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Model xP4

User Manual
18.11 - Code: ISTR_U_xP4_E_00_--

User Manual

Contents

Modbus I/O expansion module
Model xP4

L I N E

8 AI configurable for:
- Pt1000
- NTC Semitec 103AT-2

4 AI configurable for:
- mA linear inputs
- V linear inputs

2 AO 0... 10 V only
8 DI free of voltage
2 SPDT 5 A Relays
6 SPST-NO 2A Relays

Applicable standards

The xP4 module is suited for the Modbus-IDA Organization protocol [1] and implements a subset of it, as explained in the text. Modbus is a registered trademark of Schneider Automation Inc.

⚠ Warning

The product described in this manual should only be installed, operated and maintained by qualified application programmers and software engineers who are familiar with automation safety concepts and applicable national standards.

Characteristics

Technical data

Accuracy	NTC Semitec 103AT-2 probes: 0.5% FS
	Pt1000 probes: 0.3% FS
	mA/V sensors: 0.1% FS
Input impedance	NTC/Pt1000: > 1.0 MΩ
	mA < 50 Ω, V > 100 kΩ
Digital resolution	12 bit (0.1 °C)
Data format	Binary Integer
Input range	0... 5/10 V
	0/4... 20 mA
Type of sensor NTC	Semitec 103AT-2 probes
Type of sensor RTD	Pt1000 probes

General

Power supply	24 Vac/ Vdc (± 10%) 50 Hz
Power consumption	400 mA (Vdc)
Dimensions	WxHxD: 108 x 110 x 60 mm (6 DIN module)
Weight:	512 g
Safety regulations	EN61010-1: Isolation class II (50 Vrms), Installation cathegory II Pollution degree 2
CE marking	EN61326-1: Electrical equipment for measurement, control and laboratory use. EMC requirements

Environment

	Operating	Storage
Temperature	0... 55°C	-20... +60°C
Relative Humidity	5... 85% non condensing. Appropriate measures must be taken against humidity >85%	5... 95% non condensing. For a short period, slight condensation may appear on the housing
Mounting	Vertical, free air	
Protection	IP20	
Vibrations (3 axes)	10... 57 Hz 0.0375 mm, 57... 150 Hz 0.5 G	
Shock (3 axes)	15 G, 11 ms half sine	

Function Codes used by the module

				Functions	(hex)
Data access	Bit access	Physical Digital Inputs	Read Inputs status	02	02
		Internal Bits or Physical Digital output	Read Coil status	01	01
			Write Single Coil	05	05
			Write Multiple Coils	15	0F
	Word access	Physical Input Registers	Read Input Register	04	04
		Internal Registers or Physical Output Registers	Read Holding Registers	03	03
			Write Single Register	06	06
			Write Multiple Registers	16	10

The function codes provided for all the modules are a subset of the "*Public Function Codes*", validated by the Modbus-IDA Organization.

Function 01 and Function 02 can be used to read both digital outputs and digital inputs.

Function 03 and Function 04 can be used to read both output and input registers.

Diagnostics

Modbus Exception Responses

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the server (or slave)
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the server (or slave).
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for server (or slave).

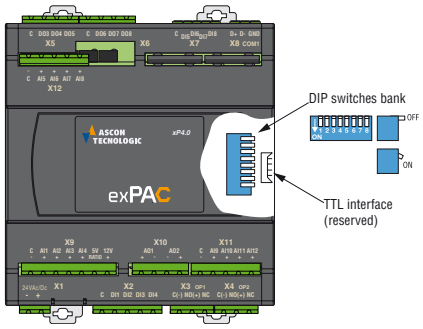
Modbus Address Map organisation

Writing and reading data length limits:

Number of Digital Outputs to be written in a single message	max. 32;
Number of Digital I/O to be read in a single message	max. 32;
Number of Output Registers to be written in a single message	max. 16;
Number of I/O Registers to be read in a single message	max. 32.

Hardware Set-up

Inside the xP4 case, in the right side, of the lower PCB is inserted a DIP Switches bank that must be used to configure the RS485 COM1 serial communications board.



The 8 Switches can be used to set:

SW	Description	Default
1	Node address bit 0	ON
2	Node address bit 1	ON
3	Node address bit 2	ON
4	Node address bit 3	ON
5	Node address bit 4	ON
6	Baud rate bit 0	ON
7	Baud rate bit 1	ON
8	Protocol	OFF

Switches 6,7 and 8 set the protocol and the BaudRate:

SW8	SW7	SW6	Protocol	Baud Rate
OFF	OFF	OFF	Modbus	9.6 kbps
OFF	OFF	ON		19.2 kbps
OFF	**ON**	**OFF**		**38.4 kbps**
OFF	ON	ON		57.2 kbps
ON	OFF	OFF	Reserved	Reserved
ON	OFF	ON		
ON	ON	OFF		
ON	ON	ON		

Switches 1... 5 set the module node Address.

SW5	SW4	SW3	SW2	SW1	Node Address
OFF	OFF	OFF	OFF	OFF	Reserved
OFF	OFF	OFF	OFF	ON	1
OFF	OFF	OFF	ON	OFF	2
OFF	OFF	OFF	ON	ON	3
OFF	OFF	ON	OFF	OFF	4
OFF	OFF	ON	OFF	ON	5
OFF	OFF	ON	ON	OFF	6
OFF	OFF	ON	ON	ON	7
OFF	ON	OFF	OFF	OFF	8
OFF	ON	OFF	OFF	ON	9
OFF	ON	OFF	ON	OFF	10
OFF	ON	OFF	ON	ON	11
OFF	ON	ON	OFF	ON	12
OFF	ON	ON	OFF	OFF	13
OFF	ON	ON	ON	ON	14
OFF	ON	ON	ON	OFF	15
ON	OFF	OFF	OFF	ON	16
ON	OFF	OFF	OFF	ON	17
ON	OFF	OFF	ON	OFF	18
ON	OFF	OFF	ON	ON	19
ON	OFF	ON	OFF	OFF	20
ON	OFF	ON	OFF	ON	21
ON	OFF	ON	ON	ON	22
ON	OFF	ON	ON	OFF	23
ON	ON	OFF	OFF	ON	24
ON	ON	OFF	OFF	OFF	25
ON	ON	OFF	ON	ON	26
ON	ON	OFF	ON	ON	27
ON	ON	ON	OFF	OFF	28
ON	ON	ON	OFF	ON	29
ON	ON	ON	ON	OFF	30
ON	**ON**	**ON**	**ON**	**ON**	**31**

Note: The module node address must unique on the Modbus fieldbus network.

Common parameters

AI Status warnings for Field Values

Modbus address	Access	Name	Notes
016	R	Analogue Input 1 status	0 Signal OK; 1 Underrange; 2 Overrange; 4 Not configured; 8 Invalid measure.
. . .	R	. . .	
027	R	Analogue Input 12 status	

AO Status warnings for Field Values

Modbus address	Access	Name	Notes
028	R	Analogue Output 1 status	0 Signal OK; 1 Underrange; 2 Overrange.
029	R	Analogue Output 2 status	

Input Type Configuration

Modbus address	Access	Name	Notes
048	R/W	Analogue Input 1 Config.	See Selection codes
. . .	R/W	. . .	
059	R/W	Analogue Input 12 Config.	

Input Type Selection Codes

Type		Dec.	Range	Bit Mask
RTD	Pt1000	1	-100.0 ... 400.0°C	2#0001 0000 0001 0101
NTC	103AT-2	1	-50.0 ... 110.0°C	2#0001 0000 0001 0100
mA	0... 20	3	0.000 ... 20.000 mA	2#0011 0000 0010 0001
mA	4... 20	3	4.000 ... 20.000 mA	2#0011 0000 0011 0001
V	0... 5	3	0.000 ... 5.000 V	2#0011 0000 0001 0010
V	0... 10	3	0.000 ... 10.000 V	2#0011 0000 0011 0010

Output Type Configuration

Modbus address	Access	Name	Notes
060	R/W	Analogue Output 1 Config.	0 Disabled; 2 0... 10 V
061	R/W	Analogue Output 2 Config.	

Input Type Selection

Modbus address	Access	Name	Notes
062	R/W	E.U. selection	0 °C 1 °F

Measurement readings

Modbus address	Access	Name	Notes
000	R	Digital Input readings	bit mask
001	R	Analogue Input 1 reading	
. . .	R	. . .	
012	R	Analogue Input 12 reading	

Internal Cold Junctions readings

Modbus address	Access	Name	Notes
013	R	Internal Cold Junction reading	Reference for X12 terminals
014	R	Internal Cold Junction reading	Reference for X11 terminals

Analogue Output writings

Modbus address	Access	Name	Notes
046	R/W	Analogue Output 1 writing	Range 0... 10000
047	R/W	Analogue Output 2 writing	

Digital Outputs writing

Modbus address	Access	Name	Notes
044	R/W	Digital Outputs writing	bits mask
045	R/W	Digital Outputs Config.	bits couple mask (following table)

Notation	DO8	DO7	DO6	DO5	DO4	DO3	DO2	DO1
bits	16&15	14&13	12&11	10&09	08&07	06&05	04&03	02&01
OFF	00	00	00	00	00	00	00	00
ON	01	01	01	01	01	01	01	01

E.g.: *To activate DO1, DO5, DO7 write Modbus registers 044* ***and*** *045 as:*

```
044 =  0  1  0  1  0  0  0  1
045 = 00 01 00 01 00 00 00 01
```

Diagnostic Information

Operational Diagnostic Information

Modbus address	Access	Name	Notes
030	R	Analogue board status	0 = Device OK; 1 = Device Busy.
. . .		. . .	. . .
032	R	Analogue board FW rev.	
033	R	Analogue board HW rev.	
. . .		. . .	. . .
039	R	Analogue board Life counter	
. . .		. . .	. . .

042	R	Status Word	Bit mask:
			bit 0 = Card Present;
			bit 1 = Reserved;
			bit 2 = Modbus type;
			bit 3 = Analogue board present;
			bit 4&5 = Reserved

. . .		. . .	. . .
064	R	Internal comms. errors	Boards intercommunication counter
. . .		. . .	. . .
067	R	Digital board FW Rev.	
068	R	Digital board HW Rev.	

Modbus Map summary

Modbus address	Access	Description
000	R	Digital Input readings
001	R	Analogue Input 1 reading
002	R	Analogue Input 2 reading
003	R	Analogue Input 3 reading
004	R	Analogue Input 4 reading
005	R	Analogue Input 5 reading
006	R	Analogue Input 6 reading
007	R	Analogue Input 7 reading
008	R	Analogue Input 8 reading
009	R	Analogue Input 9 reading
010	R	Analogue Input 10 reading
011	R	Analogue Input 11 reading
012	R	Analogue Input 12 reading
013	R	Internal Cold Junction reading (for X12 terminals)
014	R	Internal Cold Junction reading (for X11 terminals)
…	…	…
016	R	Analogue Input 1 status
017	R	Analogue Input 2 status
018	R	Analogue Input 3 status
019	R	Analogue Input 4 status
020	R	Analogue Input 5 status
021	R	Analogue Input 6 status
022	R	Analogue Input 7 status
023	R	Analogue Input 8 status
024	R	Analogue Input 9 status
025	R	Analogue Input 10 status
026	R	Analogue Input 11 status
027	R	Analogue Input 12 status
028	R	Analogue Output 1 status
029	R	Analogue Output 2 status
030	R	Analogue board status
…	…	…
032	R	Analogue board FW revision
033	R	Analogue board HW revision
…	…	…
039	R	Analogue board life counter
…	…	…
042	R	Status Word
044	**R/W**	**Digital Outputs writing (⚠)**
045	**R/W**	**Digital Outputs Configuration (⚠)**
046	R/W	Analogue Output 1 writing
047	R/W	Analogue Output 2 writing
048	R/W	Analogue Input 1 Configuration
049	R/W	Analogue Input 2 Configuration
050	R/W	Analogue Input 3 Configuration
051	R/W	Analogue Input 4 Configuration
052	R/W	Analogue Input 5 Configuration
053	R/W	Analogue Input 6 Configuration
054	R/W	Analogue Input 7 Configuration
055	R/W	Analogue Input 8 Configuration
056	R/W	Analogue Input 9 Configuration
057	R/W	Analogue Input 10 Configuration
058	R/W	Analogue Input 11 Configuration
059	R/W	Analogue Input 12 Configuration
060	R/W	Analogue Output 1 Configuration
061	R/W	Analogue Output 2 Configuration
062	R/W	Engineering Unit selection (°C, °F)
…	…	…
064	R	Counter of the internal communications errors
…	…	…
067	R	Digital board FW Revision
068	R	Digital board FW Revision

⚠ **These two particular registers MUST be written in a specific multiple datablock, BUT separated from any other datablock.**

Reference documents

The user should refer to the following list of documents:
[1]Modbus.ORG: Modbus Application Protocol Specification V1.1b3, April 2012

Accessories, Spare Parts and Warranty

Power Supply 75W 24Vdc 3A APS2ALDR75-24
Power Supply 120W 24Vdc 5A APS2ALDR12024

Warranty: 18 months excluding improper use defects