

BASIC COMMUNICATION PARAMETERS

Coding	8-bit binary
Data bits	8 bits
Parity bit	None
Stop bit	1 bit
Error check	CRC (Redundant cyclic code)
Baud Rate	2400bit/s, 4800bit/s, 9600bit/s can be set Factory standard is 4800bit/s

DATA FRAME FORMAT DEFINITION

Modbus-RTU communication protocol is adopted, and the format is as follows:

Time of initial structure \geq 4 bytes

Address code=1 byte

Function code=1 byte

Data area=N bytes

Error check=16-bit CRC code

Time to end structure \geq 4 bytes

Address code: the address of the transmitter,

which is unique in the communication network (factory standard 0x01)

Function code: the instruction function indication sent by the host.

This transmitter only uses function code 0x03 (read register data)

Data area: The data area is specific communication data.

Note that the high byte of 16bits data comes first

CRC code: two-byte check code.

Host query frame structure:

Address code	Function code	Register start address	Register length	Check code low	Check code high
1 byte	1 byte	2 byte	2 byte	1 byte	1 byte

Slave response frame structure:

Address code	Function code	Number of valid bytes	Data area 1	Data area 2	Data area N	Data area check code
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte	2 byte

Register address:

Register address	PLC or configuration address	Content	Operation
0000H	40001	Humidity	R
0001H	40002	Temperature	R
0050H	40081	Temperature calibration	R/W
0051H	40082	Humidity calibration	R/W
07D0H	42001	Address register	R/W: 1-254
07D1H	42001	Baud rate register	R/W: 0: 2400/ 1: 4800/ 2:9600

COMMUNICATION PROTOCOL EXAMPLES & EXPLANATIONS

Example: Read the temperature and humidity value of the device address 0x01
Query frame (hexadecimal):

Address code	Function code	Start Address	Data Length	Check Code Low	Check Code High
0x01	0x03	0x00 0x00	0x00 0x02	0xC4	0x0B

Response frame (hexadecimal): (For example, when reading a temperature of - 10.1 °C and a humidity of 65.8% RH)

Address code	Function code	Returns the number of valid bytes	Humidity Value	Temperature Value	Check Code Low	Check Code High
0x01	0x03	0x04	0x02 0x92	0xFF 0x9B	0x5A	0x3D

Temperature calculation:

When the temperature is lower than 0 °C, the temperature data is uploaded in the form of a complement code.

Temperature: FF9B H (hexadecimal)=- 101=>Temperature=- 10.1 °C

Humidity calculation:

Humidity: 292 H (hexadecimal)=658=>Humidity=65.8% RH

DEVICE ADDRESS SETTING METHOD

The device address supports two methods: software configuration and dial switch settings, Only one method can be selected to set the address.

When all four dial switches are turned to the "OFF" position, it is supported to use the configuration software to set the address,

You can set the address through the "Configuration Software".

When one of the four dial switches is in the "ON" position, the device address can only be the address represented by the dial switch,

At this time, the address set by the software is invalid, and the address range set by the dial switch is 1 to 15.

The address mode for setting the dial switch is as follows: 1 represents ON, 0 represents OFF.

Modbus Address	1	2	3	
Address set using software	0	0	0	0
1	0	0	0	1
2	0	0	0	0
.....
15	1	1	1	1

DCO COMMUNICATION PARAMETERS

RS-485 interface, Hardware named D+, D-

Slave Address: 1~247

- Baud rate: 9600, 19200, 38400, 57600, 115200
- Parity: None, Even, Odd
- Data length: 8 bit
- Stop bit: 1 or 2 bit
- Default Address = 1, Data format= 9600, N81

Modbus (ref PI-MBUS-300)

- Support RTU mode
- Broadcast support (Address 0)
- Bit addressable items (i.e. Coils and Discrete inputs) will not be implemented
- Measurement Values are represented in IEEE 754 single-precision 32-bit floating point type
http://en.wikipedia.org/wiki/IEEE_754
- Modbus protocol structure:
 - 1st byte: Address (1~247)
 - 2nd byte: Function code (1 byte)
 - 3~Nth bytes: Data bytes
 - N+1th~N+2th byte: CRC (16 bits), LSB first

DCO RS-485 PROTOCOL (Application) ex:ModScan

Item No.	Add.	Add. HEX	Parameter	Point Type	Data Type	Value
1	1025	0401H	Temperature	HOLDING REGISTER	Floating Pt.	°C
2	1029	0405H	Relative Humidity	HOLDING REGISTER	Floating Pt.	%
3	1033	0409H	Dew Point Temperature	HOLDING REGISTER	Floating Pt.	°C
4	1037	040DH	Forst Point Temperature	HOLDING REGISTER	Floating Pt.	°C
5	1041	0411H	Wet Bulb Temperature	HOLDING REGISTER	Floating Pt.	°C
6	1045	0415H	Saturation Vapour Pressure	HOLDING REGISTER	Floating Pt.	mbar
7	1049	0419H	Vapour Pressure	HOLDING REGISTER	Floating Pt.	mbar
8	1053	041DH	Mixture Ratio	HOLDING REGISTER	Floating Pt.	g/kg
9	1057	0421H	Absolute Humidity	HOLDING REGISTER	Floating Pt.	g/m ³
10	1061	0425H	Specific Enthalpy	HOLDING REGISTER	Floating Pt.	kJ/kg

- The base address is 1 rather than 0 in ModScan application.
- The register shown on the table is 1 byte whereas the ModScan 2 bytes.
- So the corresponding value against address 1029 of the "table" would be address 1027 of the Modscan
(e.g. 05 of the table equals to 40003 of the ModScan)

Item No.	Address	Value
1	01	<3B3EH>
2	05	<41COH>
3	09	<A7EDH>
4	13	<4273H>
		<2000H>
		<4495H>
		<0000H>
		<0000H>

DCO RS-485 PROTOCOL(Software)

Item No.	Add.	Add. HEX	Parameter	Data Bytes	Data type	Value
Information						
1	17-26	0011H-001AH	Firmware version	10 bytes	ASCII	
2	33-48	0021H-0030H	Serial Number	16 bytes	ASCII	
RS-485 Slave Address, Baud rate, Data format						
3	49	0031H	Slave Address	1 byte	unsigned Integer	1-247
4	51	0033H	Baud rate	1 byte	unsigned Integer	0: 9600
						1: 19200
						2: 38400
						3: 57600
						4: 115200
5	53	0035H	Data type	1 byte	unsigned Integer	0: N81
						1: N82
						2: E81
						3: E82
						4: O81
5: O82						

Item No.	Add.	Add. HEX	Parameter	Data Bytes	Data type	Value
Physical Quantities						
6	1	001H	OUT1	4 bytes	IEEE 754	Relate to OUT1 setting
7	5	005H	OUT2	4 bytes	IEEE 754	Relate to OUT2 setting

ASCII format, Item No. 1-2

1st Word		2nd Word		3rd Word		4th Word		5th Word		6th Word		7th Word		8th Word	
Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte
Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo

"ABCDEF0123456789" is represented in byte of hexadecimal as

<41><42><43><44><45><46><30><31><32><33><34><35><36><37><38><39>

IEEE754 format, Item No. 6-7

Data Hi Word, Hi Byte	Data Hi Word, Lo Byte	Data Lo Word, Hi Byte	Data Lo Word, Lo Byte
SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

Where

S represents the sign bit where 1 is negative and 0 is positive

E is the two's complement exponent with an offset of 127 i.e. an exponent of zero is represented by 127, an exponent of 1 by 128 etc.

M is the 23-bit normal mantissa. The highest bit is always 1 and, therefore, is not stored.

Using the above format the floating point number 23.83 is represented in byte of hexadecimal as <41><BE><A3><D7>:

Data Hi Word, Hi Byte	Data Hi Word, Lo Byte	Data Lo Word, Hi Byte	Data Lo Word, Lo Byte
0x41	0xBE	0xA3	0xD7

COMMUNICATION EXAMPLES

Read Temperature Measurement Value

Request the host (PC or PLC) to polling the data of DCO			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	04	Byte	1
Starting Address Lo	00	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	02	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Temperature are 0x0400 ~ 0x0403

Response DCO response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	04	Byte	1
IEEE 754 Data Lo Word, Hi Byte	0xA3	Byte	1
IEEE 754 Data Lo Word, Lo Byte	0xD7	Byte	1
IEEE 754 Data Hi Word, Hi Byte	0x41	Byte	1
IEEE 754 Data Hi Word, Lo Byte	0xBE	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*the floating point number 23.83 is represented in byte of hexadecimal as <41><BE><A3><D7>

Read Relativity Humidity Measurement Value

Request the host (PC or PLC) to polling the data of DCO			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	04	Byte	1
Starting Address Lo	04	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	02	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Relativity Humidity are 0x0404 ~ 0x0407

Response DCO response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	04	Byte	1
IEEE 754 Data Lo Word, Hi Byte	0x77	Byte	1
IEEE 754 Data Lo Word, Lo Byte	0xCF	Byte	1
IEEE 754 Data Hi Word, Hi Byte	0x42	Byte	1
IEEE 754 Data Hi Word, Lo Byte	0x13	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the floating point number 36.87 is represented in byte of hexadecimal as <42><13><77><CF>: