MODBUS network communication protocol of UC-5N

1: Communication format

Intelligent Control station UC-5N uses Modbus RTU protocol, data is transmitted by RS-485.

modbus RTU communication format:

start	address	Function code	Data field 1...n	CRC check code	end

Address is 1 byte (Hexadecimal), valid range is 0~247, in which, 0 is broadcast address. Factory setting address is 247, when user wants to form a network with UC-5N, user need to readdress the slave stations according to their requirements.

The slave station's quantity of UC-5N network is 1~246 pieces. In order to guarantee the network operates reliable when network connection exceeds RS-485 bus regulation/standard, 485 repeater or Hub is required to expend the networking control stations quantity and distance.

Function code is one byte (hexadecimal), to identify the function of each communication frame. UC-5N supports one subset of standard modbus function code. Please refer to following chapters for the detailed definition.

Data field shows the content of the communication. The length will be different according to different function code.

CRC check code is a 2 bytes Cyclic Redundancy Check code. low-order byte is appended first, the calculation polynomial form of CRC-16 is $X^{16}+X^{15}+X^{2}+1$.

Messages start and end with a silent interval of at least 3.5 character times to validate the integrity of the message frame.

RS-485 interface mode is as follow:

Asynchronous half duplex communication. Default data format is 8 data bits, 1 stop bit, even parity, Baud rate 9600.

Available baud rates are 300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400

User can configure controllers for No Parity checking, Even or Odd Parity checking. Note: If No Parity is used, it is 2 stop bits; if Even or Odd Parity is used, it is 1 stop bit.

2: Read input status register

Function code: 02H

It is used to read the input status of 6 switches of UC-5N. Broadcast is not supported.

Address	Description	Read/Write	Meaning(digits in this column is decimal)
0000①	Input switch status	R②	D0-signal 0, D1-signal 1, D4-external control, D5-oil level, D6-Air pressure, Others-reserved.

① In the above figure, address and data are all hexadecimal. Same as below tables

②Read/Write: R-read only; W-write only; RW-Read and Write; —preserved address, network Read/Write is not supported.

Example: data frame format

address	Function	Starting address		Read switches bits quantity		CRC parity code	
F7	02	00	00	00	08	6D	5A

Response frame format

address	function	Bytes of response data	data	CRC parity code	
F7	02	01	21	52	18

Each bit status of the response data bytes represents the corresponding input status.

3: Read holding registers

Function code: 03H

It is used to read internal holding register of UC-5N. It is only allowed to read out a data of one word (2 bytes) each time. Broadcast is not supported.

High-order 2 bits of the 16 bits address is for channel number, low-order 2 bits is for the internal address of the channel. 01-channel 1； 02-channel 2； 03-channel 3.... As a special case, 00 represents system address.

Example： in address 0120, the high-order 2 bits 01 means channel 1, 20 means this is the address 20 of channel 1 （Pause control mode of channel 1）

address	Description	Read/Write	Meaning (the figure in this column is decimal figure)
0000	station number	RW	Modbus station number. Range 1~247, 0 is broadcast station number.
0001	MODBUS protocol type	—	'A'-ASCII protocol; 'R'-RTU protocol; 'T'-modbus TCP protocol
0002	Communication Baud rate	W	300, 600, 1200, 2400, 4800, 9600, 14400, 19200, 38400
0003	Parity	W	'N'-no parity, 'E'-Even parity, 'O'-Odd parity
0010	control station type	R	'5' means UC-5N
0011	Serial number (low)	R	0~9 9999 9999
0012	Serial number (high)	R	Must read high-order byte first, followed by low-order byte.
0013	software version	R	High-order byte is for major version number, low-order byte is for subversion number.
0014	Language	RW	0-Chinese; 1-English
0015	System protection password	RW	Range 0000~9999
0020	System monitoring status register	R	Low byte D7-power off, D3-signal 2 warning, D2-signal 1 warning, D1-pressure warning, D0-oil level warning
0021	Power off protection function	—	Preserved
0022	Power off protection voltage	—	Preserved
0023	External control	RW	Low byte 'N'-off ①, 'E'-on. Ignore high-order byte. Same as below.
0024	Oil level monitoring setting	—	Preserved
0025	Air pressure monitoring setting	RW	Low byte 'N'-off, 'E'-on

00FF	Terminal status	R	This is preserved for compatible those modbus main control equipments that do not support function code 02H. Its function and definition is same as chapter 2 <read input status register>.
0100	Current status of channel 1	R	'C'-lubricating, 'M'-inserted lubrication, 'P'-pause, 'D'-drain oil, 'T'-stop, O'-low level 'A'-low pressure, 'S'-no signal, 'E'-system error, 'N'-off ②
0110	Lubrication control mode of channel 1	—	preserved
0111	Lubrication control parameter of channel 1 (low)	RW	Merge high and low order is 1~999 999 pulses ③
0112	Lubrication control parameter of channel 1 (high)	RW	
0113	Lubrication remaining parameter of channel 1 (low)	R	
0114	Lubrication remaining parameter of channel 1 (high)	R	
0120	Pause control mode of channel 1	RW	'C'-Counter, 'T'-Timer ④
0121	Pause control parameter of channel 1 (low)	RW	0~3599 9999s or 0~9999 9999 pulses
0122	Pause control parameter of channel 1 (high)	RW	Must read high-order byte first, followed by low-order byte.
0123	Pause remaining parameter of channel 1 (low)	R	
0124	Pause remaining parameter of channel 1 (high)	R	Must read high-order byte first, followed by low-order byte.
0130	Pulse current on time of channel 1	RW	1~999, unit 10ms
0131	Pulse interval time of channel 1	RW	Preserved
0132	Pulse ratio of channel 1	RW	1~999
0133	fine adjustment for oil injection of channel 1	—	0~999, unit 10ms
0140	Monitoring signal level setting	—	
0141	Monitoring signal status	—	
0142	Set signal monitoring parameter of channel 1	RW	0~255 minutes
0143	Signal monitoring remaining parameter of channel 1	R	
0144	signal counter	—	
0200	Current status of channel 2	R	All parameters order are same as those of channel 1
0210	Lube control mode of channel 2	RW	

① When one monitoring function is deactivated, fault message that caused by this function will be erased.

② 'M'-Inserted lubrication is a special lubrication state. After get into inserted lubrication, lubrication system performs lubrication according to the preset lube control mode and control parameters, but it can be aborted,

this function is mainly for testing, manually lubrication or resume work state after exit error state. It is prior than force channel status change query sent by modbus network.

Example 1: data frame format of reading software version

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	00	12	00	01	30	99

Response frame format

Address	Function	Bytes of response data	Response data		CRC check	
F7	03	02	01	00	71	C1

Response data 01 00 means the software version is 1.0.

Example 2: Data frame format of reading monitoring status register

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	00	20	00	01	91	56

Response frame format

Address	Function	Bytes of response data	Response data		CRC check	
F7	03	02	00	01	B1	91

Low bytes 01H of response data's status (00000001) represents corresponding monitoring status. D0 is 1, means oil level error is detected.

Example 3: Data frame format of reading current status of channel 1

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	01	00	00	01	91	60

Response frame format

Address	Function	Bytes of response data	Response data		CRC check	
F7	03	02	00	43	31	A0

Low byte 50H of response data is the ASCII code of letter C, which means current status of channel 1 is lubricating.

Example 4: According to word reading method to read current pause rest parameter. This has to be divided into 2 words to read out. And high-order has to be read first, followed low-order. Then merge the high and low order words to a double-word data.

Data frame format of reading high-order data

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	01	24	00	01	D1	6B

Response frame format

Address	Function	Bytes of response data	Response data		CRC check	
F7	03	02	87	65	D3	8A

Then read low order data, data frame format is as follow:

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	01	23	00	01	60	AA

Response frame format

Address	Function	Bytes of response data	Response data		CRC check	
F7	03	02	43	21	81	79

Merge the high-order data 8765H and low-order data 4321H to a 4 bytes (hexadecimal) data 87654321H, which is the queried data result.

Example 5: According to double-word method to read Pause rest parameter of channel 1. With this method to get double-word data once.

Data frame format

Address	Function	Starting address		Read data quantity		CRC check	
F7	03	01	23	00	02	20	AB

Response frame format

Address	Function	Bytes of response data	Response data				CRC check	
F7	03	04	87	65	43	21	A5	BF

The consecutive 4 bytes 87654321H in the response data field is the current PAUSE rest parameter.

4: Preset single register

Function code: 06H

It is used to set UC-5N's internal register. Except the address 0000 of the queried station number, all the other addresses support broadcast.

Addresses are same as chapter 3: Read holding registers

Example: data frame format for setting station number as 1.

Address	Function	Starting address		Read-in data		CRC check	
F7	06	00	00	00	01	5C	9C

Response frame format (data frame is an echo of the query)

Address	Function	Starting address		Read-in data		CRC check	
F7	06	00	00	00	01	5C	9C

5: Force channel status change (force single coil)

Function code: 05H

It is used to force one of those four channels of UC-5N to change status.

Broadcast is supported

Address	Description	R/W	Meaning (figures in this column are decimal)
0000	Channel 1 state	W	The value of 1 requests the channel to be in lubrication state 'C'. The value of 0 (zero) requests the channel go to pause state 'P'①
0001	Channel 2 state	W	
FFFE	Reboot system	W	The value of 0 (zero) requests the system to reboot. Other values are invalid.

① If the channel is in halt state 'T', this function cannot be performed, it will response error code 07H; If user is carrying out local manual operation (the corresponding channel state is already ‘M’ or ‘D’), or ignore this query and response error code 06H (slave device busy) when user is operating menu. Constants in data field regulated the forced channel states. The value FF00H force the channel as 1 (lubricating); the value of 0000H force the channel as 0 (pause). Other values are invalid. If the channel is in no signal state, force this channel as 1 will get this channel exit no signal error state.

Example: data frame format of forcing channel 1 as 0 (zero)

Address	Function	Starting address		Control constants		CRC check	
F7	05	00	00	00	00	D9	5C

Response frame format (data frame is an echo of the query)

Address	Function	Starting address		Read-in data		CRC check	
F7	05	00	00	00	00	00	D9

6: Preset multiple registers

Function code:10H

It is used to set UC-5N’s internal register. Except the address 0000 of the queried station number, all the other addresses support broadcast. Limited data quantity is 1.

Addresses are same as chapter 3: Read holding registers

Example: Data frame format for setting station number as 1

Address	Function	Starting address		Data quantity		Bytes quantity	Read-in data		CRC check	
F7	10	00	00	00	01	02	00	01	48	34

Response frame format(Data frame is an echo of query)

Address	Function	Starting address		Data quantity		CRC check	
F7	06	00	00	00	01	15	5F

7: Error code

Function code: slave received function code +80H

code	Description	Meaning (figures in this column are decimal)
01	Illegal function	The function code received in the query is not an allowable action for the slave
02	Illegal data address	The data address received in the query is not an allowable address for the slave.
03	Illegal data	The value contained in the data field is not an allowable value for the slave.
06	Slave device busy	Slave device is engaged. Typical reasons are the salve is busy in processing a local manual operation or setting parameters.
07	Negative acknowledge	The slave cannot perform the program function received in the query. For example, ask slave to perform force status change when channel is in halt state.

If the CRC check error occurs in the frame slave received, or parity error occurs in data transmission, slave will remain silence.

Example: error frame format of response illegal data

Address	Function	Error code	CRC check	
F7	82	02	D9	5C

Response function code 82 means slave detected error, error code is 02 (illegal data address)