

D08-8C、D08-8CM

Flow Accumulator

Instruction Manual



北京七星华创流量计有限公司
Beijing Sevenstar Flow Co., Ltd.
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D08-8C、D08-8CM Flow Accumulator revision:

Author	Date	Description	Revision
Zhao Di	05/12/2005	Initial version	1.01
Zhao Di	03/06/2006	This version can make the function that one master(PC) communicates with 16 D08-8C/8CM Accumulators comes true.	1.02
Zhao Di	03/15/2010	The program in D08-8C/8CM were modified to make it more stable; The command of reading instantaneous flow set point value was added in D08-8C communication protocol. Please see Appendix One for details.	2.01


A NOTE TO OUR CUSTOMERS

Dear customer,

Thank you for purchasing SEVENSTAR D08 series Flow Readout Boxes.

This user manual is important when installing and doing maintenance. Please keep it carefully.

We strongly recommend that you read this manual thoroughly before you starting to use the product. This user manual introduces the important issues including the proper and safe use of the products.

And please notice the words and section with the symbol . Not in accordance with the user manual for the use of property caused by loss or personal injury, SEVENSTAR may not be responsible.

If you require any additional information or assistant of Sevenstar D08 series Flow Readout Boxes. Please feel free to contact your local Sevenstar Sales Agent or Sevenstar Customer Service at:
(8610)- 6436 2925.

Yours sincerely,

Sevenstar

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D08 SERIES FLOW READOUT BOXES

D08 SERIES FLOW READOUT BOXES

D08-8C Flow Accumulator Operating Instruction

1. APPLICATION

D08-8C Flow Accumulator provides operating power supply, flow accumulating, instantaneous flow rate and cumulate flow rate digital display of MFC/MFM. General speaking, D08-8C Flow Accumulator is compatible with D07 series MFC & MFM, and it can also compatible with other MFCs.

2. SPECIFICATIONS

2.1 Output Power Supply (for MFC or MFM operation)	+15V, 200 mA Voltage Difference: $\pm 5\%$ -15V, 400 mA Voltage Difference: $\pm 5\%$
2.2 Max Display Range	999999 SL (or 999999 Standard M ³)
2.3 Flow Cumulated Error	< 0.3 %
2.4 Instantaneous Flow Display Distinguish ability	0.1% F.S
2.5 Standard Power Supply	+5.00V, 5mA Voltage Difference: $\pm 0.1\%$
2.6 Supply Power	~85-265V AC 50Hz/60Hz
2.7 Serial Communication interface	RS232, RS485
2.8 Max power consumption	10W
2.9 Bypass Control	1 Way MFC or 1 Way MFM
2.10 Dimension	(72×72×168) mm
2.11 Weight	0.5 kg

3. OPERATION PRINCIPLE

D08-8C Accumulator is consisted of $\pm 15V$ power supply, 5V power supply, modulus converter, instantaneous flow & cumulated flow displayer, 6 keys and communication part. The flow test voltage (0V~+5V) that came from MFC/MFM converts to digital signal after pass through A/D converter to operate and cumulate processing in SCU(Single Chip Micoyoco). After that, the instantaneous flow rate is delivered to four-place-LED displayer, the displaying units are SCCM (Standard Milliliter/Min) or SLM (Standard Liter/Min); it also could be: SLM or KSLM (Standard Kiloliter /Min, viz. Standard M3/Min). The cumulated value is delivered simultaneously to 6-place-LED displayer, the displaying units are SCC (Standard Milliliter) or SL (Standard Liter); it also could be: SL or KSL (Standard Kiloliter, viz. M3).

The maximum cumulated flow could match to 999999 SL, if MFM unit is SCCM, the preliminary cumulated flow unit is SCC, when cumulated value matched to 1000 SCC, the cumulated flow unit will change to SL automatically. If cumulated value exceeds the maximum, the arithmometer will reset automatically and begin accumulating from zero. If user used 100 SCCM MFM, the minimum cumulated time could match to 166666.67 hours(about 19 years). Our Flow Accumulator is quite good at long-time continuous accumulation, circulate accumulation, cumulated value radix point and unit automatic adjustment.

D08-8C Accumulator offers Serial Communication function, it can communicate with master(PC) via Standard RS232 or RS485 Serial Communication Interface (RS-232 and RS-485 is switched by the slide switch S2 on circuit board). Please refer to the Chapter 4.5 for more details of the serial communication. Please refer to appendix one for more details of the communication protocol.

4. INSTALLATION & CONNECTION

4.1 Dimensions: It used standard plastic chassis, as showing in figure 1:

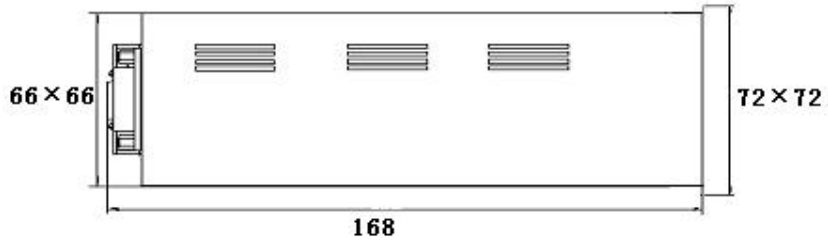


Figure1. Dimensions of D08-8C

4.2 Installation Tapping Dimensions: (67×67)mm

4.3 Installation Mode: Standard Inlay Installation

4.4 Front panel view(Figure 2) and rear panel view(Figure 3)



Figure2. Front panel view of D08-8C

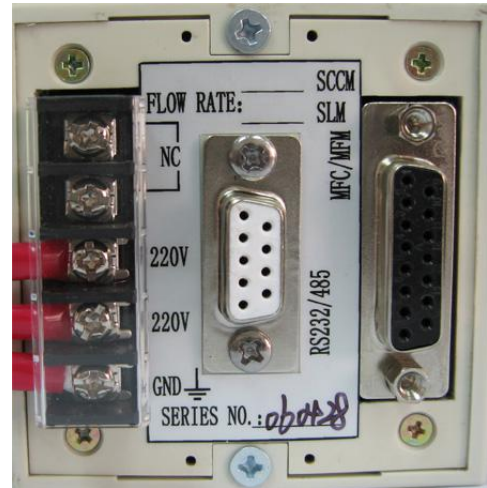


Figure3. Rear panel view of D08-8C

4.5 Serial communication connection(Figure 4)

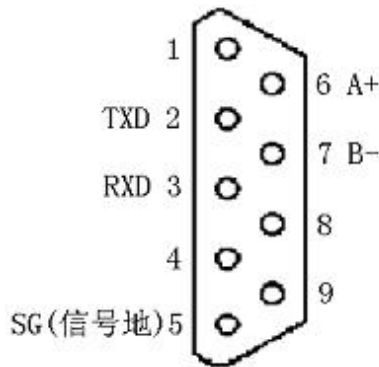


Figure4. 9-pin Standard D-Sub socket

When you use one Master(PC) communicated with one D08-8C Accumulator, we commend RS232 communication mode; When you use one Master(PC) communicated with many D08-8C Accumulators(the maximum is 16), we commend RS485 communication mode;

When you select RS232 communication mode:

Please connect pin 2(TXD) , pin 3(RXD) and pin 5(SG) showed in figure 4 to PC's standard RS232 serial port's corresponding pin 2(RXD),pin 3(TXD) and pin 5(Signal COM);

When you select RS485 communication mode:

Please connect pin 6(A +) , pin 7(B -) showed in figure 4 to the Master(PC)'s standard RS485 serial port's corresponding pin(A +) , pin(B -). In fact, this is the Half-Duplex RS485 Communication Mode, you should set every 8C Accumulator to the different address, the Master(PC) can discern every 8C Accumulator by the different address, in this mode you can use one Master(PC) communicate with 16 8C Accumulators (if you want know more about the communication protocol, please read the Appendix One).

4.6 15 pin Standard D-Sub connection with MFC

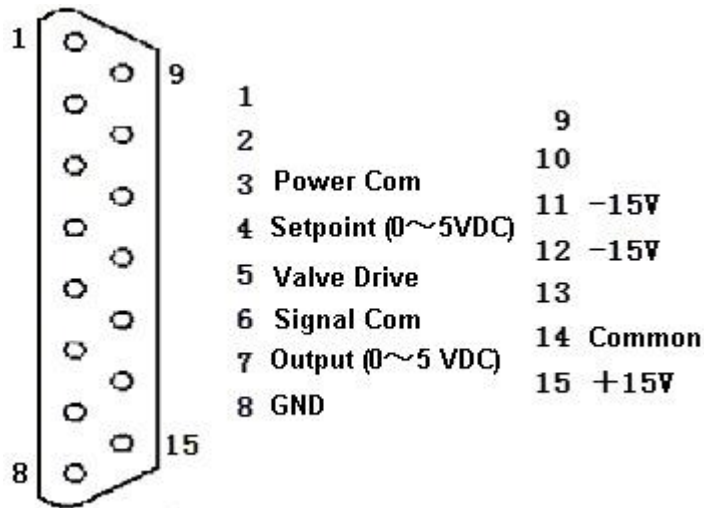


Figure 5. 15 pin Standard D-Sub connection with MFC

It can be directly connected with MFC through D-Sub by cable.

4.7 ~220V power connection is showed in figure 3. **For the sake of safety GND must be connected.**

5. OPERATION

5.1 Startup

There is no power switch of Flow Accumulator, it could be operated after external alternating current connecting.

5.2 Initial State

“ Valve Drive ” is default when you connect external alternating current, the green “ Valve Drive ” LBD will light at the same time. Full scale readout defaults to 100.0SCCM; communication address

defaults to 1, and cumulate flow unit defaults to SCC.

5.3 Keys Definitions

The D08-8C Accumulator is operated and configured by the six keys in the front panel, The keys' meaning is shown below:

“SET” Key

This key is used to implementation functions under mentioned in 5.4, it has six submenus.

“OK” Key

This key let users enter the menu and save the value they have set.

“+” Key

This key can increase the value of Full Scale, Flow Setpoint and Address, when you quickly press this Key one time, the value will goes up “1”, when you press this key and continue several seconds, the value will goes up continuously.

“-” Key

This key can diminish the value of Full Scale, Flow Setpoint and Address, when you quickly press this Key one time, the value will goes down “1”, when you press this key and continue several seconds, the value will goes down continuously.

“AUTO” Key

MFC's valve defaults to “ Valve Drive ” when the power is connected. This key can make MFC's valve reset to “ Valve Drive ” state when MFC's valve is in “OFF” or “PURGE” state.

“OFF” Key

This key is used to set MFC's valve state to “OFF” state.

5.4 The submenus

The D08-8C has six submenus. All the submenus can be accessed and displayed easily: you can change from one submenu to another using the “+/-” keys or return to the state of displaying instantaneous flow value at any time by pressing the “SET” key.

Submenu1 : SET INSTANTANEOUS FLOW

To enter submenu1, press “SET” key and the display will read “1”. Then you have four selections:

Press “+” key to enter submenu 2, and the display will read “2” ;

Press “-” key to enter submenu 6, and the display will read “6”;

Press “SET” key again to return to the state of instantaneous flow display;

Press “OK” key to set the instantaneous flow. The setting sequence is as follows:

At first the last digit of setpoint value will flash, you can increase or diminish the last digit value by the “+ key” and “- key”, when the desired value is displayed, press the “OK key” and then the tens digit will flash allowing being updated in the same way. So you can change the setpoint value from the last digit to the first digit.

NOTICE

1 When the setpoint exceeds the Full Scale value, the setpoint value will automatically default to the Full Scale value after the “OK key” is pressed.

2 To avoid zero drift value being added to the cumulate value, D08-8C Accumulator is designed when the instantaneous flow value is less than or equal to one percent of the Full Scale value, this instantaneous flow value will not be added to the cumulate flow value.

Submenu2: SET FULL SCALE

This submenu’s operation method is identical to submenu 1. The only difference is that when you complete the first digit setting, the display value does not return to “2”, instead of that, the radix point

will flash, and you can change the radix point's location by the “+ key”. After that, press “OK key” to save the Full Scale value. At last, press “Set key” to return to the state of displaying instantaneous flow.

NOTICE

The Full Scale's radix point location will have a effect on the instantaneous flow, it means the Full Scale and the instantaneous flow's radix point have the same location.

Submenu3: SET UNIT

In this mode, the displayed reading is “3” indicating submenu 3. Press the OK key, it appears “31” in the display; then use “+/-” keys to make SLM LBD or SCCM LBD turns on or off. After that, press “OK key” to save the unit. At last, press “Set key” to return to the state of displaying instantaneous flow.

Submenu4: SET ADDRESS

This function of submenu is identical to submenu1, the range of address is 0~255.

NOTICE

When D08-8C accumulator communicate with PC, you should make sure that accumulator's address is match to the protocol data's address sent by Master(PC). If not, communication does not work. For the details, see 《The Communication Protocol of D08-8C Flow Accumulator》 below.

Submenu5: PURGE

When the displayed reading is “5”, press the “OK key” once, the display will read “51”; Press the “OK key” again, AUTO LBD will turn off, and PURGE LBD will flash, the MFC's valve will be set to the “Valve Purge ” state.

NOTICE

When MFC's valve is in " Purge " state, the displayed reading will overflow and flash, indicating that the instantaneous flow measured value is far greater than the Full Scale value.

Submenu6: CUMULATE FLOW RESET TO ZERO

When the displayed reading is "6", press the "OK key" once, the display will read "61"; Press the "OK key" again, the cumulate flow will reset to zero, and then will automatically return to the state of instantaneous flow display(this process may take 1.5 seconds).

5.5 SHUT DOWN

Disconnected AC power, the accumulator will turn off.

Cumulate flow value's SAFEGUARD FUNCTION when power is off

The setpoint of instantaneous flow, Flow Full Scale and Units will be saved at the time of power off. When the power on, these values will not be changed. Specially, the cumulate flow value will be saved every 30 seconds, when the power on the cumulate flow matches to the last saved value.

6. EXAMPLES

ONE: If you want to change the Full Scale value from 100.0SCCM to 2000SCCM, perform the following steps:

- 1 Press the "SET key" once, "1" will appear on the display; increase it to "2" with the "+ key";
- 2 Press the "OK key" to enter submenu2,unit digit "0" will flash;
- 3 Press the "OK key" three times, thousands digit "1" will flash, allowing being updated by using "+ key" or "- key" ;
- 4 Increment it to "2" with the "+ key";
- 5 Press the "OK key", the current radix point location will be shown and flash;
- 6 Press the "+ key" three times, the radix point will extinguish;

- 7 Press the “OK key” to save operation and return to submenu2, then depress the “SET key” to
- 8 exit;
- 9 When you change the Full Scale, you should reset the cumulate flow value to zero, please following the steps shown below:
Press the “SET key” once, “1” will appear on the display indicating submenu1 is entered;

Press the “— key” once to scroll the number, the display will read “6” indicating submenu6 is entered;

Press the “OK key” once, “61” will be displayed;

Press the “OK key” again and wait for 1.5 seconds, the accumujlated value will be set to zero and exit.

TWO: If you attempt to change the unit from SCCM to SLM, follow the steps shown below:

- 1 Press the “SET key” once, “1” will appear on the display indicating submenu1 is entered; then press the “+ key” twice to display “3”;
- 2 Press the “OK key” once to display “31”;
- 3 Press the “+ key” once, SCCM LBD will turn off and SLM LBD will turn on;
- 4 Press the “OK key” once to save and return to submenu3;
- 5 Press the “SET key” to exit;
- 6 Perform step 8 described in Example One.

7. CAUTION

- 7.1 When voltage signal of flow is negative, “-00.0” will be displayed.
- 7.2 When the MFC is in the state of “Valve control”, You can change MFC’s valve state to “OFF” state by pressing the “OFF key”, in this situation, you can also enter the submenu 1 and

change the instantaneous flow setpoint value, but when you complete the setpoint setting, the new value will not take effect at once, because the MFC's valve is still in the "OFF" state, you must press the "AUTO key" making the MFC's valve be changed to the "AUTO" state, and then the new setpoint value will take effect.

7.3 D08-8C Flow Accumulator can also operate together with MFM, in this situation, the "Valve control" and Setpoint didn't work, it just tests instantaneous flow and displays instantaneous flow and cumulate flow.

7.4 Reference appendix 1 for more information about communication protocol.

8. PRODUCTION SELECTION

8.1 Type selection

Type	Circuit				Cases			Display			Power supply		Output voltage		Other funtions								
	MFC	MFM	Ana.	Dig.	Mini-Type	Desk-style	Rack-desk-style	1 channel Display	Multi-Channel Display	Multi-Channel Multi-Display	~110 VAC	~220 VAC	~85-265 VAC	±15 VDC	+24 VDC	4~20mA/0~10mA I input	4~20mA/0~10mA I output	4~20mA / 1~5V Input Signal	4~20mA / 1~5V Output Signal	RS232/RS485 Communication	Setpoint display	Flow Accumulator	
1F	✓	✓	✓		✓			✓					✓	✓		✓	✓						
1FM		✓	✓		✓			✓					✓	✓		✓							
1FP	✓	✓	✓		✓			✓					✓	✓		✓	✓					✓	
1/2/4	✓	✓	✓			✓			✓			✓	✓										
2F/3F/4F	✓	✓	✓			✓				✓	✓	✓	✓										
2B/3B/4B 2E/3E/4E	✓	✓	✓			✓					✓	✓	✓										
1K	✓	✓	✓		✓			✓					✓	✓			✓	1~5V					
1G	✓	✓		✓	✓			✓					✓	✓						✓			
1GM		✓		✓	✓			✓					✓	✓						✓			
8C	✓	✓		✓	✓			✓					✓	✓						✓			✓
8CM		✓		✓	✓			✓					✓	✓						✓			✓

8.2 Order form

D08- [t] - [b] - [s]

[t] – Type ←

8C

[c] – Communication type ←

-[2] RS232

-[4] RS485

[s] – Special request ←

-[-] percentage display(100.0),Chinese label.

-[S] List full scale(see table on right side) and other request.

Full scale	Code
5sccm	A
10sccm	B
20sccm	C
30sccm	D
50sccm	E
100sccm	F
200sccm	G
300sccm	H
500sccm	J
1slm	K
2slm	L
3slm	M
5slm	N
10slm	P
20slm	Q
30slm	R
50slm	U
100slm	V
150slm	W
200slm	X
250slm	Y
300slm	Z

1: Summary

This protocol is applied to the communication between the Master(PC) and D08-8C Flow Accumulator.

Data format: hexadecimal

Baud rate: 9600 b/s

Data bits: 8 bits

Stop bits: 1 bit

Check bits: none

2: DETAILED DATA FORMAT

2.1 Read flow accumulator's current state

→ Request message from the Master(PC) 8 bytes

01 03 00 02 00 08 E5 CC

which means:

01 Address of the device, here 1;

03 Reading command;

00 02 Address to read, here 0x0002;

00 08 Number of word to read: Here 8 words(16 bytes);

E5 CC CRC(calculated)

← Answer message from the Slave device

01 03 10 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) CRCL CRCH

which means:

01 Address of the device, here 1;

03 Reading command;

10 Number of bytes read, here 16 bytes;

(1)~(4) Instantaneous flow value;

The data "00~09" denotes corresponding number "0~9" ;

The data "10~19" denotes corresponding number "0.~9.";

“0F” denotes blank;

“0A” denotes “-” ;

“1A” denotes “-.” ;

Transferred sequence is from low digit to high digit;

For example: (1)~(4)=00 10 09 0F denotes the instantaneous flow is “90.0”;

(5)~(10) Cumulate flow value;

The Data definitions are the same as that of instantaneous flow value;

For example: (5)~(10)=05 13 04 02 0F 0F denotes the cumulate flow is “243.5”;

(11)~(14) Full Scale

The Data definitions are the same as that of instantaneous flow value;

For example: (11)~(14)=00 10 00 01 denotes the Full Scale is “100.0”;

(15) Units;

00 denotes SCCM and SCC(or SLM and SL);

01 denotes SCCM and SL(or SLM and KSL);

11 denotes SLM and SL(or KSLM and KSL);

(16) Valve state;

00 denotes “Valve OFF”; 80 denotes “Valve AUTO”; FF denotes “Valve PURGE”;

CRCL CRCH: CRC(calculated)

2.2 Read Instantaneous flow set point value

→ Request message from the Master(PC) 8 bytes

01 03 01 0A 00 02 E5 F5

which means:

01 Address of the device, here 1;

03 Reading command;

01 0A Address to read, here 0x010A;

00 02 Number of word to read: Here 2 words(4 bytes);

E5 F5 CRC(calculated)

←Answer message from the Slave device

01 03 04 (1) (2) (3) (4) CRCL CRCH

which means:

01 Address of the device, here 1;

03 Reading command;

04 Number of bytes read, here 4 bytes;

(1)~(4) Instantaneous flow set point value;

The data "00~09" denotes corresponding number "0~9" ;

The data "10~19" denotes corresponding number "0.~9.";

Transferred sequence is from low digit to high digit;

For example: (1)~(4)=00 10 08 00 denotes the instantaneous set point flow is "80.0";

CRCL CRCH: CRC(calculated)

2.3 Reset the cumulate flow value to zero

→ Request message from the Master(PC) 8 bytes

01 05 00 18 00 FF 0D 8D

which means:

01 Address of the device, here 1;

05 Command number;

00 18 Starting address;

00 FF The meaning is Reset the cumulate flow value;

0D 8D CRC(calculated)

←Answer message from the Slave device

The answer is identical to the request.

2.4 Changing the Valve state

→ Request message from the Master(PC) 8 bytes

01 06 00 16 00 00 68 0E

"Valve OFF"

01 06 00 16 00 80 69 AE

“Valve Control”

01 06 00 16 00 FF 28 4E

“Valve PURGE”

which means:

- 01 Address of the device, here 1
- 06 Command, here writing 1 word;
- 00 16 Starting address;
- 00 00 Valve OFF;
- 00 80 Valve Control;
- 00 FF Valve PURGE;

Last two bytes CRC(calculated)

←Answer message from the Slave device

The answer is identical to the request.

2.5 Set the setpoint value of instantaneous flow

→ Request message from the Master(PC) 8 bytes

01 06 01 0A (1) (2) CRCL CRCH

which means:

- 01 Address of the device, here 1
- 06 Command, here writing 1 word;
- 01 0A Starting address;
- (1) (2) Setpoint value in hex. (1) is the Hi byte, (2) is the Lo byte;

NOTICE

When you set the setpoint value, you shouldn't be concerned about the location of radix point, because the radix point's location is identical to the Full Scale's.

Examples

Data	Radix point location	Setpoint value
------	----------------------	----------------

00 00		0
	Decimal location	0.0
01 F4		500
	Decimal location	50.0
02 EE		750
	Decimal location	75.0
03 E8		1000
	Decimal location	100.0
1D 4C		7500
	Decimal location	750.0

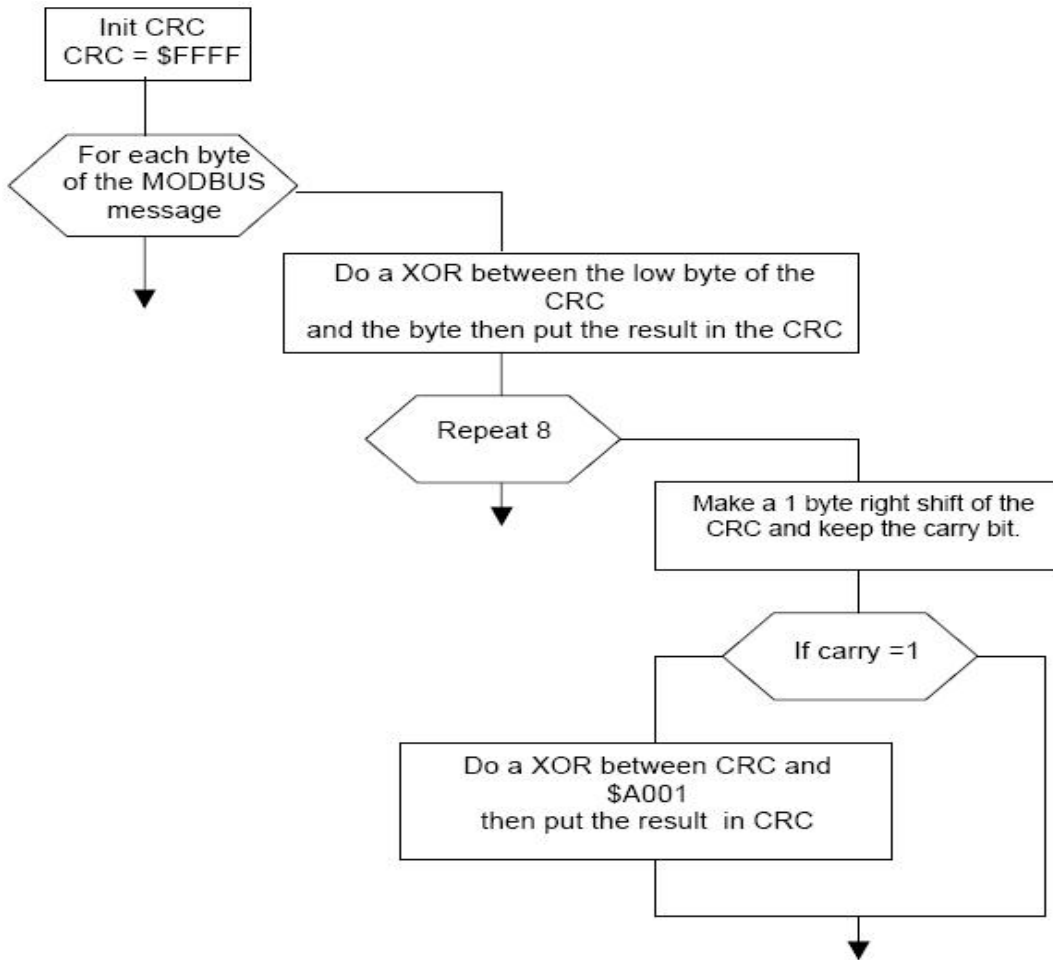
CRCL CRCH: CRC(calculated)

←Answer message from the Slave device

The answer is identical to the request.

3: CRC calculation algorithm

The CRC is calculated from all the bytes of the message excepted the CRC itself by using a “Cyclic redundancy check” with the following algorithm:



C code for a CRC calculation:

```

CRC=0xFFFF;
for(i=0;i<length(message)-1;i++)
{
  CRC=CRC^(message[i] & 0x00FF);
  for(j=0;j<8;j++)
    {
      carry=CRC & 0x0001;
      CRC=CRC>>1;
      if(carry==0x0001)CRC=CRC^0xA001;
    }
}

```

Pascal Code for a CRC calculation:

```

PROCEDURE CALCRC(var CRC:word; c:char);
Var carry:word;
    l:byte
BEGIN
CRC := CRC XOR ( ord(c) AND $00FF );
For d := 0 To 7 Do
    Begin
    carry := CRC AND $0001 ;
    CRC := CRC SHR 1 ;
    If carry = $0001 Then CRC := CRC XOR $A001 ;
    End;
END;

CRC := $FFFF;
For i := 1 To Length(Message) Do CALCRC(CRC, Message [i]);

```

Message := Message + chr((CRC + 256) MOD (((CRC div 256)+1)*256))+ chr(CRC div 256);

D08-8CM Flow Accumulator Operating Instruction

1. APPLICATION

D08-8CM Flow Accumulator provides operating power supply, flow accumulating, instantaneous flow valve and cumulate flow rate digital display of MFM. General speaking, D08-8CM Flow Accumulator could operate together with D07 series MFM, and it can also operate together with other international models of MFM.

2. SPECIFICATIONS

2.1 Output Power Supply (for MFC or MFM operation)	+15V, 200 mA Voltage Difference: $\pm 5\%$ -15V, 400 mA Voltage Difference: $\pm 5\%$
2.2 Max Display Range.....	999999 SL (or 999999 Standard M ³)
2.3 Flow Cumulated Error.....	< 0.3 %
2.4 Instantaneous Flow Display Distinguish ability.....	0.1% F.S
2.5 Standard Power Supply.....	+5.00V, 5mA Voltage Difference: $\pm 0.1\%$
2.6 Supply Power.....	~85-265V AC 50Hz/60Hz
2.7 Serial Communication interface.....	RS232, RS485
2.8 Max power consumption.....	10W

2.9 Bypass Control.....	1 Way MFM
2.10 Dimension.....	(72×72×168) mm
2.11 Weight.....	0.5 kg

3. OPERATION PRINCIPLE

D08-8CM Accumulator is consisted by $\pm 15V$ power supply, 5V power supply, modulus converter, instantaneous flow & cumulated flow displayer, 4 keys and communication part. The flow test voltage (0V~+5V) that came from MFM converts to digital signal after pass through A/D converter to operate and cumulate processing in SCU(Single Chip Micyoco). After that the instantaneous flow rate is delivered to four-place-LED displayer, the displaying units are SCCM (Standard Milliliter/Min) or SLM (Standard Liter/Min); it also could be: SLM or KSLM (Standard Kiloliter /Min, viz. Standard M3/Min). The cumulated value simultaneously is delivered to 6-place-LED displayer, the displaying units are SCC (Standard Milliliter) or SL (Standard Liter); it also could be: SL or KSL (Standard Kiloliter, viz. M3).

The maximum cumulated flow could match to 999999 SL, if MFM unit is SCCM, the preliminary cumulated flow unit is SCC, when cumulated value matched to 1000 SCC, the cumulated flow unit will change to SL automatically. If cumulated value exceeds the maximum, the arithmometer will reset automatically and begin accumulating from zero. If user used 100 SCCM MFM, the minimum cumulated time could match to 166666.67 hours(about 19 years).

Our Flow Accumulator is quite good at long-time continuous accumulation, circulate accumulation, cumulated value radix point and unit automatic adjustment.

D08-8CM Accumulator offers Serial Communication function, it can communicate with master(PC) via Standard RS232 or RS485 Serial Communication Interface(RS-232 and RS-485 is switched by the slide switch S2 on circuit board). Please refer to the Chapter 4.5 for more details of the serial communication. Please refer to appendix two for more details of the communication protocol.

4. INSTALLATION & CONNECTION

4.1 Dimensions: It used standard plastic chassis, as showing in figure 1:

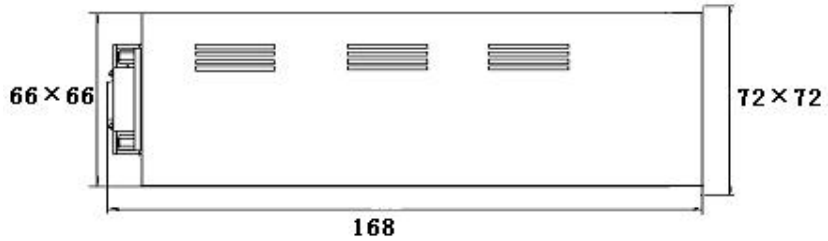


Figure1. Dimensions of D08-8C

4.2 Installation Tapping Dimensions: (67×67)mm

4.3 Installation Mode: Standard Inlay Installation

4.4 Front panel view(Figure 2) and rear panel view(Figure 3)



Figure2. Front panel view of D08-8CM



Figure3. Rear panel view of D08-8CM

4.5 Serial communication connection(Figure 4)

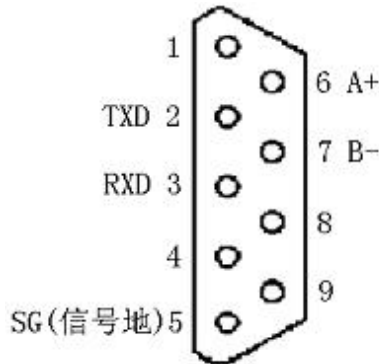


Figure4. 9-pin Standard D-Sub socket

When you use one Master(PC) communicated with one D08-8CM Accumulator, we commend RS232 communication mode; When you use one Master(PC) communicated with many D08-8CM Accumulators(the maximum is 16), we commend RS485 communication mode;

When you select RS232 communication mode:

Please connect pin 2(TXD) , pin 3(RXD) and pin 5(SG) showed in figure 4 to PC's standard RS232 serial port's corresponding pin 2(RXD),pin 3(TXD) and pin 5(Signal COM);

When you select RS485 communication mode:

Please connect pin 6(A +) , pin 7(B -) showed in figure 4 to the Master(PC)'s standard RS485 serial port's corresponding pin(A +) , pin(B -) . In fact, this is the Half-Duplex RS485 Communication Mode, you should set every 8CM Accumulator to the different address, the Master(PC) can discern every 8CM Accumulator by the different address, in this mode you can use one Master(PC) communicate with 16 8CM Accumulators (if you want know more about the communication protocol, please read the Appendix One).

4.6 15 pin Standard D-Sub connection with MFC

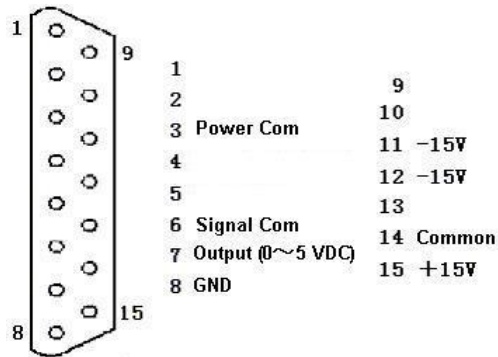


Figure 5. 15 pin Standard D-Sub connection with MFM

It can be directly connected with MFC through D-Sub by cable.

4.7 ~220V power connection is showed in figure 3. **For the sake of safety GND must be connected.**

5. OPERATION

5.1 Startup

There is no power switch of Flow Accumulator, it could be operated after external alternating current connecting.

5.2 Initial State

Full scale readout defaults to 100.0SCCM; communication address defaults to 1, and cumulate flow unit defaults to SCC.

5.3 Keys Definitions

The D08-8CM Accumulator is operated and configured by the four keys in the front panel, The keys' meaning is shown below:

“SET” Key

This key is used to implementation functions under mentioned in 5.4, it has four submenus.

“OK” Key

This key let users enter the menu and save the value they have set.

“+” Key

This key can increase the value of Full Scale and Address, when you quickly press this Key one time, the value will goes up 1, when you press this key and continue several seconds, the value will goes up continuously.

“—” Key

This key can diminish the value of Full Scale and Address, when you quickly press this Key one time, the value will goes down 1, when you press this key and continue several seconds, the value will goes down continuously.

5.4 The submenus

The D08-8CM has four submenus. All the submenus can be accessed and displayed easily: you can change from one submenu to another using the “+/-” keys or return to the state of displaying instantaneous flow value at any time by pressing the SET key.

Submenu1 : SET FULL SCALE

To enter submenu1, press “SET” key and the display will read “1”. Then you have four selections:

Press “+” key to enter submenu 2, and the display will read “2” ;

Press “—” key to enter submenu 4, and the display will read “4”;

Press “SET” key again to return to the state of instantaneous flow display;

Press “OK” key to set the Full Scale. The set sequence is as follows:

At first the last digit of Full Scale value will flash, you can increase or diminish the last digit value by the “+ key” and “- key”, when the desired value is displayed, press the “OK key” and then the tens digit will flash allowing being updated in the same way. So you can change the Full Scale value from the last digit to the first digit. After that, the radix point will flash, and you can change the radix point’s location by the “+ key”. And then, press “OK key” to save the Full Scale value. At last, press “Set key” to return to the state of displaying instantaneous flow.

NOTICE

The Full Scale’s radix point location will have an effect on the instantaneous flow, it means the Full Scale and the instantaneous flow’s radix point have the same location.

Submenu2: SET UNIT

In this mode, the displayed reading is “2” indicating submenu 2. Press the “OK” key, it appears “21” in the display; then use “+/-” keys to make SLM LBD or SCCM LBD turns on or off. After that, press “OK key” to save the unit. At last, press “Set key” to return to the state of displaying instantaneous flow.

Submenu3: SET ADDRESS

This function of submenu is identical to submenu1, the address’s range is 0~255.

NOTICE

When D08-8CM accumulator communicate with PC, you should make sure that accumulator’s address is match to the protocol data’s address sent by Master(PC). If not, communication does not work. For the details, see 《The Communication Protocol of D08-8CM Flow Accumulator》 below.

Submenu4: CUMULATE FLOW RESET TO ZERO

When the displayed reading is “4”, press the “OK key” once, the display will read “41”; Press the “OK key” again, the cumulate flow will reset to zero, and then will automatically return to the state of instantaneous flow display(this process may take 1.5 seconds).

5.5 SHUT DOWN

Disconnected AC power, the accumulator will turn off.

Cumulate flow value's SAFEGUARD FUNCTION when power is off

The Full Scale and Units will be saved at the time of power off, when the power on these values will not be changed. Specially, the cumulate flow value will be saved every 30 seconds, when the power on the cumulate flow matches to the last saved value.

6. EXAMPLES

ONE: If you want to change the Full Scale value from 100.0SCCM to 2000SCCM, perform the following steps:

1. Press the "SET key" once, "1" will appear on the display;
2. Press the "OK key" to enter submenu1, unit digit "0" will flash;
3. Press the "OK key" three times, thousands digit "1" will flash, allowing being updated by using "+ key" or "- key" ;
4. Increment it to "2" with the "+ key";
5. Press the "OK key", the current radix point location will be shown and flash;
6. Press the "+ key" three times, the radix point will extinguish;
7. Press the "OK key" to save operation and return to submenu1, then depress the "SET key" to

exit;

8. When you change the Full Scale, you should reset the cumulate flow value to zero, please following the steps shown below:

Press the “SET key” once, “1” will appear on the display indicating submenu1 is entered;

Press the “— key” once to scroll the number, the display will read “4” indicating submenu4 is entered;

Press the “OK key” once, “41” will be displayed;

Press the “OK key” again and wait for 1.5 seconds, the accumujlated value will be set to zero and exit.

TWO: If you attempt to change the unit from SCCM to SLM, follow the steps shown below:

1. Press the “SET key” once, “1” will appear on the display indicating submenu1 is entered; then press the “+ key” once to display “2”;
2. Press the “OK key” once to display “21”;
3. Press the “+ key” once, SCCM LBD will turn off and SLM LBD will turn on;
4. Press the “OK key” once to save and return to submenu2;

5. Press the “SET key” to exit;

6. P Perform step 8 described in Example One.

7. CAUTION

7.1 When voltage signal of flow is negative, “-00.0” will be displayed.

7.2 Reference appendix 2 for more information about communication protocol.

8. PRODUCTION SELECTION

8.1 Type selection

Type	Circuit				Cases			Display			Power supply			Output voltage		Other functions							
	MFC	MFM	Ana.	Dig.	Mini-Type	Desk-style	Rack-desk-style	1 channel Display	Multi-Channel 1 Display	Multi-Channel Multi-Display	~110 VAC	~220 VAC	~85-265 VAC	±15 VDC	+24 VDC	4~20mA/0~10mA I input	4~20mA/0~10mA I output	4~20mA / 1~5V Input Signal	4~20mA / 1~5V Output Signal	RS232/RS485 Communication	Setpoint display	Flow Accumulator	
1F	✓	✓	✓		✓			✓					✓	✓		✓							
1FM		✓	✓		✓			✓					✓	✓		✓							
1FP	✓	✓	✓		✓			✓					✓	✓		✓						✓	
1/2/4	✓	✓	✓			✓			✓			✓		✓									
2F/3F/4F	✓	✓	✓			✓				✓	✓	✓		✓									
2B/3B/4B		✓	✓																				
2E/3E/4E	✓	✓	✓			✓						✓		✓									
1K	✓	✓	✓		✓			✓					✓	✓			✓	1~5V					
1G	✓	✓		✓	✓			✓					✓	✓						✓			
1GM		✓	✓	✓	✓			✓					✓	✓						✓			
8C	✓	✓	✓	✓	✓			✓					✓	✓						✓			✓
8CM		✓		✓	✓			✓					✓	✓						✓			✓

8.2 Order form

D08- [t] - [b] - [s]

[t] – Type

8CM

[c] – Communication type

-[2] RS232

-[4] RS485

[s] – Special request

-[-] percentage display(100.0),Chinese label.

-[S] List full scale(see table on right side) and other request.

Full scale	Code
5sccm	A
10sccm	B
20sccm	C
30sccm	D
50sccm	E
100sccm	F
200sccm	G
300sccm	H
500sccm	J
1slm	K
2slm	L
3slm	M
5slm	N
10slm	P
20slm	Q
30slm	R
50slm	U
100slm	V
150slm	W
200slm	X
250slm	Y
300slm	Z

APPENDIX 2

D08-8CM COMMUNICATION PROTOCOL

1: Summary

This protocol is applied to the communication between the Master(PC) and D08-8CM Flow Accumulator.

Data format: hexadecimal

Baud rate: 9600 b/s

Data bits: 8 bits

Stop bits: 1 bit

Check bits: none

2: DETAILED DATA FORMAT

2.1 Read flow accumulator's current state

→ Request message from the Master(PC) 8 bytes

01 03 00 02 00 08 E5 CC

which means:

01 Address of the device, here 1;

03 Reading command;

00 02 Address to read, here 0x0002;

00 08 Number of word to read: Here 8 words(16 bytes);

E5 CC CRC(calculated)

←Answer message from the Slave device

01 03 10 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12) (13) (14) (15) (16) CRCL CRCH

which means:

01 Address of the device, here 1;

03 Reading command;

10 Number of bytes read, here 16 bytes;

(1)~(4) Instantaneous flow value;

The data "00~09" denotes corresponding number "0~9" ;

The data "10~19" denotes corresponding number "0..9.";

"0F" denotes blank;

"0A" denotes "-";

"1A" denotes "-." ;

Transferred sequence is from low digit to high digit;

For example: (1)~(4)=00 10 09 0F denotes the instantaneous flow is "90.0";

(5)~(10) Cumulate flow value;

The Data definitions are the same as that of instantaneous flow value;

For example: (5)~(10)=05 13 04 02 0F 0F denotes the cumulate flow is "243.5";

(11)~(14) Full Scale

The Data definitions are the same as that of instantaneous flow value;

For example: (11)~(14)=00 10 00 01 denotes the Full Scale is "100.0";

(15) Units;

00 denotes SCCM and SCC(or SLM and SL);

01 denotes SCCM and SL(or SLM and KSL);

11 denotes SLM and SL(or KSLM and KSL);

(16) Not defined

CRCL CRCH: CRC(calculated)

2.2 Reset the cumulate flow value to zero

→ Request message from the Master(PC) 8 bytes

01 05 00 18 00 FF 0D 8D

which means:

01 Address of the device, here 1;

05 Command number;

00 18 Starting address;

00 FF The meaning is Reset the cumulate flow value;

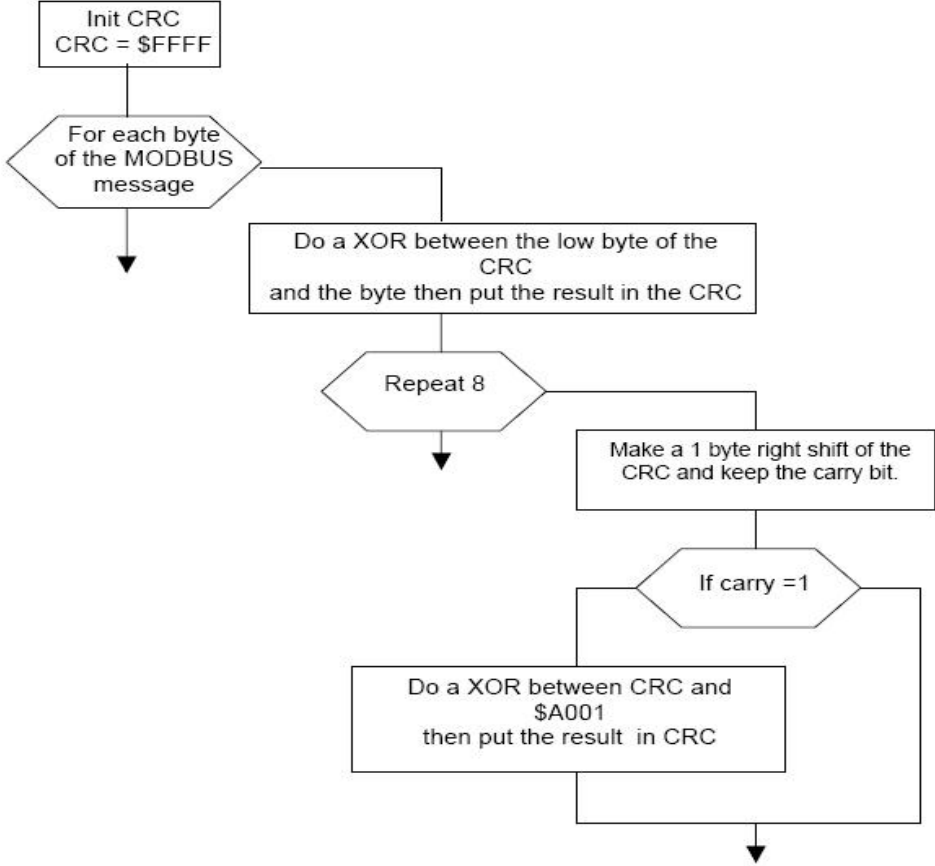
0D 8D CRC(calculated)

←Answer message from the Slave device

The answer is identical to the request.

3: CRC calculation algorithm

The CRC is calculated from all the bytes of the message excepted the CRC itself by using a “Cyclic redundancy check” with the following algorithm:



C code for a CRC calculation:

```
CRC=0xFFFF;
for(i=0;i<length(message)-1;i++)
{
    CRC=CRC^(message[i] & 0x00FF);
    for(j=0;j<8;j++)
        {
            carry=CRC & 0x0001;
            CRC=CRC>>1;
            if(carry==0x0001)CRC=CRC^0xA001;
        }
}
```

Pascal Code for a CRC calculation:

```
PROCEDURE CALCRC(var CRC:word; c:char);
Var carry:word;
    l:byte
BEGIN
CRC := CRC XOR ( ord(c) AND $00FF );
For d := 0 To 7 Do
    Begin
        carry := CRC AND $0001 ;
        CRC := CRC SHR 1 ;
        If carry = $0001 Then CRC := CRC XOR $A001 ;
    End;
END;
CRC := $FFFF;
For i := 1 To Length(Message) Do CALCRC(CRC, Message [i]);
Message := Message + chr( (CRC + 256) MOD (((CRC div 256)+1)*256))+ chr(CRC div 256);
```



Beijing Sevenstar Flow Co.,Ltd.

D08 Series Flow Readout Boxes Beijing Sevenstar Flow Co., Ltd.

Address: No.8 Wenchang Avenue Beijing Economic-Technological
Development Area
Post code: 100176
Tel: (+86) 10-56178088
Fax: (+86) 10-56178099
Homepage: www.mfcsevenstar.cn
E-Mail: mfcsales@sevenstar.com.cn

Shanghai Office: Room 511, Building 29, No.368 Zhangjiang Road, Pudong
New District, Shanghai
Tel: (+86)-21-63532370
Fax: (+86)-21-63533265

Shenzhen Office: Room 202,Section B, No. 1 Chuangiin, No.125 Chuangye
Erlu, 28th Section, Baoan District, Shenzhen
Tel: (+86)-755-88290258
Fax: (+86)-755-88294770

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