

**CS series Mass Flow Controller Profibus
Communication User's Manual**

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1. Description

This manual is designed for CS series digital Mass Flow Controller's Profibus application and programmers who want to develop a software to communicate with 1 or several CS series Profibus Mass Flow Controllers.

For more details, please contact your Sevenstar sales representative.

2. Scope

This manual applies to Sevenstar CS series Profibus Mass Flow Controller (MFC).

3. Introduction

CS series Profibus MFC is a latest generation MFC for use in semiconductor applications and demanding industrial uses where its high accuracy and flexibility in interfacing are required. CS series Profibus MFC supports Profibus-DP communication.

3.1 Definition

GSD file	The GSD file contains the characteristic device data of the product, i.e. the device profile.
Input/Output	Profibus-DP conventions define all input/output directions as seen from the master system. Data transferred by the master to the slave (e.g.commands, setpoints) is referred to as 'output data'. Slave (sensor) data to be transferred to the master is referred to as 'input data'.
Profibus-FMS	Process field bus-Fieldbus Message Specification. Profibus protocol for high-level, object oriented data communication. Can be operated together with Profibus-DP.
Profibus-DP	Process field bus-Decentralized Periphery. Profibus protocol for high-speed, cyclic data communication.
Profibus-PA	Process field bus-Process Automation. Profibus protocol for intrinsically safe data communication.
PI	Profibus International.
PNO	Profibus Nutzer Organization.

VPC3	Profibus-DP ASIC. Component manufactured by Profichip to provide Profibus-DP slave functionality to a host processor.
ASIC	Application Specific Integrated Circuit.
MFC	Mass Flow Controller.
Bit	Smallest binary information representation: 0 or 1.
Byte or Octet	Binary number representation, consists of 8 bits. Represents 1 value or 8 situations ('bitmapped'). Bits in a byte are numbered from right to left, i.e. least significant bit is bit 0, most significant bit is bit 7. Examples: Value: binary 00110011 = 51 decimal Bitmapped: binary 00010111 = bits 0,1,2 and 4 are true, others are false.
Word	Combination of 2 bytes or 16 bits. Represents 1 value or 16 situations ('bitmapped'). Examples: Value: binary 00010001 00110011 = 4403 decimal Bitmapped: binary 00010001 00010111 = bits 0,1,2,4,8 and 12 are true, others are false.

3.2 Electrical Interfacing

3.2.1 General

With simple switching power supply, CS series MFC is available for ± 8 to ± 16 VDC (dual-ending) and +14 to +28VDC (single-ending). Customer can choose as need.

CS series Profibus MFC has 15-pin male Sub-D and 9-pin female Sub-D connectors. 15-pin male Sub-D connector provides 0~5V analog setpoint signal, flow output signal and RS485 communication. 9-pin female Sub-D connector is Profibus-DP connector.

CS series Profibus MFC can communicate with PC via RS485 or Profibus.

3.2.2 Connections

The 15-pin male Sub-D connector and 9-pin female Sub-D connector are shown in Figure2-1 and Figure 2-2.

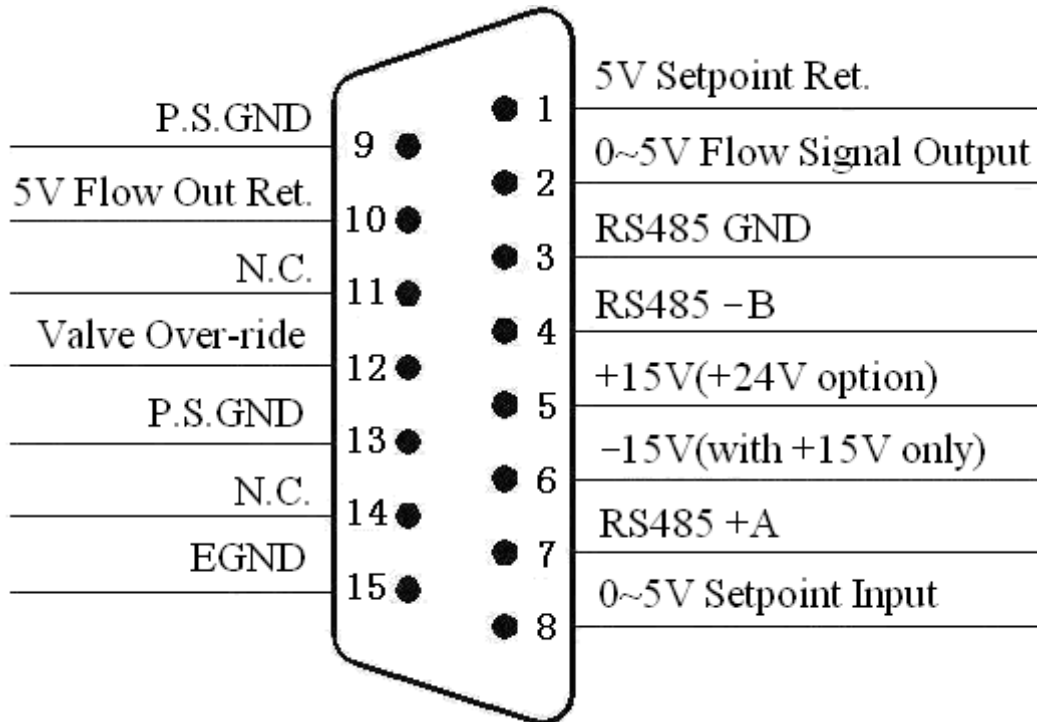


Figure2-1 15-pin male Sub-D connector

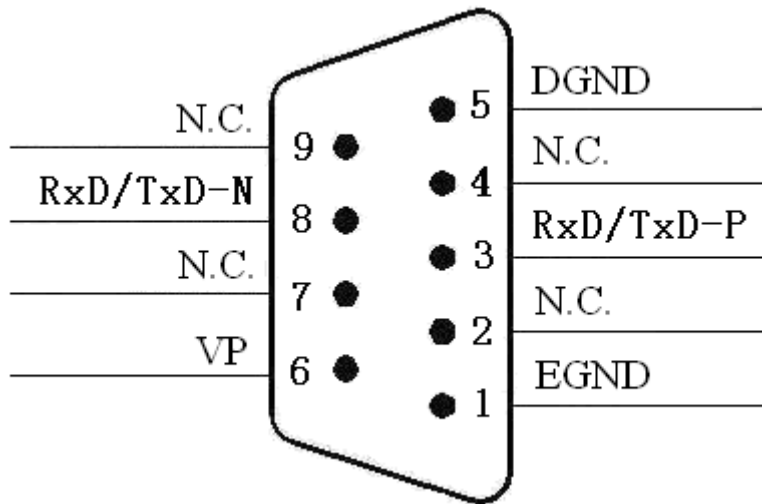


Figure2-2 9-pin female Sub-D connector

3.3 Address Selection

Every MFC on Profibus network requires unique communication address in order to correctly communicate with the master device. CS series Profibus MFC has address in the range 1 through 125.

MFC's address selection is implemented by two rotary switches located on the top side of the MFC. Refer to Figure 3-1. Each of the switches allows a setting of an integer number, the units between 0 and 9 and the decimals 0 and 12. The decimal address digit indicates the multiples of ten, whereas the unit address digit indicates the multiples of one. Therefore the allowable station address number ranges from 0 to 125.

The decimal switch has a labelling from 0 through F, which is hexadecimal. The letters A through F represents 10 through 15. The letter D, E and F are not allowed since they represent addresses in the range 130, 140 and 150, which is outside the Profibus range of 125.

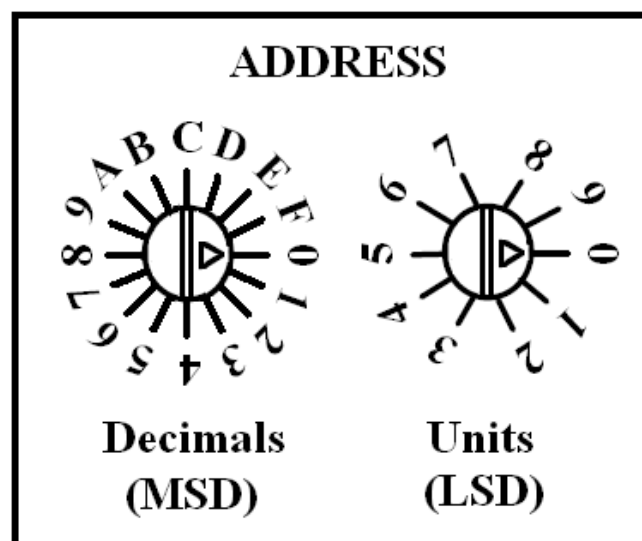


Figure3-1 Address Rotary Switch Layout

3.4 Baud Rates

Since CS series MFC's Profibus-DP interface has been implemented using the Profichip VPC3 slave ASIC, the baud rates supported are determined by the capabilities of this component. The baud rates supported are 9600bps, 19.2kbps, 45.45kbps, 93.75kbps, 187.5kbps, 500kbps, 1.5Mbps, 3Mbps, 6Mbps and 12Mbps.

The VPC3 supports automatic baud rate detection. Therefore no hardware means are necessary to select the required baud rate at the slave. Communication initiated by the master at a any of the supported baud rate values will cause the CS series Profibus MFC to lock on to this baud rate after an automatic search for it.

4 Slave configuration

4.1 Parameterization of the slave (MFC)

Byte	Definition
1-7	Bus parameters (System parameters)
8	Code for VPC3 ASIC
9	Reserved
10	Failsafe state
11	Alarm option
12	Warning option
13	Reserved
14	Softstart selection
15	Softstar data (%/sec)
16	Flow unit
17	Temperature unit
18	Totalize unit
19	Setpoint source
20	Valve command mode

The parameters are described more in detail on the next pages.

Byte	Bit	Type	Range	Default	Options	Description
8		Byte	/	0	Reserved	
9		byte	/	0	Reserved	
10		byte	0-3	1	0 = no effect 1 = Valve close 2 = setpoint=0.0 3 = Valve open	Select emergency state if communication is lost
11	0	Bit	0-1	0	0 = disable 1 = enable	Temperature alarm
	1	Bit	0-1	0	0 = disable 1 = enable	Sensor drift alarm
	2	Bit	0-1	0	0 = disable 1 = enable	Valve alarm
	3	Bit	0-1	0	0 = disable 1 = enable	EEPROM alarm
	4	Bit	/	0	Reserved	
	5	Bit	/	0	Reserved	
	6	Bit	/	0	Reserved	
	7	Bit	/	0	Reserved	
12	0	Bit	0-1	0	0 = disable 1 = enable	Temperature warning
	1	Bit	0-1	0	0 = disable 1 = enable	Sensor drift warning
	2	Bit	/	0	Reserved	
	3	Bit	/	0	Reserved	
	4	Bit	/	0	Reserved	
	5	Bit	/	0	Reserved	
	6	Bit	/	0	Reserved	
	7	Bit	/	0	Reserved	
13		byte	/	0	Reserved	

14		Byte	0-1	0	0 = off 1 = enable	Softstart selection
15		Byte	0-100	0	%/sec	Softstar data
16		Byte	0-12	0	0 = %FS 1 = ml/sec 2 = ml/min 3 = ml/hour 4 = Liter/sec 5 = Liter/min 6 = Liter/hour 7 = M3/sec 8 = M3/min 9 = M3/hour 10 = Ft3/sec 11 = Ft3/min 12 = Ft3/hour	Flow unit
17		Byte	0-2	1	0 = Kelvin 1 = Celsius 2 = Fahrenheit	Temperature unit
18		Byte	0-3	0	0 = ml 1 = liter 2 = m3 3 = ft3	Totalize unit
19		Byte	1-3	3	1 = RS485 2 = 0-5Vdc 3 = Profibus	Setpoint source
20		Byte	0-2	2	0 = Mode0 1 = Mode1 2 = Mode2	Valve command mode
21		Byte	/	0	Reserved	

4.2 Configuration of the slave

According to respective I/O data requirement customer can select one of the following three Modules.

Module	Code	Description
Module1	0x C1	Special identifier with one length byte each for Output and Input follows, with one byte of manufacturer special data.
	0x 83	Output data, 4 bytes (1 float)
	0x 83	Input data, 4 bytes (1 float)
	0x 01	Manufacturer special data, module 1.
Module2	0x C1	Special identifier with one length byte each for Output and Input follows, with one byte of manufacturer special data.
	0x 84	Output data, 5 bytes (1 float + 1 byte)
	0x 88	Input data, 9 bytes (2 floats + 1 byte)
	0x 02	Manufacturer special data, module 2.
Module3	0x C1	Special identifier with one length byte each for Output and Input follows, with one byte of manufacturer special data.
	0x 84	Output data, 5 bytes (1 float + 1 byte)
	0x 94	Input data, 21 bytes (4 floats + 1 unsigned integer + 1 byte)
	0x 03	Manufacturer special data, module 3.

I/O memory map Mass Flow Controller SCS.gsd				
Module1: "out[Setp], in[Flow]"				
Output	description	byte #	byte size	type
Setp	setpoint	0.....3	4	floating point
Input	description	byte #	byte size	type
Flow	flow	0.....3	4	floating point

I/O memory map Mass Flow Controller SCS.gsd				
Module2: “out[Setp,CMD], in[Flow,Tot,CMD]”				
Output	description	byte #	byte size	type
Setp	setpoint	0.....3	4	floating point
CMD	command	4	1	unsigned byte
Input	description	byte #	byte size	type
Flow	flow	0.....3	4	floating point
Tot	totalizer	4.....7	4	floating point
CMD	command	8	1	unsigned byte

I/O memory map Mass Flow Controller SCS.gsd				
Module3: “out[Setp,CMD], in[Setp,Flow,Temp,Tot,Valv,CMD,]”				
Output	description	byte #	byte size	type
Setp	setpoint	0.....3	4	floating point
CMD	command	4	1	unsigned byte
Input	description	byte #	byte size	type
Setp	actual setpoint of the MFC	0.....3	4	floating point
Flow	flow	4.....7	4	floating point
Temp	temperature	8....11	4	floating point
Tot	totalizer	12...15	4	floating point
Valv	valve current value	16...19	4	unsigned integer
CMD	command	20	1	unsigned byte

The function of CMD is totalizer and valve override. The details are shown in the following table.

Function: CMD			
bit#	range	default	options
0...3	0...3	0	Valve Override command
			0= Normal control
			1= Valve shut off
			2= Valve Max Value
			3= Valve Hold
4...7	0...2	0	Totalizer command
			0= Stop totalizer
			1= Begin totalize
			2= Reset totalizer

4.3 Diagnosis of the slave

CS series Profibus MFC can provide the function of diagnosis. When the MFC's sensor, valve, EEPROM or temperature has any error, MFC will send diagnostics message to Profibus master. The following table summarizes the diagnostic data bytes to be sent at the event of an error.

Diagnostics message			
Byte0	Byte1	Byte2	Byte3
Fatal system Alarm	Fatal system Warning	Non Fatal system Alarm	Non Fatal system Warning

For detailed information please refer to the following tables.

Diagnostics byte 0: Fatal system Alarm		
Bit	Diagnosis	Value
Bit 7	Sensor negative drift Alarm	0=normal ; 1=alarm
Bit 6	Reserved	0
Bit 5	Valve open Alarm	0=normal ; 1=alarm
Bit 4	Valve short Alarm	0=normal ; 1=alarm
Bit 3	EEPROM Alarm	0=normal ; 1=alarm
Bit 2	Sensor Positive drift Alarm	0=normal ; 1=alarm
Bit 1	Reserved	0
Bit 0	Reserved	0

Diagnostics byte 1: Fatal System Warning		
Bit	Diagnosis	Value
Bit 7	Sensor negative drift Warning	0=normal ; 1 warning
Bit 6	Sensor Positive drift Warning	0=normal ; 1 warning
Bit 5	Reserved	0
Bit 4	Reserved	0
Bit 3	Reserved	0
Bit 2	Reserved	0
Bit 1	Reserved	0
Bit 0	Reserved	0

Diagnostics byte 2: Non Fatal system Alarm		
Bit	Diagnosis	Value
Bit 7	Temperature Low Alarm	0=normal ; 1=alarm
Bit 6	Temperature High Alarm	0=normal ; 1=alarm
Bit 5	Reserved	0
Bit 4	Reserved	0
Bit 3	Reserved	0
Bit 2	Reserved	0
Bit 1	Reserved	0
Bit 0	Reserved	0

Diagnostics byte 3: Non Fatal system Warning		
Bit	Diagnosis	Value
7	Temperature Low Warning	0=normal ; 1=alarm
6	Temperature High Warning	0=normal ; 1=alarm
5	Reserved	0
4	Reserved	0
3	Reserved	0
2	Reserved	0
1	Reserved	0
0	Reserved	0

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