## 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.



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 | Equipment Directive 73/23/EEC |
| Safety Compliance | IEC 950 |  |
| General Specifications: (Unless otherwise stated in other input specifications). |  |  |
| Operating Temperature |  | $-10 \sim 50^{\circ} \mathrm{C}$ |
| Storage Temperature |  | -40~85 ${ }^{\circ} \mathrm{C}$ |
| Operating Humidity |  | Up to 95\% non condensing |
| Housing | -Dimensions | $\mathrm{L}=97.5, \mathrm{~W}=22.6, \mathrm{H}=109 \mathrm{~mm}$ |
|  | -Mounting | 35mm Symmetrical Mounting Rail. |

Note 1. Contact INTECH INSTRUMENTS for more detailed programming information.
Product Liability. This information describes our products. It does not constitute guaranteed properties and is not intended to affirm the suitability of a product for a particular application. Due to ongoing research and development, designs, specifications, and documentation are subject to change without notification. Regrettably, omissions and exceptions cannot be completely ruled out. No liability will be accepted for errors, omissions or amendments to this specification. Technical data are always specified by their average values and are based on Standard Calibration Units at 25C, unless otherwise specified. Each product is subject to the 'Conditions of Sale'.
Warning: These products are not designed for use in, and should not be used for patient connected applications. In any critical installation an independent fail-safe back-up system must always be implemented.

## 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
100001
210001
30001
440001

Variable
Digital Outputs
Digital Inputs
Input registers (Analog)
Output registers (Analog)

Access
Read \& Write
Read Only
Read Only
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 | $(x 10 \mathrm{~ms})$ |

## 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:
RS485 Rx:
RS485 Tx: Input Status:

Flashes to indicate the CPU is running.
Flashes to indicate the unit has received a valid Modbus message.
Flashes to indicate the unit has sent a Modbus message.
"OFF" when the input is off.
"ON" when the input is on.


## Dip Switch Settings.

DIP SWITCH FUNCTION


## 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 <br> 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 <br> Address | Register Name | Low <br> 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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