DW9 series single phase coulometer user manual

96H×96W×100L mm

Features:

⊙ To measure: voltage, current, power factor, active power, reactive power, apparent power, frequency, KWH at the same time.
⊙ Isolation for input / output.
⊙ Two alarm output for voltage, current, power factor, active power, reactive power, apparent power, frequency, KWH, the upper and lower limit is settable.
⊙ 4-20mA transmit current output for voltage, current, power factor, active power, reactive power, apparent power, frequency.
⊙ RS485 communication inferface, Modbus RTU protocol.
⊙ To measure true effective value.
⊙ Easy to shift display value and operate menu setting, with power down memory function for running data and KWH value.

The coulometers are widely applied to factories, enterprises, science research institue, machinery manufacturers, electricity dept., etc. Toky Electrical is always dedicating to providing our users good performance meters and apparatus.

1. Code illustration

DW 9 - □ □ □ □

- Input measuring range: A: 3Ax100V B:5A×450V D: Others
- Input：10: single phase input (no communication)
  18: single Phase input (with communication)
- Alarm function：A: No alarm C: 2 alarm output
- Output：Blank / R: no transmit analog output D: with transmit analog output (4-20mA)
- Dimension：9: 96W×96H×100L mm
- DW series single phase coulometer (True effective value)

2. Model Indication

Model	Alarm mode	Transmit function	Communication	Dimension (mm)	Input range
DW9-A10A	No	No	No	96HX96WX100L	A: 3A×100V B: 5A×450V D: Other range, to be special ordered.
DW9-A10B	No	No	No	96HX96WX100L	
DW9-A18A	No	No	RS485	96HX96WX100L	
DW9-A18B	No	No	RS485	96HX96WX100L	
DW9-RC10A	Two	No	No	96HX96WX100L	
DW9-RC10B	Two	No	No	96HX96WX100L	
DW9-RC18A	Two	No	RS485	96HX96WX100L	
DW9-RC18B	Two	No	RS485	96HX96WX100L	
DW9-DC10A	Two	4-20mA	No	96HX96WX100L	
DW9-DC10B	Two	4-20mA	No	96HX96WX100L	
DW9-DC18A	Two	4-20mA	RS485	96HX96WX100L	
DW9-DC18B	Two	4-20mA	RS485	96HX96WX100L	

3. Main function

No.	Function	Indication
1	Measuring	① Voltage (True effective value). Direct input for voltage 0-450V, the display range is 1%-100% of measuring range, meter can't display the value which is below 1% of the measuring range. It must be special ordered for input above 600V. ② Current (True effective value). Direct input for current 0-5A, the display range is 0.5%-100% of measuring range, meter can't display the value below 0.5% of the measuring range. A current transformer has to be connected to meter if above 5A input. ③ Active power: Max.measuring value 9999KW. ④ Power factor: measuring range 0-1.0. ⑤ Frequency: measuring range 40-200Hz, meter can't display the frequency if voltage input below 120V. ⑥ KWH: Max.measuring value 9999KWH.
2	Output	① Alarm output: optional parameters: voltage, current, power factor, active power, reactive power, apparent power, KWH. ② Transmit output: optional parameters: voltage, current, power factor, active power, reactive power, apparent power, ③ RS485 communication: Readable & writable parameters, please refer to the parameters address table on page 5 to 7.

4. Main technical parameters

Measuring function	voltage, current, power factor, active power, reactive power, apparent power, frequency, KWH
Input impedance	Voltage input impedance: ≥300KΩ(600V)
	Current input impedance: ≤0.02 Ω (Direct input 5A)

Display range	Voltage：4.5-450V Current：0.025-5A
Display digit	3 lines 4 digit per line LED display
Measuring mode	True effective value measuring for voltage, current, power factor
Measuring frequency range	40～200Hz
Measuring accuracy	Voltage: ± 0.5%FS ± 2Digit
	Current: ± 0.5%FS ± 2Digit
	Power: ± 0.5%FS ± 2Digit (40 ～100Hz); ±1%FS(100-200Hz);
	Power factor: ±0.5%FS (40 ～100Hz); ±1%FS(100-200Hz);
Total power consumption	<5VA
Relay capacity	250VAC/3A or 30VDC/5A
Working condition	Temperature:0-50 C° Humidity: <85%RH

5. Panel indication

SET: Parameters select / confirm key

Shift key

Decrease key

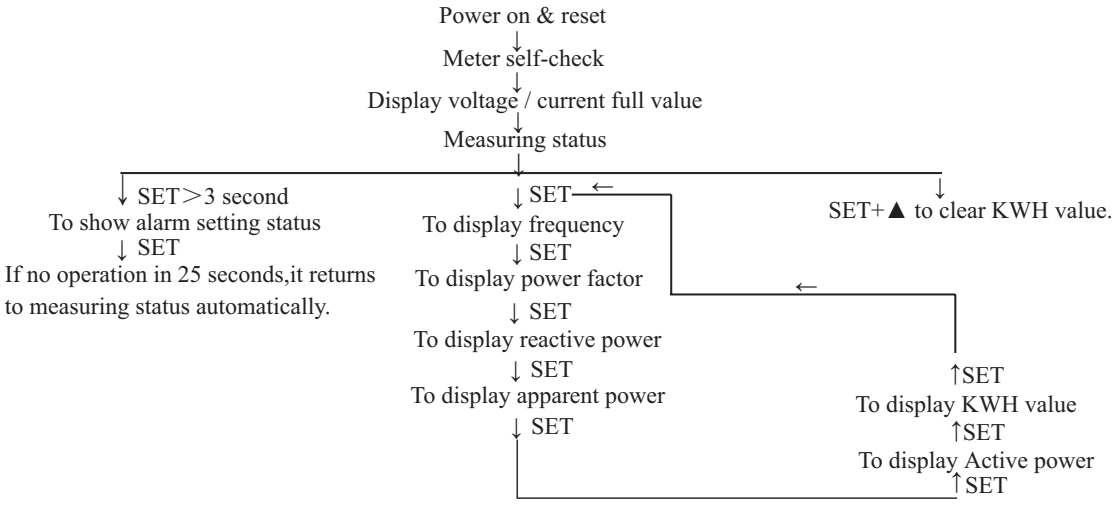
Increase key

Hz: Frequency indication lamp
VA: Apparent power indication lamp
PF: Power factor indication lamp
W/KW: Active power indication lamp
VAR: Reactive power indication lamp
KWh: KWH indication lamp
V, KV: Voltage unit indication lamp
A, mA: Current unit indication lamp
AL1: Alarm #1 indication lamp
AL2: Alarm #2 indication lamp

When meter measures active power, if W/KW indication lamp is on, it means the measuring unit is W. If W/KW indication lamp flashes, it means the measuring unit is KW. When meter measures reactive power and apparent power, if W/KW lamp flashes, it means the unit of measured value is 1000 times of international unit. If W/KW is off, it means the unit of measured value is international unit.. For example, if VAR lamp is on, the display value is 1.200, meanwhile W/KW lamp flashes, it means the measured reactive power is 1200VAR. If W/KW lamp is off, it means the measured reactive power is 1.200VAR.

6. Operation sequence

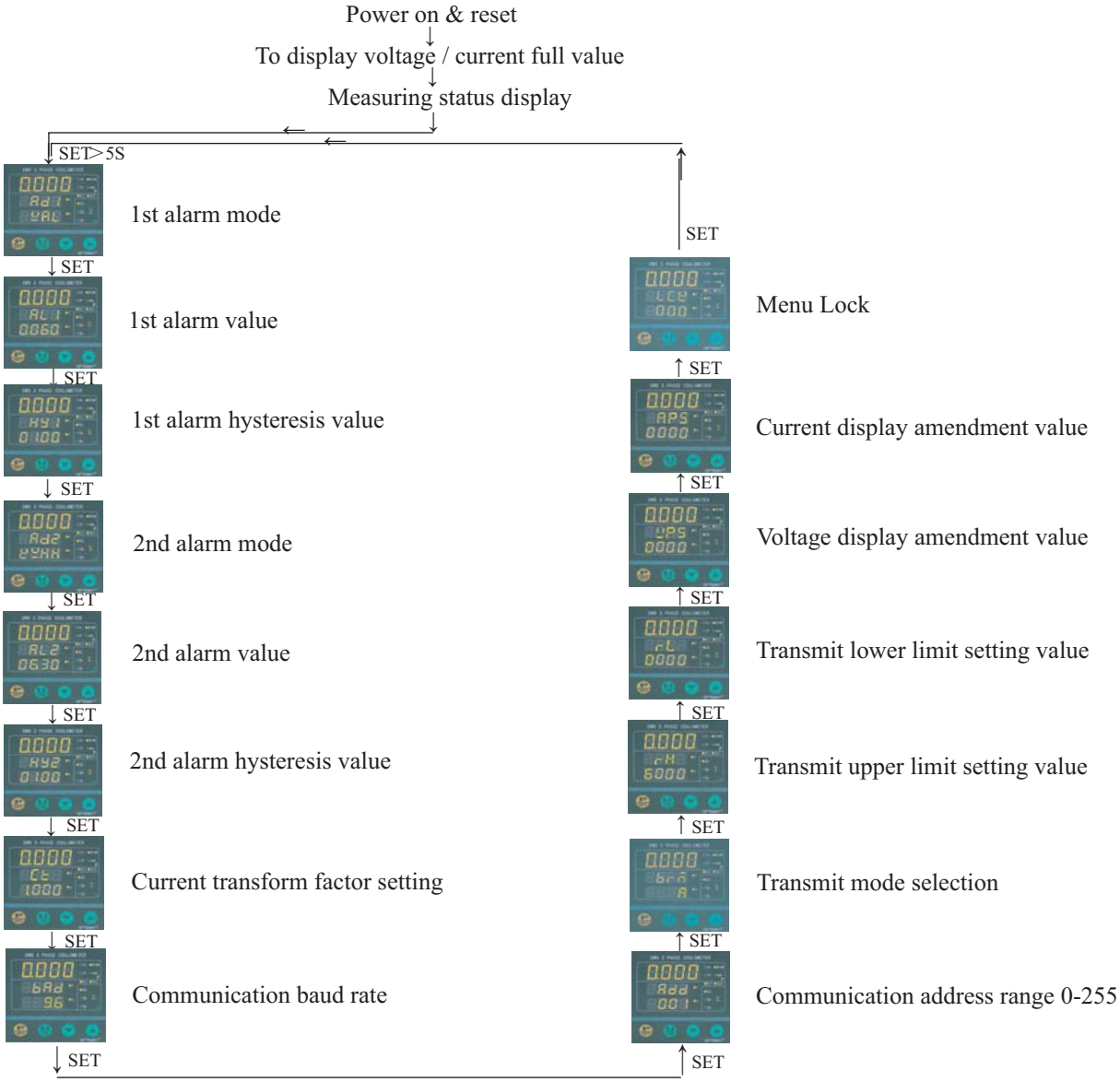
Meter operation status shift chart:



1. Before power on, please make sure all connection is correct, after all connection is confirmed, the meter can be power on.
2. There are total 4 button key on the panel, two operation status. SET key is the parameter display shift key and confirm key, ▲/▼ is increase / decrease key, ◄ is shift key.

∗In measuring status, no matter what parameter is displayed, press SET more than 3 seconds, meter displays Alarm Parameters Setting menu. The 1st line LED displays the selected parameter, and the relevant indication lamp turns on.

3. Alarm output setting
   For 1st & 2nd alarm output setting, please refer to the setting indication on page 3 (the setting for AL1, HY1, Ad1 & AL2, HY2, Ad2)
4. Parameters change operation
   In menu setting status, SET key is to select parameters and confirm the setting. ◄ key is the shift key for parameter change, ▲/▼ is increase / decrease key. When a digit is flashing, press ▲ or ▼ key to change the value. Press ◄+▲ or ◄+▼ to shift decimal point, after operation press SET key to confirm. Press SET key for a few seconds to quit the setting menu.

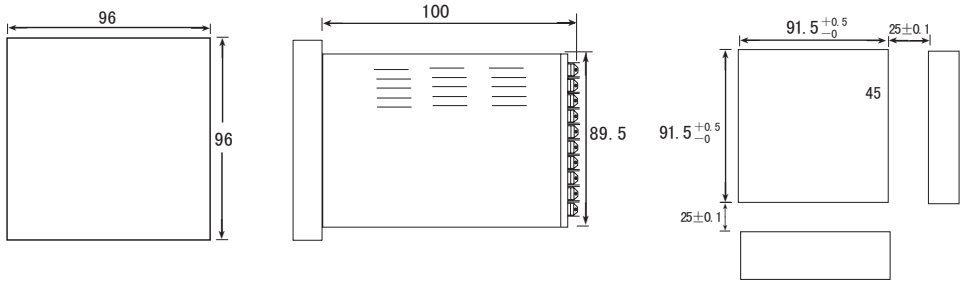


Parameter setting indication

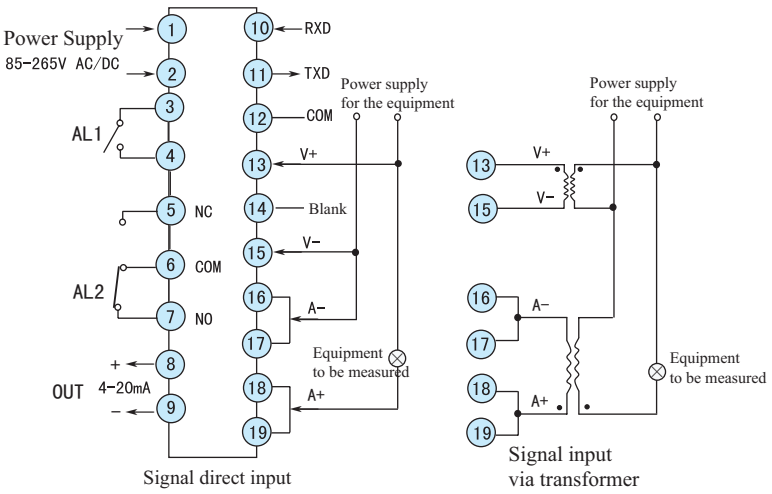
No.	Parameter Code	Parameter meaning	Indication	Setting range	Ex-factory value
1		1st alarm mode setting	VH：Voltage upper limit alarm, VL: Voltage lower limit alarm AH：Current upper limit alarm, AL: Current lower limit alarm PFH: Power factor upper limit alarm, PFL: Power factor lower limit alarm KWHH：KWH value upper limit alarm, KWHL: KWH value lower limit alarm VARH: Reactive power upper limit alarm, VARL: Reactive power lower limit alarm VAH: Apparent power upper limit alarm, VAL：Apparnet power lower limit alarm KWH: Active power upper limit alarm, KWL: Active power lower limit alarm HzH: Frequency upper limit alarm, HzL: Frequency lower limit alarm	Please refer to parameter setting indication.	VH
2		1st alarm value setting	If alarm mode Ad1 is VH, and AL1 is 300, when actual measured value ⩾300, the alarm output turns on automatically.	-1999～9999	540.0
3		1st alarm hysteresis setting	If alarm mode is VH (voltage upper limit alarm), and AL1 is 300, HY1 is 10, when actual measured voltage value ⩽(300-10), the alarm output turns off automatically.	-1999～9999	10.0
4		2nd alarm mode setting	Please refer to Ad1	Same as the setting of Ad1	AH
5		2nd alarm value setting	Please refer to AL1	-1999～9999	4.500
6		2nd alarm hysteresis setting	Please refer to HY1	-1999～9999	0.500
7		Current transform (CT) setting	For example: If the measured current range is 20A, users must use a current transformer which transform value is 20:5. The CT value of our meter should be set as 4.000,(20/5=4.000). For other range, the setting is on the analogy of this.	1.0～1999	1.000

8	[illegible]	Baud rate	Communication data speed	4.8Kbit 9.6Kbit	9.6Kbit
9	[illegible]	Communication address	Add is used to define meter communication address, for the meters on the same communication line, they should be set different address value for identification.	0～255	0
10	[illegible]	Transmit mode selection	V：Voltage transmit A：Current transmit PF：Power factor transmit Var：Reactive power transmit Hz：Frequency transmit VA：Apparent power transmit KW：Active power transmit	Please refer to the parameter setting indication	V
11	[illegible]	Transmit upper limit setting	Display setting value for 20mA transmit output	-1999～9999	540.0
12	[illegible]	Transmit lower limit setting	Display setting value for 4mA transmit output	-1999～9999	0.000
13	[illegible]	Voltage amendment value	Voltage display value after amendment: measured value+VPS value	-1999～9999	0.000
14	[illegible]	Current amendment value	Current display value after amendment: measured value+APS value	-1999～9999	0.000
15	[illegible]	Menu lock	If the value is 000, parameters can be changed. If the value is 010, parameters can be read but not changed.	000 010	000

7. Appearance & mounting dimension



8. Connection drawing



For the current input connectors, there are two connectors for one end. If load current ⩾3A, please connect wire with all current input connectors as per the above drawing in order to share the input current per each end and avoid connectors over heating.

Note: Please subject to the drawing on the meter if it is different to the one on the user manual.

9. Communication protocol

DW9 series coulometer adpots Modbus RTU communication protocol, RS485 half duplex communication, read function code 0x03, write function code 0x10, adpots 16 digit CRC check, the coulometer does not feedback check error.

Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	No

Communication abnormal solution:

When abnormal answer, the highest bit of function code will be set to 1. For example, if the request function code from host is 0x04, the return function code from meter is 0x84.

Error type code

0x01---Function code error: Meter does not support the function code it receives.
0x02---Data position error: The data position assigned by host is out of the range of meter.
0x03---Data value error: The data value sent from host is out of the range of meter.

1. Read multi-register

For example, host reads float data AL1（1st alarm value 241.5)
The address code of AL1 is 0x0000, because AL1 is float data(4 byte),seizes 2 data register. According to IEEE-754, the standard hexadecimal memory code of decimalist float data 241.5 is 0x00807143.

Host request (Read multi-register)							
1	2	3	4	5	6	7	8
Meter address	Function code	Start address High bit	Start address Low bit	Data byte length High bit	Data byte length Low bit	CRC code Low bit	CRC code high bit
0x01	0x03	0x00	0x00	0x00	0x02	0xC4	0x0B

Meter normal answer (Read multi-register)								
1	2	3	4	5	6	7	8	9
Meter address	Function code	Data byte number	Data 1 High bit	Data 1 Low bit	Data 2 High bit	Data 2 Low bit	CRC code Low bit	CRC code high bit
0x01	0x03	0x04	0x00	0x80	0x71	0x43	0x9E	0x7A

Function code abnormal answer: (For example, host request function code is 0x04)

Meter abnormal answer (Read multi-register)				
1	2	3	4	5
Meter address	Function code	Error code	CRC code Low bit	CRC code high bit
0x01	0x84	0x01	0x82	0xC0

2. Write multi-register

For example：Host writes float data HY1（1st alarm hysteresis value 20.5). The address code of HY1 is 0x0001, because HY1 is float data (4 bytes), seizes 2 data registers. According to IEEE-754 standard, the hexadecimal memory code of decimalist float data 20.5 is 0x0000A441.

Host request (Write multi-register)												
1	2	3	4	5	6	7	8	9	10	11	12	13
Meter address	Function code	Start address High bit	Start address Low bit	Data byte length High bit	Data byte length Low bit	Data byte length	Data 1 high bit	Data 1 low bit	Data 2 high bit	Data 2 low bit	CRC code Low bit	CRC code high bit
0x01	0x10	0x00	0x01	0x00	0x02	0x04	0x00	0x00	0xA4	0x41	0x88	0x93

Meter normal answer (Write multi-register)							
1	2	3	4	5	6	7	8
Meter address	Function code	Start address High 8 bit	Start address Low 8 bit	Data byte length High bit	Data byte length Low bit	CRC code Low bit	CRC code high bit
0x01	0x10	0x00	0x01	0x00	0x02	0x10	0x08

Data position error answer: (For example, host request write address index is 0x0050)

Meter abnormal answer (Write multi-register)				
1	2	3	4	5
Meter address	Function code	Error code	CRC code Low bit	CRC code high bit
0x01	0x90	0x02	0xCD	0xC1

3. DW9 parameter address reflection table

No.	Address reflection	Variable name	Byte length	Value range	Read / Write allowed	Remark
0	0x0000	1st alarm value AL1	2	-1999～9999	R/W	
1	0x0001	1st alarm hysteresis HY1	2	-1999～9999	R/W	
2	0x0002	2nd alarm value AL2	2	-1999～9999	R/W	
3	0x0003	2nd alarm hysteresis HY2	2	-1999～9999	R/W	
4	0x0004	Current transform CT	2	-1999～9999	R/W	
5	0x0005	Transmit output upper limit rH	2	-1999～9999	R/W	
6	0x0006	Transmit output lower limit rL	2	-1999～9999	R/W	
7	0x0007	Voltage amendment value VPS	2	-1999～9999	R/W	
8	0x0008	Current amendment value APS	2	-1999～9999	R/W	
9	0x0009	Voltage ful scale FSV	2	0.000～9999	R	
10	0x000A	Current full scale FSA	2	0.000～9999	R	
11	0x000B	Voltage effective value	2	0.000～9999	R	
12	0x000C	Current effective value	2	0.000～9999	R	
13	0x000D	Power factor	2	-1.0～1.0	R	
14	0x000E	Active power	2	0.000～9999	R	
15	0x000F	Reactive power	2	0.000～9999	R	
16	0x0010	Apparent power	2	0.000～9999	R	
17	0x0011	KWH value	2	0.000～9999	R	
18	0x0012	Frequency	2	0-255	R	
Reservation						
20	0x0014	1st alarm mode Ad1	1	0~7	R/W	Remark ①
21	0x0015	2nd alarm mode Ad2	1	0~7	R/W	Remark ①
22	0x0016	Transmit mode brM	1	0~4	R/W	Remark ②
23	0x0017	Menu lock code LCK	1	0~255	R/W	
24	0x0018	Baud rate bAd	1	0~1	R	Remark ③
25	0x0019	Meter address Add	1	0~255	R	
26	0x001A	Measurement status indication	1	0~255	R	Remark ④
27	0x001B	Meter name	1	0xD9	R	
Reservation						

R/W----Read and Write R----Read only

Remark ①: Alarm mode

Upper limit alarm	Communication value	Lower limit alarm	Communication value	Alarm object
VH	0	VL	1	Voltage
AH	2	AL	3	Current
PFH	4	PFL	5	Power factor
KWH	6	KWL	7	Active power
VArH	8	VArL	9	Reactive power
VAH	10	VAL	11	Apparent power
KWHH	12	KWHL	13	KWH value
HZH	14	HZL	15	Frequency

Remark ②: Transmit mode

Communication value	0	1	2	3	4	5	6
Menu display	V	A	PF	KW	VAr	VA	HZ
Transmit object	Voltage	Current	Power factor	Active power	Reactive power	Apparent power	Frequency

Remark ③: Baud rate

Communication value	0	1
Menu display	4.8	9.6

Remark ④: Measurement status indication

D7	D6	D5	D4	D3	D2	D1	D0
AL2	AL1	KWH	W	VA	VAR	PF	0

The program of 4 byte character code float data converting to decimalist float data

```
float BytesToFloat (unsigned char*pch)
{
     float result;
     unsigned char *p;
     p=(unsigned char*)&result;
   * p=*pch; *(p+1)=*(pch+1); *(p+2)=*(pch+2); *(p+3)=*(pch+3);
    return result;
}
```

The program of decimalist float data converting to 4 byte character code float data as per IEEE-754 standard

```
void FloatToChar(float Fvalue,unsigned char*pch)
{
    unsigned char*P;
    p=(unsigned char*)&Fvalue;
   *pch=*p; *(pch+1)=*(p+1); *(pch+2)=*(p+2); *(pch+3)=*(p+3);
}
```

The program of achieving 16 bit CRC check code

```
unsigned int Get_CRC (uchar*pBuf, uchar num)
{
    unsigned i,j;
    unsigned int wCrc=0xFFFF;
    for(i=0; i＜num; i++)
    {
        wCrc^=(unsigned int)(pBuf[i]);
        for(j=0; j＜8; j++)
        {
             if(wCrc &1){wCrc＞＞=1;   wCrc^=0xA001;}
             else wCrc＞＞=1;
         }
    }
    return wCrc;
}
```