

1. INTRODUCTION

1.1 Application

RBDM-CR insertion density meter for the application of on-line density measurement. It is applied in the product process control based on the parameters of density, or the mass control system as the solid's percentage or the concentration reference.

Typical Industries include petroleum, chemical industry, food & beverage, pharmaceutical and mineral processing, (for example clay, carbonate carbon, silicate, etc.). The RBDM-CR density meter is applied in the pipeline detection of the multiple media of the industries aforementioned, density testing of the combined mixture, the reaction kettle end monitoring and the separator interface detection.

1.2 Characteristics

RBDM-CR density meter fully integrates digital density measurement for monitoring and control; Capable of direct insertion into large bore pipe work applications, substantially reducing the installation cost compared to flow through devices;

1.3 Technical Parameters

Density range	0.5 – 2.5 g /cc (500 – 2500 kg/m ³)
Calibration range	0.8 – 1.2 g /cc (800 – 1200 kg/m ³)
Accuracy	± 0.002 g /cc (± 2 kg/m ³); ± 0.001 g /cc (± 1kg/m ³)
Repeatability	± 0.0002 g /cc (± 0.2 kg/m ³)
Temperature range (Process)	-20 ~ +150 Degree Celsius (°C)
Pressure rating	10MPa ~ 20MPa
Viscosity range	0 – 20000 cP
Temperature effect	Less than 0.1 kg/m ³ /°C (After Calibration)
Impact from pressure	Negligible
Built-in temperature sensor	PT100
Wetted parts	Stainless steel 316L/ HC Hastelloy
Tine finish	Standard, PFA coated, or Electro-polished
Power supply	24VDC, ≥500 mA
Analog Output	4 -20 mA, 0-1000Hz, RS485 Modbus RTU
Density accuracy - process (20°C)	± 0.1% or ± 0.05% FS of indicated figures
Repeatability - process (-40~85°C)	± 0.05% FS
Process connection	ANSI 150 ~ 1500 RF DIN 50 PN16 DIN 50 PN40 IDF and RJT hygienic type
Protection Grade	IP65
Outer covering	Aluminum alloy



2. INSTALLATION

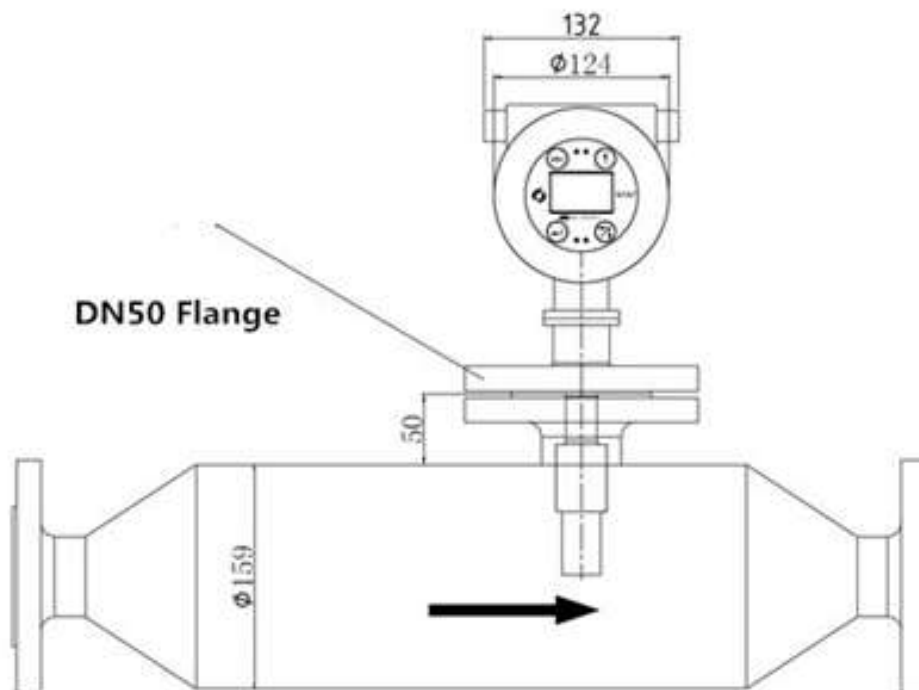
2.1 Pipe Installation details

To ensure the stability and the accuracy, the flow velocity of the liquid should not be higher than 1m/s, and the diameter of the installed pipeline is required to be $\geq 159\text{mm}$, (equal to or higher than 159mm). In addition to this, the position of the installed insertion density meter should be away from the pump as far as possible. The advised distance is to be longer than 5 metres.

If the flow velocity of the liquid is higher than 1m/s, it is advised to enlarge the size of the pipeline. When the velocity of the liquid increases every 1m, then the size of the installed pipe should be enlarged by 1.5 times.

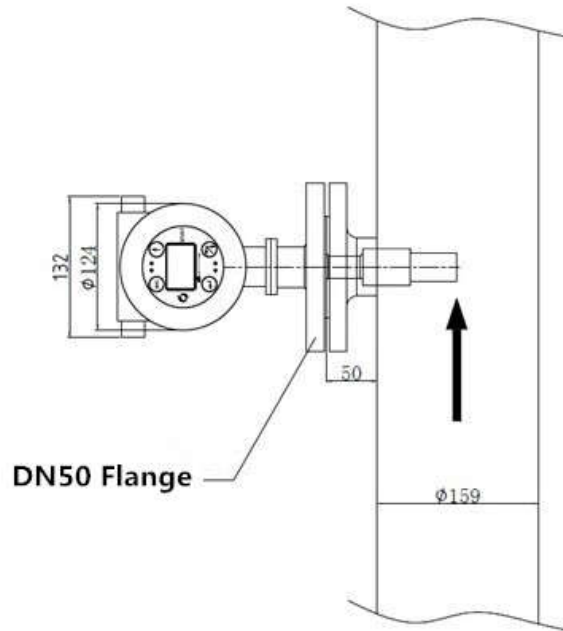
The length of the straight pipe in front of the insertion density meter is required to be $\geq 600\text{ mm}$, and the length of the straight pipe behind the installation of the insertion density meter is required to be $\geq 300\text{ mm}$. This is to ensure the laminar flow state when flowing through the fork of the insertion density meter.

a. Horizontal Pipeline Installation



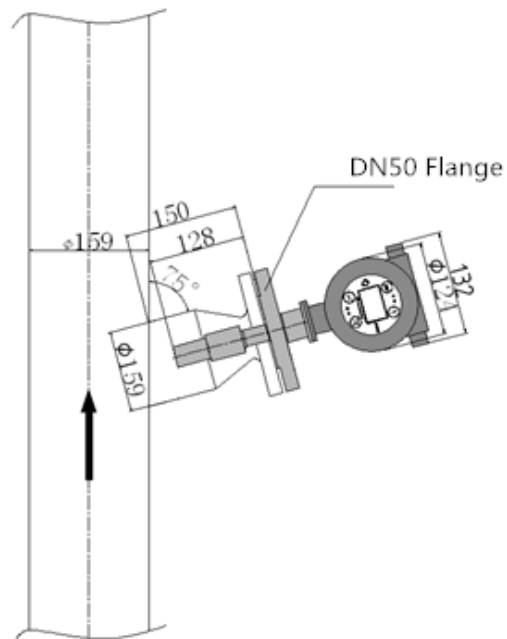
RBDM Insertion Density Meter Horizontal Pipeline Installation

b. Vertical Pipeline Installation
(1) Flow Velocity $\leq 1\text{m/s}$

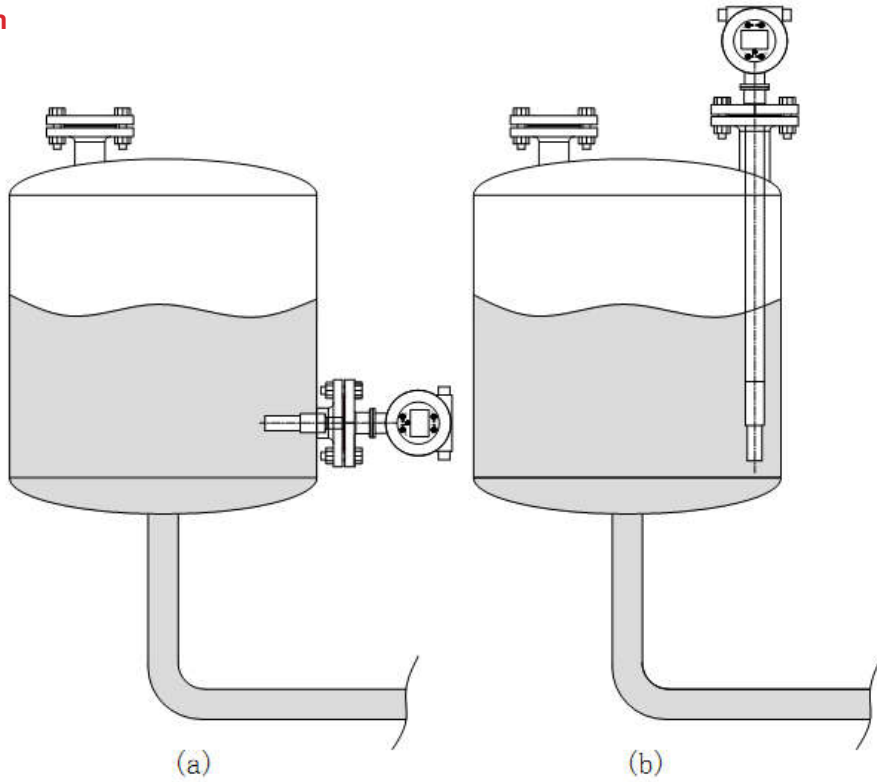


Vertical Pipeline Installation

(2) Flow Velocity $\geq 1\text{m/s}$ and Desulphurisation



c. Tank Installation



3. Dimensions of Density Meter and Flanges

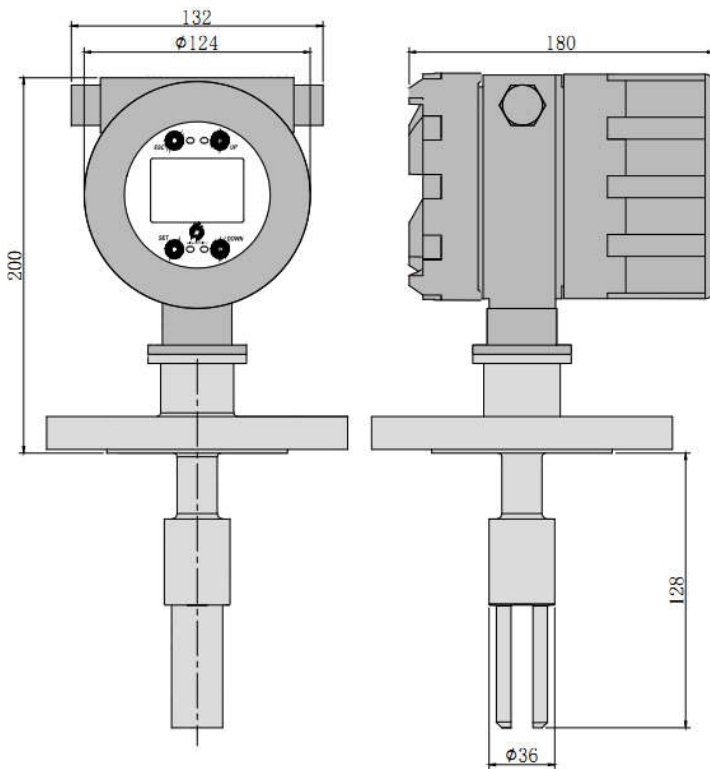
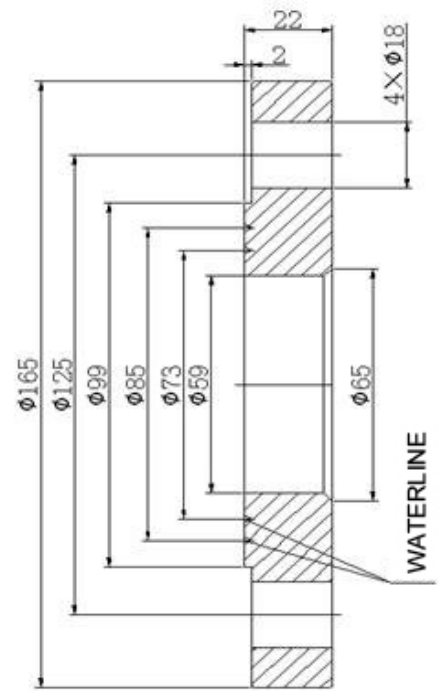


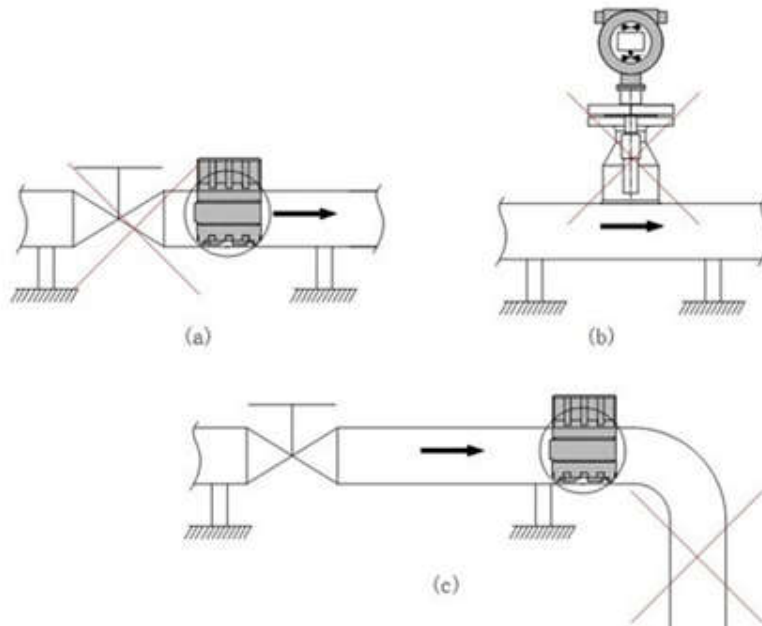
Figure 1, Density Meter Dimension



**4Mpa DN50 Flat Welding Flange
Unlabeled Chamfer are all 1×45°**

Figure 2, Density Meter Dimension

4. Incorrect Installation Sketches:



a)

Figure 1: RBDM-CR Insertion Density Meter Horizontal Pipe Incorrect Installation

b)

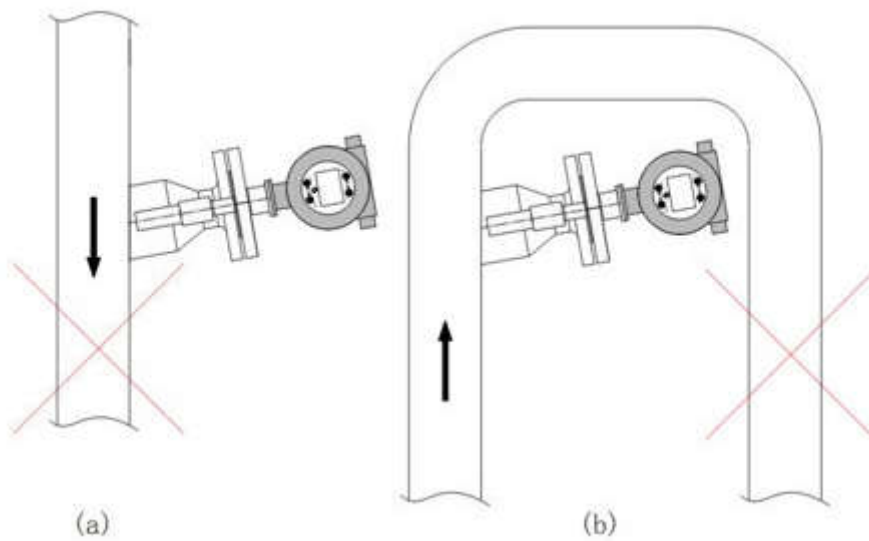
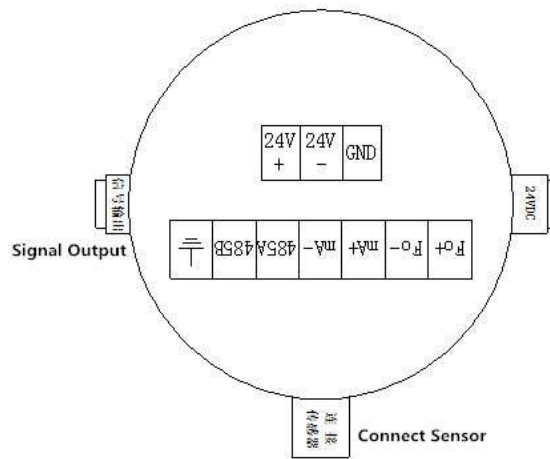


Figure 2: RBDM-CR Insertion Density Meter Vertical Pipe Incorrect Installation


3. ELECTRICAL INSTALLATION

3.1 Introduction

RBDM-CR is a 4-wired design, output (analogue) 4-20 mA, (pulse) 0-1000Hz and MODBUS RTU digital connection. Outputs analogue and frequency can be stored in the system. Software can be selected for particular condition of density, temperature, mass percentage or volume percentage. The diagram below illustrates electrical connectivity:



Wiring instructions

24V + \ -	24VDC power supply (>50mA)
Fo + \ -	frequency output 0-1000 Hz (temperature/ density/ ingredient percentage – optional adjustment)
mA + \ -	analogue output 4-20 mA (temperature/ density/ ingredient percentage – optional adjustment)
485A \ 485B	RS-485 contact (Baud rate: “9600”, address: set as“1”)
GND	Signal shielding
	Housing ground

An identical power supply can be shared by multi-installed meters. To prevent electricity usage overloaded, a separated power supply should be considered.

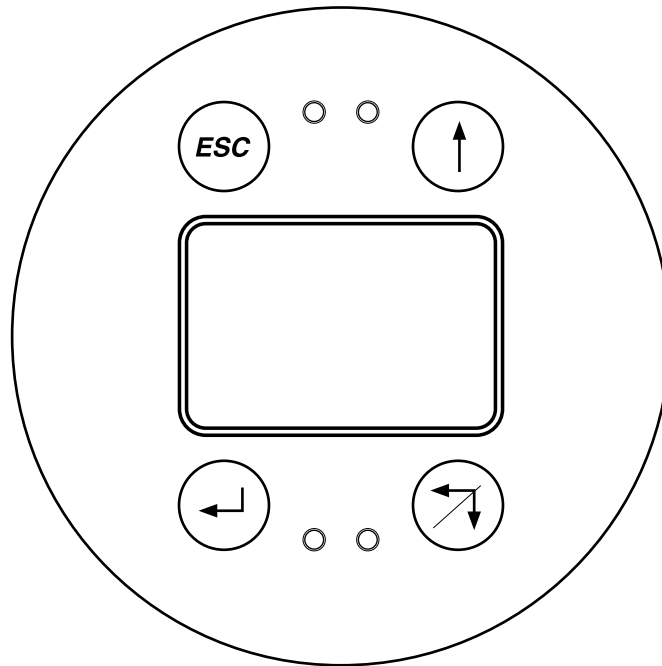
4. PRECAUTIONARY ADVICE

















It is recommended that there is none of the following;






1. Any physical damage to the meter.
2. Measurement incompatible fluid.
3. Operate the device if exceeding its rated pressure or maximum temperature.
4. Do any pressure test beyond the specified test pressure.
5. Expose the meter to excessive vibration (> 0.5 g continuous).
6. Modify this instrument in any way (mechanical or electrical), otherwise the factory warranty will be invalidated. This meter can be ordered with Zirconium wetted parts. In this case, mechanical modifications of any kind may produce a safety hazard and must not be performed.
7. Exceed the stated supply voltage range, otherwise the meter may be damaged and a hazard may exist.
8. Ensure all explosion-proof requirements have been applied.
9. Ensure the meter and associated pipe work are pressure tested to 1-1/2 times at the maximum operating pressure after installation.
10. Ensure the transmitter outer covers are tightened properly after wiring to maintain ingress protection.
11. Be aware of handling PFA-coated tines as the coating is not resistant to any impact. Always keep the protective cover on when the meter is not in use.
12. Maintain the meter in its original packaging. For the long-stem meters, ensure the transit cover secured by the grub screws.

5. OPERATING INSTRUCTIONS

- The buttons of the transmitter are all via touch screen and through glass operation.
- Detailed instructions are listed as below:



1. Touch  or  to switch the two function interfaces;
2. Touch  to enter the "Password" interface. Then touch  to shift, and touch  to scroll the number to 20. And touch  to enter the Menu interface. In this interface, you could touch  to get back to the previous interface. Or you could touch  to enter the next interface needed.
 - 1) Enter the "Records" interface, the detailed information of the module and the serial number of the density meter is shown. Touch  to get back to the "Menu".
 - 2) In the section of preference adjustment, selecting options by obstructing  and  arrow key and  to enter into the particular sector. Setting can be adjusted by  and  function key, and confirming and saving changes by obstructing  key. Alternatively, obstructing  key to quit preference setting. A detailed demonstration is listed below:

- a) “Density Unit”: to select the unit type displaying in system (density unit includes: lb/gal, g/cc, kg/m³, lb/ft³);
 - b) “Temp. Unit”: to select the unit type displaying in system (temperature unit includes: °C, °F);
 - c) “Frequency”: the most suitable functioning modes can be selected according to the level of frequency output (1.density: frequency output changes as the density of measuring liquid varies; 2.temperature: frequency output changes as the temperature of measuring liquid varies; 3.V/V: frequency output changes as the mass ratio of measuring liquid varies; 4.m/m: frequency output changes as the mass ratio of measuring liquid varies);
 - d) “Current”: the most suitable functioning mode can be selected according to the level of analogue output (1.density: analogue output changes as the density of measuring liquid varies; 2.temperature: analogue output changes as the temperature of measuring liquid varies; 3.V/V: analogue output changes as the mass ratio of measuring liquid varies; 4.m/m: analogue output changes as the mass ratio of measuring liquid varies);
 - e) “Response Time”: screen refreshing speed can be set in the preference setting section;
 - f) “Light”: screen light can be switched, and brightness can be tuned in the preference setting section;
 - g) “Part A Density”: specific in multi-measurements;
 - h) “Part B Density”: specific in multi-measurements;
 - i) “Component %”: can be set in the general setting preference section (1.V/V volume ratio; 2.m/m mass ratio);
 - j) “Reset”: setting can be default as original setting;
 - k) “Address”: address used for communicating via RS485,defaulted setting as “1”;
 - l) “Baud rate”: Baud rate used for communicating via RS485, defaulted setting as“9600”;
 - m) “Communication Protocol”: advised to tune the communication setting of RS485 as standard MODBUS RTU to match with Sincerity’s CRC compatibility.;
3. In the section of “Output Test”, frequency output and electricity output can be measured. Enter setting mode by obstructing  key, and adjusting figures by using  arrow key (advised setting for each level of frequency output: 0%--0Hz; 25%--250Hz; 50%--500Hz; 75%--750Hz; 100%--1000Hz; advised setting for each level of electricity output: 0%--4mA; 25%--8mA; 50%--12mA; 75%--16mA; 100%--20mA), Obstructing the “ESC” key to return to main menu;
4. The “Calibration” section enables more suitable preference setting according to the particular operating conditions. (It would be strongly recommended for new installed density meter.). In the case of measuring known-density liquid, users can store the data into system by setting the density with  and  arrow keys Density meter will start auto-customizing after confirmed setting by obstructing  key. A notification of “saving changes in progress” will be shown on the screen to enable users to check the status. Moreover, stored data of liquid density will not be erased until next new auto-tuning.



Address Book of MODBUS RTU

No.	Holding Register	Address (16/10 Bit)	Definition	Note
1	41001	0x03E8 / 1000	Density	
2	41003	0x03EA / 1002	Temperature	
3	41005	0x03EC / 1004	Frequency rate	
4	41007	0x03EE / 1006	Adjusted frequency rate	
5	41009	0x03F0 / 1008	Contains of measurement A	

Address Book of MODBUS RTU

1. To prevent unnecessary issues which might occur, editing the address info is not recommended

2. Default setting for communication setting:

Data bit: 8

Stop bit: 1

Check: None

Baud rate: 9600

Station: 1

Protocol: MODBUS RTU



6. MODEL SELECTION GUIDANCE

Code	Production							
RBDM	RBDM Liquid Insertion Density Meter							
	Code	Material						
	A	316 Stainless Steel Standard						
	B	HC Hastelloy Standard						
	P	316 Stainless Steel(Four Fluorine Coating)						
	E	Requested preference: Please inform for particular						
		Code	Transmission output					
		C	4-20mA 0-1000Hz RS485 MODBUS RTU					
			Code	Transmission device cover case				
			B	Aluminum alloy				
			Code	Connection process				
			16	50mmGB/T 9123.1-2000 RF DN50/PN16				
			40	50mmGB/T 9123.1-2000 RF DN50/PN40				
			XX	Requested preference: Please inform for particular				
			Code	Length				
			128	Standard length 128mm				
			XX	User length				
			Code	Marked edge				
			A	Pipeline Insertion				
			B	Tank Insertion				
			C	Offer Horizontal Variable				
			D	Please inform for particular				
			Code	Original setting				
			G	Options for original setting				
RBDM	A	C	B	40	150	A	G	Typical module selection