

DDSU666 Single-phase Smart Meter

User manual

ZTY0.464.1413

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1. Summarize

1.1 The main purpose and the suitable occasion

DDSU666 Single-phase Smart Meter (Hereinafter referred to as "the instrument") is designed for power monitoring and energy metering demand of the electric power system, communication industry, and construction industry. It is a new generation of intelligent instruments, integrated Communication and Measurement, mainly used as measurement and display of voltage and current, power, frequency, power factor and active power in electrical circuit. It will realize the data network of external devices by RS485 communication. It uses standard DIN35mm rail mounting structure, modular design. It has the advantages of small size, easy installation and easy networking .It is used widely as energy monitoring and assessment in industrial and mining enterprises, hotels, schools, and large public buildings.

Conform to the following standards:

IEC 61010-1:2010 《Safety requirements for electrical requirement for measurement, control, and laboratory use Part1:General requirements》

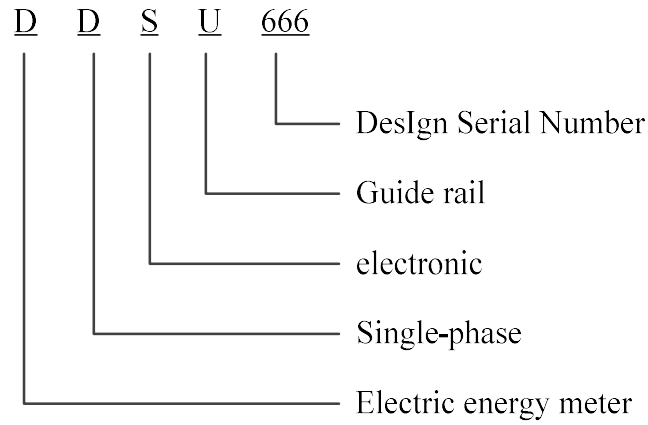
IEC 61326-1:2013 《Electrical requirement for measurement, control and laboratory use –EMC requirements Part1:General requirements》

1.2 Product features

- 1) Accurately metering the positive/ reverse active energy and combined active energy, no storage data loss for the Meter after power interruption.
- 2) Use wide temperature LCD;
- 3) Use standard DIN35mm rail mounting structure, modular design. It has the advantages of small size, easy installation and easy networking.

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1.3 Model composition and significance



1.4 Environmental conditions

Rated temperature: $-25^{\circ}\text{C} \sim +55^{\circ}\text{C}$;

Limit temperature : $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$;

Relative humidity(average annual): $\leq 75\%$;

Atmosphere: $86\text{kPa} \sim 106\text{kPa}$.

2. The overall principle block-diagram

The follow figure 1 is the overall principle block-diagram of the instrument.

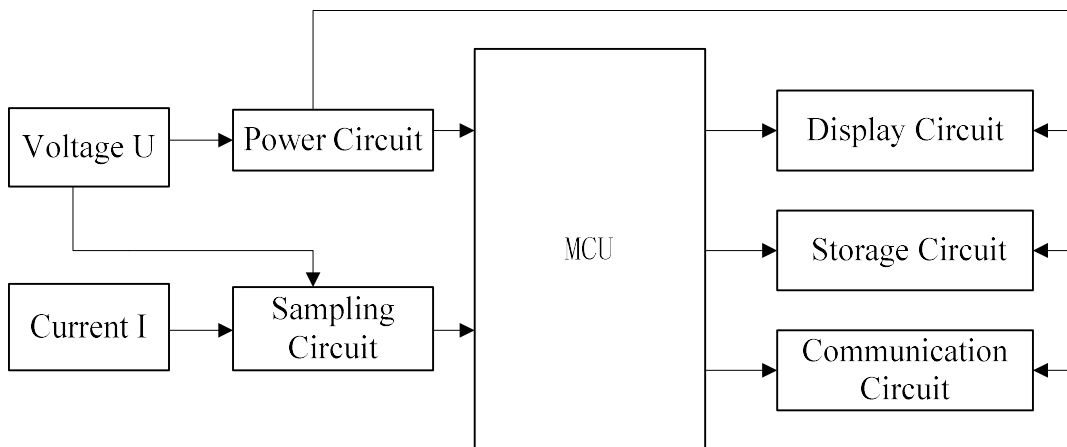


Figure 1 the overall principle block-diagram

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3. The major specifications and parameter

3.1 types and specifications

Model No.	Accuracy grade	Referenced voltage	Current specification	constant	type
DDSU666	Active power 1	230 V	100A/40mA	800imp/kWh	Transformer access

*Note: in order to prevail in kind

3.2 Percentage error

The percentage error of single-phase electric meter shall not exceed the following limit value.

Current value		power factor	Percent error limit of Each level meter
direct access meter	Connected with electronic transformers		1
$0.05 I_b \leq I < 0.1 I_b$	$0.02 I_n \leq I < 0.05 I_n$	1	± 1.5
$0.1 I_b \leq I \leq I_{max}$	$0.05 I_n \leq I \leq I_{max}$	1	± 1.0
$0.1 I_b \leq I < 0.2 I_b$	$0.05 I_n \leq I < 0.1 I_n$	0.5L	± 1.5
		0.8C	± 1.5
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5L	± 1.0
		0.8C	± 1.0
The user's special requirements		0.25L	± 3.5
$0.2 I_b \leq I \leq I_{max}$	$0.1 I_n \leq I \leq I_{max}$	0.5C	± 2.5

3.3 Start

Under the condition of reference voltage and table 4, the electric meter can start and continuously measure the electric energy.

instrument	grade of electric meter	power factor
	1 grade	
direct access meter	$0.004 I_b$	1

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Connected with electronic transformers	0.002In	
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3.4 Creeping

The meter should have good anti creeping logic, when the voltage loop is applied with 1.15 times reference voltage and current circuit is open, the meter will not produce more than 1 pulse.

3.5 Electrical parameters

Specified operating voltage range	0.9Un~1.1Un
Extended operating voltage range	0.7Un~1.15Un
Limiting operating voltage range	0.7Un~1.3Un
Voltage line power consumption	≤2W/10VA
Current line power consumption	≤2.5VA

3.6 Other technical parameters

Range of measurement	0~999999.99 kWh (Only show 6 bits, decimal shift automatically)
Display mode	LCD
Communication protocol	Modbus-RTU

3.7 Key Components

SOC	SH79F7019
Crystal oscillator	32.768kHz
Power transformer	ZTY6.170.234
Printed circuit board	ZTY8.067.2729、ZTY8.067.2730 (Notes: The actual plate number is determined according to the actual sample table)
Current transformer	ZTY6.176.301

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4. Main functions

4.1 Metering function(Not as the basis for billing, for reference)

Accurately metering the positive/ reverse active energy and combined active energy, no storage data loss for the Meter after power interruption.

4.1 Display function

The instrument adopts field LCD design, characterized with display function for electrical parameters and energy data. Please see LCD display in figure 2-3.

The display bit of energy measurement value can be six bits, with display range from 0 to 999999kWh.



Meaning of liquid crystal identification

The measurement data pages display per 5 seconds, and the pages as follows.

Display instructions

No.	Content	Description
1	<p>The display shows 'Imp.' above the first three digits '000' and 'kW h' above the last two digits '1.20'.</p>	Current positive active energy Imp = 1.20kWh
2	<p>The display shows 'Exp.' above the first three digits '000' and 'kW h' above the last two digits '1.00'.</p>	Current reverse active energy Exp = 1.00kWh

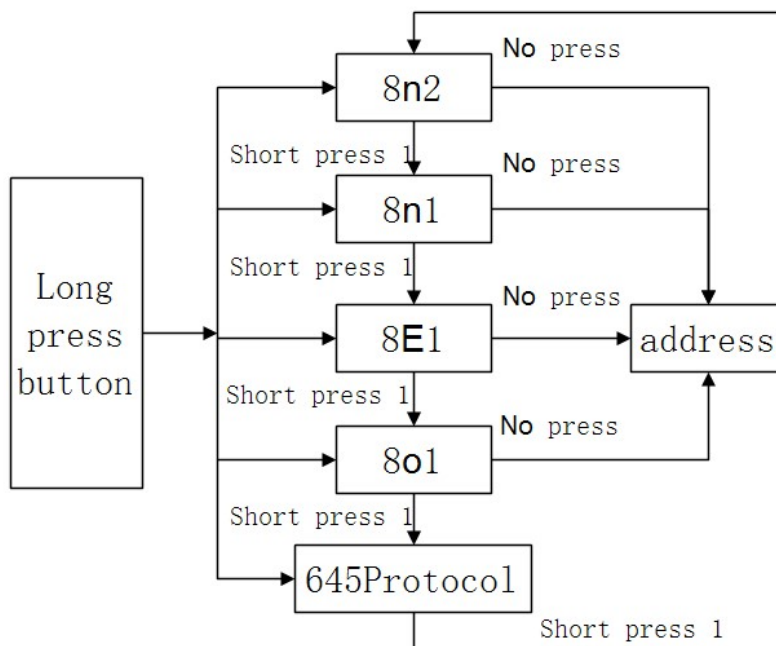
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3	NO. iiodbus	Modbus
4	NO. i- 8n1	8Data bits,None Parity,1 Stop Bit
5	NO. i- 011	Comm.Add=11
6	NO. bAUD-3	baud rate to be 9600bps
7	^v U 220.0	Voltage U=220.0V
8	^A I 5.000	Current I=5.000A
9	^{kW} P 1.100	Active power P=1.100kW
10	Ft 1.000	Power factor Ft=1.000
11	F 50.00	Frequency F=50.00Hz

The Meter can set the communication address and baud rate through buttons.

Long press the button 3s, the Meter will automatically enter into the communication address setting interface, with cyclic display for setting display interface of baud rate and communication address. Please press the button when required for baud rate or communication address settings, it will exit to communication address and baud rate settings without button operation for twenty seconds.

The details are as follows:



4.2 Communication function

The Meter is equipped with one RS485 communication interface, with baud rate changed among 1200bps and 9600bps. The default baud rate is 9600bps with check bit and stop bit to be n.1, communication address (see factory number or LCD display , Default address 03), support ModBus—RTU protocol.

Parameter address	Parameter code	Instruction of the parameters	Type of data	Length of data Word	Read&write attributes
0000H	RESERVED	RESERVED	16-bit with symbols	1	
0001H	REV.	Reserved, actual read is the version number	16-bit with symbols	1	R
0002H	ClrE	Electric energy zero clearing CLr.E(1:zero clearing)	16-bit with symbols	1	R/W
0003H	RESERVED	RESERVED	16-bit with symbols	1	

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0004H	RESERVED	RESERVED	16-bit with symbols	1	
0005H	ChangeProtocol	Protocol changing-over	16-bit with symbols	1	R/W
0006H	Addr	Communication address Addr	16-bit with symbols	1	R/W
0007H	RESERVED	RESERVED	16-bit with symbols	1	
0008H	RESERVED	RESERVED	16-bit with symbols	1	
0009H	RESERVED	RESERVED	16-bit with symbols	1	
000AH	RESERVED	RESERVED	16-bit with symbols	1	
000BH	Meter type	Meter type	16-bit with symbols	1	R
000CH	BAud	Communication baud rate bAud	16-bit with symbols	1	R/W
000DH	RESERVED	RESERVED	16-bit with symbols	1	
000EH	RESERVED	RESERVED	16-bit with symbols	1	
000FH	RESERVED	RESERVED	16-bit with symbols	1	
0010H	RESERVED	RESERVED	16-bit with symbols	1	
Electric quantity of the secondary side					
2000H	U	Voltage	single precision floating decimal	2	R
2002H	I	Current	single precision floating decimal	2	R
2004H	P	Conjunction active power, the unit is KW	single precision floating decimal	2	R
2006H	Q	Conjunction reactive power, the unit is Kvar	single precision floating decimal	2	R
2008H	RESERVED	RESERVED	single precision floating decimal	2	R
200AH	PF	Conjunction power factor	single precision floating decimal	2	R
200CH	RESERVED	RESERVED	single precision floating decimal	2	R

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200EH	Freq	Frequency	single precision floating decimal	2	R
2010H	RESERVED	RESERVED	single precision floating decimal	2	R
Electrical data of the secondary side					
4000H	Ep	Active in electricity	single precision floating decimal	2	R
400AH	-Ep	Reverse in electricity	single precision floating decimal	2	R

CLr.E: electric energy cleared, when write 1 will clear the total electric energy;

BAud: 0:1200bps; 1:2400bps; 2:4800bps; 3:9600bps.

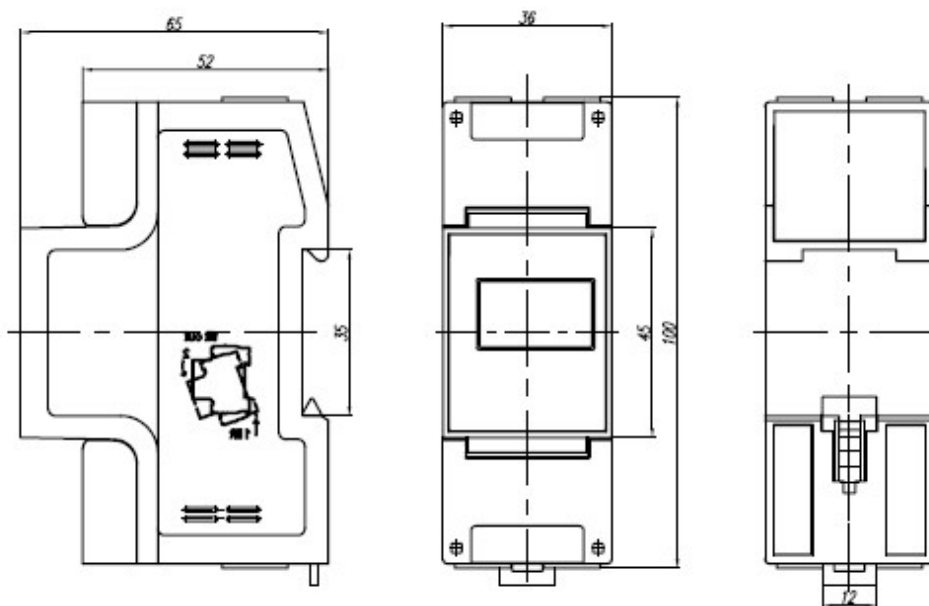
4.3 Output function

The electric energy pulse output interface of the meter is a passive photoelectric isolated output, and the output pulse waveform is 80 + 16ms square wave.

Meter pulse indication uses long life led display.

5. Externa and installation dimension

Externa dimension: 36mmx89mmx74mm; Installation dimension: 35mm.



Outline and installation dimension

6. Installation and instructions for use

6.1 Check

- 1) Before installation, please check whether the model and specifications of the products on the box are in line with the material, if not, please contact the supplier;
- 2) Check the packing case of the product is damaged, if damaged, please contact the supplier.

6.2 Install

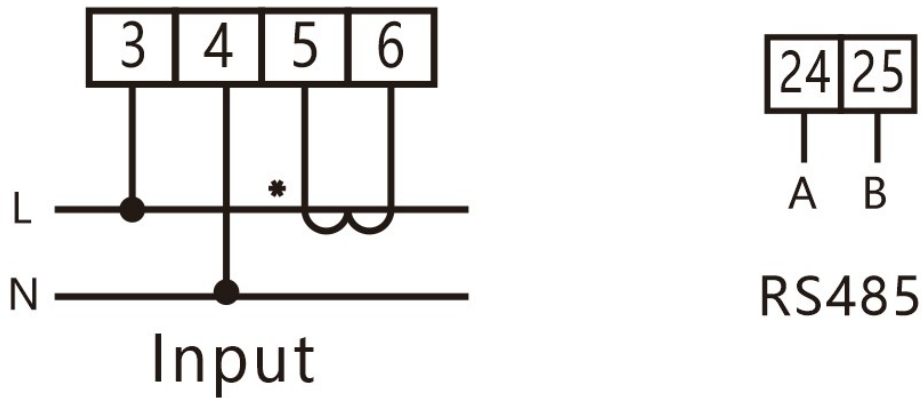
Stuck the instrument on the guide rail directly, and install the instrument and the rail in the distribution box finally.

- 1) when installed, stuck the end of the card slot in the guide rail.
- 2) when uninstalled, use a screwdriver to press the card to remove the instrument

6.3 Connection

6.3.1 Terminal description

Prior to power up, check the wiring is correct, wiring diagram is as follow:



7. Diagnosis, analysis and troubleshooting of common faults

Fault phenomenon	Factor analysis	Elimination method
No display after the instrument being powered on	<p>Incorrect wiring mode;</p> <p>Abnormal voltage supplied for the instrument;</p>	<p>If the wiring mode is incorrect, please connect based on the correct wiring mode (see the wiring diagram).</p> <p>If the supplied voltage is abnormal, please supply the</p>

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		voltage on the instrument specification.
Abnormal RS485 communication	<p>The RS485 communication cable is disconnected, short circuit or reversely connected.</p> <p>The address, baud rate, data bit and parity bit of the instrument is not in accordance with the host computer;</p>	<p>If any problems for the communication cable, please reconnect or change the cable.</p> <p>Set the address, baud rate, data bit, parity bit to be the same as the host computer through buttons, for button settings, please see “parameter setting”.</p>
Inaccurate for energy metering	<p>Incorrect wiring, please check whether the corresponding phase sequence of voltage and current is correct.</p> <p>Check whether the high & low end of current transformer inlet is reversely connected. Please observe the power of Pa, Pb, Pc, to be abnormal if any negative values.</p>	<p>If the wiring mode is incorrect, please connect based on the correct wiring mode (see the wiring diagram).</p>

8. Package, transportation and storage

The package of the meter should use the material which can meet environmental requirements. The storage environment temperature is $-40^{\circ}\text{C} \sim 70^{\circ}\text{C}$, relative humidity should be no more than 75%.

The package should meet the standards in GB/T 13384-2008, Conventional storage and transportation environment should meet the standards in GB/T 25480-2010.

A complete set of packaging products, including follows:

- 1) A meter
- 2) A user manual
- 3) A packet of desiccant

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4) Certificate

9. Maintenance and repair

If users find any quality problem within 18 months from the date of dispatch, our company is responsible for repairing or replacing for free, on the condition that users operate according to the manual's provision with correct operation and the factory's seal is complete.

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Appendix A MODBUS-RTU Communication protocol

A.1 Communication format

Transmission of information is adopted asynchronous mode and byte as the unit. The communication data transmitted between the host and slave computer is the format of 11-digit bits, including 1 start bit(0), 8 data bits and 2 stop bits(1).

Format of information frame:

Table A.1

Start	Address code	Function code	Data field	CRC check code	End
Pause time for more than 3.5 characters	1 byte	1 byte	N bytes	2 bytes	Pause time for more than 3.5 characters

A.2 Communication information transmitting procedure

When communication command is transmitted from the host computer to the slave device ,the slave device which matches the address code sent by the host computer receives communication command. If CRC checks without any fault, then corresponding operation is carried out, after that the implement result (data) is returned to the host computer. The returned information contains address code, function code, implement date and CRC check code. No information will be returned upon erroneous CRC verification code.

A.2.1 Address code

Address code is the first byte of each communication frame, the range is 1~247. Each slave must have an exclusive address code in the bus, only the slave device which matches the address code sent by the host computer can respond returned information. When the slave device returns back information, returned data all begins with respective address code. The address code sent from the host computer indicates the slave address, and the returned address code of the slave computer indicates the slave address. The corresponding address code indicates the source of the information.

A.2.2 Function code

It's the second byte of each communication frame. It's sent by the host and tells the slave computer what actions should be carried out. The slave will respond, it indicates the slave have

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responded the host and carry out relative operations .The returned function code of the slave is the same as the function code sent by the host.

The meter supports the following two function codes:

Table A.2

Function code	Definition	Operation
03H	Read register	Read the data of one or several registers
10H	Write multi-port register	Write n 16-digit binary data into n continuous registers

A.2.3 Data field

The data field is different with different function codes. These data can be numerical values, reference addresses and so on. For different slave devices, both the address and data information are different, and the communication information table should be provided.

The host utilizes communicate command (function code 03H and 10H) to read and modify the data registers of the slave freely. But the data length which is read or write at one time should not be out of the effective range of the data register's address.

A.3 Function code

A.3.1 Function code 03H: Read register

For example: The host intends to read slave address 01H, 2 register data whose start register address is 0CH, then the host will send:

Table A.3

Host to send		Sent data
Address code		01H
Function code		03H
Start register address	High byte	00H
	Low byte	0CH
The number of registers	High byte	00H
	Low byte	02H
CRC check code	Low byte	04H

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	High byte	08H
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If the data of the slave register 0CH, 0DH is 0000H, 1388H, the slave will return:

Table A.4

Slave to return		Returned information
Address code		01H
Function code		03H
The number of bytes		04H
Data of register 0CH	High byte	00H
	Low byte	00H
Data of register 0DH	High byte	13H
	Low byte	88H
CRC check code	Low byte	F7H
	High byte	65H

A.3.2 Function code 10H: Write multi-port register

For example: The host intends to keep the data 0002H、1388H、000AH into 01H slave address, 3 registers whose start register address is 00H, the host will send:

Table A.5

Host to send		Sent information
Address code		01H
Function code		10H
Start register address	high byte	00H
	low byte	00H
The number of registers	high byte	00H
	low byte	03H
Number of written bytes		06H
Data of 00H to be	high byte	00H

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written	low byte	02H
Data of 01H to be written	high byte	13H
	low byte	88H
Data of 02H to be written	high byte	00H
	low byte	0AH
CRC check code	low byte	9BH
	high byte	E9H

The slave will return:

Table A.6

Slave to return		Returned information
Address code		01H
Function code		10H
Start register address	high byte	00H
	low byte	00H
The number of registers	high byte	00H
	low byte	03H
CRC check code	low byte	80H
	high byte	08H

A.4 16-digit CRC check code

The host and slave can be judged by the check code to see if the received information is correct or not. The interruption by electronic noises or other factors may cause errors during information transmission. The check code can check the communication information of the host or slave is correct or not.

16-digit CRC check code is calculated by the host, it's located at the end of the transmit information frame. The slave recalculates the CRC of the received information and compares if the calculated CRC goes in line with the received CRC, if not, there is error. Only 8 data bits are used during CRC calculation, both the start bits and the stop bits are not involved in the calculation.

The calculation method of CRC check code is as follows:

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1) Pre-arrange one 16-digit register as a hexadecimal FFFF (i.e. fully 1), the register is called CRC register;

2) Make the first 8-digit binary data (the first byte of the communication information frame) with the lower 8 digits of the 16-digit CRC register by XOR calculation, the result is placed in CRC register;

3) Shift the content of CRC register rightward by one digit (towards the lower digit) and fill in the highest digit with 0, check the shift-out digit after rightward shifting;

4) If the shift-out digit is 0: repeat step 3) (shift rightward one digit again);

If the shift-out digit is 1: make CRC register with multinomial A001 (1010 0000 0000 0001) by XOR calculation

5) Repeat step 3) and 4) until shift rightward for 8 times, then all the 8 digits are processed;

6) Repeat step 2) and 5), process the next byte of the communication information frame;

7) After calculating all the bytes of the communication information frame (exclude CRC check code) according to the above steps, the content of the CRC register to be get is: 16-digit CRC check code.

A.5 Error handling

When the meter detects other errors except the error of CRC check code, the information will be returned to the host, the highest digit of the function code is 1, i.e. the function code returned to the host from the slave is adding 128 base on the function code sent from the host. The error returned from the slave is as follows:

Table A.7

Address code	Function code (the highest digit is 1)	Error code	low byte of CRC check code	high byte of CRC check code
1 byte	1 byte	1 byte	1 byte	1 byte

Error code is as follows:

Table A.8

01H	Illegal function code	the meter does not support the received function code
02H	Illegal register address	The received register address exceeds the register address

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		range of the meter
03H	Illegal data value	The received data exceeds the data range of the corresponding address

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Dear Clients:

Please help me to do one thing: when the product is reaching the end of its useable life, in order to protect our environment, please do well in recovery of the products or the component materials. Please also deal with the materials which cannot be recycled.

Thank you very much for your help and support!

Statement

1. The products, services or functions you purchase are subject to the commercial contracts and terms signed with our company. All or part of the products, services or functions described in this manual may not be included in the scope of products you purchase.

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3. The information in this manual is subject to change without prior notice.

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