mA	TC L
9	-20... +20 mA	TC N
10	-	TC R
11	-	TC S
12	-	TC T
13	-	Pt 100
14	-	Pt 1000
15	-	Potentiometer

Engineering Units in case of Universal Type Inputs

Address	Size [byte]	Format	Data
%MB22.0	1	BYTE	Analog Input_7 Engineering Units
%MB23.0	1	BYTE	Analog Input_8 Engineering Units

Possible Values

Value	Type
0	°C
1	°K
2	°F

Optional Analogue Outpus

Address	Size [byte]	Format	Data
%MB16.0	1	BYTE	Optional Analogue Output 1 configuration information
%MB17.0	1	BYTE	Optional Analogue Output 2 configuration information
%MB18.0	1	BYTE	Optional Analogue Output 3 configuration information
%MB19.0	1	BYTE	Optional Analogue Output 4 configuration information

Possible Values

Value	Type
0	-10... +10 V
1	-20... +20 mA
2	0... +10 V
3	0... +20 mA
4	4... +20 mA

7-4 Complete Memory Map

7-4-1 Input Memory Areas

Address	Size [byte]	Format	Data
%I100.0	1	WORD	Digital Inputs
%I112.0	4	REAL	AI High Level CH1
%I116.0	4	REAL	AI High Level CH2
%I120.0	4	REAL	AI High Level CH3
%I124.0	4	REAL	AI High Level CH4
%I128.0	4	REAL	AI High Level CH5
%I132.0	4	REAL	AI High Level CH6
%I136.0	4	REAL	AI High Level CH7
%I140.0	4	REAL	AI High Level CH8
%I152.0	4	REAL	AI Universal CH7
%I156.0	4	REAL	AI Universal CH8
%I160.0	4	REAL	AI Universal CH7 mV
%I164.0	4	REAL	AI Universal CH8 mV
%I170.0	1	BYTE	AI High Level CH1 Status
%I171.0	1	BYTE	AI High Level CH2 Status
%I172.0	1	BYTE	AI High Level CH3 Status
%I173.0	1	BYTE	AI High Level CH4 Status
%I174.0	1	BYTE	AI High Level CH5 Status
%I175.0	1	BYTE	AI High Level CH6 Status
%I176.0	1	BYTE	AI High Level CH7 Status
%I177.0	1	BYTE	AI High Level CH8 Status
%I178.0	1	BYTE	AI Universal CH7 Status
%I179.0	1	BYTE	AI Universal CH8 Status
%I180.0	1	BYTE	AO CH1 Status
%I181.0	1	BYTE	AO CH2 Status
%I182.0	1	BYTE	AO CH3 Status
%I183.0	1	BYTE	AO CH4 Status
%I192.0	4	REAL	Temp 1 (cold junction temperature)
%I196.0	4	REAL	Temp 2 (internal temperature)
%I200.0	4	UDINT	Counter channel 1
%I204.0	4	UDINT	Counter channel 2
%I208.0	4	UDINT	Counter channel 3
%I212.0	4	UDINT	Counter channel 4
%I216.0	4	UDINT	Counter channel 5
%I220.0	4	UDINT	Counter channel 6
%I224.0	4	UDINT	Counter channel 7
%I228.0	4	UDINT	Counter channel 8
%I240.0	1	USINT	Expansion Unit 1 Status
%I241.0	1	USINT	Expansion Unit 2 Status
%I242.0	1	WORD	MP-D1/08-08 Pos1 Inputs
%I243.0	1	WORD	MP-D1/08-08 Pos2 Inputs
%I244.0	1	WORD	MP-D1/16-16 Pos1 Inputs 1...8
%I245.0	1	WORD	MP-D1/16-16 Pos1 Inputs 9...16
%I246.0	1	WORD	MP-D1/16-16 Pos2 Inputs 1...8
%I247.0	1	WORD	MP-D1/16-16 Pos2 Inputs 9...16

7-4-2 Output Memory Areas

Address	Size [byte]	Format	Data
%Q100.0	1	WORD	Digital Outputs
%Q112.0	4	REAL	AO CH1
%Q116.0	4	REAL	AO CH2
%Q120.0	4	REAL	AO CH3
%Q124.0	4	REAL	AO CH4
%Q130.0	1	WORD	MP-D1/08-08 Pos1 Outputs
%Q131.0	1	WORD	MP-D1/08-08 Pos2 Outputs
%Q132.0	1	WORD	MP-D1/16-16 Pos1 Outputs 1...8
%Q133.0	1	WORD	MP-D1/16-16 Pos1 Outputs 9...16
%Q134.0	1	WORD	MP-D1/16-16 Pos2 Outputs 1...8
%Q135.0	1	WORD	MP-D1/16-16 Pos2 Outputs 9...16

7-4-3 Marker Memory Areas

Addr	Size [byte]	Format	Data
%M0.0	1	BYTE	Diagnostics CPU Information
%M10.0	1	BYTE	High Level Input 1 configuration information
%M11.0	1	BYTE	High Level Input 2 configuration information
%M12.0	1	BYTE	High Level Input 3 configuration information
%M13.0	1	BYTE	High Level Input 4 configuration information
%M14.0	1	BYTE	High Level Input 5 configuration information
%M15.0	1	BYTE	High Level Input 6 configuration information
%M16.0	1	BYTE	Optional Analogue Output 1 configuration information
%M17.0	1	BYTE	Optional Analogue Output 2 configuration information
%M18.0	1	BYTE	Optional Analogue Output 3 configuration information
%M19.0	1	BYTE	Optional Analogue Output 4 configuration information
%M20.0	1	BYTE	Optional High Level or Universal Input 7 configuration information
%M21.0	1	BYTE	Optional High Level or Universal Input 8 configuration information
%M22.0	1	BYTE	Analog Input_7 Engineering Units
%M23.0	1	BYTE	Analog Input_8 Engineering Units
%M100.0	1	BYTE	Model Code - Character_1
%M101.0	1	BYTE	Model Code - Character_2
%M102.0	1	BYTE	Model Code - Character_3
%M103.0	1	BYTE	Model Code - Character_4
%M104.0	1	BYTE	Model Code - Character_5
%M105.0	1	BYTE	Model Code - Character_6
%M106.0	1	BYTE	Model Code - Character_7
%M107.0	1	BYTE	Model Code - Character_8
%M108.0	2	WORD	Field Code “A” - AI PRECONFIG.
%M110.0	2	WORD	Field Code “B” - RESERVED

%M112.0	2	WORD	Field Code "C" - RESERVED
%M114.0	2	WORD	Field Code "D" - RESERVED
%M116.0	2	WORD	Field Code "E" - OUT AO1..AO4
%M118.0	2	WORD	Field Code "F" - RESERVED
%M120.0	2	WORD	Field Code "G" - COM PORTS
%M122.0	2	WORD	Field Code "H" - COM2 PORT
%M124.0	2	WORD	Field Code "I" - TERMINALS
%M126.0	2	WORD	Field Code "J" - PACKAGING
%M128.0	2	WORD	Field Code "K" - INSTRUCTIONS
%M130.0	2	WORD	CUSTOMIZATION - HARDWARE
%M132.0	2	WORD	CUSTOMIZATION - SOFTWARE
%M134.0	2	WORD	SOFTWARE - SUB VERSION
%M136.0	1	BYTE	Serial Number - Character 1
%M137.0	1	BYTE	Serial Number - Character 2
%M138.0	1	BYTE	Serial Number - Character 3
%M139.0	1	BYTE	Serial Number - Character 4
%M140.0	1	BYTE	Serial Number - Character 5
%M141.0	1	BYTE	Serial Number - Character 6
%M142.0	1	BYTE	Serial Number - Character 7
%M143.0	1	BYTE	Serial Number - Character_8
%M144.0	2	WORD	Hardware code identifier
%M146.0	2	WORD	Firmware code identifier
%M148.0	2	WORD	RESERVED

Chapter 8
Ascon Tecnologic Function Blocks Libraries

In this chapter all the libraries present in the Ascon installation of the OpenPCS programming tool and all the function blocks present in the firmware of the MP-02 device are listed. For each library the complete list of the function blocks with a little description is also indicated. For more details please refer to the specific documentation for the tool in question.

8-1 AT_Generic_Advanced_Lib

The *AT_Generic_Advanced_Lib* is a function block library that contains a set of generic functionalities that come from the Ascon Tecnologic AC Station Device useful for the IEC 61131 programming (see the "*IEC 61131-3 Function Block Library*" [**4**] manual for details).
The table here reported gives the complete list of the function blocks of the library

Function Block name	Description
AVG_ADV_8REAL	Advanced Instantaneous Average calculation
AVG_MOVING	Moving Average calculation
AVG_RUNNING	Running Average calculation
CHARACTERIZER_8	Linear Interpolation with 8 points
CHARACTERIZER_16	Linear Interpolation with 16 points
COMPARATOR	Comparator with hysteresis Function Block
CONV_AD8	From BYTE to 8 bits
CONV_AD16	From WORD to 8 bits
CONV_AD32	From DWORD to 8 bits
CONV_DA8	From bits to BYTE
CONV_DA16	From bits to WORD
CONV_DA32	From bits to DWORD
COUNTER	Rising Edge Counter
DECODER_8	Decoder Function Block
FLIPFLOP_D	D Type FlipFlop Function Block
FLIPFLOP_JK	JK Type FlipFlop Function Block
HOLD_VALUE	Sample & Hold Function Block
INBETWEEN	Middle Selector Function Block
LIMITER_VALUE	Limiter Function Block
MIN_MAX_SELECTOR	Min/Max Selector Function Block
MONOSTABLE_DS	Monostable with Delay

Function Block name	Description
MONOSTABLE_NED	Monostable with Delay on the Negative Edge
MONOSTABLE_PED	Monostable with Delay on the Positive Edge
MONOSTABLE_PUL	Monostable Pulse Generator
MUX_A8	Analog Multiplexer 8 Input
MUX_A16	Analog Multiplexer 16 Input
MUX_D8	Digital Multiplexer 8 Input
MUX_D16	Digital Multiplexer 16 Input
RESCALE	Rescaling Function Block
POWER_FAIL	Power Fail Condition Monitor
SLOPE_LIMIT	Slope Limiter
TIMER_ADV	Advanced countdown timer function block
TOTALIZER	Totalizer Function Block
TOTALIZER_AVD	Advanced Totalizer Function Block

8-2 AT_Process_Generic_Lib

The *AT_Process_Generic_Lib* is a function block library which contains a set of generic process function blocks useful for the IEC 61131 programming.

The table here reported gives the complete list of the function blocks.

Function Block name	Description
AI_COND_ADV	Advanced conditioning of an AI value
AI_COND_STD	Standard conditioning of an AI value
ALARM_ABS	Absolute Alarm Function Block
ALARM_ADVANCED	General Alarm Function Block
ALARM_BND	Band Alarm Function Block
ALARM_DEV	Deviation Alarm Function Block
ALARM_RATE	Rate Alarm Function Block
DEW_POINT	Dew Point calculation
F0_CALCULATION	Sterilization time for bacterial load reduction calculation
HR_DRY_WET_BULB	Relative humidity calculation method with dry/wet bulb
MASS FLOW	Compensate Flow calculation
MP_RTD_LIN	RTD Linear rescaling (for microPAC ONLY)
ZrO2_PROBE	% Carbon Potential calculation
ZrO2_PROBE_CLN	% Carbon potential probe cleaning management

8-3 AT_Process_Control_Lib

The *AT_Process_Control_Lib* is a function block library dedicated to the process control. It includes advanced function blocks combining the basic PID functions coming within the M81 firmware in order to provide a ready to use solution. The most advanced function blocks in the library are a complete standard PID single action controller and the equivalent double action, for heat and cool applications. Advanced auto-tuning function blocks also with the klibrary, using different tuning algorithms such as “Natural Frequency” or “Step Response”.
Follows the complete list of the function blocks available with the library (see the “*IEC 61131-3 Function Block Library*” [**4**] manual for details).

Function Block name	Description
S2_CONTROLLER	Single Action Controller
S2_EZ_TUNE	Tuning with Modified Step Response Algorithm for Single Action Loops
S2_FILTER	First Order Filter
S2_HC_CONTROLLER	Heat and Cool Controller
S2_HC_EZ_TUNE	Tuning with Modified Step Response Algorithm for Heat and Cool Loops
S2_HC_TFUZZY	Tuning with Fuzzy Logic for Heat and Cool Loops
S2_HC_TNATFREQ	Tuning with Natural Frequency Algorithm for Heat and Cool Loops
S2_HC_TSTEPRESP	Tuning with Step Response Algorithm for Heat and Cool Loops
S2_HCMV	AutoMan station for output manual value direct access for double action loop
S2_MV	AutoMan station for output manual value direct access for single action loop
S2_SPLITMV	AutoMan station for output manual value direct access for double action loop with SplitRange
S2_TFUZZY	Tuning with Fuzzy Logic for Single Action Loops
S2_TNATFREQ	Tuning with Natural Frequency Algorithm for Single Action Loops
S2_TSTEPRESP	Tuning with Step Response Algorithm for Single Action Loops

8-4 AT_Communications_Lib

The *AT_Communications_Lib* allows a simplified access to the communication functions of MP-02 CPU (see the "*IEC 61131-3 Function Block Library*" [**4**] manual for details). Follows the complete list of the function blocks available with the library:

Function Block name	Description
COMMS_MNGT_MP0x	MP-0x Serial Comm Ports Management
MB_MST_SYNC	Modbus Master: Synchronization of operations
MB_MST_RD_COIL	Modbus Master: Coil reading
MB_MST_WR_COIL	Modbus Master: Coil writing
MB_MST_RD_WORD	Modbus Master: Word reading
MB_MST_WR_WORD	Modbus Master: Word writing
MB_16WORD_TO_ARRAY	Modbus Master: packaging of 16 WORD in an array
MB_ARRAY_TO_16WORD	Modbus Master: un-packaging of an array into 16 WORD
MB_MST_RD8_DINT	Modbus Master: conversion and management of 8 DINT read values
MB_MST_RD8_DWORD	Modbus Master: conversion and management of 8 DWORD read values
MB_MST_RD8_REAL	Modbus Master: conversion and management of 8 REAL read values
MB_MST_RD8_UDINT	Modbus Master: conversion and management of 8 UDINT read values
MB_MST_WR8_DINT	Modbus Master: conversion and management of 8 DINT write values
MB_MST_WR8_DWORD	Modbus Master: conversion and management of 8 DWORD write values
MB_MST_WR8_REAL	Modbus Master: conversion and management of 8 REAL write values
MB_MST_WR8_UDINT	Modbus Master: conversion and management of 8 UDINT write values
MB_SLV_RD8_DWORD	Modbus Slave: reading of 8 DWORD values
MB_SLV_RD8_REAL	Modbus Slave: reading of 8 REAL values
MB_SLV_RD16_WORD	Modbus Slave: reading of 16 WORD values
MB_SLV_RD32_DIGITAL	Modbus Slave: reading of 32 digital values
MB_SLV_RD_DIGITAL	Modbus Slave: reading of 1 digital value
MB_SLV_RD_DWORD	Modbus Slave: reading of 1 DWORD value
MB_SLV_RD_REAL	Modbus Slave: reading of 1 REAL value
MB_SLV_RD_WORD	Modbus Slave: reading of 1 WORD value
MB_SLV_WR8_DWORD	Modbus Slave: writing of 8 DWORD values
MB_SLV_WR8_REAL	Modbus Slave: writing of 8 REAL values
MB_SLV_WR16_WORD	Modbus Slave: writing of 16 WORD values
MB_SLV_WR32_DIGITAL	Modbus Slave: writing of 32 digital values
MB_SLV_WR_DIGITAL	Modbus Slave: writing of 1 digital value
MB_SLV_WR_DWORD	Modbus Slave: writing of 1 DWORD value
MB_SLV_WR_REAL	Modbus Slave: writing of 1 REAL value
MB_SLV_WR_WORD	Modbus Slave: writing of 1 WORD value
MODEM_CHECK	Modem operational verification
MODEM_CONF	Modem configuration management
MODEM_SMS_SEND	Modem SMS (Short text Message Service) send management
MP_SERIAL_PORTS	Set the configuration for the ModbusRTU ports of the MP-02 unit
SEND_EMAIL	SMTP server Configuration
SERIAL_PORTS	Set the configuration for the Modbus RTU ports of the CU unit
SYS_OPRS_MNGT	Set communication operational parameters on Modbus RTU and TCP agents
TCP_IP_PORT	Set the configuration for the Modbus TCP port

8-5 Firmware Function Blocks List

The Firmware function blocks coming with the M81 (hardware version 5.0.1.0) are listed in this section. For each of the function blocks a short description is provided (see the "*Ascon Firmware Function Block Library*" [**3**] manual for details): for more details please refer to the specific help documentation available in the OpenPCS programming tool.

Function Block name	Description
ASCON_FLATTEN_TO_REAL	Convert the 4 bytes of the input parameters as the flattened equivalent of a real number which is then output-returned
ASCON_REAL_TO_FLATTEN	Convert the REAL variables in their FLATTEN equivalents
CLOSE_MODBUS_TCP_SERVER	Disable MBTCP/IP Server
CLOSE_SERIAL_COMM	Close the serial communication port
CONV_ASCII_TO_CHAR	ASCII conversion from binary code to character
CONV_CHAR_TO_ASCII	ASCII conversion from character to binary code
CTRL_HCMV	Automan Station for heat and cool regulation
CTRL_MV	Automan Station for single action regulation
CTRL_PID	PID algorithm
CTRL_SPLITMV	Automan Station for heat and cool regulation with split range
CTRL_SRV	Servomotors algorithm
CTRL_SRV_POS	Servomotors algorithm close loop (potentiometer)
CTRL_TPO	Time proportional output
CTD	Counter Down pulses
CTU	Counter Up pulses
CTUD	Counter Up/Down pulses
ENABLE_MODBUS_TCP_SERVER	Set and activate the MBTCP/IP Server agent
F_TRIG	Falling edge detection
R_TRIG	Rising edge detection
MB_TCP_CLOSE_CONN	Close one of the 10 active connections
MB_TCP_CONN_STATUS	Show the status of a MBTCP/IP connection
MB_TCP_GET_CONN_BY_ADDR	Return information of a connection identified by the IP address of the client
MB_TCP_GET_CONN_CONFIG	Return configuration data of a specified active connection
MEMCOPY_FROM_M	Copies data from %M memory areas
MEMCOPY_TO_M	Copies data into %M memory areas
MEMCPY_I_TO_M	Copy a specific %I memory into a specific %M memory area
MEMCPY_M_TO_M	Copy a specific %M memory into a specific %M memory area
MEMCPY_M_TO_Q	Copy a specific %M memory into a specific%Qmemory area
MEMCPY_Q_TO_M	Copy a specific %Q memory into a specific %M memory area
MODBUS_GET_DIGITAL_SLAVE	Read 16 digital value from a memory area dedicated to a MB slave
MODBUS_GET_SLAVE_DATA	Read registers from a memory area dedicated to a MB slave
MODBUS_MASTER_EXECUTE	Execute a query in compliance with the MB protocol
MODBUS_MASTER_STATUS	Check the status of the MB agent.

Function Block name	Description
MODBUS_SET_DIGITAL_SLAVE	Write 16 digital value to a memory area dedicated to a MB slave
MODBUS_SET_DWORD_DATA	Write two contiguous registers (4 bytes) to a memory area dedicated to a MB slave
MODBUS_SET_WORD_DATA	Write registers to a memory area dedicated to a MB slave
MODBUS_SLAVE_SETTINGS	Set the node_id and timeout parameters of the MB slave agent
MODBUS_SLAVE_STATUS	Check the status of the MB agent
OPEN_SERIAL_COMM	Configure the serial port and set the protocol used on it
RAND	Generete random numbers from 0... 65535
RESET_PULSE_COUNTER	Reset the counter value connected to a specific digital input
RTC_SETUP	Set the system clock
RTC_GET_VALUES	Read the system clock
RS	Reset dominant Flip-Flop
SR	Set dominant Flip-Flop
SEND_EMAIL	Set the configuration for a client SMTP to send e-mail
SERIAL_IO_CONFIG	Configure the ASCII serial port
SERIAL_IO_READ	Read data from the ASCII serial port
SERIAL_IO_READ_BYTE	ASCII serial port Byte reading
SERIAL_IO_WRITE	Write data on the ASCII serial port
SERIAL_IO_WRITE_BYTE	ASCII serial port Byte writing
TOF	Delay OFF timer
TON	Delay ON timer
TP	Time pulse generator
WATCHDOG_SET	Configure the system watchdog
WATCHDOG_STATUS	Checking the status of the system watchdog

Chapter 9
Technical data

9-1 General and environmental characteristics

Features	Description
Power supply	24Vdc (-15...+25%)
Micro power interruption immunity	≤1 ms (repeated 20 times), see CE directives
Reverse polarity protection	Yes
Power consumption	10W (+5W with I/O modules)
Operating temperature	0…55°C
Storage temperature	-40…70°C
Relative Humidity	5...95% non condensing
Protection degree	IP20
Mounting	DIN rail
Vibrations resistance (on 3 axis)	10...57Hz, 0.0375mm, 57...150Hz, 0.5g
Shock resistance	15g
Dimensions	**L**: 156mm, **H**: 110mm, **W**: 65mm
Weight	450g
Isolation resistance	Isolation class II (50Vrms), EN61010-1
Safety	Compliance to EN 61131-2
Approvals	CE, UL and cUL (pending)

9-2 Functional characteristics

Features	Description
Programming languages	IL. ST, FBD, LD, SFC, CFC
Program memory	max. 2 MB
Dynamic memory	16MB
Retentive memory	64kB redundant
Data retention in case of power failure	10 years
Min. cycle time	Typical 10ms
Min. response time	Input acquisition time + cycles execution time
Max. timer resolution	1ms
Real Time Clock	Yes
Max. P.I.D. number	Unlimited, application dependent, suggested up to 20

9-3 I/O Characteristics

Features	Description
Digital Inputs	
Input power supply	24Vdc (ON 5...30V, OFF 0...3V)
Max. input frequency	80Hz (ON/OFF limit)
Type	Sink
Isolation	800V channels-power supply
	800V channels-logic components
Protection	Reverse polarity, overvoltage
Status indicator	LED
Compliance	IEC/EN 61131-2 (type 1)
Digital Outputs	
Output power supply	24Vdc
Output current (nominal)	0.5A
Type	Source
Protection	Overvoltage/short circuit
Isolation	800V channels-power suply
Analogue Inputs	
1... 6	Configurable: 0...10V, 0...1V, 1...5V, 0...5V, 0...20mA, 4...20mA
Input inpedance	>100kΩ (V); <300Ω (mA)
7... 8 (option) **[note 1]**	Configurable: the 2 input channels can be configure as: • Universal; • High level input.
Input inpedance	>10MΩ
Resolution	16 bit
Accuracy	±1%
Isolation	800V channels-power supply
	800V channels-logic components
Analogue Output	
1... 4 **[note 2]**	Configurable: ±10V, ±20mA
Resolution	13 bit

Notes: **1.** All the available input types are listed at:
"Setup the Selected AI High Level Channel" on page 20 and
"Setup the Selected AI Universal Channel" on page 21.

2. All the available output types are listed at:
"Local AO Ch Setup Menu" on page 24.

Appendix A
Communication Ports Configuration

The MP-02 system unit has 3 different communication ports (see "*Figure 1.2 - Control Unit I/O and Communication Ports*" for details):

X0 Port used to configure the Basic Unit and for Modbus communications. It can be set, through external microswitches, either as RS232 or as RS485;

X1 This port is an RS485 dedicated to Modbus communications.

LAN Ethernet port (TCP/IP) used to configure, program, debug, commission and for Modbus TCP data exchange;

A-1 Configuring the optional serial communications ports

The 2 serial ports are optional and can be configured through 8 selectors located between the two connectors.

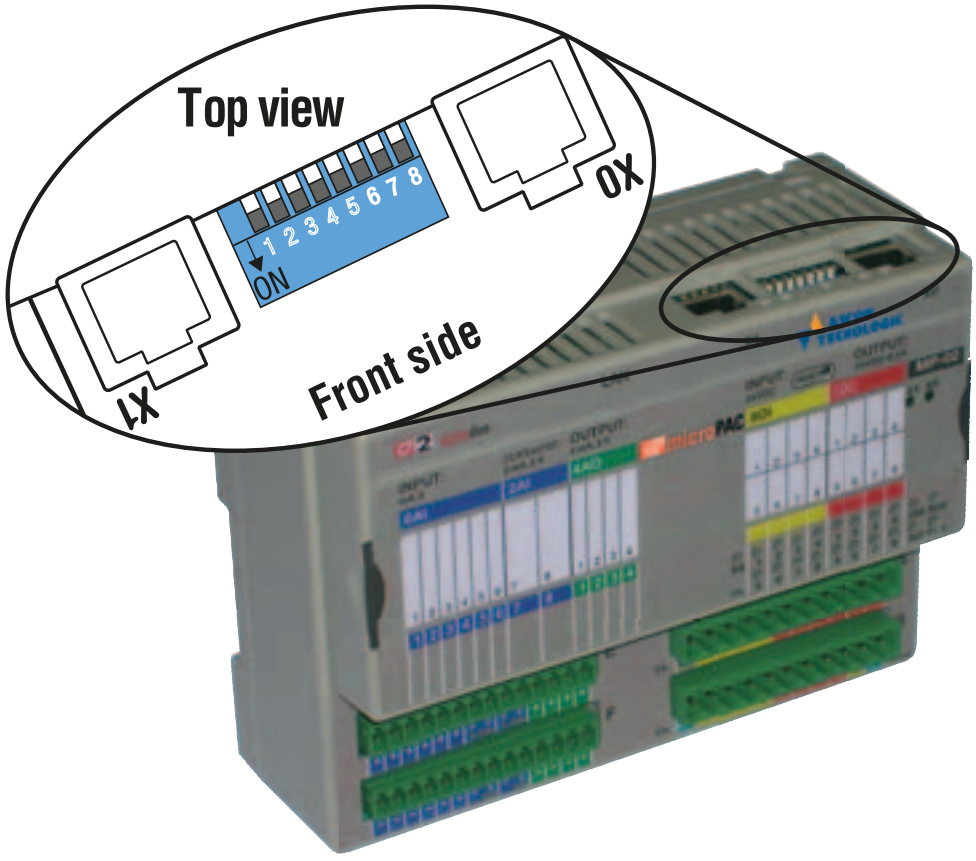


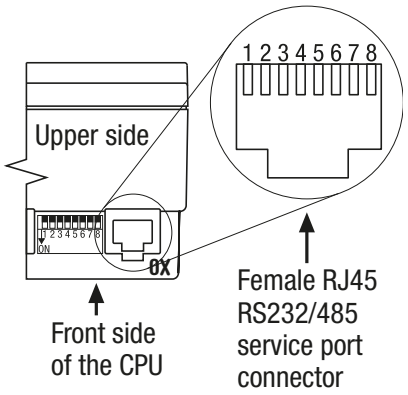
Figure A.1 - Position of the serial port configuration microswitches.

A-1-1 Configuring the X0 Port

The **X0** Service Port can be used to configure the CPU ad its devices using a VT100 terminal. The RJ45 RS232/485 Service Port connector is located in the upper side (on the right) of the CPU. The 8 contacts are arranged as illustrated in the drawing.

The signals present at the RJ45 connector of the Service Port are:

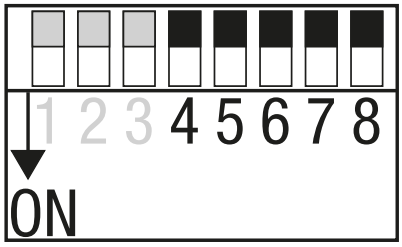
Pin	Signal
1	D+ (RS485)
2	D- (RS485)
3	GND (RS485)
4	GND (RS232)
5	RX (RS232)
6	TX (RS232)
7	NC
8	NC



Some parameters of the Service Port can be configured using selectors 4...8 of the microswitch block. Please note that the ON/OFF position of the selectors is shown by an arrow printed on the selectors block.

The following table describes the possible options:

Selector	ON	OFF
4	RS232 enabled	RS232 disabled
5	RS485	RS232
6	Termination resistance (ON/OFF) (110Ω) (default disabled = OFF)	
7	Line polarization Pull-Down (ON/OFF) (default disabled = OFF)	
8	Line polarization Pull-Up(ON/OFF) (default disabled = OFF)	



The default communication parameters for the **X0** port are (RS232 and RS485):

- Baud Rate: 9600 bps;
- Data: 8 bit;
- Stop bit: 1;
- Parity: none;
- Flow Control: none.

The serial port communication parameters can be changed during the CPU Setup Session (see paragraph: *"Serial Setup Menu" on page 12* for details).

WARNING

If the communication parameters are changed during the CPU Setup Session, the communication parameters of the connected devices must be changed in accordance.

Caution

The RS232 cable must be shorter than 15 m.

A-2 Connect the Setup Terminal

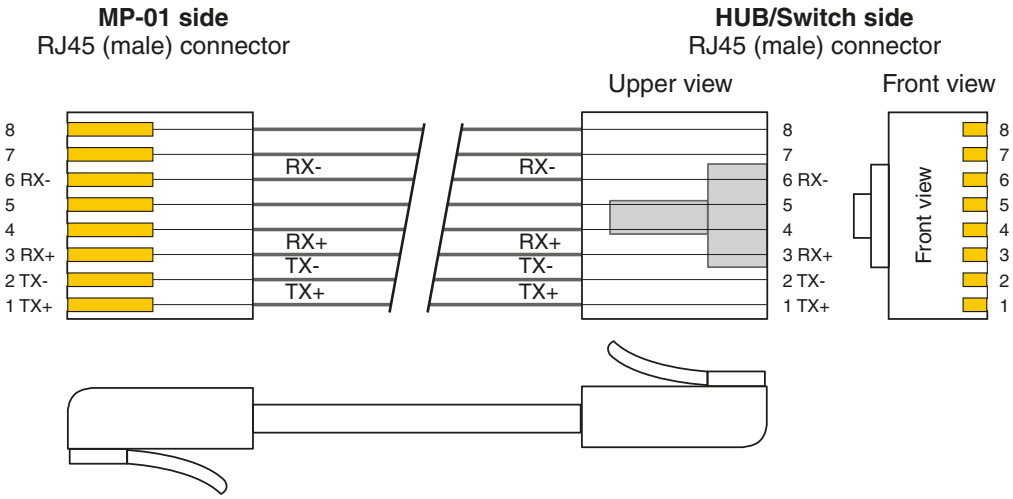
At start-up, the system starts a configuration session to perform the setup of the system module and configure the system I/O. Setup data can inserted using two different instruments:

- A Personal Computer using a Telnet session connected to the Ethernet port of the Base Unit (LAN connector).
- A VT100 terminal or a Personal Computer with Hyper Terminal program and connected to the optional RS232 port of the Base Unit (X0 connector);

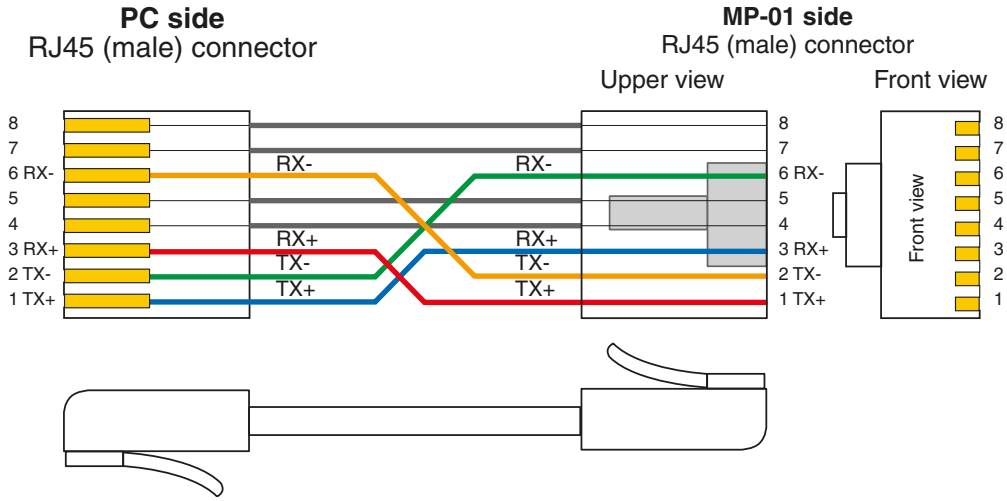
A-2-1 Telnet Communications Connection

In order to connect the Basic Unit to a Personal Computer using the Ethernet port there are two possibilities:

1. **Through a Switch or a HUB (MP -> HUB/Switch -> PC).**
   Connect to the **LAN** connector a straight through (not crossed) LAN cable to connect the Basic Unit to the Switch or HUB (the connection between the HUB/Switch is also a straight through connection):



2. **Directly to the Personal Computer**
   Connect to the **LAN** connector crossed LAN cable to connect the Basic Unit directly to the PC:



Once the PC is connected to the basic unit, start the Telnet program in order to communicate with the MP-02 and begin the setup session.

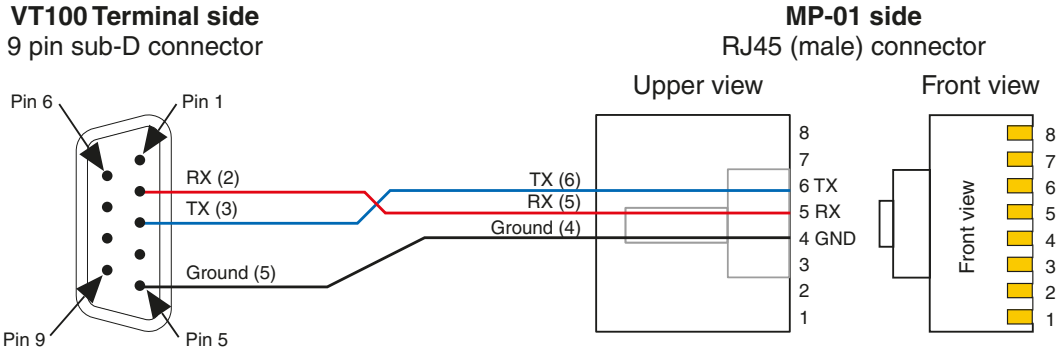
A-2-2 Connect the serial setup terminal

On the **X0** RJ45 connector is an optional serial communications port with RS232/485 protocol. Depending to the terminal used to setup the system, the user must:

- Set the **X0** port as RS232;
- Provide the proper connection cable;
- Set the correct communications parameters;
- Run the communications program.

RS232 Serial Communications Connection

To connect a VT100 terminal or a PC with Hyper Terminal program, connect the **X0** connector to an RS232 cable with the following characteristics:



Setting the comm.s parameters

At this point the HyperTerminal must be configured in order to communicate with the correct COM Serial port. When the Personal Computer has no serial port, the connection can be done through a USB-Serial adapter; in this case the number of the COM port linked to the USB connector can be found in:
Start\ControlPanel\System\Hardware\Peripherals\Ports (COM and LPT)
Using the COM port number open a new session of HyperTerminal and set the default communication parameters in order to match those of the service port:

Baud rate	9600
Data	8bit
Stop bit	1
Parity	None
Flow Control	None

During the configuration session it will be possible to change the baudrate, stop bit and parity (see *"Serial Setup Menu" on page 12* for details). When the communications parameters of the system are changed, the communications parameters of the terminal (or PC) must be changed accordingly. The setup is performed by browsing the menus sent to the VT100 terminal or to the terminal emulation program (HyperTerminal) by the system.

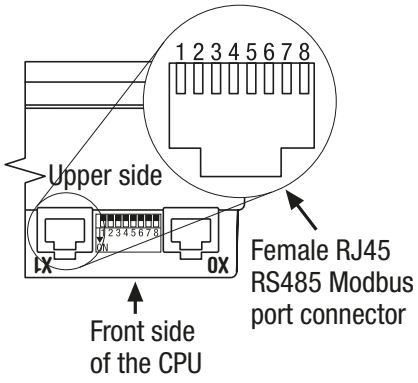
A-3 Configuring the Modbus Connections

A-3-1 Configuring the X1 Modbus Port

The **X1** Port can be used for Modbus communications. The RJ45 RS485 Modbus Port connector is located in the upper side (on the left) of the CPU. Looking at the hole of the plug the 8 contacts are arranged as illustrated in the drawing.

The signals present at the RJ45 connector of the Service Port are:

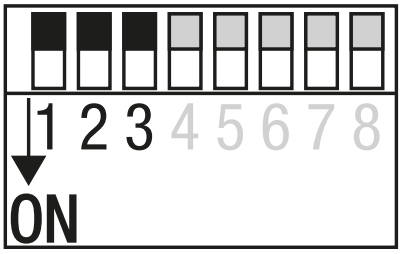
Pin	Signal
1	D+ (RS485)
2	D- (RS485)
3	GND (RS485)
4	NC
5	NC
6	NC
7	NC
8	NC



Some parameters of the Modbus Port can be configured using selectors 1...3 of the microswitch block. Please note that the ON/OFF position of the microswitches is pointed out by an arrow printed on the selectors block.

The following table describes the possible options.

Selector	ON	OFF
1	Termination resistance (ON/OFF) (110Ω) (default disabled = OFF)	
2	Line polarization Pull-Down (ON/OFF) (default disabled = OFF)	
3	Line polarization Pull-Up(ON/OFF) (default disabled = OFF)	



The default communication parameters for the **X1** port are:

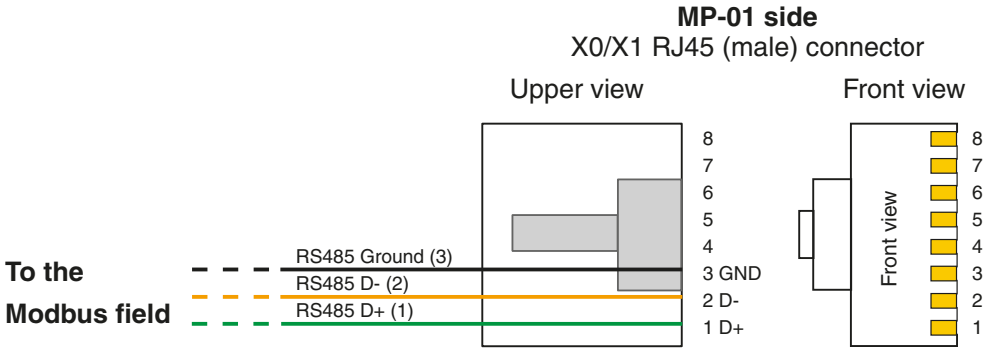
- Baud Rate: 9600 bps;
- Data: 8 bit;
- Stop bit: 1;
- Parity: none;
- Flow Control: none.

WARNING

The default communication parameters can be set only using the specific Function Block. See "*Ascon Firmware Function Block Library* **[3]**" for details.

A-3-2 Configuring the Modbus Ports

To connect an RS485 Modbus fieldbus (through the **X0** and/or **X1** ports), use cables with the following characteristics:



Setting the comm.s parameters

Changes to the RS485 communication parameters can be done through a specific Function Block. See "*Ascon Firmware Function Block Library* **[3]**" for details.

Appendix B
Reference documents

[1] "*Infoteam OpenPCS programming system – user manual*" – version 6.0 English

[2] "*IEC 61131-3: Programming Industrial Automation Systems*" – Karl-Heinz John, Michael Tiegelkamp - Springer

[3] "*Ascon Firmware Function Block Library*"

[4] "*IEC 61131-3 Function Block Library*".

[5] "*Estensioni per gestire porte di comunicazione dell'ambiente OpenPCS*" V1.0 – Maurizio Grassi

[6] "*Modbus Messaging on TCP/IP implementation guide*" - http://www.Modbus-IDA.org

[7] "*MODBUS over Serial Line Specification & Implementation guide*" - http://www.Modbus-IDA.org

[8] "*MODBUS APPLICATION PROTOCOL SPECIFICATION*" - http://www.Modbus-IDA.org

[9] "*MP-02 Installation manual*" (code: ISTR-MI MP-02ENG01).

[10] "*MP-02 User manual*" (code: ISTR-MU MP-02ENG01).

[11] "*micro**PAC** I/O modules Installation Manuals*".

[12] "*micro**PAC** I/O modules User Manuals*".