Intech Micro 2300-D16 analogue input station MODBUS RTU slave application supplementary manual.

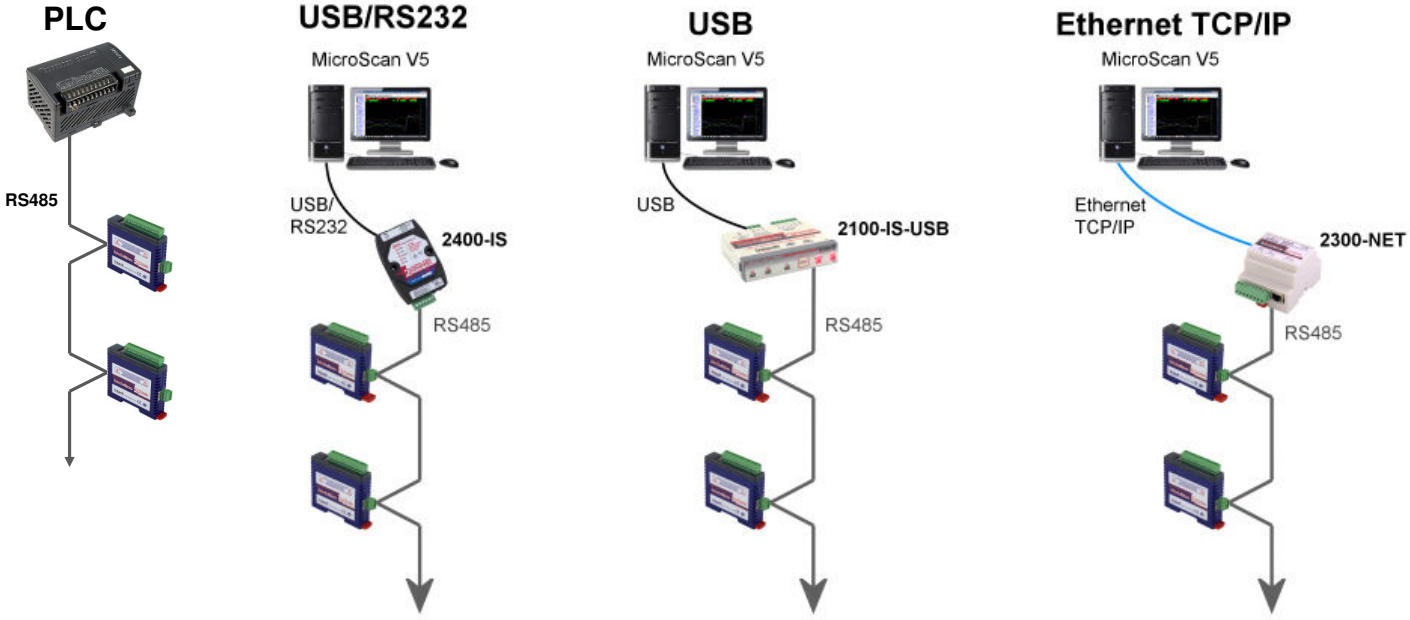
MODBUS supplementary manual to the 2300-D16 Installation Guide.

The 2300 series stations are designed to connect as slaves to MODBUS RTU masters such as PC's or PLC's to offer an economical I/O solution.

Intech Micro 2300 Series I/O stations:

2300-A8II - 8 Isolated Current Inputs.
2300-A8VI - 8 Isolated Voltage Inputs.
2300-Tc8 - 8 Isolated Thermocouple Inputs.
2300-RTD6 - 6 RTD Inputs.
2300-MULTI - 2 RTD, 2 AI, 1 AO, 4 DI, 2 DO.
2300-D16 - 16 Digital Inputs.
2300-RO4 - 4 Relay Outputs.
2300-AO8I - 8 Current Outputs.
2300-NET - Isolated Ethernet TCP/IP to RS485.

Intech Micro 2300 Series - Connection Examples.



2300-D16 Specifications.

Digital Inputs:	16 individually isolated inputs with LED indication of each input		
	-Input Voltage		12~24Vdc
	-Load	@ 12 Vdc	5mA per Channel
		@ 24 Vdc	11mA per Channel
	-Isolation		1500 Vrms between field and logic
	-Resolution		32 bits
	-Frequency		1KHz (max)
	-Pulse Width		500us (min)
Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.			
Connectors:	-Power and Comms		4 Pin plug-in connector on side of station
	-Inputs		18 Way screw plug-in connector on top of station
Comms:	-Protocols		RS485, Modbus RTU
	-Baud Rate		2400, 4800, 9600, 19200, 38400, 57600, 115200
	-Format		Parity: 0 = none, 1 = even, 2 = odd Stop Bits: 1 = 1 stop bit, 2 = 2 stop bits
Power:			12~30Vdc
			30mA @ 12V / 17mA @ 24V
Safety and EMC Compliances:			
EMC Compliance	89/336/EEC and Low Voltage Equipment Directive 73/23/EEC		
Safety Compliance	IEC 950		
General Specifications: (Unless otherwise stated in other input specifications).			
Operating Temperature			-10~50˚C
Storage Temperature			-40~85˚C
Operating Humidity			Up to 95% non condensing
Housing	-Dimensions		L=97.5, W=22.6, H=109mm
	-Mounting		35mm Symmetrical Mounting Rail.

Note 1. Contact INTECH INSTRUMENTS for more detailed programming information.

Modbus Register Types.

There are 4 types of variables which can be accessed from the station. Each station has one or more of these data variables.

Type	Start Address	Variable	Access	
1	00001	Digital Outputs	Read & Write	
2	10001	Digital Inputs	Read Only	
3	30001	Input registers (Analog)	Read Only	
4	40001	Output registers (Analog)	Read & Write	(Holding type)

Note: The Modbus message length must be limited to 100 consecutive read or write registers. If more registers are required then a new poll group must be added for the next xxx registers.

The 2300-D16 station is a 16 channel digital input station. The inputs are isolated from the logic by bi-directional opto-couplers. The inputs are divided into 2 isolated groups of 8 inputs each. This allows for many configurations in which the input station may be used. One such configuration could be where one group is connected as common positive and the second group connected as common negative.

The counters operate in three modes.
In **mode 0**: All the counters are disabled.
In **mode 1**: The counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.
In **mode 2**: The inputs are connected as up/down counters. Input 1 will increment counter 1 while input 2 decrements counter1. In the same way, inputs 3&4 operate counter 2, inputs 5&6 operate counter 3 and inputs 7&8 operate counter 4 etc.

Modbus Register Types cont.

Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.
Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.

Communications Settings.

The data in the station is stored in 16 bit registers. These registers are accessed over the network using the MODBUS RTU communication protocol.

Communications Settings with DIP Switch 10 OFF (IOStudio Mode)

BAUD RATE	9600
DATA BITS	8
PARITY	NONE
STOP BITS	1

Communications Settings with DIP Switch 10 ON (Programmed Baud Rate, MicroScan SCADA Factory Default)

BAUD RATE	2400, 4800, 9600, 19200, 38400, 57600, 115200
DATA BITS	8
PARITY	None, Even, Odd
STOP BITS	1, 2

Note: To change these settings, download the free **IOStudio 2300 Series MODBUS Configuration** software via the link from the Intech website: **www.intech.co.nz/2300**
During this mode, DIP Switch 10 should be turned OFF so that the PC can communicate with the 2300 station using the IOStudio Mode communications settings. Once the Communications Settings are programmed, power down the 2300 station and change DIP Switch 10 to the ON position. Restore the power to the 2300 station and the configured Communications Settings will be ready for use.
Warning: Only program ONE 2300 station at a time!

Communications Settings Registers.

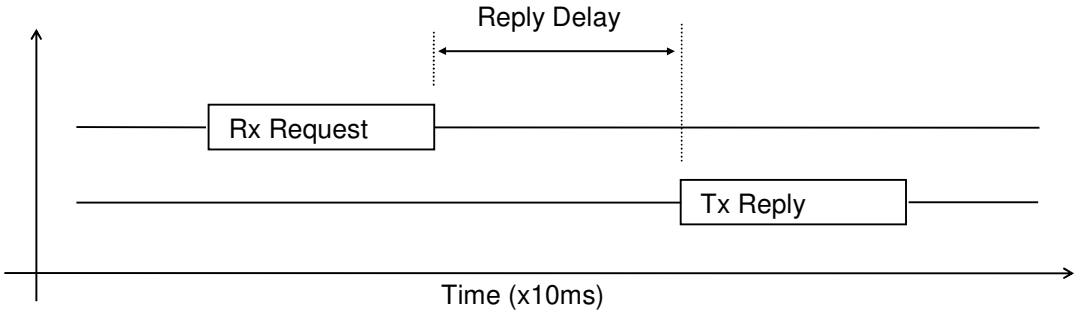
40121	Baud Rate	2400	11520	R/W	2400, 4800, 9600, 19200, 38400,57600,11520
40122	Parity	0	2	R/W	0 = none, 1 = even, 2 = odd
40123	Stop Bits	1	2	R/W	1 = 1 stop bit, 2 = 2 stop bits
40124	Reply Delay	0	65535	R/W	(x10ms)

Baud Rate Register (40121)
The baud rate value is programmed directly into the baud rate register. The only exception is the 115200 baud rate where the value 11520 is used.

Parity Register (40122)
The parity can be set to none by writing a 0 to the parity register, set to even by writing a 1 to the parity Register or set to odd by writing a 2 to the parity register.

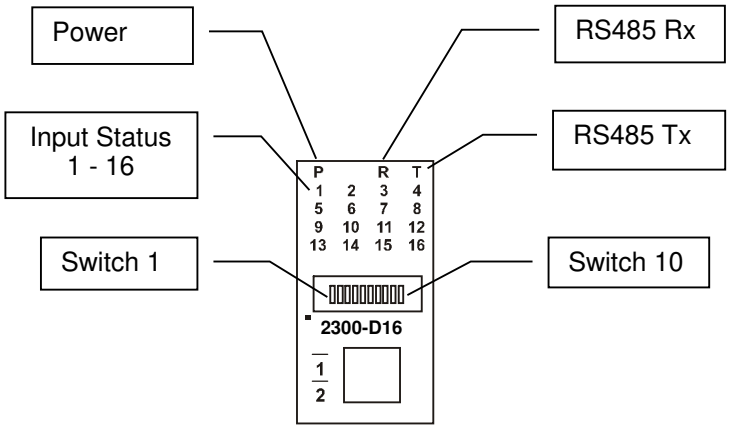
Stop Bits Register (40123)
The number of stop bits can be set to 1 by writing a 1 to the stop bits register or set to 2 by writing a 2 to the stop bits Register.

Reply Delay Register (40124)
The reply delay is a time delay between the Modbus message received to the reply being sent. In some applications where a modem or radio is used in the RS485 network, it may be necessary to add a reply delay due to turn around delays in the equipment.



Status Indicators.

Power: Flashes to indicate the CPU is running.
RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.
Input Status: "OFF" when the input is off.
"ON" when the input is on.



Dip Switch Settings.

DIP SWITCH	FUNCTION	DESCRIPTION
1	STATION ID	+1 Station ID's from 0 to 127 are set up using switches 1 to 7
2	STATION ID	+2 "
3	STATION ID	+4 "
4	STATION ID	+8 " Note: See Installation Guide for the
5	STATION ID	+16 " *Station ID Table* (Dip Switch Settings).
6	STATION ID	+32 "
7	STATION ID	+64 "
8	INVERT	When switched ON the status of the inputs is inverted in the Modbus status register (30002).
9	-	Not Used.
10	BAUD RATE	Selects 9600 in OFF position (IOStudio Mode) or Programmed Baud Rate in ON position (MicroScan SCADA Factory Default) See Page 3 '*Communications Settings.*' for more information.

Data Registers.

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
10001	Digital Input 1	0	1	R	Status of Digital Inputs.
10002	Digital Input 2	0	1	R	"
10003	Digital Input 3	0	1	R	"
10004	Digital Input 4	0	1	R	"
10005	Digital Input 5	0	1	R	"
10006	Digital Input 6	0	1	R	"
10007	Digital Input 7	0	1	R	"
10008	Digital Input 8	0	1	R	"
10009	Digital Input 9	0	1	R	"
10010	Digital Input 10	0	1	R	"
10011	Digital Input 11	0	1	R	"
10012	Digital Input 12	0	1	R	"
10013	Digital Input 13	0	1	R	"
10014	Digital Input 14	0	1	R	"
10015	Digital Input 15	0	1	R	"
10016	Digital Input 16	0	1	R	"

Data Registers cont.

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
30001	S/W Version / Module Type	N/A	N/A	R	High Byte = Software Version Low Byte = 100
30002	Digital Inputs	N/A	N/A	R	Digital Inputs in 16 bits. 16 - 1.
40003	Counter 1 MSB	0	65535	R/W	Counter MSB and LSB combine to give a 32 bit
40004	Counter 1 LSB	0	65535	R/W	Counter with range 0 to 4294967295.
40005	Counter 2 MSB	0	65535	R/W	"
40006	Counter 2 LSB	0	65535	R/W	"
40007	Counter 3 MSB	0	65535	R/W	"
40008	Counter 3 LSB	0	65535	R/W	"
40009	Counter 4 LSB	0	65535	R/W	"
40010	Counter 4 LSB	0	65535	R/W	"
40011	Counter 5 MSB	0	65535	R/W	"
40012	Counter 5 LSB	0	65535	R/W	"
40013	Counter 6 MSB	0	65535	R/W	"
40014	Counter 6 LSB	0	65535	R/W	"
40015	Counter 7 MSB	0	65535	R/W	"
40016	Counter 7 LSB	0	65535	R/W	"
40017	Counter 8 MSB	0	65535	R/W	"
40018	Counter 8 LSB	0	65535	R/W	"
40019	Counter 9 MSB	0	65535	R/W	"
40020	Counter 9 LSB	0	65535	R/W	"
40021	Counter 10MSB	0	65535	R/W	"
40022	Counter 10LSB	0	65535	R/W	"
40023	Counter 11MSB	0	65535	R/W	"
40024	Counter 11LSB	0	65535	R/W	Counter MSB and LSB combine to give a 32 bit
40025	Counter 12MSB	0	65535	R/W	Counter with range 0 to 4294967295.
40026	Counter 12LSB	0	65535	R/W	"
40027	Counter 13MSB	0	65535	R/W	"
40028	Counter 13LSB	0	65535	R/W	"
40029	Counter 14MSB	0	65535	R/W	"
40030	Counter 14LSB	0	65535	R/W	"
40031	Counter 15MSB	0	65535	R/W	"
40032	Counter 15LSB	0	65535	R/W	"
40033	Counter 16MSB	0	65535	R/W	"
40034	Counter 16LSB	0	65535	R/W	"
40035	Counter Capture	0	65535	R/W	Bit1 = 1 to Capture Counter1, Bit2 = 1 to Capture Counter2, etc.

Data Registers cont.

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
40036	CCounter 1 MSB	0	65535	R/W	Capture Counter Registers. MSB and LSB
40037	CCounter 1 LSB	0	65535	R/W	combine to give a 32 bit Value.
40038	CCounter 2 MSB	0	65535	R/W	Counter with range 0 to 4294967295.
40039	CCounter 2 LSB	0	65535	R/W	
40040	CCounter 3 MSB	0	65535	R/W	"
40041	CCounter 3 LSB	0	65535	R/W	"
40042	CCounter 4 LSB	0	65535	R/W	"
40043	CCounter 4 LSB	0	65535	R/W	"
40044	CCounter 5 MSB	0	65535	R/W	"
40045	CCounter 5 LSB	0	65535	R/W	"
40046	CCounter 6 MSB	0	65535	R/W	"
40047	CCounter 6 LSB	0	65535	R/W	"
40048	CCounter 7 MSB	0	65535	R/W	"
40049	CCounter 7 LSB	0	65535	R/W	"
40050	CCounter 8 MSB	0	65535	R/W	"
40051	CCounter 8 LSB	0	65535	R/W	"
40052	CCounter 9 MSB	0	65535	R/W	"
40053	CCounter 9 LSB	0	65535	R/W	"
40054	CCounter 10MSB	0	65535	R/W	"
40055	CCounter 10LSB	0	65535	R/W	"
40056	CCounter 11MSB	0	65535	R/W	"
40057	CCounter 11LSB	0	65535	R/W	"
40058	CCounter 12MSB	0	65535	R/W	"
40059	CCounter 12LSB	0	65535	R/W	"
40060	CCounter 13MSB	0	65535	R/W	"
40061	CCounter 13LSB	0	65535	R/W	"
40062	CCounter 14MSB	0	65535	R/W	"
40063	CCounter 14LSB	0	65535	R/W	"
40064	CCounter 15MSB	0	65535	R/W	"
40065	CCounter 15LSB	0	65535	R/W	"
40066	CCounter 16MSB	0	65535	R/W	"
40067	CCounter 16LSB	0	65535	R/W	"
30100	DIP Switch	0	65535	R	Status of DIP Switch on Front Panel
40101	Counter Mode	0	2	R/W	0=Disable, 1=Up Counting, 2=Up/Down Count
40102	Input Filter	0	65535	R/W	0 = Disable, >0 = Enable. (x10ms)
40103	Capture Zero	0	65535	R/W	0 = Disabled, bit1 = auto zero counter 1.
40121	Baud Rate	2400	11520	R/W	2400, 4800, 9600, 19200, 38400, 57600, 115200
40122	Parity	0	2	R/W	0 = none, 1 = even, 2 = odd
40123	Stop Bits	1	2	R/W	1 = 1 stop bit, 2 = 2 stop bits
40124	Reply Delay	0	65535	R/W	0 = Disable, >0 = Enable. (x10ms)

Digital Input Register.

The digital inputs can be read in a single register as follows:

MSB					**2300-D16 DIGITAL INPUTS**										LSB	ADDRESS
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1	30002

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Digital Input Number

Counter Registers.

The counters are stored a two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.
Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

Counter Capture.

To capture a counter a 1 must be written to the corresponding bit position in the Counter Capture Register 40035. For example:

Writing 1 to Register 40035 results in Counter 1 value being captured to Counter Capture 1.
Writing 2 to Register 40035 results in Counter 2 value being captured to Counter Capture 2.
Writing 3 to Register 40035 results in Counter 1 value being captured to Counter Capture 1 and Counter 2 value being captured to Counter Capture 2.

Once the station has captured the counters the Counter Capture Register 40035 is cleared to zero. It is possible to read this register to get confirmation that the capture is complete before reading the captured counter values.

Counter Auto Zero.

The counter being captured can be auto zeroed. The purpose of this function is to let the station zero the counter so that no counts get lost due to delays from communication latency, etc.

To ensure that a counter is auto zeroed, a 1 must be written to the corresponding bit position in the Capture Zero Register 40103.
For example: Writing 1 to Register 40103 results in Counter 1 value being zeroed when the Counter Capture bit is 1, the value in the Capture Zero Register 40103 is permanently stored in memory and only has to be configured once.

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