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sigmadue microPAC M81

User Manual

User Manual
M.U. microPAC M81-1/12.11
Cod. ISTR-M M81ENG01

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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`

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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.

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Chapter 1
Technical data

1-1 General and environmental characteristics

Features	Description
Power supply	24 Vac/dc (-15... +25%)
Power consumption	10 W (+5 W with I/O modules)
Operating temperature	0… 50°C
Storage temperature	-40… 70°C
Relative Humidity	5... 95% non condensing
Protection degree	IP20
Mounting	DIN rail
Dimensions	**L**: 175 mm, **H**: 110 mm, **D**: 60 mm
Weight	450g
Protection Degree	IP20
Safety	Compliance to EN 61131-2 Isolation class II (50Vrms), EN61010-1
Approvals	CE, UL and cUL (pending)

1-2 Functional characteristics

Features	Description
Programming languages	IL, ST, FBD, LD, SFC, CFC
Program memory	Max. 2 MB internal, 3.5 MB on USB key
Dynamic memory	16 MB
Retentive memory	64 kB redundant
Data retention (for power failure)	10 years (for Flash memory)
Min. cycle time	Typical 10ms
Max. timer resolution	1 ms
Real Time Clock	Yes
Max. P.I.D. number	Unlimited, application dependent, suggested up to 20

1-3 I/O Characteristics

1-3-1 Digital Inputs (DI1... DI12)

Features	Description
Input type	For free of voltage contacts (contact closure)
Isolation	800V channels-power supply
	800V channels-logic components
Compliance	IEC/EN 61131-2 (type 1)
Output connectors	X4, X5 and X6

1-3-2 Digital Outputs (D01... DI10)

Relay Outputs DO1 and DO2

DO1 and DO2 are relay outputs with SPDT (Single Pole, Double Throw) contacts configuration. The characteristics are:

Features	Description
Contact configuration	SPDT (Single Pole, Double Throw)
Contact rate	5 A (for resistive loads)
Isolation	2500V between channel and Power Supply and between channel and main electronics
Output connectors	X2 and X3

Relay Outputs DO3... DO10

DO3... DO10 are 8 relay outputs with SPST (Single Pole, Single Throw, Normally Open) contacts configuration. The characteristics are:

Features	Description
Contact configuration	SPST (Single Pole, Single Throw)
Contact rate	2 A (for resistive loads)
Isolation	2500V between channel and Power Supply and between channel and main electronics
Output connectors	X7 and X8

Note: The output of the watchdog timer function can be addressed to the DO3 relay output.

1-3-3 Analogue Inputs (AI1... AI12)

High level Analogue Inputs AI1... AI4

AI1... AI4 are 4 High Level Analogue Inputs that can be configured through the Setup masks. The characteristics of these Inputs are:

Features	Description
Type of input	0/1... 5 V, 0/2... 10 V, Ratiometric (with 5 V reference) and 0/4... 20 mA
Resolution	16 bit
Accuracy	±0.5 %
Input inpedance	>100kΩ (V); <300Ω (mA)
Isolation	2500V between channel and Power Supply and between channel and main electronics
Input connectors	X12

Temperature Analogue Inputs AI5... AI12

AI5... AI12 are 8 Temperature Analogue Inputs that can be configured through the Setup masks. The characteristics of these Inputs are:

Features	Description
Type of input	Pt1000, NTC SEMITEC 103AT-2, NTC Custom
Resolution	16 bit
Accuracy	±1%
Isolation	800V channels-power supply
	800V channels-logic components
Input inpedance	>10MΩ
Input connectors	X14 and X15

1-3-4 Analogue Output (AO1... AO4)

Features	Description
AO1... AO4 **[note 2]**	0... 10 V
Load	>1 kΩ
Resolution	16 bit
Accuracy	±0.5%
Isolation	800V channel-power supply
	50V channel-main electronics
Connector	X13

Notes: **1.** All the available input types are listed at:
"Setup Temperature Channels" on page 29 and
"Setup the Selected AI Channel" on page 28.

2. All the available output types are listed at:
"AO Channels Setup Menu" on page 31.

1-3-5 Auxiliary Analogue Output

Features	Description	
Power output 1	+5 VDC	Output Voltage
	30 mA max.	Max load
	X12	Output connector
Power output 2	+12 VDC	Output Voltage
	80 mA max.	Max load
	X12	Output connector
Power output 3	+15 VDC	Output Voltage
	200 mA max.	Max load
	X9	Output connector

1-4 Communication ports

1-4-1 Serial Communication ports (COM1 and COM2)

Features	Description
Isolation	800V between the com port and main electronics
Connector	X10 and X11

Chapter 2
Hardware description

The system described in this User Manual is mainly composed by:

- Ascon Tecnologic sigma**due** micro**PAC** M81 CPU with 8 analogue temperature inputs (NTC, Pt1000), 4 high level analog inputs (0/4... 20 mA, 0... 10 V, 0... 5V ratiometric), 12 free voltage inputs, up to 4 (0/10V) analogue outputs, 2 x Normally Closed (Form C) SPDT (5A) and 8 x Normally Open (Form A) SPST (2A) Relay Outputs.
- sigma**due** I/O ModBus modules;
- Infoteam OpenPCS programming tool system.

micro**PAC** M81 is a powerful processing device based on an ARM RISC 32 bit processor, with different memory types, onboard I/Os and up to 3 communication ports.

sigma**due** I/O is a family of I/O analogue and digital modules with special functions that can be also connected to the M81 module through a dedicated ModBus RTU serial bus.

Infoteam OpenPCS is a powerful and useful standard EN61131-3 compliant programming tool for PLC applications.

It is a clearly structured and easily operated tool to edit, compile, debug, manage and print PLC applications during all the development phases.

OpenPCS runs on Windows server 2003, Windows XP SP2, Windows Vista (32 bit) and Windows 7 (32 or 64 bit) platforms

The Ascon Tecnologic M81 unit based on sigma**due** micro**PAC** line, combines its functionalities with the capabilities of a PLC. "*Modular concept*" means that you can adapt the system quickly and easily to your requirements. This gives the sigma**due** automation systems an amazing price/performance ratio.

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

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

2-1 Architecture

From the programmer's point of view, a complete system can be arranged as in "*Figure 2.1 - Programming the sigmadue M81 Control Unit*" below:

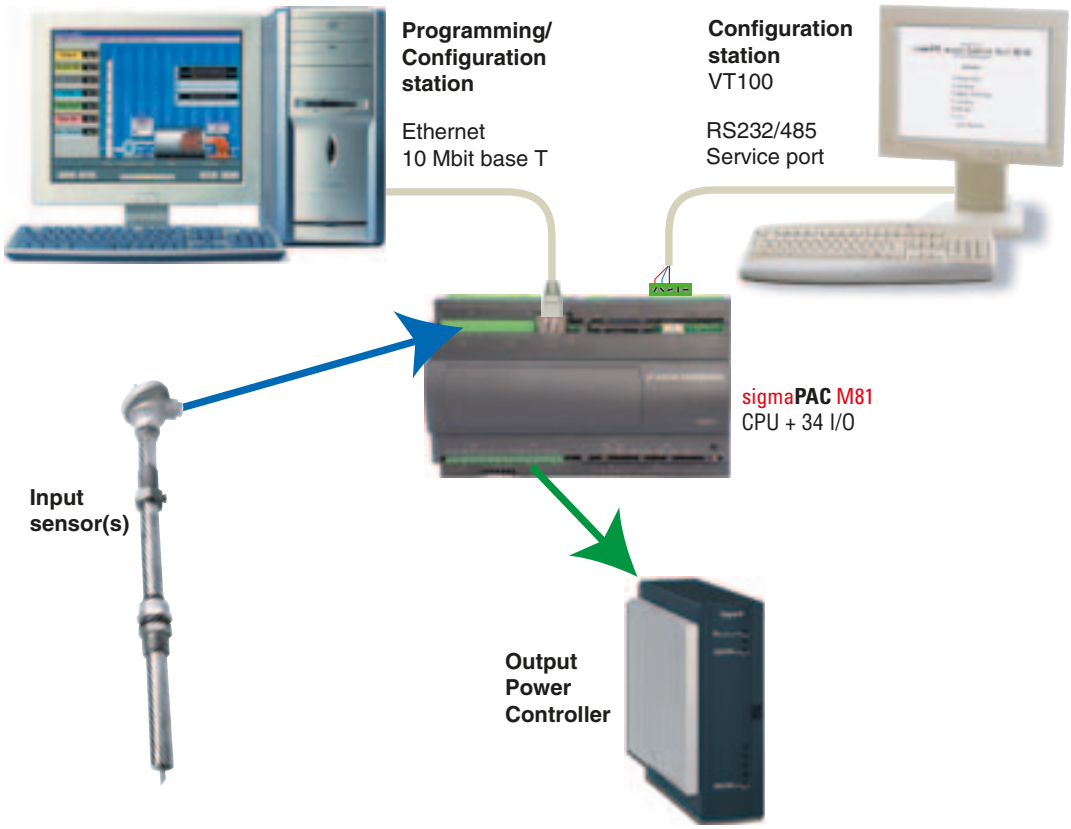


*Figure 2.1 - Programming the sigma**due M81** Control Unit*

In "*Figure 2.1 - Programming the sigmadue M81 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. PuTTY/HyperTerminal).

2-1-1 Communication ports

The CPU has 3 communication ports (*see* "*Chapter 2 - Control Unit Supply, I/O and Communication Ports*"):

- One Ethernet port (TCP/IP) to be used for the connection to the PC for:
  - CPU configuration using a telnet session;
  - Programming, debugging and commissioning;
  - Modbus TCP data exchange;
- One Service RS232/485 port (connector X10) to be used as:
  - Standard ASCII serial port;
  - Modbus RTU master/slave data exchange port.
- One RS485 port (connector X11) to be used as:
  - Standard ASCII serial port;
  - Modbus RTU master/slave data exchange port.
- One USB port for data logging and backup/restore functions (uploading or downloading the configuration and the programs to/from an external USB mass memory storage).

Pinout of all communication ports is described hereafter and in:
"*M81 Installation Manual*" **[9]**.

2-1-2 Integrated I/Os

The **M81** base unit can house up to 36 I/O ports:

8 AI Analogue temperature inputs configurable for NTC, Pt1000 (connectors X14 - X15);

4 AI High level isolated analogue inputs configurable for: 0/1... 5 V, 0/2... 10 V, Ratiometric (5 V reference) and 0/4... 20 mA (connector X12);

4 AO High level analogue outputs 0...10 V (connector X13);

12 DI General purpose Digital Inputs for Free Voltage Contacts (connectors X4... X6);

2 DO Isolated General Purpose SPDT 5A Relay Outputs (connectors X2... X3);

8 DO Isolated General Purpose SPST NO 2A Relay Outputs (connectors X7... X8).

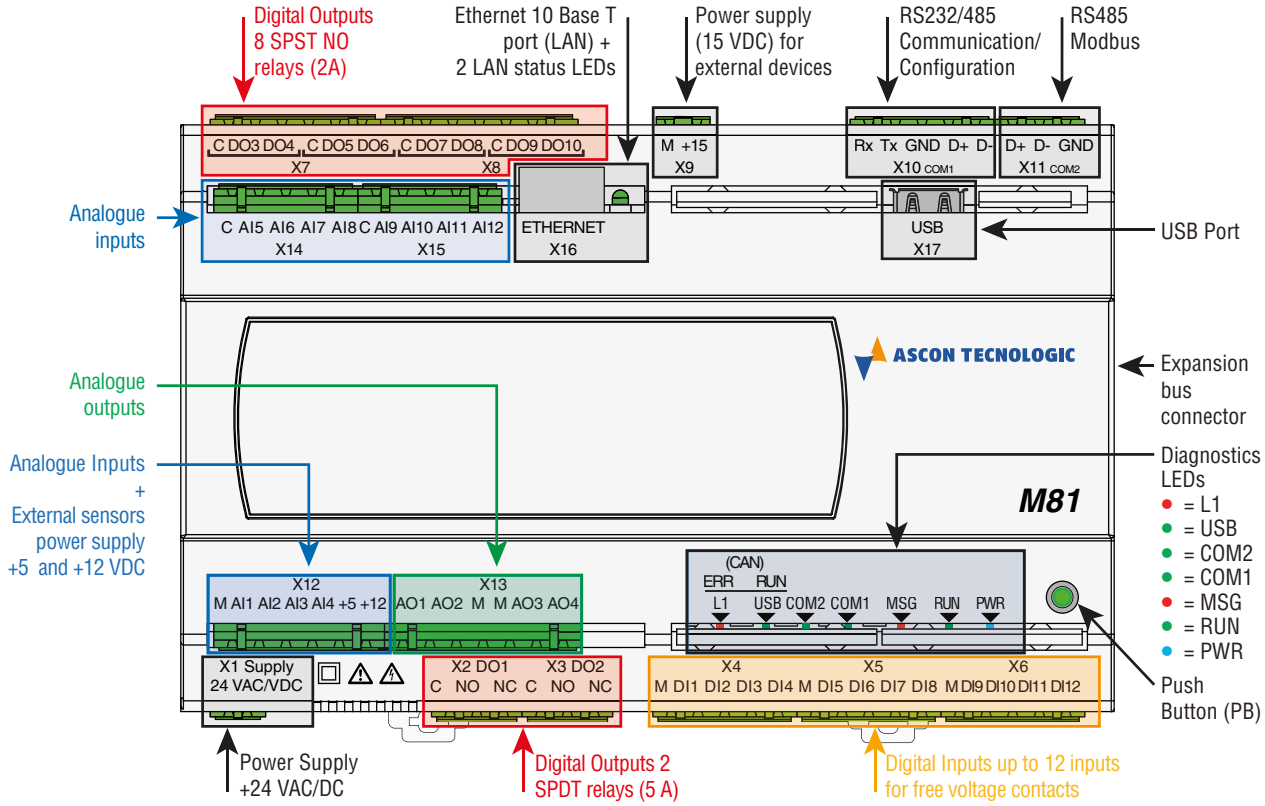


Figure 2.2 - Control Unit Supply, I/O and Communication Ports

WARNING

The **PB** button performs different operations accorndingly to the system status but **does not restart** the CPU or the 1131 application.

WARNING

1) At Power ON, if the PB button is pressed ***the stored setup parameters are restored the factory defaut*** (as well as those set by the user).

2) Then, a phase while is possible to manage the upload/download of the status, configuration and program files from/to the USB Key as described in the "*Chapter 6 - USB Mass Storage Device*".

3) While the PLC program is running, the PB behaves as a Standard Input as described in "*Chapter 10 - Digital Inputs Status (DI1... DI12)*".

2-1-3 Diagnostic LEDs

Referring to "*Figure 2.2 - Control Unit Supply, I/O and Communication Ports*" a description of the LEDs functions is given in the table below.

LED	Colour	Action (note 1)	Description
PWR	Blue	ON	Power Supply present
RUN LED during the normal PLC operations			
RUN	Green	ON	1131 program running
		OFF	1131 program stopped or not present
RUN + MSG LEDs			
RUN	Green	GREEN Flickering RED Flickering	Configuration
MSG	Red	GREEN Flickering RED OFF	Watch Monitor
MSG LED during the normal PLC operations			
MSG	Red	OFF	Normal Opeartion
		Single flash	CRC error in the configuration file, reset to default
		Double flash	Flash File System error
		Triple flash	Checksum VAR % RETAIN error (note 2)
		Blinking	Backup battery low
		Flickering	Checksum error in RETAIN data
COM1	Green	OFF	PLC in Configuration or Watch monitor
		Blinking	Normal PLC operation, data traffic on COM1
COM2	Green	OFF	PLC in Configuration or Watch monitor
		Blinking	Normal PLC operation, data traffic on COM2
RUN USB	Green	ON	USB Mass Storage Device Inserted
		Blinking	Access to the USB Mass Storage Device
		OFF	USB Mass Storage Device not present
ERR/L1	Red	ON/OFF	The LED can be managed by the application

Table 2.1 - 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 %M variables have been defined as RETAIN (see "*Chapter 5 - Retain Config Menu*"), the system needs to reboot in order to properly create the dedicated files. The error indication will disappear automatically in case of positive result.

Chapter 3
Installation

3-1 Mechanical installation

The sigma**due** micro**PAC** M81 unit and the additional external expansion I/O units are designed to be installed on standard DIN rails.

The M81 unit has the expansion port connector on the right side of the case. For this reason, consider to keep enough space in case of needs of expansion modules.
Up to two additional external expansion I/O units can be connected in chain to the M81.

3-1-1 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 "*M81 Installation Manual*" **[9]**.

3-2 Electrical installation

Refer to: "*Figure 2.2 - Control Unit Supply, I/O and Communication Ports*" and "*M81 Installation Manual*" **[9]** for details.

3-2-1 X1: Supply 24 VAC/DC Power Supply Connector

This 2 terminals connector brings the Power Supply to the CPU. They have no polarity as the 24 V Power Supply can be in Direct or Alternate Current.

3-2-2 X2, X3: DO1, DO2 Digital Output SPDT Relays (5A)

These 3 terminal connectors are the output ports of the DO1 and DO2 SPDT relays. The terminals of both the connectors have the following Pinout:

Label	**C**	**NO**	**NC**
Signal	Common	Normally Open position	Normally Close position

3-2-3 X4, X5, X6: DI1... DI12 Digital Input for Free Voltage Contacts

These connectors are the input terminals of the DI1... DI12 for free voltage contacts Digital Inputs. The connectors have the following pinout:

X4 Connector *DI1... DI4 - Digital Inputs*

Label	**M**	**DI1**	**DI2**	**DI3**	**DI4**
Signal	Common	DI1 Input	DI2 Input	DI3 Input	DI4 Input

X5 Connector *DI5... DI8 - Digital Inputs*

Label	**M**	**DI5**	**DI6**	**DI7**	**DI8**
Signal	Common	DI5 Input	DI6 Input	DI7 Input	DI8 Input

X6 Connector *DI9... DI12 - Digital Inputs*

Label	M	DI9	DI10	DI11	DI12
Signal	Common	DI9 Input	DI10 Input	DI11 Input	DI12 Input

3-2-4 X7, X8: DO3... DO10 Digital Output SPST Relays (2A)

These connectors are the output terminals of the DO1... DO10 SPST relays. The connectors have the following pinout:

X7 Connector *DO3... DO6 - Digital Outputs*

Label	C	DO3	DO4	C	DO5	DO6
Signal	Common	DO3 Output	DO4 Output	Common	DO5 Output	DO6 Output

X8 Connector *DO7... DO10 - Digital Outputs*

Label	C	DO7	DO8	C	DO9	DO10
Signal	Common	DO7 Output	DO8 Output	Common	DO9 Output	DO10 Output

3-2-5 X9: Power Supply (15 VDC) for external devices

The maximum load applicable to this output is 3 W.
The connectors have the following pinout:

Label	M	+15
Signal	0 V	+15 VDC

3-2-6 X10, X11: Serial Communication Ports Connectors

Through these 2 connectors is possible to connect 2 different serial communication ports. Some parameters of these ports can be configured using the switches of the DIP switch block located close to the X10 connector (see the Installaton Manual for more information).

X10 Connector *COM1 - RS232/485 Port*

The X10 connector allows to connect an RS232/485 terminal (also for setup purposes). Through this port, using the protocol Modbus (master/slave) or serial ASCII the PLC can connect a fieldbus network. The connector has the following pinout:

Label	RX	TX	GND	D+	D-
Signal	RX (RS232)	TX (RS232)	GND (RS232/RS485)	D+ (RS485)	D- (RS485)

X11 Connector *COM2 - RS485 Port*

Connector X11: RS485 port to connect a fieldbus network using the Modbus protocol (master/ slave) or serial ASCII. The connector has the following pinout:

Label	D+	D-	GND
Signal	D+ (RS485)	D- (RS485)	GND (RS485)

3-2-7 X12: AI1... AI4: High Level Analogue Inputs

X12 is used to connect up to 4 High Level Analogue Inputs (AI1... AI4) to the system (types: 0/1... 5 V, 0/2... 10 V, ratiometric with 5 V reference, 0/4... 20 mA). On the connector are present also two different voltage outputs that can be used to power external sensors/transmitters. The connector has the following pinout:

Label	M	AI1	AI2	AI3	AI4	+5	+12
Signal	Common (-)	AI1 Input	AI2 Input	AI3 Input	AI4 Input	+5 VDC	+12 VDC

3-2-8 X13: AO1... AO4: Analogue Outputs

X13 is used to connect up to 4 Analogue Outputs (AO1... AO4) to the system (type: 0... 10 V). The connector has the following pinout:

Label	AO1	AO2	M	M	AO3	AO4
Signal	+AO1	+AO2	Common (-)	Common (-)	+AO3	+AO4

3-2-9 X14...X15: AI5... AI12: Temperature 2 Wires Analogue Inputs

X14 and X15 are used to connect up to 8 Temperature Analogue Inputs (AI5... AI12) to the system (types: NTC, Pt1000 all with two wires connection). The connectors have the following pinout:

X14 Connector *AI5... AI8 - Temperature Analogue Input*

Label	C	AI5	AI6	AI7	AI8
Signal	Common	AI5 Input	AI6 Input	AI7 Input	AI8 Input

X15 Connector *AI9... AI12 - Temperature Analogue Input*

Label	C	AI9	AI10	AI11	AI12
Signal	Common	AI9 Input	AI10 Input	AI11 Input	AI12 Input

3-2-10 X16: LAN Ethernet 10baseT Connector

The X16 connector is a standard Ethernet RJ45 type.

3-2-11 X17: USB Flash Drive Connector

The X17 connector is a standard USB Type A receptacle to connect a flash drive (system files upload or data logging download).

Chapter 4
Communication Ports Configuration

The M81 system unit has 3 different communication ports (see "*Figure 2.2 - Control Unit Supply, I/O and Communication Ports*" for details):

X10 COM1 can be set, through the DIP switches, as RS232 or RS485 and can be used to configure the Basic Unit and for Modbus communications;

X11 COM2 is an RS485 dedicated to Modbus communications.

X16 Ethernet port (TCP/IP) used to configure, program, debug, commission and for Modbus TCP data exchange.

4-1 Configuring the optional serial communications ports

The 2 serial ports are optional and can be configured through 8 DIP switches located nearby to the Serial Ports connectors.

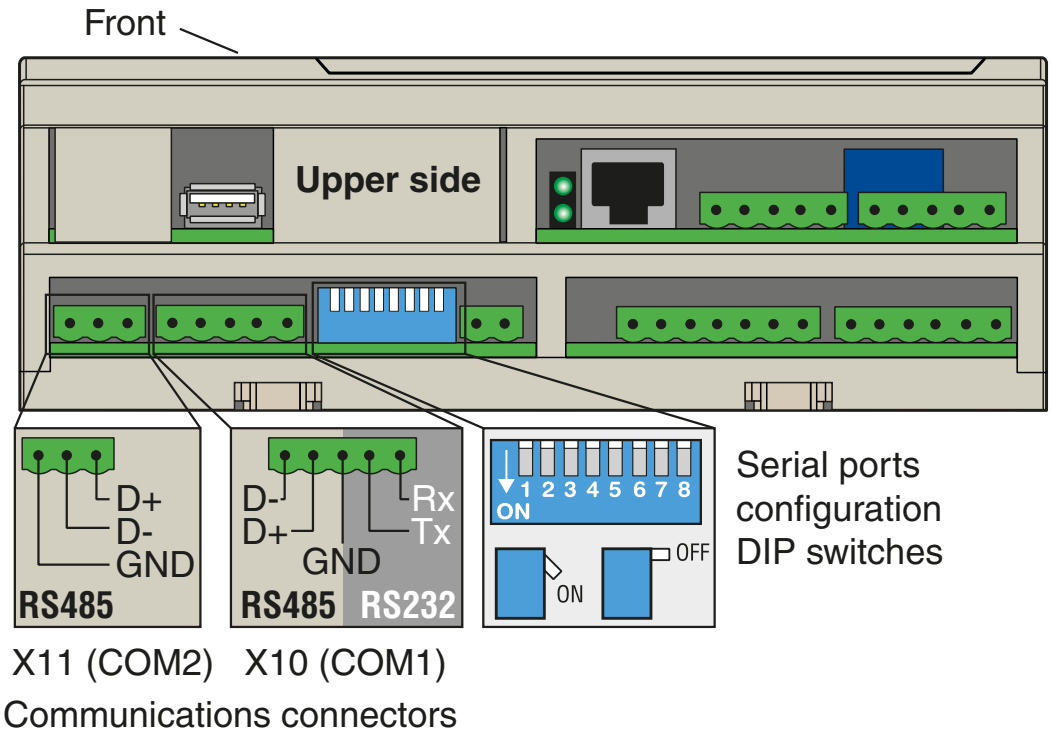


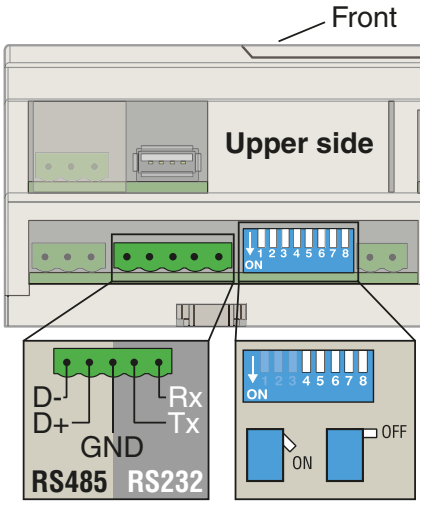
Figure 4.1 - Position of the serial port configuration DIP switches

4-1-1 Configuring the COM1Port

The **X10** COM1 Port can be used to configure the CPU using a VT100 terminal. The RS232/485 COM1 connector is located in the upper-right side of the CPU. Looking at the connector, the 5 terminals are arranged as illustrated.

The signals present on the COM1 Port terminals are (as printed on M81 case):

Signal
D+ (RS485)
D- (RS485)
GND (RS485)
GND (RS232)
RX (RS232)
TX (RS232)



X10 (COM1) connector

Some operational hardware settings of the COM1 Port can be configured using DIP switches 4... 8. 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:

Switch	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 **X10** 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 21* for details).

Caution

The RS232 cable must be shorter than 15 m.

4-2 Connect the Setup Terminal

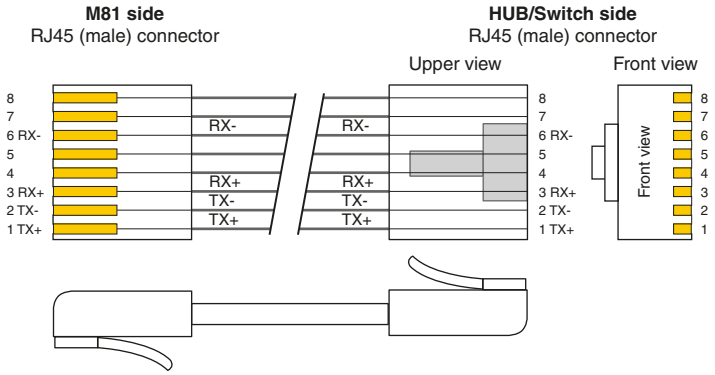
At start-up, the system starts a configuration session to perform the setup of the system module and configure the system I/Os. Setup data can be inserted using two different instruments:

- A Personal Computer using a Telnet session connected to the Ethernet port of the System Unit (ETHERNET connector).
- A VT100 terminal or a Personal Computer with Hyper Terminal program and connected to the optional RS232 port of the Base Unit (X10 connector);

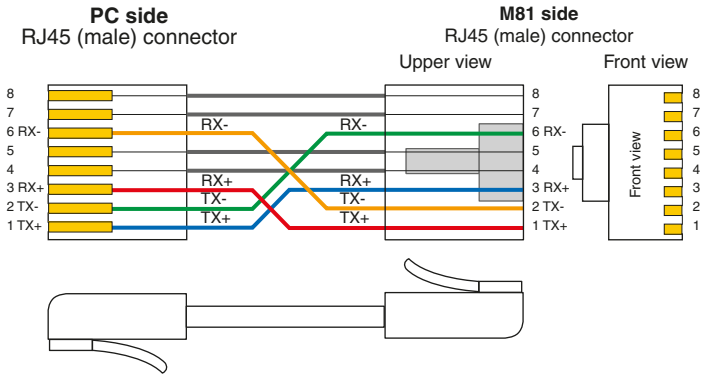
4-2-1 Telnet Communications Connection

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 (M81 -> HUB/Switch -> PC).**
   Connect to the **ETHERNET** 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 **ETHERNET** connector crossed LAN cable to connect the Basic Unit directly to the PC:



WARNING

Even if many Personal Computers (and ETHERNET switches) are able to manage the connection switching the signals to match the type of connection made (straight or crossed), is suggested to use the correct type of cable.

Once the PC is connected to the basic unit, start the Telnet program in order to communicate with the M81 and begin the setup session.

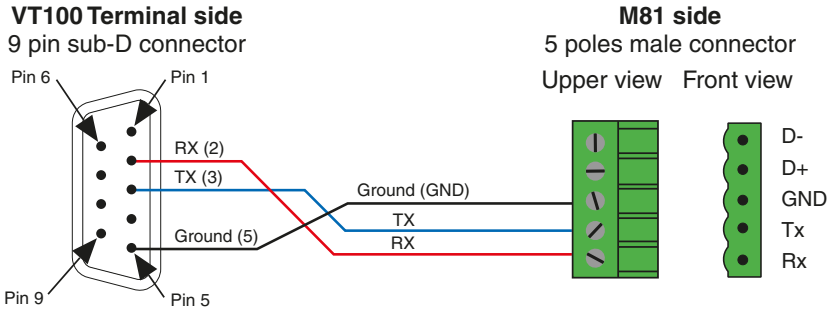
4-2-2 Connect the serial setup terminal

Depending to the configuration, the user should:

- Set the **X10** port as RS232;
- Provide the proper communication connection cable;
- Set the correct communications parameters;
- Run the communications program.

RS232 Serial Communications Connection

A VT100 terminal or a PC with Hyper Terminal program, can be connected to the **X10** port through an RS232 cable with the following characteristics:



Setting the comm.s parameters

The HyperTerminal must be configured accordingly to the communication port desired. When the Personal Computer has no serial ports, the connection can be made through an USB-Serial adapter; the COM number assigned 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 to match those of the service port:

Baud rate	9600
Data	8 bit
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 21* for details).
If the communications parameters of the system are modified, those of the terminal (or PC) must be changed accordingly.

4-3 Configuring the Modbus Connections

WARNING

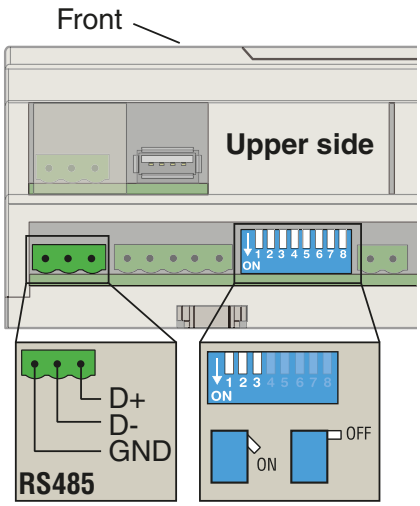
The data blocks transmitted by M81 on the Mobus slave RTU/TCP on the communication ports are 44 WORD (22 REAL) lenght maximum. Pay particular attention when connecting the CPU on a Modbus network in order to verify that the Modbus Master/Client uses a block length compatible with the one indicated (less than or equal to 44 WORD).

4-3-1 Configuring the COM2 Modbus Port

When present, the COM2 Port can be used for Modbus communications.
The RS485 Port connector is located in the upper-right side of the CPU. Looking at the connector, the 3 terminals are arranged as illustrated in the drawing.

The signals present on the COM2 Port terminals are (as printed on M81 case):

Signal
D+ (RS485)
D- (RS485)
GND (RS485)



X11 (COM2) connector

Some operational hardware settings of the COM2 Port can be configured using DIP switches 1...3. Please note that the ON/OFF position is pointed out by an arrow printed on the selectors block.

The following table describes the possible options.

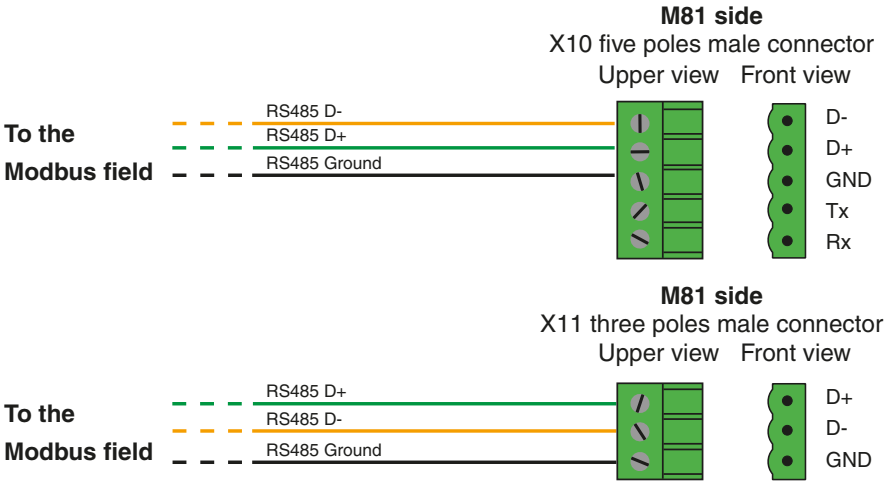
Switch	ON	OFF
1	Termination resistance (ON/OFF) (110Ω) (default disabled = OFF)	
2	Line polarization Pull-Down (ON/OFF) (default disabled = OFF)	
3	Line polarization Pull-Up(ON/OFF) (default disabled = OFF)	

WARNING

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

4-3-2 Connecting the Modbus Ports

To connect an RS485 Modbus fieldbus (through the **X10** and/or **X11** ports), use cables with the following characteristics:



Chapter 5
CPU Configuration Session

At Power ON, 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 with an Hyper Terminal program or a Personal Computer with a Telnet client.

5-1 Connect the Setup Terminal

There are 2 ports available on the CPU to enter the configuration session: the **X10** COM port in case of serial connection or the **X16** ETHERNET port.
Depending on the setup method used, the user must:

- Set the **X10** or the **X16** port (consult the "*M81 Installation Manual*" **[9]** for details);
- Get the proper connection cable;
- Set the correct communications parameters;
- Run the communication program.

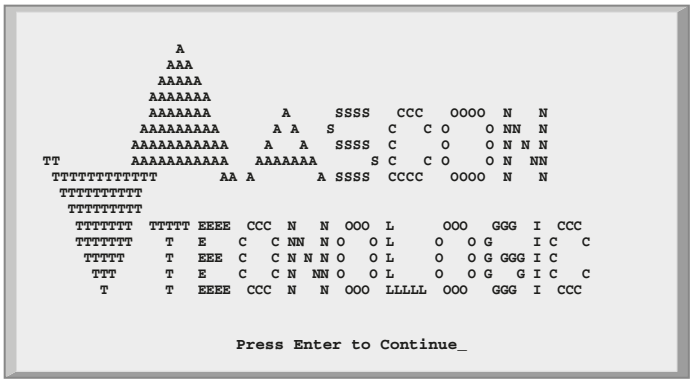
Caution
Chapter 4 describes the connection set up details and communication ports configuration.

Once the setup terminal (VT100 or PC) is correctly connected to the M81 basic unit, the user can start the configuration session.

5-1-1 Starting the Configuration Session

Accessing the Main Menu

To start the Configuration 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 exits the configuration session and runs the PLC application. In this chapter some screens of a configuration session are shown.
After the acnowledgement 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 30 seconds timeout if NO KEY is pressed; 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 closed automatically and the PLC application will be started.
Both the described timeouts can be set during the configuration session. The user should not set too short timeouts to avoid undesired abort of the configuation session. 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**.

5-2 CPU Main Menu

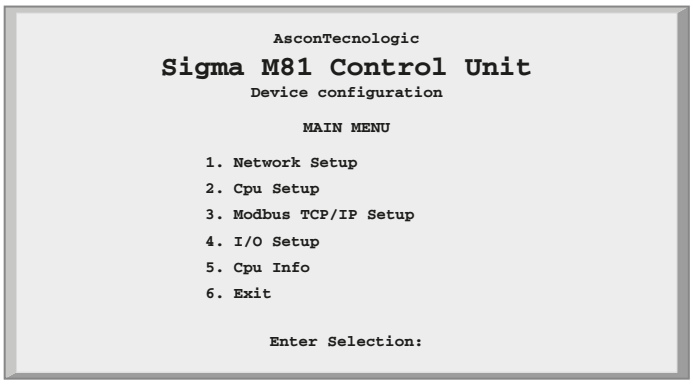


Figure 5.1 - Base Unit configuration Main Menu

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

Network Setup	CPU communication ports settings
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

5-2-1 Network Setup Menu

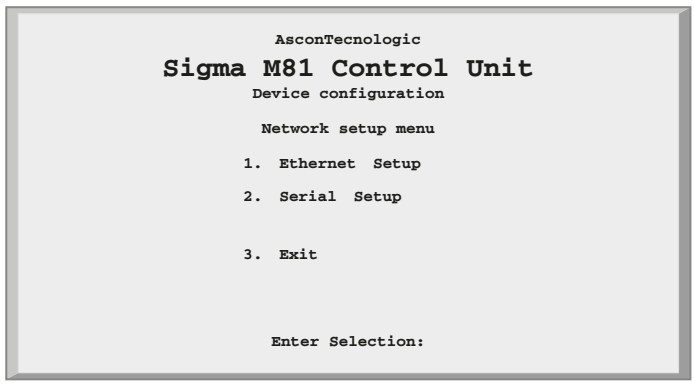


Figure 5.2 - Network Setup Menu

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

5-2-2 Ethernet Setup Menu

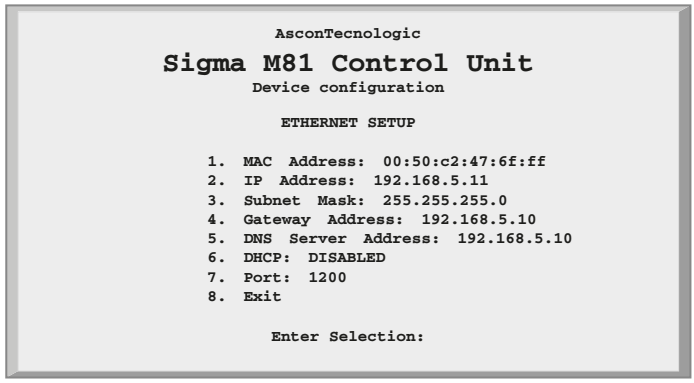


Figure 5.3 - Ethernet Setup Menu

MAC Address	Device MAC Address Values
IP Address	Device IP Address
Subnet Mask	Device subnet mask
Gateway Address	Network Gateway Address
DNS Server Address	DNS Server Address
DHCP	DHCP Protocol Enable/Disable
Port	OpenPCS Logic Port Number
Exit	Return to previous menu

5-2-3 Serial Setup Menu

This menu must be used to configure the RS232 serial port (COM1) to different values from the default (9600 baud/s, no parity, 1 stop bit) for the COM1 port.

WARNING

The Serial Setup Menu configures the COM1 serial port parameters for configuration purposes only. The type (RS232/RS485) of the COM1 (X10 connector) can be changed using the DIP switches located nearby the Serial port communications connectors. See the installation manual for futher details.

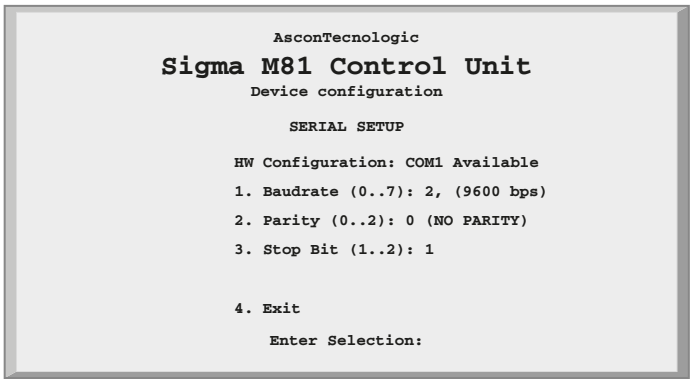


Figure 5.4 - Serial Setup Menu

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	

5-2-4 CPU Setup Menu

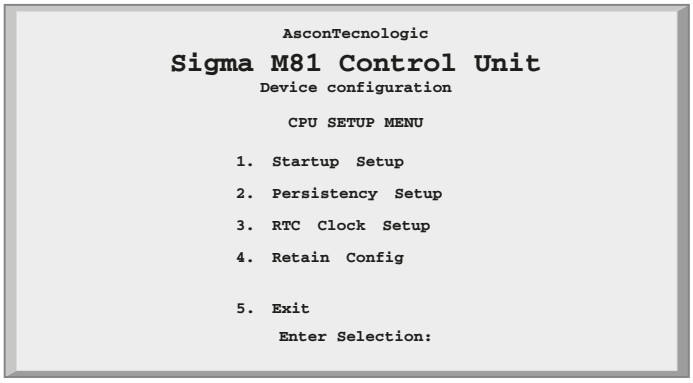


Figure 5.5 - CPU Setup Menu

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

5-2-5 Startup Setup Menu

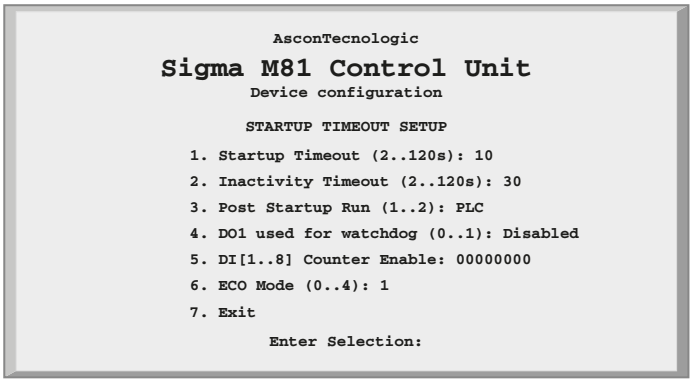


Figure 5.6 - Startup Setup Menu

Startup Timeout	Timeframe window to enter the startup session
Inactivity Timeout	Inactivity Timeout (please see *3-1-3* for details)
Post Startup Run	After the startup session will run the PLC program or the I/O Watching window (1 = PLC, 2 = I/O Watch)
DO3 used by watchdog	If enabled, the digital output DO3 is reserved to the specific function block for the watchdog event
DI[1...8] Counter Enable	A counter function can be enabled for each digital input (0 = counter disabled, 1 = counter enabled)
ECO Mode	Activates relays PWM management for energy saving and prevent overheating
Exit	Return to previous menu

5-2-6 Persistency Setup Menu

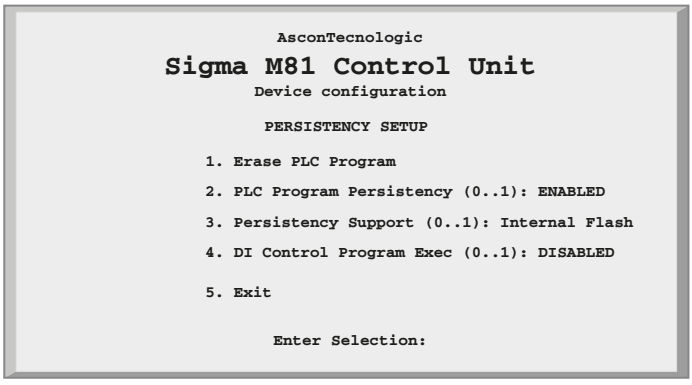


Figure 5.7 - Pesistency Setup Menu

Erase PLC Program	Command to erase the resident PLC program in the flash memory
PLC Program Persistency	Stores a valid PLC program in the flash memory
Persistency Support	Media on which the persistent copy of the PLC program is present (0 = Internal Flash Memory; 1 = USB Mass Storage Device)
DI Control Program Exec	Enables PLC program RUN/STOP function on DI1
Exit	Return to previous menu

The CPU can save the PLC program in a persistent memory support. Every time the user downloads a new program into the CPU (during the development activities), it is saved permanently and at next device start up, the stored program will be executed. The selection "*Erase PLC program*" deletes the stored PLC program. This activity can take several seconds. When the "*Persistency setup menu*" screen reappears then the PLC program has been erased.

5-2-7 RTC Clock Setup Menu

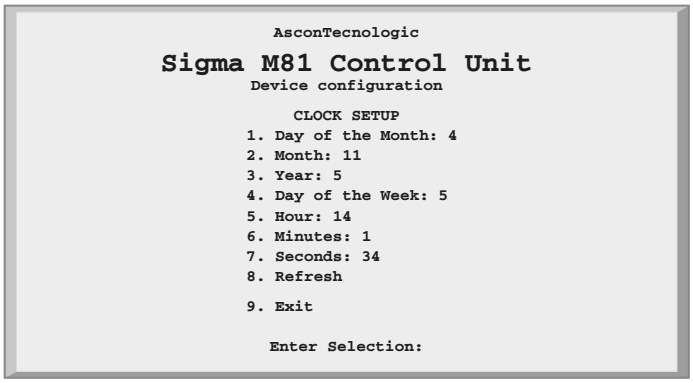


Figure 5.8 - Clock Setup

Day of the Month	Sets the day of the month number
Month	Sets the month of the year number
Year	Sets the last 2 digits of the year
Day of the Week	Sets the day of the week number (monday = 1)
Hour	Sets the Hour value (based on the 24 h format)
Minutes	Sets the Minutes value
Seconds	Sets the Seconds value
Refresh	Command to refresh the clock values
Exit	Return to previous menu

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

5-2-8 Retain Config

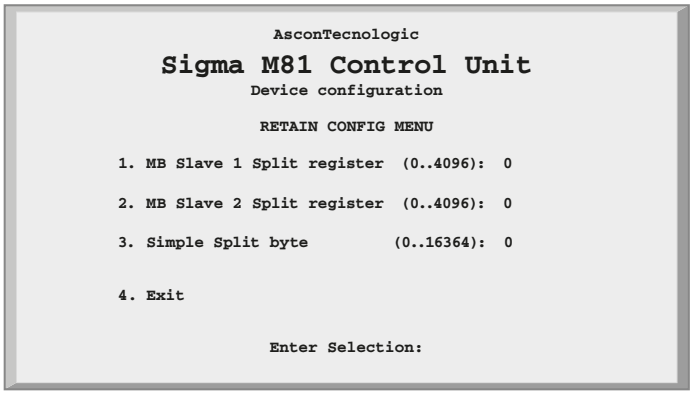


Figure 5.9 - Retain Config Menu

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 tool allows to declare retentive variables using specific files and syntax. These variables are saved and loaded from/to the 32kB size memory (for security reasons, the memory is duplicated for redundancy and refreshed during runtime operations). Differently, it is possible to declare variables up to 16 kB in the % marker memory area (8192 Bytes for each Modbus slave agent).

The standard memory locations available as retentive variables can be accessible by using the specific IEC 1131 data-types, up to the maximum amount normally available for each Modbus agent (Slave 1 and Slave 2).

In particular, the range available as retentive are:

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

Slave 1 4096 registers	Slave 2 4096 registers	Marker 16364 bytes

Figure 5.10 - 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 area, to be saved as retentive.
From the main menu select "*CPU setup*" -> "*Retain Config*".

The "*Retain Config*" menu allows to specify the split point between the ones to be retained and the standard memory location.

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

It is possibile to upload or download both the retentive memory areas, standard and/or percentage variables, using a TFTP session. The timeframe window to perform this operation is available only during the boot-up phase before the configuration session. To upload or download the retentive memory files, please follow the procedure described at paragraph: "*Chapter 9 - TFTP Protocol Access" on page 45*.

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

During PLC program execution is possible to verify some operational information. In particular:

%M0.0 : Battery status (**1** = low, **0** = OK);
%M0.1 : Standard retain memory status (**1** = corrupted, **0** = OK);
%M0.2 : Percentage retain memory status (**1** = corrupted, **0** = OK);
%M0.3 : Error reading the Production Code.

The battery status is checked at Power ON and runtime on daily bases. The remaining two bits are updated at startup and the value remains unchanged after a warm or a cold startup.

5-2-9 Modbus TCP/IP Setup

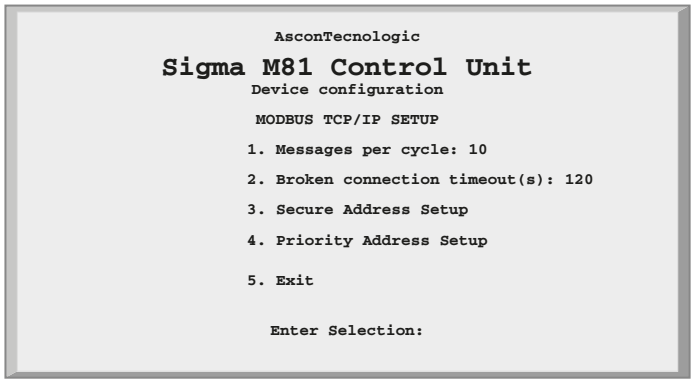


Figure 5.11 - Modbus TCP/IP Setup Menu

Messages per Cycle	Max. 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 status 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 reset;
2. If timeout expires, a "test" message is sent in order to verify if the connection is still active;
3. If an answer to the "test" is received, then the timeout is reset;
4. In case of no answer, the "test" will be sent again three times, every 10 s;
5. After the fourth "test" has received no answer the connection will be closed.

5-2-10 Modbus TC/IP Secure Addresses Table Menu

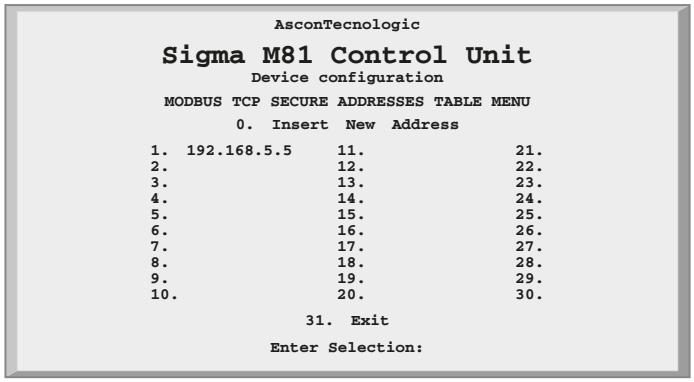


Figure 5.12 - Modbus TCP/IP Secure Addresses Table Menu

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 Modbus TCP/IP server.
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.

5-2-11 Modbus TC/IP Priority Addresses Table Menu

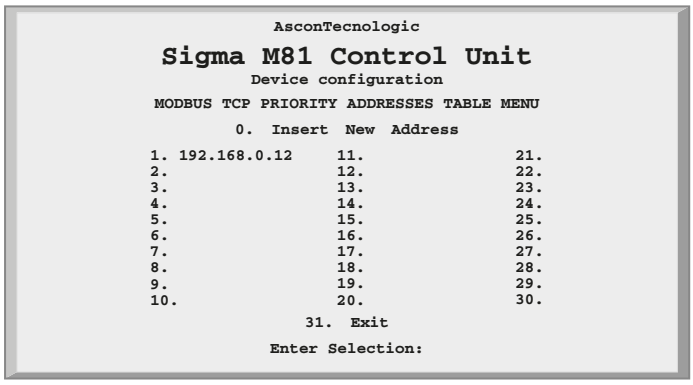


Figure 5.13 - Modbus TCP/IP Secure Addresses Table Menu

The procedure to insert the desired values is the same as described above for the "*Secure address table*". Addresses inserted in the "*Priority connection table*" are managed in a specific way. The Modbus TCP/IP server agent can support up to 10 TCP connections at the same time. When a new connection request is made and all available connections are used, the system will close one of the present active connections to satisfy the new request. Addresses not belonging to the "*Priority connection table*" will be closed first, followed by those which have been inactive longest.

5-2-12 Local I/O Setup Menu

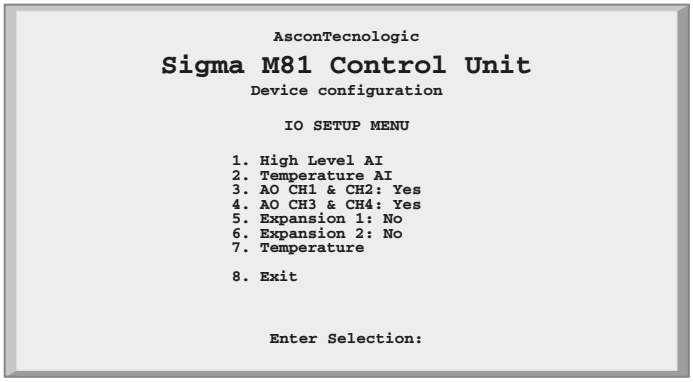


Figure 5.14 - I/O Setup Menu

High Level AI	High Level (V, mA) Analogue Inputs Configuration
Temperature AI	Temperature (NTC, Pt1000) Analogue Inputs Configuration
AO CH1 & CH2	Analogue Outputs 1 and 2 Configuration
AO CH3 & CH4	Analogue Outputs 3 and 4 Configuration
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 Sensor
Exit	Return to previous menu

5-2-13 Setting the I/O Channels

Standard AI Menu

Select a Standard AI Channel

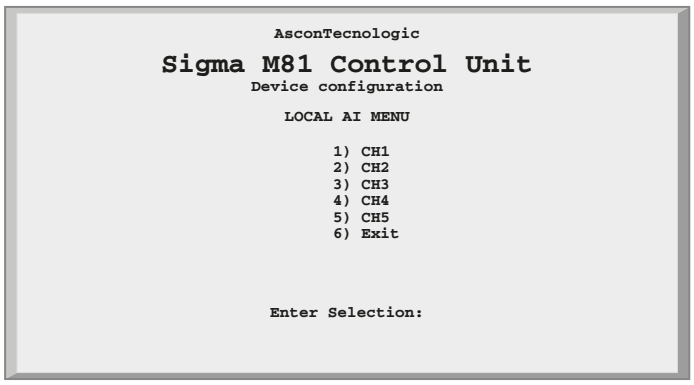


Figure 5.15 - Standard AI Selection Menu

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 (ratiometric only)
Exit	Return to previous menu

Note: Channel 5 is internally connected to a 5 Volts generator which must be connected to ratiometric sensors, therefore input 5 is always configured as input in Volts.

Setup the Selected AI Channel

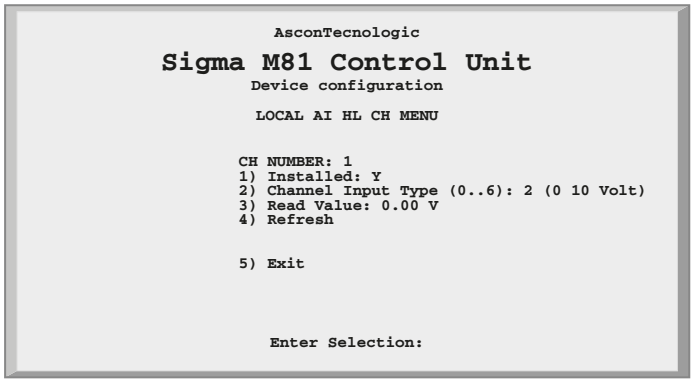


Figure 5.16 - Local Analogue Input High Level Setup Menu

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... +5 V
	1	1...+5 V
	2	0...+10 V
	3	2... 10 V
	4	0...+20 mA
	5	4...+20 mA
	6	Ratiometric (with 5 V generator)
Read Value	Read the Input value	
Refresh	Refresh command to update the "*Read Value*" item	
Exit	Return to previous menu	

Note: The setup menu of all the 4 high level input channels is as described in the table.

Temperature Analogue Input Menu

Select a Temperature Analogue Input Channel

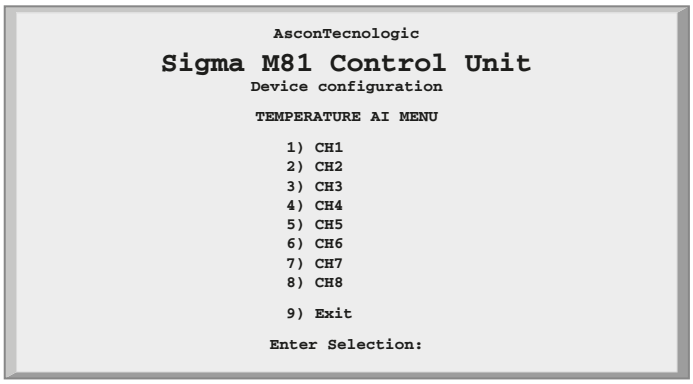


Figure 5.17 - Temperature AI Selection Menu

Ch1	Temperature Input Channel 1 Configuration
Ch2	Temperature Input Channel 2 Configuration
Ch3	Temperature Input Channel 3 Configuration
Ch4	Temperature Input Channel 4 Configuration
Ch5	Temperature Input Channel 5 Configuration
Ch6	Temperature Input Channel 6 Configuration
Ch7	Temperature Input Channel 7 Configuration
Ch8	Temperature Input Channel 8 Configuration
Exit	Return to previous menu

Setup Temperature Channels

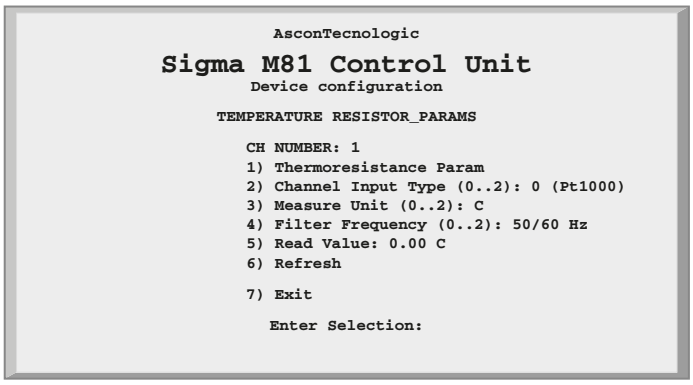


Figure 5.18 - Temperature AI Setup Menu

CH Number	Chosen Analogue Input Channel (**Note**)	
Channel Input Type	**Analogue Input Type**	
	Possible values	
	Value	**Type**
	0	Pt1000 (-200... +850°C)
	1	NTC SEMITEC 103AT-2 (-40... +125°C)
	2	NTC Custom
Measure Unit	Unit measured (0 = °C, 1 = °K, 2 = °F)	
Filter Frequency	Filtered frequency (0 = 50/60 Hz, 1 = 50 Hz, 2 = 60 Hz)	
Read Value	Read the Input value	
Refresh	Refresh command to update the "*Read Value*" item	
Exit	Return to previous menu	

Note: The setup menu of all the 8 Temperature input channels is as described in the table.

NTC custom linearization Menu

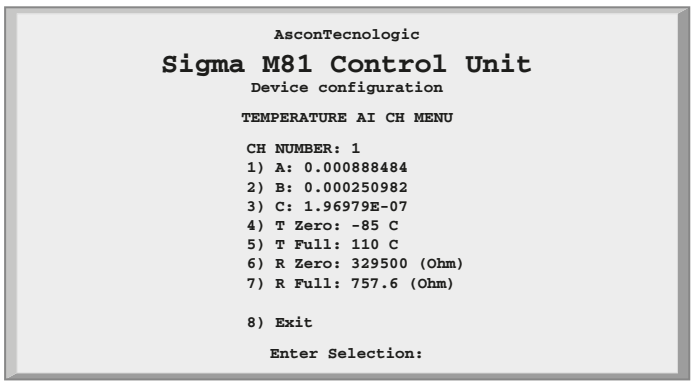


Figure 5.19 - NTC custom linearization Menu

CH Number	Chosen Analogue Input Channel (**Note**)
A	Parameters for the NTC custom linearization as temperature input probe. A, B, C are those characteristic parameters of Steinhart-Hart equation with which is performed the linearization of the NTC
B	
C	
T Zero	Start of temperature measure range (low range)
T Full	End of temperature measure range (high range)
R Zero	Probe resistance at low range
R Full	Probe resistance at high range
Exit	Return to previous menu

Note: The setup menu of the 8 Temperature input channels (when set as NTC custom) is as described in the table.

5-2-14 AO Channel 1 & Channel 2 Menu

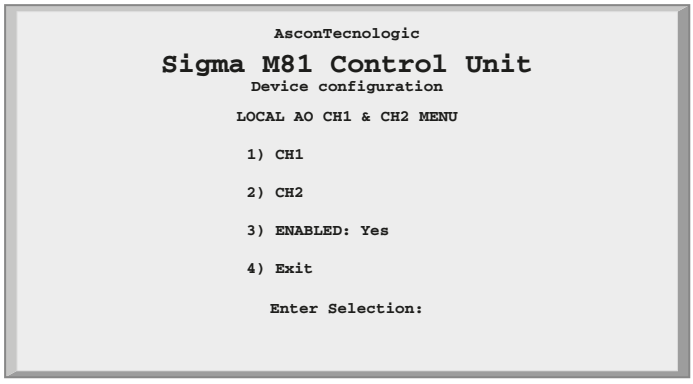


Figure 5.20 - AO Channel 1 & Channel 2 Menu

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

5-2-15 AO Channel 3 & Channel 4 Menu

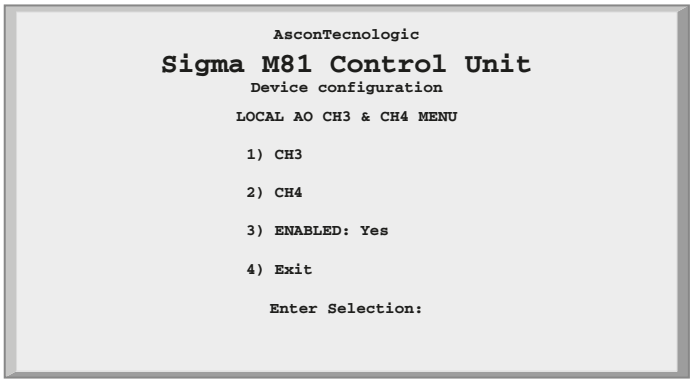


Figure 5.21 - AO Channel 3 & Channel 4 Menu

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

AO Channels Setup Menu

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

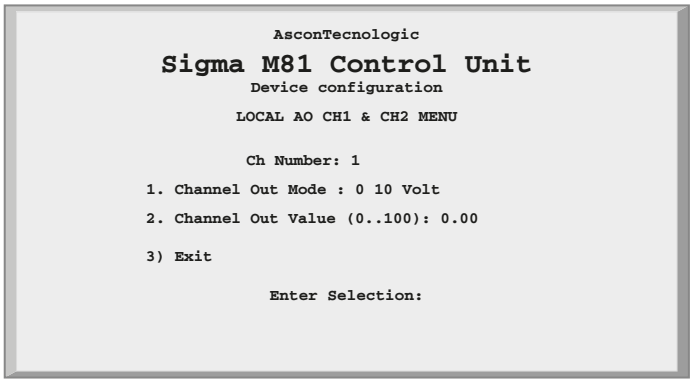


Figure 5.22 - AO Setup Menu

Ch number	Chosen Analogue Output Channel (**Note**)	
Channel Out Mode	**Analogue Output Type**	
	Value	**Type**
	0	0... +10 V (warning)
Channel Out Value	Field to be used to set temporary the analogue output value: please note that the range of the value is 0... 100% for single polarity signals	
Exit	Return to previous menu	

Caution

The only option available is 0... 10 Volts analogue output.
No other option can be selected.

5-2-16 Internal Temperature Menu

To acquire the internal temperature, the M81 CPU is equipped with a thermistor. The value can be read through the “Temperature Menu”.

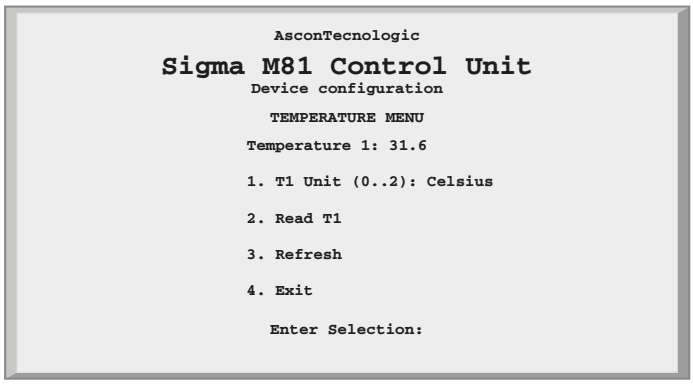


Figure 5.23 - Temperature Menu

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

5-2-17 CPU Info Menu

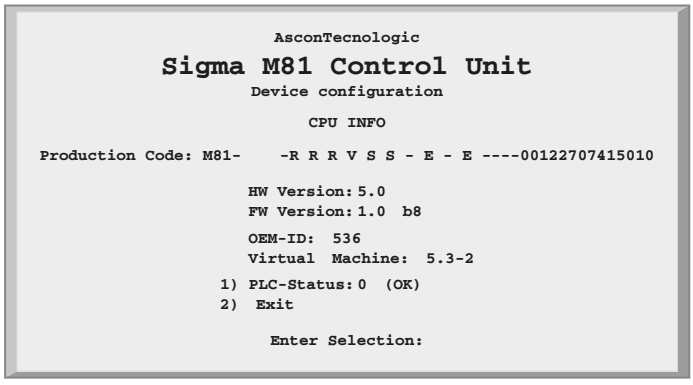


Figure 5.24 - CPU Info

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 errors	
	Possible Errors 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
	8	**(Flash) File System Error (FSE)**
	9	FSE + DCE
	10	FSE + RE
	11	FSE + RE + DCE
	12	FSE + BL
	13	FSE + BL + DCE
	14	FSE + BL+ RE
	15	FSE + BL + RE + DCE
	16	**Error Retain Data % (ER)**
	17	ER + DCE
	18	ER + RE
	19	ER + RE + DCE
	20	ER + BL
	21	ER + BL + DCE
	22	ER + BL + RE
	23	ER + BL + RE + DCE
	24	ER + FSE
	25	ER + FSE + DCE
	26	ER + FSE + RE
	27	ER + FSE + RE + DCE
	28	ER + FSE + BL
	29	ER + FSE + BL + DCE
	30	ER + FSE + BL + RE
	31	ER + FSE + 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 "*Chapter 9 - CPU TFTP File Access" on page 45*" for details).

Active errors are acknowledged by entering **1** and the **return** key while displaying the "*CPU Info*" screen.

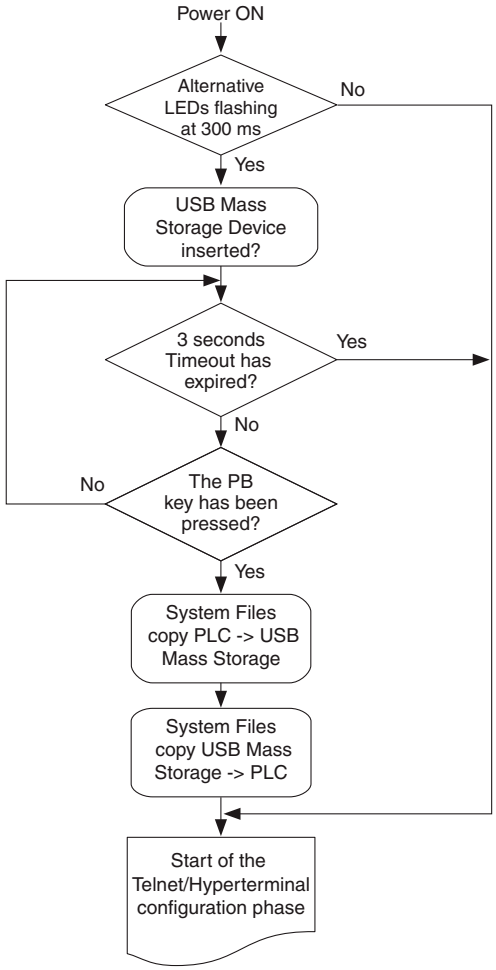
Chapter 6
USB Mass Storage Device

6-1 Configuring the CPU with the USB Mass Storage Device

The instrument can use an USB Mass Storage Device (***USB key***) to download/ upload to/from the PLC system configuration/application files. Both processes take place at the same instant as a result of a specific sequence of actions.

6-1-1 Boostrap sequence

The flowchart that follows illustrates the activities that are performed after the power ON and before to start the system configuration session (via telnet/ hyperterminal).



6-1-2 Upload of the status, configuration and program files from the PLC

At the end of the bootstrap phase, the PLC copies some files in the USB key (if present).

File location in the PLC	File location in the USB key
/fs1/restore_file	**1**:/sys_sts/apl_rest.bin
/fs1/sys_file	**1**:/sys_sts/sys_conf.bin
/fs1/errlog_file	**1**:/sys_sts/err_log.bin
/fs2/perc_ret	**1**:/sys_sts/retper_v.bin
/fs2/retain	**1**:/sys_sts/ret_var.bin

Note: "**1**:" identifies the drive letter assigned to the USB key by the File System.

6-1-3 Download of the status, configuration and program files in the PLC

Once the copy activity described in paragraph 4.1.2 has ended, the system copies some files from the USB key (if present) to the PLC memory.

File location in the USB key	File location in the PLC
1:/cnfg_sys/apl_rest.bin	/fs1/restore_file
1:/cnfg_sys/sys_conf.bin	/fs1/sys_file
1:/cnfg_sys/ret_var.bin	/fs2/retain
1:/cnfg_sys/retper_v.bin	/fs2/perc_ret

Note: "**1:**" identifies the drive letter assigned to the USB key by the File System.

6-1-4 File system support for the PLC application

Application file executed by the PLC

The program executed by the PLC may reside in the internal Flash file system or in the USB key. The memory support where the program will be present can be set in the "**Persistency Menu**" using the Setup terminal.

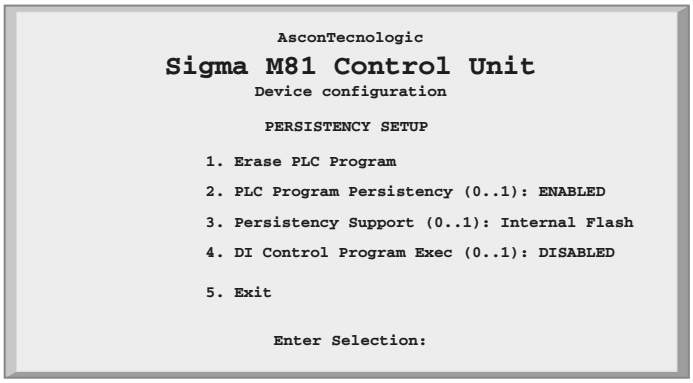


Figure 6.1 - Pesistency Setup Menu

Through the"**Persistency Support**" parameter the user can set the area where a persistent copy of the PLC program will be saved.

If the user sets the parameter "Persistency Support" to "0", the program will be saved in the Internal Flash Memory of the PLC. Seting the parameter to value "1" the program will be saved in the USB Key.

If the user selects to save the PLC application in the USB Key, the address where the program file is saved is:
applic/res_file.bin

If the user selects to save the PLC application in the Internal Flash memory, the address where the program file is saved is:
`fs1/restore_file`

Application file generated by OpenPCS

The binary application file generated using OpenPCS (standard IEC61131 compliant) to be downloaded via tftp to the instrument is in the "**`$GEN$/Resource`**" directory of each project. The procedure for downloading the file is:

- Open a tftp client, set the IP address and port (69) of the device you want to connect;
- Execute a "**put**" command where the source file name will be:
  `project_root/$GEN$/Resource/Resource.prs`
  while the name of the output file will be:
  `/fs1/restore_file`
  for the Flash file system, or
  `1:applic/res_file.bin`
  for the USB Key.

Chapter 7
CPU Diagnostic Tests

7-1 Accessing the diagnostic session

The M81 unit provides the user with a diagnostic session in order to test the on-board I/Os. It can be activated from the STARTUP TIMEOUT MENU using the entry "**Post Startup Run**".

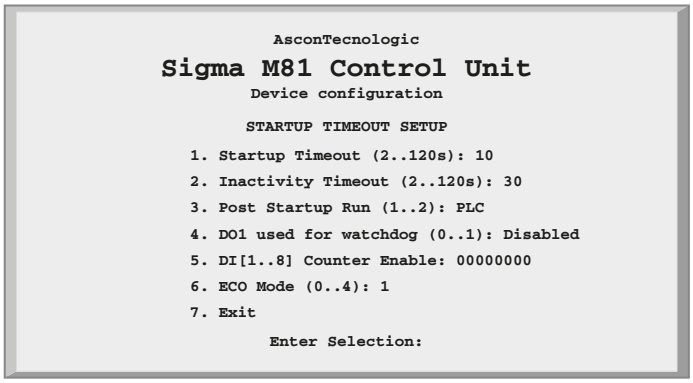


Figure 7.1 - Startup Setup Menu

To run the "*Diagnostic Watch Window*", the value "*I/O Watch*" must be set to the value "**2**". 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 selected option.

7-2 I/O Watch Window

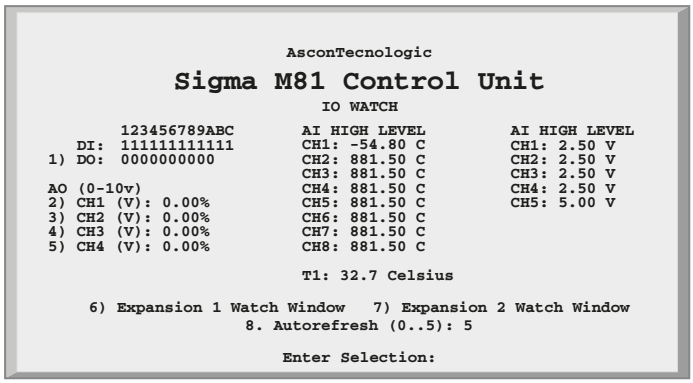


Figure 7.2 - I/O Watch Window

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

- Read the analogue input values in engineering format;
- Read the digital input values as bit mask;
- Display/Set the analogue output values in percentage (0...100);
- Display/Set the digital outputs as bit mask;

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	Refresh Time Value (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	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8
Desired value	0	0	1	0	0	0	1	1
Enter selection	1							
Insert new value	00100011							

Analogue Output Channels

Ch1 **Output Type:** 0...10 V
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 8
Programming the CPU

8-1 Installing OpenPCS

8-1-1 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 x 768 resolution;
- Windows server 2003, Windows XP SP2, Windows Vista (32 bit) and Windows 7 (32 or 64 bit).

8-1-2 Installation

The programming tool is provided within the AT Automation Suite CD. 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_663e.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' mode.

8-1-3 Starting OpenPCS

Start Windows and choose:

Start → Programs → infoteam OpenPCS 2008 → infoteam OpenPCS 2008

in the start-menu to open the Framework or double click on the specific icon from your desktop.

8-1-4 Configuring OpenPCS

In order to work with the Ascon Tecnologic CPU target, you must install in OpenPCS a **cab** file. The file **AT_sigmadue_zzzz.cab** contains all the files describing 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. AT_sigmadue_2012.cab), then "*Install*".

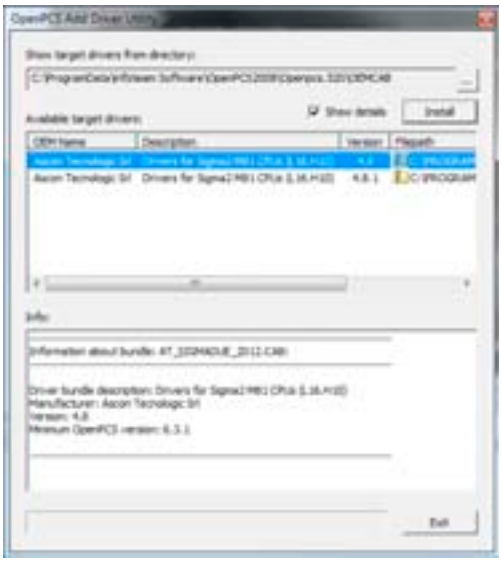


Figure 8.1 - OpenPCS OEM Driver Installation

8-2 OpenPCS Setup

To connect the OpenPCS tool to the Ascon Tecnologic target, a connection should be defined. The installation procedure creates itself a connection.
In case a new one, 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 assign a name to the connection.
By pushing the "*Select*" button you can pick the driver that manages the communication with the target: for Ascon Tecnologic CPU is TCP52.

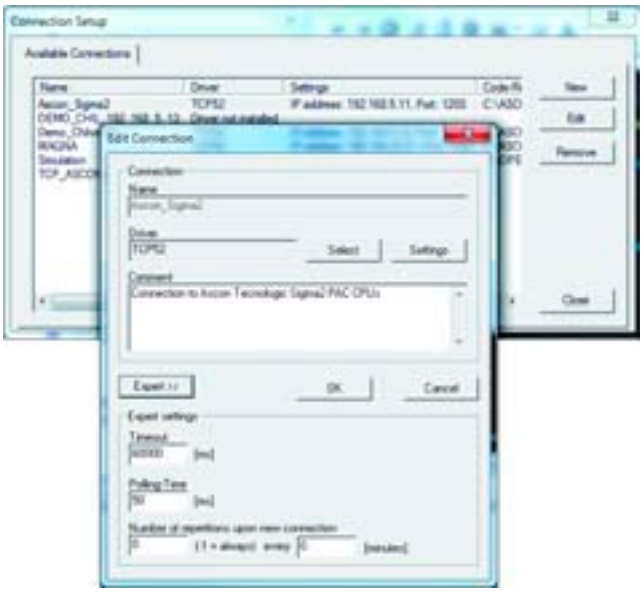


Figure 8.2 - OpenPCS Connection Setup

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

Figure 8.3 - TCP Settings

The Port number and IP address must be the same as those configured from the initial CPU configuration session. See the Ethernet setup menu, items 2 and 7 (see *"Figure 5.3 - Ethernet Setup Menu"* for details).
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 8.4 - OpenPCS resource Specifications

The "*Optimization*" option menu allows to select between three compilation choices: "*Normal*" and "*Speed only*" refers to the NCC (Native Code Compiler), 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 20000 ms can be increased by using the following register key:

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

8-3 Communication Ports Protocols

sigma**due** M81 has various communication ports and protocols. The combinations of ports and protocols are shown below:

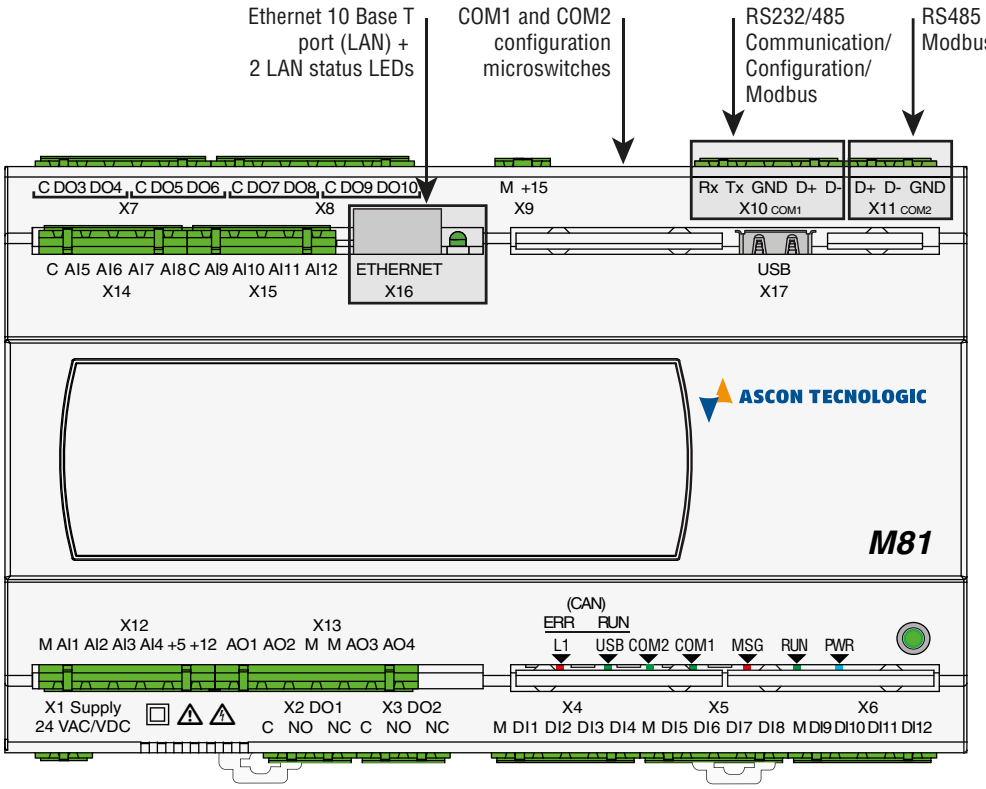


Figure 8.5 - Communication Ports and associated Protocols.

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

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

8-4 Watchdog Timer

Ascon Tecnologic M81 contains a watchdog control, managed by 2 specific FBs (WATCHDOG_SET and WATCHDOG_STATUS).
Watchdog is a down counter that is reset every program cycle. When the count value reaches zero, two different operational modes may be set:

- CPU keeps ON the program execution, it stores the event and forces the DO3 if enabled (please see *"5-2-5 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 from the PLC program. Therefore, if the program stops, the timer is still active and behaves as programmed when the counter reaches zero.
The output of the Watchdog timer can be adderssed to the DO3 relay output.

Chapter 9
CPU TFTP File Access

9-1 TFTP Protocol Access

The M81 unit allows the user to access the internal device file system using a TFTP (Trivial File Transfer Protocol) client.

All files in the Internal Flash Memory present in the instrument and those in the FAT File System of the USB Key can be reached through the TFTP protocol on **port 69** of the Ethernet connection.

As well as for the other files, the user can also download the PLC data logging one.

Caution
Working with large files on the USB key is a very slow procedure that impacts the whole cycle time of the application. **For this reason, it is STRONGLY recommended to not exceed 120 MB maximum as data - logging file dimension!**

With TFTP protocol it is possible to upload/download the device configuration, IEC61131 program, retained variables and log files to/from the PLC.
For security reasons, the name and the number of the accessible files is limited and fixed. The following table lists the Internal Flash Memory accessible files:

File Name	Description
/fs1/restore_file	IEC61131 program file name
/fs1/sys_file	Configuration file
/fs1/prodstr_file	Product identifcation file
/fs1/errlog_file	RUNTIME errors file name
/fs2/retain	Classic retained variable file name
/fs2/perc_ret	% retained variable file name
/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.

WARNING

The ***Configuration file*** (*/fs1/sys_file*) contains specific information about the system hardware and must not be changed, otherwise a memory mismatch may occur.

Caution

The ***Reset Command file*** (*/fs2/reset*) activates the CPU reset command.
The access to the /fs2/reset file using the tftp connection causes the instantaneous reset of the CPU.

To connect the unit, the user needs the device IP address (see *“Ethernet Setup Menu” on page 21* for details) and the logic port used, which is always **69** for the TFTP. The TFTP protocol has only two different services:

- GET (upload)
- PUT (download)

The GET service allows the user to upload a file from the M81 unit, while the PUT service allows files to be downloaded. Using the TFTP client available with Windows (see *C:\Windows\System32\tftp.exe*) the possible commands are:

- To GET a file from the M81
  tftp –i <remote host address> get <remote file_name><local file name>
- To PUT a file into the M81
  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 M81 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 M81 is 192.168.5.11.

If the user wants to PUT the IEC61131 program file into the M81 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”.

Alternatively, the “free software” called Tftpd32 (or 64 in case of 64 bit OS) provides a nice graphical interface in order to perform the same above described operations.

9-2 IEC61131-3 OpenPCS Runtime Errors log file

Sometimes 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 uploaded from the M81. 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	23-04-12	2002
Wed	16:37:25	23-04-12	2002
Wed	16:36:36	23-04-12	2001
Thu	11:56:29	22-04-12	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
kLzsIpVerError	1019
kLzsIpExecError	1020
kLzsNcExecError	1021
kLzsNoBkupMem	1022
kLzsIOConfigError	1023
kLzsNoHDMem	1024
kLzsNotValidInRunState	1025
kLzsCycleLengthExceeded	1101
kLzsRtxBaseTimerLengthExceeded	1102
kLzsNetErrorLastSession	1103
kLzsUplErrorNotEnabled	1104
kLzsHistNoFreeEntry	1105
kLzsHistInvalidID	1106

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

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 10
CPU Data Memory Map

The sigma**due** micro**PAC** M81 unit, has several onboard I/O points that can be easily accessed by the memory map area. The memory areas are divided into different sections:

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

Caution
Please check the M81 order Code to verify the available options in your device.

10-1 Central Unit Data

10-1-1 Digital Inputs Status (DI1... DI12)

The 12 Digital Input channels are always present on the CPU and their status can be found in a word data type at address:

Addr	Memory type	Size [Bytes]	Data type	Data
340.0	%I	2	WORD	Onboard DI status

Note: The WORD is organized like xxxx.0... xxxx.11 where the input status of DI1... DI12 are present, while xxx.15 returns the status of the button present on PLC front side (called PB as Push Button).

10-1-2 High Level Analogue Inputs (AI1... AI4)

The 4 High Level Analogue Inputs are always present on the device. The inputs Configuration is performed using the CPU Configuration Session (see Chapter 4 for details). The values present in the memory map are in engineering unit (V or mA), using a REAL 32 bit floating point format

Addr	Memory type	Size [Bytes]	Data type	Data
132.0	%I	4	REAL	AI value Channel_1
136.0	%I	4	REAL	AI value Channel_2
140.0	%I	4	REAL	AI value Channel_3
144	%I	4	REAL	AI value Channel_4

These four High Level Analogue Inputs can be configured as:

Value to be inserted in configuration Menu	Range selected
1	0... 5 V
2	1... 5 V
3	0... 10 V
4	2... 10 V
5	0... 20 mA
6	4... 20 mA
7	Ratiometric with 5 V generator

10-1-3 Temperature Analogue Input Value (AI5... AI12)

Also the 8 Temperature Analogue Inputs (AI05... AI12) are always present in the CPU and their value can be found in a REAL 32 bit floating point format at addresses:

Addr	Memory type	Size [Bytes]	Data type	Data
100.0	%I	4	REAL	AI value Channel_5
104.0	%I	4	REAL	AI value Channel_6
108.0	%I	4	REAL	AI value Channel_7
112.0	%I	4	REAL	AI value Channel_8
116.0	%I	4	REAL	AI value Channel_9
120.0	%I	4	REAL	AI value Channel_10
124.0	%I	4	REAL	AI value Channel_11
128.0	%I	4	REAL	AI value Channel_12

The Ohm raw value of these inputs can be found at addresses:

Addr	Memory type	Size [Bytes]	Data type	Data
180.0	%I	4	REAL	AI ohm value Channel_5
184.0	%I	4	REAL	AI ohm value Channel_6
188.0	%I	4	REAL	AI ohm value Channel_7
192.0	%I	4	REAL	AI ohm value Channel_8
196.0	%I	4	REAL	AI ohm value Channel_9
200.0	%I	4	REAL	AI ohm value Channel_10

Addr	Memory type	Size [Bytes]	Data type	Data
204.0	%I	4	REAL	AI ohm value Channel_11
208.0	%I	4	REAL	AI ohm value Channel_12

10-1-4 I/O Diagnostic Status

For each analogue channel (Input and Output), the M81 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

Memory map for the input diagnostic indications:

Addr	Memory type	Size [Bytes]	Data type	Data
240.0	%I	1	BYTE	AI Status Channel_5
241.0	%I	1	BYTE	AI Status Channel_6
242.0	%I	1	BYTE	AI Status Channel_7
243.0	%I	1	BYTE	AI Status Channel_8
244.0	%I	1	BYTE	AI Status Channel_9
245.0	%I	1	BYTE	AI Status Channel_10
246.0	%I	1	BYTE	AI Status Channel_11
247.0	%I	1	BYTE	AI Status Channel_12
248.0	%I	1	BYTE	AI Status Channel_1
249.0	%I	1	BYTE	AI Status Channel_2
250.0	%I	1	BYTE	AI Status Channel_3
251.0	%I	1	BYTE	AI Status Channel_4

Memory map for the output diagnostic indications:

Addr	Memory type	Size [Bytes]	Data type	Data
260.0	%I	1	BYTE	AO Status Channel_1
261.0	%I	1	BYTE	AO Status Channel_2
262.0	%I	1	BYTE	AO Status Channel_3
263.0	%I	1	BYTE	AO Status Channel_4

10-1-5 Onboard Temperature Values

The M81 unit provides an indication about the internal temperature of the device. The data format used for the value present in the memory map is a REAL 32 bit floating point format in engineering unit (°C, °F or °K).

Addr	Memory type	Size [Bytes]	Data type	Data
216.0	%I	4	REAL	Internal Temperature Value

10-1-6 Digital Counters

In the Configuration session (please see *"5-2-5 - Startup Setup Menu" on page 23* for details) it is possible to enable a Counter function to each digital input. In memory map, there is a section where all the values of the Counters are available. The data format is the Unsigned Double INTeger (UDINT) 64 bit.

Addr	Memory type	Size [Bytes]	Data type	Data
280.0	%I	4	UDINT	Counter Channel_1
284.0	%I	4	UDINT	Counter Channel_2
288.0	%I	4	UDINT	Counter Channel_3
292.0	%I	4	UDINT	Counter Channel_4
296.0	%I	4	UDINT	Counter Channel_5
300.0	%I	4	UDINT	Counter Channel_6
304.0	%I	4	UDINT	Counter Channel_7
308.0	%I	4	UDINT	Counter Channel_8
312.0	%I	4	UDINT	Counter Channel_9
316.0	%I	4	UDINT	Counter Channel_10
320.0	%I	4	UDINT	Counter Channel_11
324.0	%I	4	UDINT	Counter Channel_12

The value of each Counter can be Reset using a specific function block inside the PLC program (see the "*Ascon Firmware Function Block Library*" for details).

10-1-7 Digital Outputs Status (DO1... DO10)

Addr	Memory type	Size [Bytes]	Data type	Data
140.0	%Q	2	WORD	Status DO onboard

10-1-8 Analogue Output Value (AO1... AO4)

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

- no analogue outputs;
- 4 analogue outputs.

Even if the AO channels are optional, the specific memory areas are anyway reseved. The values are espressed in REAL 32 bit floating point. For the active channels, the user has to write the percentage value.

Addr	Memory type	Size [Bytes]	Data type	Data
100.0	%Q	4	REAL	AO CH1
104.0	%Q	4	REAL	AO CH2
108.0	%Q	4	REAL	AO CH3
112.0	%Q	4	REAL	AO CH4

10-2 Battery and Retentive Memory Status, I/O Configuration Information

10-2-1 Battery and Retentive Memory Status

Addr.	Memory type	Size [bit]	Format	Data
0.0	%M	1	bit	Battery status (0: empty, 1: OK)
0.1	%M	1	bit	Classic Retain Menory Startup Status (0: Corrupted; 1: OK)
0.2	%M	1	bit	Percentage Retain Menory Startup Status (0: Corrupted; 1: OK)
0.3	%M	1	bit	Production Code (0: Corrupted; 1: OK)

10-2-2 I/O Configuration Information

Digital Configuration Information

Addr.	Memory Type	Size [Bytes]	Data Type	Data
3	%M	2	WORD	DI Configuration

Analogue Configuration Information

Addr	Memory type	Size [Bytes]	Data type	Data
11.0	%M	1	BYTE	AI Configuration Channel_5
12.0	%M	1	BYTE	AI Configuration Channel_6
13.0	%M	1	BYTE	AI Configuration Channel_7
14.0	%M	1	BYTE	AI Configuration Channel_8
15.0	%M	1	BYTE	AI Configuration Channel_9
16.0	%M	1	BYTE	AI Configuration Channel_10
17.0	%M	1	BYTE	AI Configuration Channel_11
18.0	%M	1	BYTE	AI Configuration Channel_12
19.0	%M	1	BYTE	AI Configuration Channel_1
20.0	%M	1	BYTE	AI Configuration Channel_2
21.0	%M	1	BYTE	AI Configuration Channel_3
22.0	%M	1	BYTE	AI Configuration Channel_4
...	...	...	...	...
31.0	%M	1	BYTE	AI Channel_5 E.U. (note)
32.0	%M	1	BYTE	AI Channel_6 E.U. (note)
33.0	%M	1	BYTE	AI Channel_7 E.U. (note)
34.0	%M	1	BYTE	AI Channel_8 E.U. (note)
35.0	%M	1	BYTE	AI Channel_9 E.U. (note)
36.0	%M	1	BYTE	AI Channel_10 E.U. (note)
37.0	%M	1	BYTE	AI Channel_11 E.U. (note)
38.0	%M	1	BYTE	AI Channel_12 E.U. (note)
...	...	...	...	...
51.0	%M	1	BYTE	AO Configuration Channel_1

Addr	Memory type	Size [Bytes]	Data type	Data
52.0	%M	1	BYTE	AO Configuration Channel_2
53.0	%M	1	BYTE	AO Configuration Channel_3
54.0	%M	1	BYTE	AO Configuration Channel_4

Note: The value of each Analogue Input channel (in engineering units) con be set as:
0 = °**C**,
1 = °**K**,
2 = °**F**.

10-2-3 Production Code Management Variables

Model Code

Addr	Memory type	Size [Bytes]	Data type	Data
100.0	%M	1	BYTE	Model Code - Character_1
...	...	...	...	...
107.0	%M	1	BYTE	Model Code - Character_8

Field Code

Addr	Memory type	Size [Bytes]	Data type	Data
108.0	%M	2	WORD	Field Code “A” - AI PRECONFIG.
110.0	%M	2	WORD	Field Code “B” - OOUT DO1
112.0	%M	2	WORD	Field Code "C" - OUT DO2
114.0	%M	2	WORD	Field Code "D" - OUT DO7..DO10
116.0	%M	2	WORD	Field Code "E" - OUT AO1..AO4
118.0	%M	2	WORD	Field Code "F" - USB PORT
120.0	%M	2	WORD	Field Code "G" - COM PORTs
122.0	%M	2	WORD	Field Code "H" - CAN PORT
124.0	%M	2	WORD	Field Code "I" - TERMINALS
126.0	%M	2	WORD	Field Code "J" - PACKAGING
128.0	%M	2	WORD	Field Code "K" - INSTRUCTIONS

HW and SW versions

Addr	Memory type	Size [Bytes]	Data type	Data
130.0	%M	2	WORD	CUSTOMIZATION - HARDWARE
132.0	%M	2	WORD	CUSTOMIZATION - SOFTWARE
134.0	%M	2	WORD	SOFTWARE - SUB VERSION

Serial Number Code

Addr	Memory type	Size [Bytes]	Data type	Data
136	%M	1	BYTE	Serial Number - Character 1
...	...	...	...	...
143.0	%M	1	BYTE	Serial Number - Character_8

HW and FW versions

Addr	Memory type	Size [Bytes]	Data type	Data
144.0	%M	2	WORD	Hardware code identifier
146.0	%M	2	WORD	Firmware code identifier
148.0	%M	2	WORD	RESERVED

10-3 Complete Memory Map

10-3-1 Input Memory Areas

Addr	Memory type	Size [Bytes]	Data type	Data
100.0	%I	4	REAL	AI value Channel_5
104.0	%I	4	REAL	AI value Channel_6
108.0	%I	4	REAL	AI value Channel_7
112.0	%I	4	REAL	AI value Channel_8
116.0	%I	4	REAL	AI value Channel_9
120.0	%I	4	REAL	AI value Channel_10
124.0	%I	4	REAL	AI value Channel_11
128.0	%I	4	REAL	AI value Channel_12
132.0	%I	4	REAL	AI value Channel_1
136.0	%I	4	REAL	AI value Channel_2
140.0	%I	4	REAL	AI value Channel_3
144.0	%I	4	REAL	AI value Channel_4
180.0	%I	4	REAL	AI ohm value Channel_5
184.0	%I	4	REAL	AI ohm value Channel_6
188.0	%I	4	REAL	AI ohm value Channel_7
192.0	%I	4	REAL	AI ohm value Channel_8
196.0	%I	4	REAL	AI ohm value Channel_9
200.0	%I	4	REAL	AI ohm value Channel_10
204.0	%I	4	REAL	AI ohm value Channel_11
208.0	%I	4	REAL	AI ohm value Channel_12
216.0	%I	4	REAL	Internal Temperature Value
240.0	%I	1	BYTE	AI Status Channel_5
241.0	%I	1	BYTE	AI Status Channel_6

Addr	Memory type	Size [Bytes]	Data type	Data
242.0	%I	1	BYTE	AI Status Channel_7
243.0	%I	1	BYTE	AI Status Channel_8
244.0	%I	1	BYTE	AI Status Channel_9
245.0	%I	1	BYTE	AI Status Channel_10
246.0	%I	1	BYTE	AI Status Channel_11
247.0	%I	1	BYTE	AI Status Channel_12
248.0	%I	1	BYTE	AI Status Channel_1
249.0	%I	1	BYTE	AI Status Channel_2
250.0	%I	1	BYTE	AI Status Channel_3
251.0	%I	1	BYTE	AI Status Channel_4
260.0	%I	1	BYTE	AO Status Channel_1
261.0	%I	1	BYTE	AO Status Channel_2
262.0	%I	1	BYTE	AO Status Channel_3
263.0	%I	1	BYTE	AO Status Channel_4
280.0	%I	4	UDINT	Counter Channel_1
284.0	%I	4	UDINT	Counter Channel_2
288.0	%I	4	UDINT	Counter Channel_3
292.0	%I	4	UDINT	Counter Channel_4
296.0	%I	4	UDINT	Counter Channel_5
300.0	%I	4	UDINT	Counter Channel_6
304.0	%I	4	UDINT	Counter Channel_7
308.0	%I	4	UDINT	Counter Channel_8
312.0	%I	4	UDINT	Counter Channel_9
316.0	%I	4	UDINT	Counter Channel_10
320.0	%I	4	UDINT	Counter Channel_11
324.0	%I	4	UDINT	Counter Channel_12
340.0	%I	2	WORD	Onboard DI status

10-3-2 Output Memory Areas

Addr	Memory type	Size [Bytes]	Data type	Data
100.0	%Q	4	REAL	AO CH1
104.0	%Q	4	REAL	AO CH2
108.0	%Q	4	REAL	AO CH3
112.0	%Q	4	REAL	AO CH4
140	%Q	2	WORD	Status DO onboard

10-3-3 Marker Memory Areas

Addr	Memory type	Size [Bytes]	Data type	Data
0.0	%M	1	bit	Battery status (0: empty, 1: OK)
0.1	%M	1	bit	Classic Retain Menory Startup Status (0: Corrupted; 1: OK)
0.2	%M	1	bit	Percentage Retain Menory Startup Status (0: Corrupted; 1: OK)

Addr	Memory type	Size [Bytes]	Data type	Data
0.3	%M	1	bit	Production Code (0: Corrupted; 1: OK)
3.0	%M	2	WORD	DI Configuration
11.0	%M	1	BYTE	AI Configuration Channel_5
12.0	%M	1	BYTE	AI Configuration Channel_6
13.0	%M	1	BYTE	AI Configuration Channel_7
14.0	%M	1	BYTE	AI Configuration Channel_8
15.0	%M	1	BYTE	AI Configuration Channel_9
16.0	%M	1	BYTE	AI Configuration Channel_10
17.0	%M	1	BYTE	AI Configuration Channel_11
18.0	%M	1	BYTE	AI Configuration Channel_12
19.0	%M	1	BYTE	AI Configuration Channel_1
20.0	%M	1	BYTE	AI Configuration Channel_2
21.0	%M	1	BYTE	AI Configuration Channel_3
22.0	%M	1	BYTE	AI Configuration Channel_4
31.0	%M	1	BYTE	AI Channel_5 E.U. (note)
32.0	%M	1	BYTE	AI Channel_6 E.U. (note)
33.0	%M	1	BYTE	AI Channel_7 E.U. (note)
34.0	%M	1	BYTE	AI Channel_8 E.U. (note)
35.0	%M	1	BYTE	AI Channel_9 E.U. (note)
36.0	%M	1	BYTE	AI Channel_10 E.U. (note)
37.0	%M	1	BYTE	AI Channel_11 E.U. (note)
38.0	%M	1	BYTE	AI Channel_12 E.U. (note)
51.0	%M	1	BYTE	AO Configuration Channel_1
52.0	%M	1	BYTE	AO Configuration Channel_2
53.0	%M	1	BYTE	AO Configuration Channel_3
54.0	%M	1	BYTE	AO Configuration Channel_4
100.0	%M	1	BYTE	Model Code - Character_1
107.0	%M	1	BYTE	Model Code - Character_8
108.0	%M	2	WORD	Field Code “A” - AI PRECONFIG.
110.0	%M	2	WORD	Field Code “B” - OOUT DO1
112.0	%M	2	WORD	Field Code "C" - OUT DO2
114.0	%M	2	WORD	Field Code "D" - OUT DO7..DO10
116.0	%M	2	WORD	Field Code "E" - OUT AO1..AO4
118.0	%M	2	WORD	Field Code "F" - USB PORT
120.0	%M	2	WORD	Field Code "G" - COM PORTs
122.0	%M	2	WORD	Field Code "H" - CAN PORT
124.0	%M	2	WORD	Field Code "I" - TERMINALS
126.0	%M	2	WORD	Field Code "J" - PACKAGING
128.0	%M	2	WORD	Field Code "K" - INSTRUCTIONS
130.0	%M	2	WORD	CUSTOMIZATION - HARDWARE
132.0	%M	2	WORD	CUSTOMIZATION - SOFTWARE

Addr	Memory type	Size [Bytes]	Data type	Data
134.0	%M	2	WORD	SOFTWARE - SUB VERSION
136.0	%M	1	BYTE	Serial Number - Character 1
137.0	%M	1	BYTE	Serial Number - Character 2
138.0	%M	1	BYTE	Serial Number - Character 3
139.0	%M	1	BYTE	Serial Number - Character 4
140.0	%M	1	BYTE	Serial Number - Character 5
141.0	%M	1	BYTE	Serial Number - Character 6
142.0	%M	1	BYTE	Serial Number - Character 7
143.0	%M	1	BYTE	Serial Number - Character_8
144.0	%M	2	WORD	Hardware code identifier
146.0	%M	2	WORD	Firmware code identifier
148.0	%M	2	WORD	RESERVED

Chapter 11
Ascon Tecnologic Function Blocks Libraries

In this chapter are listed the libraries part of Ascon Tecnologic automation CD and those available in the M81 firmware device. For each library the complete list of function blocks with a brief description is also indicated. For more details please refer to the specific documentation.

11-1 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
MS_MANAGER	USB Mass Storage operations manager
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

11-2 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
ZrO2_PROBE	% Carbon Potential calculation
ZrO2_PROBE_CLN	% Carbon potential probe cleaning management

11-3 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

11-4 AT_Communications_Lib

The *AT_Communications_Lib* allows a simplified access to the communication functions of M81 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_M81	M81 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

Function Block name	Description
MB_SLV_RD_DIGITAL	Modbus Slave: reading a digital value
MB_SLV_RD_DWORD	Modbus Slave: reading a DWORD value
MB_SLV_RD_REAL	Modbus Slave: reading a REAL value
MB_SLV_RD_WORD	Modbus Slave: reading a 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 a digital value
MB_SLV_WR_DWORD	Modbus Slave: writing a DWORD value
MB_SLV_WR_REAL	Modbus Slave: writing a REAL value
MB_SLV_WR_WORD	Modbus Slave: writing a WORD value
MODEM_CHECK	Modem operational verification
MODEM_CONF	Modem configuration management
MODEM_SMS_SEND	Modem SMS (Short text Message Service) send management
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

11-5 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 Tecnologic 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

Function Block name	Description
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.
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
MS_DATALOG_MNGT	Mass Storage datalogging management
MS_INFO	Mass Storage information
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

Function Block name	Description
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

Appendix A
Reference documents

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

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

[3] "*Ascon Tecnologic 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] "*M81 Installation manual*" (code: J30 - 658 - 1AM81 E).

[10] "*M81 User manual*" (code: J30 - 478 - 1AM81 E).

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

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