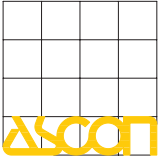


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mod. IO-MB/DO-16TS-00

M.U. IO-MB/DO-16TS-1/05.06
 Cod. J30-658-1ADO-16TS E

User manual

Contents

- Characteristics
- Functional Block Diagram
- Function Codes used by the module
- MODBUS Address Map organisation
- Hardware Setup
- Common Registers and Diagnostics
- Parameters Configuration
- Parameters Store/Restore
- MODBUS Map summary

APPLICABLE STANDARDS

The DO-16TS 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.

Characteristics

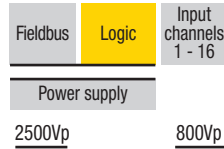
Technical data

Number of channels	16
Polarity (EN 61131-2 type 2)	Source (PNP)
Output Voltage (nominal)	24 Vdc
Output Current	0.5 A for each channel
Max. total continuous output current	11... 30 Vdc
ON/OFF delay	5 ms
Output Single Pulse width	min.: 5 ms max.: 65 s

General

3 way isolation	Channel to Channel	No
	Channel to Logic	800 Vp
	Logic to Serial Bus	800 Vp
	Power Supply to Logic	2500 Vp
Power supply	24 Vdc; -15...+25%	
Power consumption	3 W	
Overvoltage protection	40 Vdc	
Dimensions	L: 76; H: 110; W: 65	
Weight	220 g	
Safety regulations	Isolation class II (50Vrms), Installation category II, Pollution degree 2	
EN61010-1		
CE marking	EN61131-2	

3 way isolation diagram



Environment

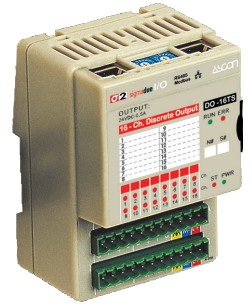
	Operating	Storage
Temperature	-10...+65°C	-40...+85°C
Relative Humidity	5...95% non condensing Appropriate measures must be taken against humidity >85%	5...95% non condensing For a short period, slight condensation may appear on the housing
Mounting	Vertical, free air	
Protection	IP20	
Vibrations (3 axes)	10...57Hz 0.0375mm 57...150Hz 0.5g	
Shock (3 axes)	15g, 11ms half sine	

MODBUS I/O module 16 Digital Outputs



mod. IO-MB/DO-16TS-00

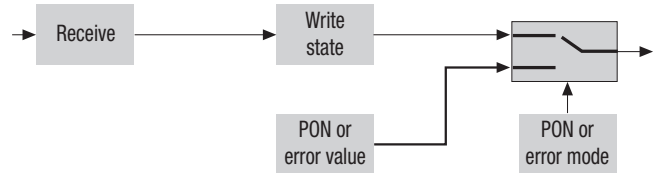
Each of the Output terminals can be programmed as standard optoisolated Output



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.

Functional Block Diagram



Function Codes used by the module

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

				Function codes	(hex)
Data access	Bit access	Physical Discrete Inputs	Read Inputs Status	02	02
			Read Coils Status	01	01
		Internal Bits Or Physical coils	Write Single Coil	05	05
	Write Multiple Coils		15	0F	
	Word access	Physical Input Registers	Read Input Register	04	04
			Read Holding Registers	03	03
Internal Registers Or Physical Output Registers		Write Single Register	06	06	
Diagnostics			Write Multiple Registers	16	10
			Read Exception status	07	07
			Diagnostics	08	08

MODBUS Address Map organisation

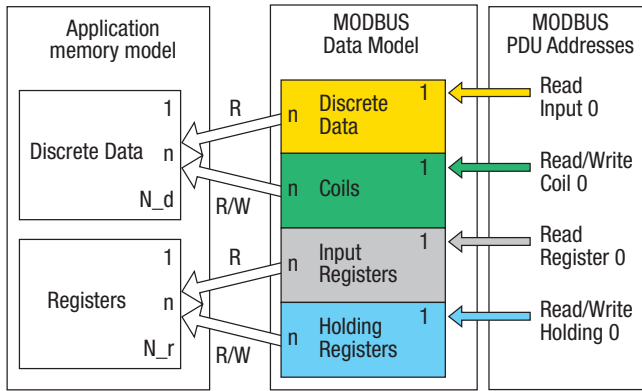
Data Type	Address Range	Sub range	Data sub type
Discrete Data	1 ... 400	1 ... 100	Physical Digital I/O
		101 ... 200	Digital I/O Extension
		20 ... 300	Alarms
		301 ... 400	Status variables
Registers	1 ... 1200	1 ... 120	Field/Process I/O Data
		121 ... 200	Device Id/Info Area
		201 ... 300	Field/Process I/O Extension
		301 ... 400	Non retentive Device Management
		401 ... 800	Retentive Device Management
		801 ... 1000	Configuration Data
		1001 ... 1050	Diagnostics
		1101 ... 1200	Reserved registers

Writing and reading data length limits:

Number of Coils to be written in a single message	Max. 128
Number of Coils to be read in a single message	Max. 160
Number of Registers to be written in a single message	Max. 16
Number of Registers to be read in a single message	Max. 125

Application Memory Model vs. MODBUS Data Model

Discrete inputs and Coils tables will be overlapped, as well as Input and Holding Registers.



Hardware Set-up

Hexadecimal rotary switches, service and I/O LEDs

Negative screwdriver 0.4 x 2.5 mm
 Top view
 Front side

Service LEDs	Status	Meaning
RUN	Single flash (1s)	1 message received
●	OFF	No messages received
ERR	Single flash (1s)	Error receiving a message
●	OFF	No error. Device working
PWR	ON	Module Power Supply ON
●	OFF	Module Power Supply OFF

I/O LEDs	Status	Meaning
OUT 1...8	ON	Output active
●	OFF	Output inactive
OUT 8...16	ON	Output active
●	OFF	Output inactive

Standard Outputs are operated through the Coils:

Discrete Input	Name	Access	Notes
1	DO-1	RW	Output values. Default value = "0"
...	...	RW	
16	DO-16	RW	

Power ON output states Register:

Discrete Input	Name	Access	Notes
401	PO-Value	RW	Output states at Power ON or error mode. Default value = "0"

Common Registers and 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)
07	NEGATIVE ACKNOWLEDGE - NAK	The server (or slave) is in the wrong state to process a request of this type or an attempt to write to a read only address has been made

Code 07 has not been provided by Modbus.org Protocol. Use it for ASCON products compatibility only.

Function Code 07: Read Exception Status:

bit	7	6	5	4	3	2	1	0
status	0	0	0	X	X	X	X	X

Discrete Input writing attempted (1) → bit 4
 Dummy Data Field (0 fill) (1) → bit 3
 Output Data Valid (1) → bit 2
 Local Value status (1) → bit 1
 Invalid Input Data (1) → bit 0

Function Code 08: Diagnostics

The only supported sub code is 0 (0000h) – Return Query Data

Common Discrete

Discrete #	Name	Access	Notes
301	ByteOrder	RW	0: Big Endian (Motorola) 1: Little Endian (Intel)
302	Parity	RW	0: Parity Disabled 1: Parity Enabled
303	EvenOdd	RW	0: Parity Even 1: Parity Odd

Common Registers

Register	Name	Access	Notes
398	Ch_LO	RW	Channel Number 16-1 selection

Bit Rate and Node ID configuration

Bit rate

Lo switch	Baud rate bps	Bus length m
0	300	-
1	1200	-
2	2400	-
3	4800	-
4	9600	1000
5	19200	500

Node ID

Hi switch	Lo switch	Valid ID Node
0	1	01h (address 1)
0	2	02h (address 2)
↓	↓	↓
F	7	F7h (address 247D)

Procedure for Node Address and Bit Rate configuration

The HI and LO hexadecimal rotary switches set the module's Bit Rate and MODBUS Node Address. During the configuration, the module must be **off line** and the MODBUS bus must be physically disconnected.

To configure the module, follow the procedure:

- 1 Turn the Power OFF
- 2 Set the **HI** and **LO** switches to "F"
- 3 Turn the Power ON
- 4 Select the desired Bit Rate value by setting the **LO** switch following the table (e.g. "4" for 9600 bps)
- 5 Shift the **HI** switch to "E" (all the module service LEDs should flash)
- 6 Turn the Power OFF. Now configure Node ID
- 7 Set the **HI** and **LO** switches to the desired valid Node ID following the table
- 8 Turn the Power ON.

Alternatively, at step 7 set the value 00h. Then, at the next Power ON, the last valid stored value will be resumed as Node ID.

The default values are: Bit Rate = 9600 bps, Node ID = 247D.

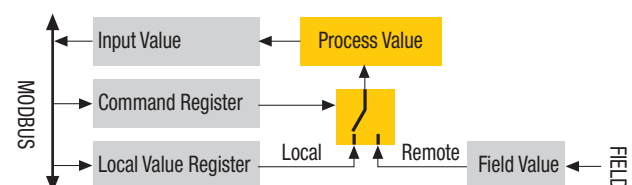
Register	Name	Access	Notes
399	ModuleCom	RW	Module Command Register

bit	15	8	7	0
default	0	0	0	0

Commands:

0x0	Normal State (all channels)
0x4C42 (ASCII code "LB")	Local Value State (only for enabled channels see reg. 398)
0x4342 (ASCII code "CB")	Calibration State (uppermost selected channel)

How Local Value command works (valid for Channel Number Bit = 1)



Register	Name	Access	Notes
1049	ModuleDiag	RW	Module Diagnostics Register
bit	15		8 7
default	0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0
Commands:			
To be defined		(ST LED Status)	

Register	Name	Access	Notes
400	StackCom	RW	Modbus Stack Command Register
bit	15		8 7
default	0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0
Commands:			
0x0		Normal State	
0x5354 (ASCII code "ST")		Store Configuration in non volatile memory	
0x5253 (ASCII code "RS")		Restore default configuration values	
0x5254 (ASCII code "RT")		RESET (Cold Start)	

Register	Name	Access	Notes
1050	StackDiag	RW	Modbus Stack Diagnostic Register
bit	15		8 7
default	0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0
Commands:			
To be defined		(Run/Err LED Status)	

Register	Name	Access	Notes
801	NodeA	RW	Node Address Register
bit	15		8 7
default	0 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0

Register	Name	Access	Notes
802	BaudR	RW	Baud Rate Register
bit	15		8 7
default	0 0 0 0 0 0 0 0		1 1 1 1 0 1 1 1

Baud Rate	Register Value	Node Address	Register Value
300	0	0 reserved	0 invalid
1200	1	1	1
2400	2
4800	3
9600	4 (default)	247	F7h (default)
19200	5	248...256 reserved	F8h..FFh invalid

Module identity Registers

Register	Name	Access	Notes
121	ManuCode	R	Manufacturer Code (note)
122	ProdCode-1	R	Product Code #1 (note)
123	ProdCode-2	R	Product Code #2 (note)
124	RelCode-1	R	Hardware Release Code
125	RelCode-2	R	Software Release Code
126	SpecialCode	R	Special Product Code
200	ProdCode-3	R	Product Code #3 (note)

Note: See the "MODBUS map summary" for details.

User defined Registers

Register	Name	Access	Notes
191	Usr#1	R/W	User Defined Register #1 (retentive)
192	Usr#2	R/W	User Defined Register #2 (retentive)
...	...	R/W	...
198	Usr#8	R/W	User Defined Register #8 (retentive)
199	CE#1	R/W	CE Defined register #1 (retentive)

Parameter Store/Restore

This module allows parameters to be saved in a non volatile memory. In order to avoid storing parameters by mistake, storage is only executed when a specific signature is written to the appropriate register. The signature is "ST".

Similarly, the default values of parameters are restored. On receipt of the correct signature in the appropriate register, the device restores the default parameters. The signature is "RS".

The new configuration becomes active after a reset, i.e. after a "Power Down" or a reset command (signature "RT").

See Register 400 in the "MODBUS map summary" and in the "Common registers and diagnostic" paragraphs.

Reference documents

List of documents the user should refer to

- [1] MODBUS.ORG: MODBUS Application Protocol Specification V1.1a, June 2004

Accessories, Spare Parts and Warranty

Power Supply 45W 24Vdc 2A	AP-S2/AL-DR45-24
Power Supply 120W 24Vdc 5A	AP-S2/AL-DR120-24
Additional Terminal Block 2x11	AP-S2/TB-211-1
Female Plug 11 Screw clamp	AP-S2/SPINA-V11
Female Plug 11 Spring clamp	AP-S2/SPINA-M11
RJ45 terminated cable 14cm	AP-S2/LOCAL-BUS76
RJ45 terminated cable 22cm	AP-S2/LOCAL-BUS152
MODBUS termination Adapter	AP-S2/TERM-

Warranty: 3 years excluding defects due to improper use

MODBUS Map summary (with default values)

Discrete	Name	Access	Description	default	V
1	DO-1	RW	Write Output 1	0	
...	...	RW	Write Output n	0	
16	DO-16	RW	Write Output 16	0	
301	ByteOrder	RW	0: Big Endian; 1: Little Endian	0	
302	Parity	RW	0: Parity Disabled 1: Parity Enabled	0	
303	EvenOdd	RW	0: Parity Even 1: Parity Odd	0	

Discrete	Name	Access	Description	default	V
121	ManuCode	R	Manufacturer Code	0600	
122	ProdCode-1	R	Number of channels	16	
123	ProdCode-2	R	Type of output (transistor)	TS	
124	RelCode-1	R	Hardware Release Code		
125	RelCode-2	R	Software Release Code		
126	SpecialCode	R	Special Product Code #1		
191	Usr#1	R/W	User Defined Register # 1	0000	
192	Usr#2	R/W	User Defined Register # 2	0000	
...	Usr#n	R/W	User Defined Register # n	0000	
198	Usr#8	R/W	User Defined Register #8	0000	
199	CE#1	R/W	CE defined register	0000	
200	ProdCode-3	R/W	Type of module (digital output)	DO	
399	ModuleCom	RW	Module Command Register	0000	
400	StackCom	RW	Modbus Stack Command Register	0000	
401	PO_Value	RW	Output states at Power On	0000	
801	NodeA	RW	Node Address Register	00F7	
802	BaudR	RW	Baud Rate Register	0004	
1049	ModuleDiag	RW	Module Diagnostics Register	0000	
1050	StackDiag	RW	Modbus Stack Diagnostic Register	0000	
...	