Programmable Transducer PRO M31

User Manual

V 1.42

ARTEL

III. Communication Protocol

3.1. Communication Protocol

Address (8bit) + function code (8bit) + Register (16bit) + Data area(N×8bit) + CRCH + CRCL

3.2. RTU command format and example

3.2. 1 Agreement form

A complete communication form definition is as follows :

Address Code: The 1st byte. The byte indicates the serving meter shall receive the information from the master meter. Every meter can only has 1 address code, Sending and receiving information must address to each meter's own address code. The master meter shall indicate the address code for the serving meter, and the serving meter shall indicate the reply address code.

Function Code: The 2nd byte. Modbus Protocol defines that the function no. is between 1 to 127. M31 use part of the code (see table blow). The master meter commands the serving meter the executions by sending the function code. When the serving meter receives the commands, it responds the master meter by sending back the same function code.

Register: The designated data storing place.

Data Area: Data areas are different according to different function code, different sending or responding command. The data in each register is 2 bytes, indicated as: no. of register H + No. of registering data L + bytes + read/write data 1H + read/write data 1L + read/write data 2H + read/write data 2L…

CRC code: 2 bytes error checking code. First send high 8, then low 8

3.2.2 M31 Functional code:

code	Function	Explanation
03H	Read multiple registers	User register part are open to the user, others for internal use.
06H	Write the single register	
10H	Write multiple registers	

3.3False command

3.3.1Return:

No	00	01	02	03	04
Function	Address	Code	Error Code	CRCH	CRCL
Explanation	01H	81H	02H	CRCH	CRCL

Example explanation: If there is error when executing 01 command, the error code is 02: Illegal data address. 01 byte = Code|80H.

3.3.2 Error code

Error Code	Explanation	Error correction
01	Illegal command	1. False function code 2. False Form command.
02	Illegal data	The data exceeding the defined register scope
03	The wrong input command	Read/write on the invalid register or attempts the read/write on the register that's protected.
04	The wrong input command	The register is inconsistent with the analog output of the meter

3.4 . M31 Functional code explanation

3.4.1 03H function code

Code Description: Read multiple register data.

Send command format(fixed 8 bytes) and example :

No	00	01	02	03	04	05	06	07
Description	Address	Code	RegAddH	RegAddL	WordsH	WordsL	CRCH	CRCL
Example	01H	03H	01H	00H	00H	02H	CRCH	CRCL

Example explanation: Read consecutive 2 register data starting from 0100H 2 （WordsH WordsL = 0002H）in 01 meter

Reply command format and example:

No	00	01	02	03	04	05	06	07	08
Description	Address	Code	Bytes	Data1H	Data1L	Data2H	Data2L	CRCH	CRCL
Example	01H	03H	04H	12H	34H	56H	78H	CRCH	CRCL

Example explanation: Reply data 1234H in 0100 Register and 5678H（grey part）in 0101 Register. In command WordsH WordsL = 02, Each register has 2 Bytes, No. 02 byte is 2*2=4 bytes.

3.4.2 06H code

Code description: Write single register value.

Sending command form:（Fixed 8 bytes, Data H and Data L as written data）:

No	00	01	02	03	04	05	06	07
Description	Address	Code	RegAddH	RegAddL	DataH	DataL	CRCH	CRCL
Example	01H	06H	01H	00H	12H	34H	CRCH	CRCL

Description explanation: Write 1234H in meter 01's 0100 register. .

Reply command:（total 8 bytes）: If writing data is successfully, then send back to the same data.

No	00	01	02	03	04	05	06	07
Description	Address	Code	RegAddH	RegAddL	DataH	DataL	CRCH	CRCL
Example	01H	06H	01H	00H	12H	34H	CRCH	CRCL

Example explanation: the meter 01 executes 03H code successfully, writing 1234H data in 0100 register.

3.4.3 10H code

Code Description: Write multiple register continuously.

Send command and example:

No	00	01	02	03	04	05	06	07	08	09	0A	0B	0C
Description	Add	Code	RegAddH	RegAddL	WordsH	WordsL	Bytes	Data1H	Data1L	Data2H	Data2L	CRCH	CRCL
Example	01H	10H	01H	01H	00H	02H	04H	12H	34H	56H	78H	CRCH	CRCL

Example explanation: Write 2 consecutive data 1234H and 5678H in meter 01 starting from 0101 register.

Reply command:

No	00	01	02	03	04	05	06	07
Description	Address	Code	RegAddH	RegAddL	WordsH	WordsL	CRCH	CRCL
Example	01H	10H	01H	01H	00H	02H	CRCH	CRCL

Example explanation: Execute command successfully.

3.5. M31 Register explanation

3.5.1 User register

Address（Hex）	type	description	byte	explanation	Register explanation
0100	R W	Address	Byte1	————	Meter address:1~255
			Byte0	addr	
0101	R W	Baud rate	Byte1		
			Byte0	00D5D4 ： None、01：Odd、10：Even	
				Baud rate	D2D1D0 000：115200 001 ：57600 010：38400 011 ：19200 100：9600 101 ：4800 110 ：2400 111：1200.
0102	R W	PT	Byte1	PTvaule H	PT scope: 0.1~6500. Remarks: Integer bit
			Byte0	PTvaule L	
0103	R W	CT	Byte1	H CT	CT scope: 0.1~6500. Remarks: Integer bit
			Byte0	L CT	
0104	RW	mode of connection	Byte1	————	Mode of connection: 0: 3P4W. 1: 3P3W, 2: single 3:3P4W _Balance 1CT 4: 3P3W_Balance1CT
			Byte0	Mode of connection	
0105	RW	Analog input secondary / primary side value	Byte1		0: Item for analog input is secondary side value 1: Item for analog input is primary side value
			Byte0		
0106	RW	PT Decimal places	Byte1	Input option	PT / CT data to two decimal places, the actual value is register values / 100, range 0 to 99.
			Byte0	Output option	
0107	RW	CT Decimal places	Byte1	Input option	
			Byte0	Output option	

Address（Hex）	type	description	byte	explanation	Register explanation
0108	RW	Analog1 out, rated Current In	Byte1	Input option	See the description
			Byte0	Output option	
0109	RW	Analog2 out, rated Current In	Byte1	Input option	
			Byte0	Output option	
010A	RW	Analog 3out, rated Current In	Byte1	Input option	
			Byte0	Output option	
010B	RW	reserve	Byte1	H	**1.**For input Voltage, the register value = input data *10; **2.**For input Current, the power factor, the register value = input data *1000; **3.**For frequency, the register value = input data *10 **4.**For output data: he register value = output data *100 ; **5.**The input and output data high is a sign bit, 1 means negative number, 0 means positive number.
			Byte0	L	
010C	RW	reserve	Byte1	H	
			Byte0	L	
010D	RW	reserve	Byte1	H	
			Byte0	L	
010E	RW	reserve	Byte1	H	
			Byte0	L	
010F	RW	reserve	Byte1	H	
			Byte0	L	
0110	RW	reserve	Byte1	H	
			Byte0	L	
0111	RW	reserve	Byte1	H	
			Byte0	L	
0112	RW	reserve	Byte1	H	
			Byte0	L	
0113	RW	reserve	Byte1	H	
			Byte0	L	
0114	RW	reserve	Byte1	H	
			Byte0	L	

Address（Hex）	type	description	byte	explanation	Register explanation
0115	RW	reserve	Byte1	H	
			Byte0	L	
0116	RW	reserve	Byte1	H	
			Byte0	L	
0117	RW	reserve	Byte1	H	The same as above
			Byte0	L	
0118	RW	reserve	Byte1	H	
			Byte0	L	
0119	RW	reserve	Byte1	H	
			Byte0	L	
011A	RW	In Analog channel 1 turning point 1 input data H	Byte1	H	
			Byte0	L	
011B	RW	In Analog channel 1 turning point 1 input data L	Byte1	H	
			Byte0	L	
011C	RW	In Analog channel 1 turning point 2 input data H	Byte1	H	
			Byte0	L	
011D	RW	In Analog channel 1 turning point 2 input data L	Byte1	H	
			Byte0	L	
011E	RW	In Analog channel 1 turning point 3 input data H	Byte1	H	
			Byte0	L	
011F	RW	In Analog channel 1 turning point 3 input data L	Byte1	H	
			Byte0	L	
0120	RW	In Analog channel 1 turning point 4 input data H	Byte1	H	
			Byte0	L	
0121	RW	In Analog channel 1 turning	Byte1	H	

Address（Hex）	type	description	byte	explanation	Register explanation
		point 4 input data L	Byte0	L	
0122	RW	In Analog channel 1 turning point 5 input data H	Byte1	H	
			Byte0	L	
0123	RW	In Analog channel 1 turning point 5 input data L	Byte1	H	The same as above
			Byte0	L	
0124	RW	In Analog channel 2 turning point 1 input data H	Byte1	H	
			Byte0	L	
0125	RW	Current analog 2 refraction points 1 input data L	Byte1	H	
			Byte0	L	
0126	RW	In Analog channel 2 turning point 2 input data H	Byte1	H	
			Byte0	L	
0127	RW	In Analog channel 2 turning point 2 input data L	Byte1	H	
			Byte0	L	
0128	RW	In Analog channel 2 turning point 3 input data H	Byte1	H	
			Byte0	L	
0129	RW	In Analog channel 2 turning point 3 input data L	Byte1	H	
			Byte0	L	
012A	RW	In Analog channel 2 turning point 4 input data H	Byte1	H	
			Byte0	L	
012B	RW	In Analog channel 2 turning point 4 input data L	Byte1	H	
			Byte0	L	
012C	RW	In Analog channel 2 turning point 5 input data H	Byte1	H	
			Byte0	L	
012D	RW	In Analog channel 2 turning point 5 input data L	Byte1	H	
			Byte0	L	

Address（Hex）	type	description	byte	explanation	Register explanation
012E	RW	In Analog channel 3 turning point 1 input data H	Byte1	H	
			Byte0	L	
012F	RW	In Analog channel 3 turning point 1 input data L	Byte1	H	The same as above
			Byte0	L	
0130	RW	In Analog channel 3 turning point 2 input data H	Byte1	H	
			Byte0	L	
0131	RW	In Analog channel 3 turning point 2 input data L	Byte1	H	
			Byte0	L	
0132	RW	In Analog channel 3 turning point 3 input data H	Byte1	H	
			Byte0	L	
0133	RW	In Analog channel 3 turning point 3 input data L	Byte1	H	
			Byte0	L	
0134	RW	In Analog channel 3 turning point 4 input data H	Byte1	H	
			Byte0	L	
0135	RW	In Analog channel 3 turning point 4 input data L	Byte1	H	
			Byte0	L	
0136	RW	In Analog channel 3 turning point 5 input data H	Byte1	H	
			Byte0	L	
0137	RW	In Analog channel 3 turning point 5 input data L	Byte1	H	
			Byte0	L	
0138	RW	In Analog channel 1 turning point1 output data	Byte1	H	
			Byte0	L	
0139	RW	In Analog channel 1 turning point2 output data	Byte1	H	
			Byte0	L	
013A	RW	In Analog channel 1 turning	Byte1	H	

Address（Hex）	type	description	byte	explanation	Register explanation
		point3 output data	Byte0	L	
013B	RW	In Analog channel 1 turning point4 output data	Byte1	H	The same as above
			Byte0	L	
013C	RW	In Analog channel 1 turning point5 output data	Byte1	H	
			Byte0	L	
013D	RW	In Analog channel 2 turning point1 output data	Byte1	H	
			Byte0	L	
013E	RW	In Analog channel 2 turning point2 output data	Byte1	H	
			Byte0	L	
013F	RW	In Analog channel 2 turning point3 output data	Byte1	H	
			Byte0	L	
0140	RW	In Analog channel 2 turning point4 output data	Byte1	H	
			Byte0	L	
0141	RW	In Analog channel 2 turning point5 output data	Byte1	H	
			Byte0	L	
0142	RW	In Analog channel 3 turning point1 output data	Byte1	H	
			Byte0	L	
0143	RW	In Analog channel 3 turning point2 output data	Byte1	H	
			Byte0	L	
0144	RW	In Analog channel 3 turning point3 output data	Byte1	H	
			Byte0	L	
0145	RW	In Analog channel 3 turning point4 output data	Byte1	H	
			Byte0	L	
0146	RW	In Analog channel 3 turning	Byte1	H	

Address（Hex）	type	description	byte	explanation	Register explanation
		point5 output data	Byte0	L	
0147	R	UA Real number	Byte3	H	Measured data = measured data 1*10^N , Byte 3 high is a sign bit, The index effective byte (Byte0) high is a sign bit, 1 is a minus sign; 0 are Positive.
			Byte2	L	
0148	R	UA Index	Byte1	————	
			Byte0	NIndex	
0149	R	UB Real number	Byte3	,H	The same as above
			Byte2	L	
014A	R	UB Index	Byte1	————	
			Byte0	Index N	
014B	R	UC Real number	Byte3	H	
			Byte2	L	
014C	R	UC Index	Byte1	————	
			Byte0	Index N	
014D	R	UAL Real number	Byte3	H	
			Byte2	L	
014E	R	UAL Index	Byte1	————	
			Byte0	Index N	
014F	R	UBL Real number	Byte3	H	
			Byte2	L	
0150	R	UBL Index	Byte1	————	
			Byte0	Index N	
0151	R	UCL Real number	Byte3	H	
			Byte2	L	
0152	R	UCL Index	Byte1	————	

Address（Hex）	type	description	byte	explanation	Register explanation
			Byte0	Index N	
0153	R	IA Real number	Byte3	H	
			Byte2	L	
0154	R	IA Index	Byte1	————	
			Byte0	Index N	
0155	R	IB Real number	Byte3	H	
			Byte2	L	
0156	R	IB Index	Byte1	————	
			Byte0	Index N	
0157	R	IC Real number	Byte3	H	
			Byte2	L	
0158	R	IC Index	Byte1	————	
			Byte0	Index N	
0159	R	PA Real number	Byte3	H	The same as above
			Byte2	L	
015A	R	PA Index	Byte1	————	
			Byte0	Index N	
015B	R	PB Real number	Byte3	H	
			Byte2	L	
015C	R	PB Index	Byte1	————	
			Byte0	Index N	
015D	R	PC Real number	Byte3	H	
			Byte2	L	
015E	R	PC Index	Byte1	————	

Address（Hex）	type	description	byte	explanation	Register explanation
			Byte0	Index N	
015F	R	P total Real number	Byte3	H	
			Byte2	L	
0160	R	P total Index	Byte1	————	
			Byte0	Index N	
0161	R	QA Real number	Byte3	H	
			Byte2	L	
0162	R	QA Index	Byte1	————	
			Byte0	Index N	
0163	R	QB Real number	Byte3	H	
			Byte2	L	
0164	R	QB Index	Byte1	————	
			Byte0	Index N	
0165	R	QC Real number	Byte3	H	The same as above
			Byte2	L	
0166	R	QC Index	Byte1	————	
			Byte0	Index N	
0167	R	Q total Real number	Byte3	H	
			Byte2	L	
0168	R	Index Q total	Byte1	————	
			Byte0	Index N	
0169	R	SA Real number	Byte3	H	
			Byte2	L	
016A	R	SA Index	Byte1	————	

Address（Hex）	type	description	byte	explanation	Register explanation
			Byte0	Index N	
016B	R	SB Real number	Byte3	H	
			Byte2	L	
016C	R	SB Index	Byte1	————	
			Byte0	Index N	
016D	R	SC Real number	Byte3	H	
			Byte2	L	
016E	R	SC Index	Byte1	————	
			Byte0	Index N	
016F	R	S total Real number	Byte3	H	
			Byte2	L	
0170	R	S total Index	Byte1	————	
			Byte0	Index N	
0171	R	Active energy real number	Byte1	H	The same as above
			Byte0	L	
0172	R	Active energy index number	Byte1	————	
			Byte0	Index N	
0173	R	Reactive energy real number	Byte1	H	
			Byte0	L	
0174	R	Reactive energy index number	Byte1	————	
			Byte0	Index N	
0175	R	UA	Byte1	H	Not *PT, register value=UA*10.
			Byte0	L	
0176	R	UB	Byte1	H	Not*PT, register value =UB*10.
			Byte0	L	

Address（Hex）	type	description	byte	explanation	Register explanation
0177	R	UC	Byte1	H	Not*PT, register value =UC*10.
			Byte0	L	
0178	R	UAL	Byte1	H	Not*PT, register value =UAL*10.
			Byte0	L	
0179	R	UBL	Byte1	H	Not*PT, register value =UBL*10.
			Byte0	L	
017A	R	UCL	Byte1	H	Not*PT, register value =UCL*10.
			Byte0	L	
017B	R	IA	Byte1	H	Not*CT, register value =IA*1000.
			Byte0	L	
017C	R	IB	Byte1	H	Not*CT, register value =IB*1000.
			Byte0	L	
017D	R	IC	Byte1	H	Not*CT, register value =IC*1000.
			Byte0	L	
017E	R	PA	Byte1	H	Not *PT, CT, No. 7 of register H data is sign bit. When No. 6 is 1, data *10; when no.6 is 0, as the raw data.
			Byte0	L	
017F	R	PB	Byte1	H	
			Byte0	L	
0180	R	PC	Byte1	H	
			Byte0	L	
0181	R	total P	Byte1	H	
			Byte0	L	
0182	R	QA	Byte1	H	
			Byte0	L	
0183	R	QB	Byte1	H	

Address（Hex）	type	description	byte	explanation	Register explanation
			Byte0	L	
0184	R	QC	Byte1	H	
			Byte0	L	
0185	R	Q total	Byte1	H	
			Byte0	L	
0186	R	SA	Byte1	H	
			Byte0	L	
0187	R	SB	Byte1	H	
			Byte0	L	
0188	R	SC	Byte1	H	
			Byte0	L	
0189	R	S total	Byte1	H	
			Byte0	L	
018A	R	CosφA	Byte1	H	Register value= CosφA *1000
			Byte0	L	
018B	R	cosφB	Byte1	H	Register value = CosφB *1000
			Byte0	L	
018C	R	CosφC	Byte1	H	Register value = CosφC *1000
			Byte0	L	
018D	R	Total Power factor	Byte1	H	Register value =total Power factor*1000
			Byte0	L	
018E	R	F	Byte1	H	Register value = F *100.
			Byte0	L	
018F	R	Read the running time	Byte3	H	

Address（Hex）	type	description	byte	explanation	Register explanation
			Byte2	Mid bit	
0190	R	Read the running time	Byte1	bitMid	
			Byte0	L	
0191	R	Hardware edition	Byte1	H	
			Byte0	L	
0192	R	Software release	Byte1	H	
			Byte0	L	
0193	R	Device address Search	Byte1	----	
			Byte0	L	
01A3	RW	In Analog channel 1 turning point 1 one decimal place in the input data	Byte1	----	
			Byte0	L	
01A4	RW	In Analog channel 1 turning point 2 one decimal place in the input data	Byte1	----	
			Byte0	L	
01A5	RW	In Analog channel 1 turning point 3 one decimal place in the input data	Byte1	----	
			Byte0	L	
01A6	RW	In Analog channel 1 turning point 4 one decimal place in the input data	Byte1	----	
			Byte0	L	
01A7	RW	In Analog channel 1 turning	Byte1	----	

Address（Hex）	type	description	byte	explanation	Register explanation
		point 5 one decimal place in the input data	Byte0	L	
01A8	RW	In Analog channel 2 turning point 1 one decimal place in the input data	Byte1	----	
			Byte0	L	
01A9	RW	In Analog channel 2 turning point 2 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AA	RW	In Analog channel 2 turning point 3 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AB	RW	In Analog channel 2 turning point 4 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AC	RW	In Analog channel 2 turning point 5 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AD	RW	In Analog channel 3 turning point 1 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AE	RW	In Analog channel 3 turning point 2 one decimal place in the input data	Byte1	----	
			Byte0	L	
01AF	RW	In Analog channel 3 turning point 3 one decimal place in	Byte1	————————	

Address（Hex）	type	description	byte	explanation	Register explanation
		the input data	Byte0	L	
01B0	RW	In Analog channel 3 turning point 4 one decimal place in the input data	Byte1	----	
			Byte0	L	
01B1	RW	In Analog channel 3 turning point 5 one decimal place in the input data	Byte1	----	
			Byte0	L	
01B2	RW	Standby	Byte1	----	
			Byte0		

3.5.2 System register table

Address（Hex）	type	description	byte	explanation	explanation
		Byte0	L		
0206	RW	Read/ write running time	Byte3	H	
			Byte2	bit Mid	
0207	RW	Read/ write running time	Byte1	bit Mid	
			Byte0	L	
			0x34	L	

Description for input options:

0: Phase A Voltage 1: Phase A current 2: Phase A active po wer 3: Phase A reactive power 4: Phase A active power 5: Phase A Power factor

6: Phase B Voltage 7:Phase B current 8: Phase B active power 9: Phase B reactive power 10: Phase B Apparent power 11:Phase B Power factor

12:Phase C Voltage 13:Phase C current 14:Phase C active power 15:Phase C reactive power 16:C phase Apparent power 17:Phase C Power factor

18:Frequency 19:Always active power 20:Total Power factor 21:Phase A Voltage 22.Phase B Voltage 23:Phase C Voltage

Voltage range :0~400V; Current range :0~5A; Active power range:-3450~3450; Reactive power range: -3450~3450;

Apparent power range: 0~3450; Power factor range: -1~1; Frequency range: 45~65

Output type:

Analog out, rated 0: default output 0 mA

1: turning points 2 output data

2: turning points 3 output data

3:turning points 4 output data

4: turning points 5 output data

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