THE MODBUS COMMUNICATION PROTOCOL FOR DATA STREAM DIGITAL TRANSDUCERS

(RTU MODE)

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1. Configuration of the Transducers

The MODBUS protocol for series CRD is completely compatible with MODBUS developed by Gould Modicon for use in Modicon PLC systems.

The transducers are configured as follow:

Address: 01. Baudrate: 9600. Check bit: none. Stop bit: 1 bit.

2. Format

2.1 Format of message

2.1.1 Function code 0x03 ── To read the contents of registers of the slave equipment.

The Message is from the master equipment.

Address of the slave equipment	0x01-0xFF	1 byte
Function code	0x03	1 byte
Address of the first register	0x01-0xFF	2 bytes
Quantity of Registers		2 bytes
CRC code		2 bytes

The correct response message from the slave equipment:

Address of the slave equipment	0x01-0xFF	1 byte
Function code	0x03	1 byte
Byte count	2 x **N***	1 byte
Data section (contents of registers)		**N*** x 2 Bytes
CRC code		2 bytes

***N** = Quantity of Registers

2.1.2 Function code 0x10 ── To set (write) data of registers of the slave equipment

The Message is from the master equipment

Address of the slave equipment	0x01-0xFF	1 byte
Function code	0x10	1 byte
Address of the first register		2 bytes
Quantity of Registers		2 bytes
Byte count	2 x **N***	1 byte
The data written to the registers		2 x **N***
CRC code		2 bytes

***N** = Quantity of Registers

The correct response message from the slave equipment:

Address of the slave equipment	0x01-0xFF	1 byte
Function code	0x10	1 byte
Address of the first register		2 bytes
Quantity of Registers		2 bytes

CRC code		2 bytes

Note: 1. For all Address of register, Quantity of registers and Contents of register (Data), their high order byte is before their low order byte. But the low order byte of CRC code is before the high order byte.

2. The length of the register is 16 bits (2 bytes).

3. Products

3.1 3-phase 4-wire multi-parameter digital transducer CRD5170 Series

3.1.1 Format of commands and explanation of the registers

3.1.1.1 List of definitions of registers of electrical parameters data

Address of register (Hex)	Content of register	Quantity of registers	Attribute of register	Range of data
0x0010	Voltage of phase A	1	Read only	-12000~+12000
0x0011	Current of phase A	1	Read only	-12000~+12000
0x0012	Voltage of phase B	1	Read only	-12000~+12000
0x0013	Current of phase B	1	Read only	-12000~+12000
0x0014	Voltage of phase C	1	Read only	-12000~+12000
0x0015	Current of phase C	1	Read only	-12000~+12000
0x0016	P: active power	1	Read only	-12000~+12000
0x0017	Q: reactive power	1	Read only	-12000~+12000
0x0018	Cosφ: power factor	1	Read only	-12000~+12000
0x0019	F: frequency	1	Read only	0~60000
0x001A	Active energy	2	Read only	0x80000000~0x7FFFFFFF
0x001C	Reactive energy	2	Read only	0x80000000~0x7FFFFFFF

3.1.1.2 List of definitions of registers for transducer's name, address and baudrate:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x0020	Address and baudrate	1	Read/write	Address (0-256) Baudrate (03-07)
0x0021	Transducer's name	2	Read only	Depend on part number (4 bytes)

3.1.1.3 The explanation of register "To clear the data of energy"

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x00A7	Clear the data of energy	1	Write	0x000

3.1.1.4 Examples:

For all Address of register, Quantity of registers and Contents of register (Data), their high order byte is before their low order byte. But the low order byte of CRC code is

before the high order byte.

A: Example of the command "To read the all data":

Address of slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
0x01	0x03	0x00	0x10	0x00	0x0E	0xC5	0xCB

Note: 1. 0x00 is the high order byte of the register, and 0x10 is the lower order byte of the register.

2. Please see above 3.1.1.1 list of definition of register of electrical parameters data for the sequence of the output data.

B: Example of the command "To modify the address and baudrate":
(Change the address from 01 to 02; set the baudrate to 9600 bps <code 06>)

Address of slave equipment	Function code	Address of the first register		Quantity of registers		Data bytes count	Data written to register		CRC-L	CRC-H
0x01	0x10	0x00	0x20	0x00	0x01	0x02	0x02	0x06	0x20	0x52

Note: Codes for baudrate setting: 03-1200bps, 04-2400bps, 05-4800bps, 06-9600bps, 07--19200bps.

C: Example of the command "To read the transducer name and configuration":

Address of slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
0x01	0x03	0x00	0x20	0x00	0x03	0x04	0x01

D: Example of the command "To clear the data of energy":

Address of slave equipment	Function code	Address of the first register		Quantity of registers		Data bytes count	Data written to register		CRC-L	CRC-H
0x01	0x10	0x00	0xA7	0x00	0x01	0x02	0x00	0x00	0xBF	0x47

3.2 Single Phase multi-parameter digital transducer CRD5110 Series

3.2.1 Format of commands and explanation of the registers

3.2.1.1 List of definitions of registers of electrical parameters data:

Address of register (Hex)	Content of register	Quantity of registers	Attribute of register	Range of data
0x0010	Voltage of phase A	1	Read only	0~12000
0x0011	Current of phase A	1	Read only	0~12000

0x0012	P: active power	1	Read only	-12000~+12000
0x0013	Q: reactive power	1	Read only	-12000~+12000
0x0014	Cosφ: power factor	1	Read only	-12000~+12000
0x0015	F: frequency	1	Read only	0~65000
0x0016	Active energy	2	Read only	0x80000000~0x7FFFFFFF
0x0018	Reactive energy	2	Read only	0x80000000~0x7FFFFFFF

3.2.1.2 List of definitions of registers for transducer's name, address and baudrate:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x0020	Address and baudrate	1	Read/write	Address (0-256) Baudrate (03-07)
0x0021	Name of transducer	2	Read only	Depend on part number (4 bytes)

3.2.1.3 The explanation of register for clearing the data of energy:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x00A7	Clearing the data of energy	1	Write	0x0000

3.2.1.4 Examples:

For all Address of register, Quantity of registers and Contents of register (Data), their high order byte is before their low order byte. But the low order byte of CRC code is before the high order byte.

A: Example of the command "To read the all data":

Address of slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
0x01	0x03	0x00	0x10	0x00	0x0A	0xC4	0x08

Note: 1. 0x00 is the high order byte of the address of register, and 0x10 is the lower order byte of the address of register.

2. Please see above 3.2.1.1 list of definitions of register of electrical parameters data for the sequence of the output data.

3. Please refer to above in 3.1.1.4 for examples of the command "To modify the address and baudrate" and the command "To clear the data of energy". They are the same as those of 3-phase 4-wire transducers.

3.3 3-phase 3-wire multi-parameter digital transducer CRD5150 Series

3.3.1 Format of commands and explanation of the registers

3.3.1.1 List of definitions of registers of electrical parameters data:

Address of register (Hex)	Content of register	Quantity of registers	Attribute of register	Range of data
0x0010	Voltage of phase A	1	Read only	0~12000
0x0011	Current of phase A	1	Read only	0~12000
0x0012	Voltage of phase C	1	Read only	0~12000
0x0013	Current of phase C	1	Read only	0~12000
0x0014	P: active power	1	Read only	-12000~+12000
0x0015	Q: reactive power	1	Read only	-12000~+12000
0x0016	Cosφ: power factor	1	Read only	-12000~+12000
0x0017	F: frequency	1	Read only	0~65000
0x0018	Active energy	2	Read only	0x80000000~0x7FFFFFFF
0x001A	Reactive energy	2	Read only	0x80000000~0x7FFFFFFF

3.3.1.2 List of definitions of registers for transducer's name, address and baudrate:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x0020	Address and baudrate	1	Read/write	Address (0-256) Baudrate (03-07)
0x0021	Name of transducer	2	Read only	Depend on part number (4 bytes)

3.3.1.3 The explanation of register for clearing the data of energy:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x00A7	Clearing the data of energy	1	Write	0x0000

3.3.1.4 Examples:

For all Address of register, Quantity of registers and Contents of register (Data), their high order byte is before their low order byte. But the low order byte of CRC code is before the high order byte.

A: Example of the command "To read the all data":

Address of slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
0x01	0x03	0x00	0x10	0x00	0x0C	0x44	0x0A

Note: 1. 0x00 is the high order byte of the address of register, and 0x10 is the lower order byte of the address of register.

2. Please see above 3.3.1.1 list of definitions of register of electrical parameters data for the sequence of the output data.

3. Please refer to above in 3.1.1.4 for examples of the command "To modify the address and baudrate" and the command "To clear the data of energy". They are the same as those of 3-phase 4-wire transducers.

3.4 Current or Voltage Only parameter digital transducer CRD4110, CRD4150, CRD4170, CRD4510, CRD4550, CRD4570

3.4.1 Format of commands and explanation of the registers

3.4.1.1 List of definitions of registers of electrical parameters data:

Address of register (Hex)	Content of register	Quantity of registers	Attribute of register	Range of data
0x0010	Current of phase A	1	Read only	0~12000
0x0011	Current of phase B	1	Read only	0~12000
0x0012	Current of phase C	1	Read only	0~12000

3.4.1.2 List of definitions of registers for transducer's name, address and baudrate:

Address of register (Hex)	Contents of register	Quantity of registers	Attribute of register	Range of data
0x0020	Address and baudrate	1	Read/write	Address (0-256) Baudrate (03-07)
0x0021	Name of transducer	2	Read only	Depend on part number (4 bytes)

3.4.1.3 Examples:

For all Address of register, Quantity of registers and Contents of register (Data), their high order byte is before their low order byte. But the low order byte of CRC code is before the high order byte.

A: Example of the command "To read the all data":

Part number	Address of slave equipment	Function code	Address of the first register		Quantity of registers		CRC-L	CRC-H
CR4170, CR4570	0x01	0x03	0x00	0x10	0x00	0x03	0x04	0x0E
CR4150, CR4550	0x01	0x03	0x00	0x10	0x00	0x02	0xC5	0xCE
CR4110, CR4510	0x01	0x03	0x00	0x10	0x00	0x01	0x85	0xCF

Note: 1. 0x00 is the high order byte of the address of register, and 0x10 is the lower order byte of the address of register.

2. Please see above 3.4.1.1 list of definitions of register of electrical parameters data for the sequence of the output data.

3. Please refer to above 3.1.1.4 for examples of the command "To modify the address and baudrate" and the command "To clear the data of energy". They are

the same as those of 3-phase 4-wire transducers.

4. Data

(Example of 3-phase 4-wire transducer with rated voltage for 380V and rated current of 5A)

This chart demonstrates the Data response of a transducer after the read command.

No.	Parameter name	Value	Hex. Data (100%)		Decimal Data (100%)	Note
			High byte	Low byte		
1	VA	380V	27	10	10000	True RMS
2	IA	5A	27	10	10000	True RMS
3	VB	380V	27	10	10000	True RMS
4	IB	5A	27	10	10000	True RMS
5	VC	380V	27	10	10000	True RMS
6	IC	5A	27	10	10000	True RMS
7	P	5700W	27	10	10000	Pa+Pb+Pc
8	Q	5700Var	27	10	10000	Qa+Qb+Qc
9	COSΦ	1.0000	27	10	10000	Average of 3 phases
10	F	50Hz	C3	50	50000	Value of phase A
11	Kwh	5.7Kwh	4 bytes (high order ahead)		Maximum accumulative value is 0x7FFFFFFF	Active energy
12	Kvarh	5.7Kvarh	4 bytes (high order ahead)		Maximum accumulative value is 0x7FFFFFFF	Reactive energy

4.1 Format of the data for current, voltage and power

2 bytes Sign + Data (No Sign for AC voltage and AC current)

Range of the data: -12000~+12000

Meaning of the data: 10000 correspond to the nominal input value. For example, when the maximum value of input current is 5.000A, the expected output value is 10000D or 2710H and 2.500A correspond to 5000D or 1388H of the expected output value.

8-bit Low order byte (responded data)

7	6	5	4	3	2	1	LSB

8-bit High order byte

Sign 1=negative 0=positive	MSB	13	12	11	10	9	8

4.2 Calculation of power:

P=3*(Xp*(5*380))/10000 (W)

Q=3*(Xq*(5*380))/10000 (Var)

Thereinto:

Xp----The active power measured by the sensor. (2 bytes, high order byte ahead, the MSB is sign.)

Xq----The reactive power measured by the sensor. (2 bytes, high order byte ahead, the MSB is sign.)

4.3 Calculation of active energy:

N=3*n*(5*380)/(10000*3600) (kWh)

Thereinto:

n---- The active energy measured by the sensor. (4 bytes, high order byte ahead, the MSB is sign.)

4.4 Calculation of frequency:

f=F/1000 (Hz)

Thereinto:

F---- The frequency measured by the sensor. (2 bytes, high order ahead, no sign bit.)

4.5 Calculation of current and voltage:

v=(V/10000)*380 (V)

Thereinto:

V---- The voltage measured by the sensor. (2 bytes, high order byte ahead, the MSB is sign.)

i= (I/10000)*5 (A)

Thereinto:

I---- The current measured by the sensor. (2 bytes, high order byte ahead, the MSB is sign.)