FBSON series ultrasonic level meter Operation instruction

Contents

FBSON series Ultrasonic Level Meter

★Overview

Ultrasonic level meter is one kind of level measurement instruments of non-contact、high reliability、low price and non-maintenance. It can meet most demands of level measurement without contacting industry medium, so it solves drastically the problems such as twist、jam、leakage、eroding and inconvenience to maintain that cause by the tradition measurement methods like pressure、capacitance、floater.

FBSON series ultrasonic level meter is a new type production designed by Better Control for years. It has the function and characteristic as following:

➢ **Advanced echo track algorithm**

    It can catch the real echo effectively in the noise such electric、sound, and so no. Multimode of the echo track algorithm can meet different demands in the field.

➢ **Intelligent send emission mode**

    Automatic/manual regulation mode、emission frequency to assure the measurement effect.

➢ Multi-compensation mode:

    Inner temperature compensation and manual compensation modes selectable.

➢ **Standard industry transmission signal and strong load capability**

    4～20 mA standard industry transmission signal and 750Ω load capability connected with PLC/DCS system directly.

➢ **Full explosion-proof design**

    It's designed with explosion-proof and noncontact magnetism-control switch.

➢ **Equip several kinds of sensor**

The level meter is equipped with several kinds of anticorrosive and high temperature resistant sensor to suit for different condition.

★Technical data and order number

☆The main technical data

Performance	Integrative
Measurement span	5M、8M、12M、15M
Accuracy	0.5%
Resolution	3mm or 0.1%（The bigger）
Display	LCD display
Analog output	4~20mA, Load:750Ω
Rating operating voltage/power	24VDC P=2.4W
Operating voltage	21V~32VDC
Operating temperature	-15~65℃
Protection type	IP66
Sensor cable	No

☆Order number of the FBSON series ultrasonic level meter

| Order number				Description
FBSON				Ultrasonic level meter
Constru ction	-Y			Integrative
Measure ment span		-05		The longest distance is 5m
		-08		The longest distance is 8m
		-12		The longest distance is 12m
		-15		The longest distance is 15m
Anticorr osive grade			N	Normal type
			F	Anticorrosive type
Please communicate with us face to face if any special demand				

※Installation

★Notice of installation

◆ The sensor should be vertical with the surface measured:
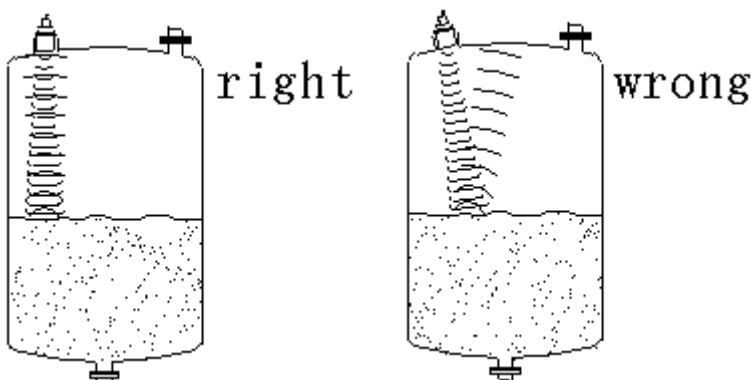
◆ The sensor should be installed far from the feed-in gate in order to avoid the obstacle:
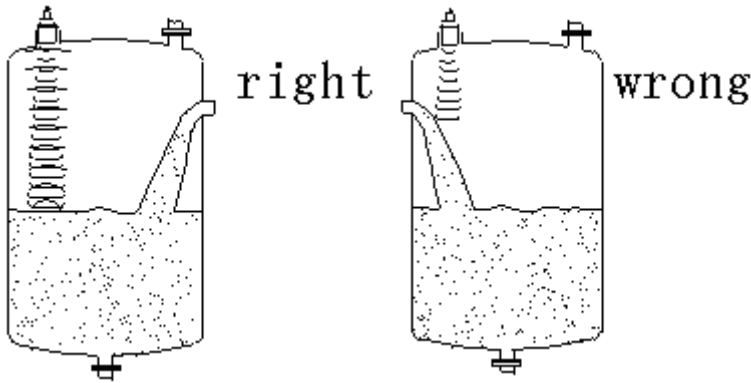
◆ It's not suit for measuring when whisk intensively:
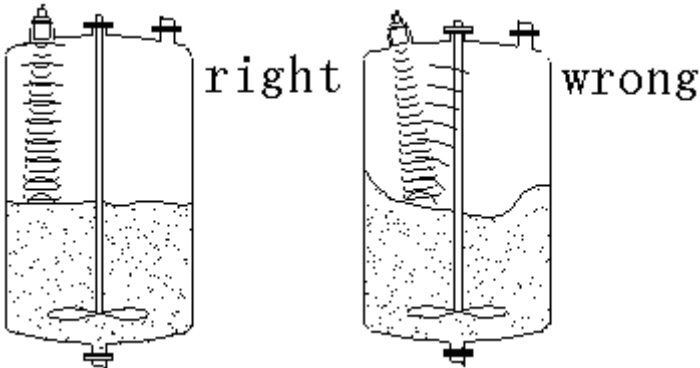
◆ Pipe

The ultrasonic level meter has a near end dead zone. In order to avoid that the surface measured enter into dead zone, it will heighten the installation position with pipe usually for the measurement accuracy.

Bigger of the pipe's inner diameter, the better; Shorter of the pipe, the better. Advice: $\dfrac{D}{L} > \dfrac{1}{2}$. At the same time keep the welding line or tuber in the interior of the pipe as least as possible. Has no burr in the interface between pipe and vessel. In order to reduce the interference to minimum, we advise to use short pipe with cut-corner(45 degree is the best).

★Outline and dimension of FBSON-Y integrative type ultrasonic level meter

➢ **Sketch map:**

170

100

SW36

φ92

111

G2 1/2″

70

φ72

75. 2 cm
26. 5 ℃
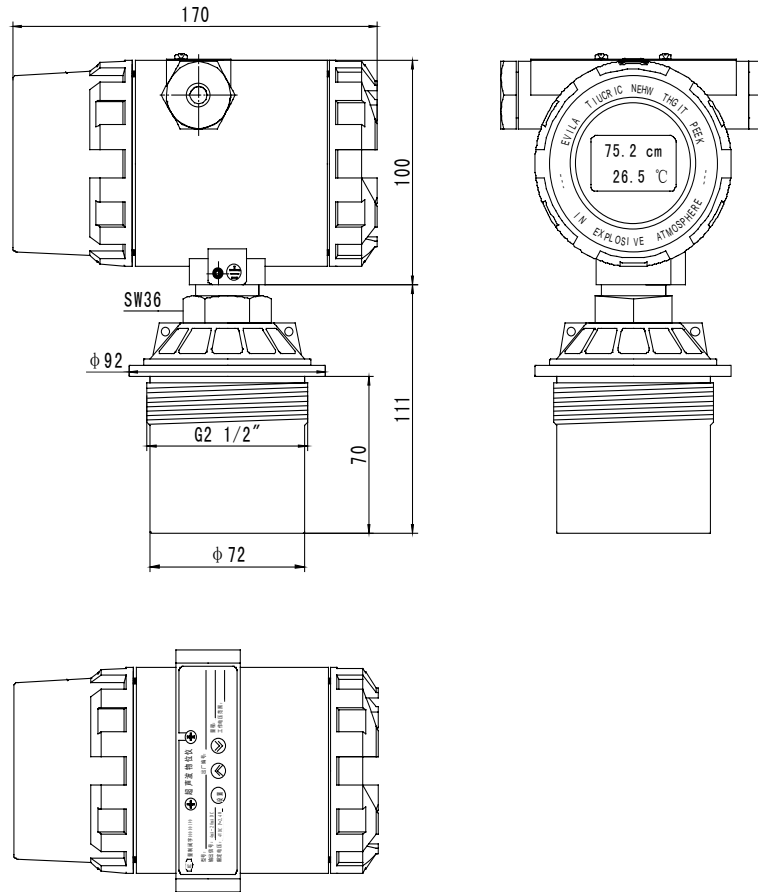
★*The installation sketch map of FBSON-Y integrative type ultrasonic level meter:*

75. 2 cm
26. 5 ℃

4-φ18均布

法兰80-25
可选配件

法兰80-25
用户自备

φ150

φ190
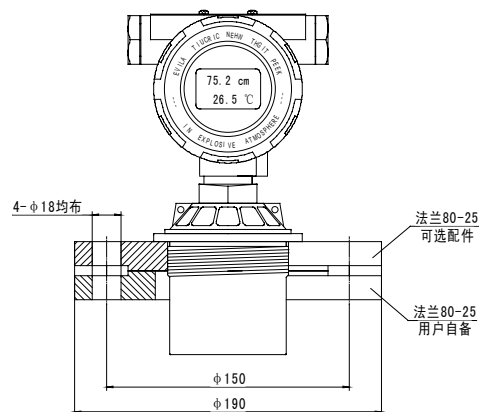
★Ｗｉｒｉｎｇ

You will see the picture as following after uncover the backcover:

```
A B C D
A and B are the input terminals of power
 A: the anode input of 24v
 B: the cathod input of 24v
C and D are the output terminals of current
 C: the anode output of 4-20mA
 D: the cathod output of 4-20mA
```
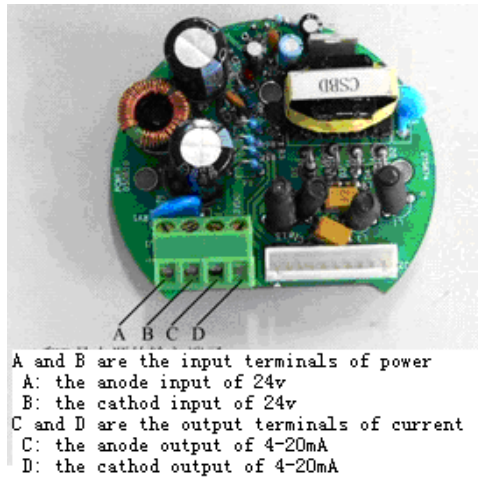
Fig-1

The wiring should be correct ,and the voltage of power shouldn't be over 35V.

The operating power is: 24VDC,2.4W

※Setup

★Brief introduction

FBSON integrative ultrasonic level meter has two modes: operating mode and setup mode. The meter will enter into operating mode automatically and start to measure after power on and initialization. The data is the distance from sensor to the surface and output 4~20mA. The output current is direct proportion to the distance.

Because FBSON ultrasonic level meter is designed with explosion-proof, the button is adopted non-contact and magnetic induction button. Use corresponding magnetic stick to click corresponding button when operating menu.

Push "SET" to enter into setup mode when in the operating mode. Push "⇑ ⇓" to carry out parameter adjustment.

Adjust the parameter in the setup mode so that the instrument will be suit for the field environment and customer's demand.

✧ The menu of setup mode:
➢ Unlock and lock
➢ Measurement span set
➢ Measurement mode selection
➢ Sensor selection
➢ Algorithm selection
➢ Calibration
➢ Factory setup recover

Push "SET" to go back to operating mode after setup finishing.

★Setup steps

1. Measurement mode selection: The measurement mode includes distance measurement and level measurement. The default mode is distance measurement.

When in the distance measurement mode, the display value of the level meter is the distance from the sensor to the surface measured. The formula of output current is: $i= (\frac{D_{dis\tan ce}}{E}*16+4)$ mA

When in the level measurement mode, the display value of the meter is height from bottom to the surface measured. The formula of output current is:

$i=(\frac{D_{level}}{L}*16+4)mA$
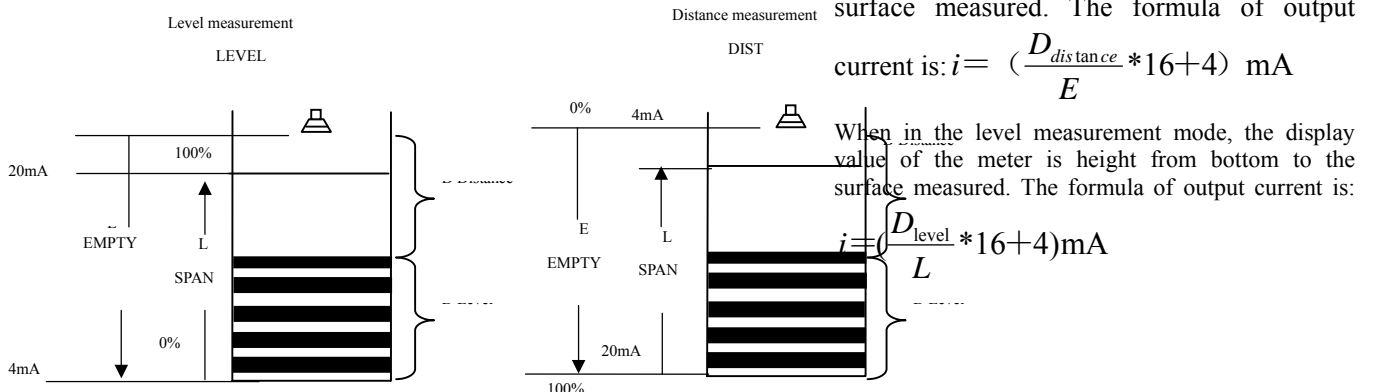
1. Set L, E and the unit.
2. If necessary, select sensor again and set the near end dead zone value. The sensor type is set already before leaving factory. The type of the sensor determines the type of ultrasonic frequency、near end dead zone value and temperature sensor, so we advise that user don't change it without permission.
3. Set reasonable response speed and safety level.
   The meter can work in three response speeds as following:

No.	Response speed	Safety timing(minute)
1	SLOW	10
2	MEDIUM	1
3	FAST	0.1

The parameters such as safety timing will be set for the defaults once you select a response speed.

The mean of the safety timing is: how long the meter will enter into protection state when the meter judges it has entered into lost echo state already. The output of the meter before entering into protection state is the value just before the echo loss occurred.

When entering into the protection state, it will output the measurement value by safety level setup. If select HOLD, the output will be the value just before the echo loss occurred; If select MIN, the output will be 4.00mA; If select MAX, the output will be 20.00mA.

At the same time, The setup of response speed will also affect the measurement accuracy. The speed faster, the update of data will be faster, so the output of "mA" will change fast too. The response speed will not be that the faster, the better. If the response speed set more slowly, the instrument will evaluate the date measured several times and then bring a more reasonable result. For example, the surface measured is shaking or there's dropping solid in the route of wave transmission, it will get a wrong result easily if the response speed is too fast. On this condition, it will improve the accuracy if reduce the response speed.

Advice：Adopt the response speed as slow as impossible to get the more reasonable data.

4. Calibrate if necessary. The calibration of FBSON ultrasonic level meter includes the calibrations of span、velocity of sound、current output、temperature, and so on. There's no need to calibrate generally.

Span calibration: It can be offset by span calibration when there's a root error between distance measured and the actual distance. The way is: Power on and wait for stabilization of the data firstly after the sensor is fixed. Enter into the menu of span calibration and input the actual data, then the system will calculate the difference S_{offset}, and regard the difference as root error. The simple formula is:

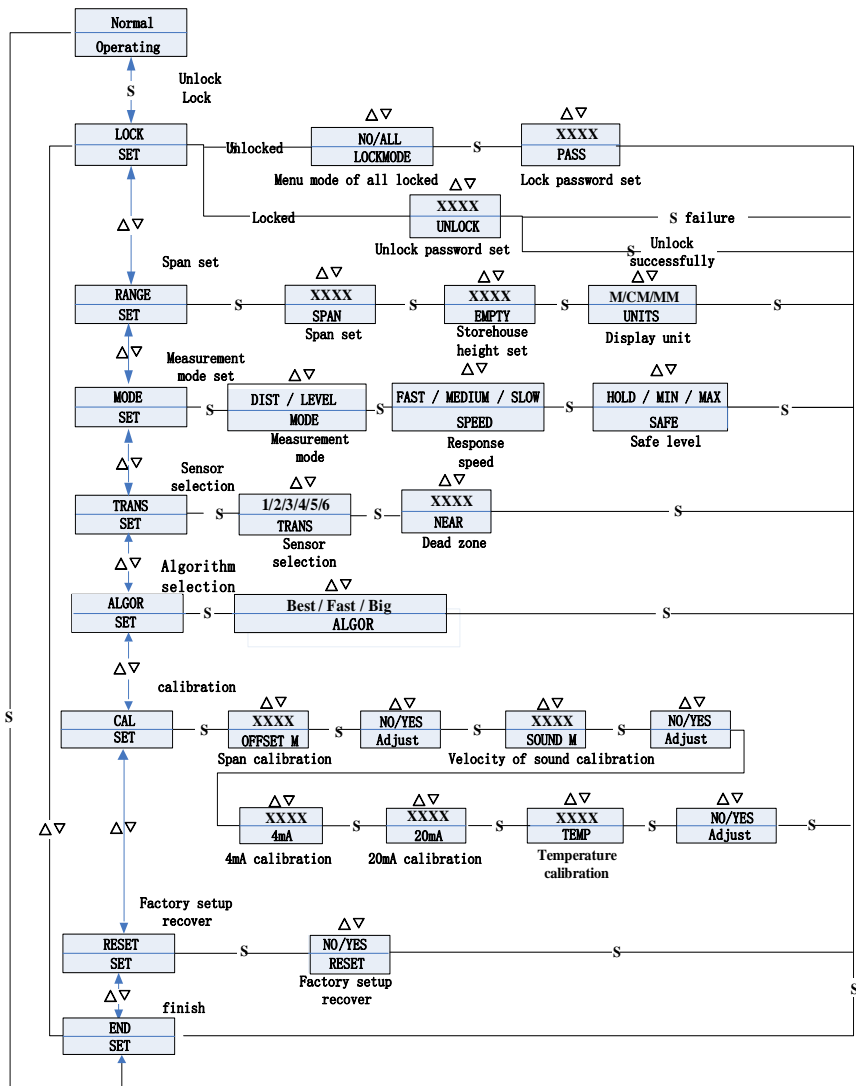$$S_{last} = V_{velocityofsound(set)} * t_{measurement} + S_{offset}$$

Velocity of sound calibration: The velocity of sound will be difference if the medium measured is not air, which will cause bigger error. Velocity of sound calibration should be carried out on this condition. The way is: Power on and wait for stabilization of the data firstly after the sensor is fixed. Enter into the menu of velocity of sound calibration and input the actual data, then the system will calculate the velocity of sound $V_{calibration}$ in this medium, and use the data in the future measurement. The simple formula is:

$$S_{last} = V_{calibration} * t_{measurement} + S_{offset}$$

Current output calibration: The output current may be incorrect because of the parameter shift bring from the components. The current output calibration should be carried out on this condition. The way is: Cut an amperemeter in the terminals of current output, The 4mA calibration first, the output of the instrument is 4mA, if the actual data is not 4mA, adjust to 4mA. The 20mA calibration is the same as 4mA calibration.

Temperature calibration: The temperature calibration should be carried out if the sensor is the type that doesn't include the temperature sensor. The way is: Enter into temperature calibration and input the actual operating temperature. Calculate the corresponding velocity of sound by this temperature value in the future measurement.

※Fast checking table

```
┌──────────┐
│  Normal  │
│ Operating│
└──────────┘
     ↕ S          Unlock
                  Lock
┌──────────┐              △▽                          △▽
│   LOCK   │  Unlocked  ┌──────────┐    S    ┌──────────┐
│   SET    │───────────│  NO/ALL  │─────────│   XXXX   │
└──────────┘           │ LOCKMODE │         │   PASS   │
     ↕                 └──────────┘         └──────────┘
                  Menu mode of all locked  △▽   Lock password set
     △▽                        ┌──────────┐
               Locked          │   XXXX   │              S failure
          ─────────────────────│  UNLOCK  │─────────────────────────
                               └──────────┘            Unlock
                          Unlock password set      ─────────────────
                                                S    successfully
          Span set
┌──────────┐        △▽              △▽              △▽
│  RANGE   │   S  ┌──────────┐  S  ┌──────────┐   ┌──────────┐
│   SET    │─────│   XXXX   │─────│   XXXX   │────│ M/CM/MM  │──── S
└──────────┘     │   SPAN   │     │  EMPTY   │    │  UNITS   │
     ↕           └──────────┘     └──────────┘    └──────────┘
                  Span set      Storehouse        Display unit
     △▽ Measurement             height set
        mode set
┌──────────┐        ┌──────────┐     ┌─────────────────┐     ┌──────────────┐
│   MODE   │   S    │DIST/LEVEL│  S  │FAST/MEDIUM/SLOW │  S  │HOLD/MIN/MAX  │── S
│   SET    │────────│  MODE    │─────│     SPEED       │─────│    SAFE      │
└──────────┘        └──────────┘     └─────────────────┘     └──────────────┘
     ↕               Measurement       Response              Safe level
     △▽ Sensor       mode              speed
        selection
┌──────────┐        △▽              ┌──────────┐
│  TRANS   │   S  ┌──────────┐      │   XXXX   │
│   SET    │─────│1/2/3/4/5/6│  S   │   NEAR   │─────────────── S
└──────────┘     │  TRANS    │──────└──────────┘
     ↕           └──────────┘        Dead zone
     △▽ Algorithm  Sensor
        selection  selection
┌──────────┐        △▽
│  ALGOR   │   S  ┌──────────────┐
│   SET    │─────│Best/Fast/Big │──────────────────── S
└──────────┘     │   ALGOR      │
     ↕           └──────────────┘
     △▽ calibration
┌──────────┐    △▽          △▽             △▽            △▽
│   CAL    │  ┌──────┐    ┌──────┐  S    ┌──────┐     ┌──────┐
│   SET    │ S│ XXXX │  S │NO/YES│───────│ XXXX │  S  │NO/YES│
└──────────┘──│OFFSET M│  │Adjust│       │SOUND M│    │Adjust│
     ↕        └──────┘    └──────┘       └──────┘     └──────┘
     △▽       Span calibration    Velocity of sound calibration
                △▽          △▽             △▽            △▽
             ┌──────┐    ┌──────┐        ┌──────┐     ┌──────┐
           S │ XXXX │  S │ XXXX │   S    │ XXXX │  S  │NO/YES│── S
             │  4mA │────│ 20mA │────────│ TEMP │─────│Adjust│
             └──────┘    └──────┘        └──────┘     └──────┘
             4mA calibration  20mA calibration  Temperature
     △▽                                         calibration
  Factory setup
  recover
┌──────────┐        △▽
│  RESET   │   S  ┌──────────┐
│   SET    │─────│  NO/YES  │─────────────────── S
└──────────┘     │  RESET   │
     ↕           └──────────┘
     △▽  finish   Factory setup
                  recover                              S
┌──────────┐
│   END    │
│   SET    │──────────────────────────────────────
└──────────┘
```

☆Lock and unlock

Menu		Factory setup	Parameter description
LOCK SETUP	Entrance of the lock key in the menu Push SET to confirm Push ▲▼ to exit		Lock menu
A		**Factory setup**	**Parameter description**
ALL/NO LOCKMODE	Locking level set Push SET to confirm Push ▲▼ to select	NO	ALL: all the menu locked NO: unlock
B		**Factory setup**	**Parameter description**
XXXX PASS	Lock password set Push SET to confirm Push ▲▼ to change password	18	
C		**Factory setup**	**Parameter description**
XXXX UNLOCK	Unlock password set Push SET to confirm Push ▲▼ to change password	18	Unlock the menu

☆Measurement span set

Menu		Factory setup	Parameter description
SPAN SETUP	Entrance of span set menu Push SET to confirm Push ▲▼ to exit		Set span, storehouse height and display unit
A		**Factory setup**	**Parameter description**
XXXX SPAN	Span set Push SET to confirm Push ▲▼ to set span	15.00	Set the measurement span
B		**Factory setup**	**Parameter description**
XXXX EMPTY	Storehouse height set Push SET to confirm Push ▲▼ to set height	15.00	Set the storehouse height of the level meter
C		**Factory setup**	**Parameter description**
M/CM/MM UNITS	Unit selection Push SET to confirm Push ▲▼ to change	CM	M: display by meter CM: display by centimeter MM: display by millimeter

☆Measurement mode set

Menu		Factory setup	Parameter description
MODE SETUP	Measurement mode set Push SET to confirm Push ▲ ▼ to exit		Measurement mode set
A		**Factory setup**	**Parameter description**
DIST/LEVEL MODE	Measurement mode Push SET to confirm Push ▲ ▼ to select	DIST	DIST: distance measurement LEVEL: level measurement
B		**Factory setup**	**Parameter description**
SLOW/MEDIUM/FAST SPEED	Response speed set Push SET to confirm Push ▲ ▼ to change	MEDIUM	SLOW: slow speed MEDIUM: medium speed FAST: fast speed
C		Factory setup	Parameter description
HOLD/MIN/MAX SAFE	Safe level set menu Push SET to confirm Push ▲ ▼ to change	HOLD	HOLD: hold MIN: the minimum value MAX: the maximum value

☆Sensor selection

Menu		Factory setup	Parameter description
TRANS SETUP	Entrance of sensor selection menu Push SET to confirm Push ▲ ▼ to exit		Select sensor and set parameters
A		Factory setup	Parameter description
1/2/3/4/5/6 TRANS	Select sensor type Push SET to confirm Push ▲ ▼ to select	1	
B		Factory setup	Parameter description
XXXX NEAR	Dead zone set Push SET to confirm Push ▲ ▼ to change value	0.4	Set the dead zone of the sensor

☆Algorithm selection

Menu		Factory setup	Parameter description
ALGOR SET	Entrance of algorithm selection Push SET to confirm Push ▲ ▼ to exit		Algorithm selection set
A		**Factory setup**	**Parameter description**
Best/Fast/Big ALGOR	Echo algorithm set Push SET to confirm	Best	Best: energy first Fast: time first Big: intensity

			first
	Push ▲ ▼ to select		

☆Calibration

Menu		Factory setup	Parameter description
CAL SETUP	Calibration entrance Push SET to confirm Push ▲ ▼ to exit		Calibration of span, velocity of sound, output current, temperature
A		**Factory setup**	**Parameter description**
XXXX OFFSET	Span calibration Push SET to confirm Push ▲ ▼ to set value	Measurement value	Input actual value, the system will calibrate automatically
B		**Factory setup**	**Parameter description**
NO Adjust	Span calibration Push ▲ ▼ to select YES/NO Push SET to confirm	NO	YES: Select Yes to confirm span calibration of the input value NO: don't calibrate
C		**Factory setup**	**Parameter description**
XXXX SOUND	Velocity of sound calibration Push SET to confirm Push ▲ ▼ to set value		Input actual value, the system will calibrate automatically
D		**Factory setup**	**Parameter description**
NO Adjust	Velocity of sound calibration Push ▲ ▼ to select YES/NO Push SET to confirm	NO	YES: Select YES to confirm velocity of sound calibration NO: don't calibrate
E		**Factory setup**	**Parameter description**
XXXX 4mA	4mA output calibration Push SET to confirm Push ▲ ▼ to set value	184	Change value until the actual output current equal to 4mA
F		**Factory setup**	**Parameter description**
XXXX 4mA	20mA output calibration Push SET to confirm Push ▲ ▼ to set value	920	Change value until the actual output current equal to 20mA
G		**Factory setup**	**Parameter description**
XXXX TEMP	Temperature calibration Push SET to confirm Push ▲ ▼ to set value	20℃	Input the actual value manually if the sensor has no temperature sensor
H		**Factory setup**	**Parameter description**

		NO	YES: Select YES to confirm manual calibration NO: don't calibrate manually
XXXX TEMP	Temperature calibration Push ▲▼ to select YES/NO Push SET to confirm		

☆Factory setup recover

Menu		Factory setup	Parameter description
RESET SETUP	Entrance of factory setup recover Push SET to confirm Push ▲▼ to exit		Recover factory setup
A		**Factory setup**	**Parameter description**
YES/NO RESET	Select recover or not Push▲▼ to select YES/NO Push SET to confirm	NO	YES: Recover factory setup NO: EXIT

※Difficulty explanation

＊Sensor

The sensor is connected with equipment by cable. It will convert the electrical signal into ultrasonic pulse and send the pulse in the direction of the surface measured, and then the pulse will reflect from the surface. The echo will be detected by the same sensor and converted back into electrical signal.

There's a temperature sensor inside part types of the integrative ultrasonic level meter, so it can transfer the temperature signal of the sensor's location to meter at the same time.

Different type sensor has different anticorrosive capability and operating temperature, user should select suited sensor according to the actual condition.

＊Temperature compensation

Because temperature affects the velocity of sound greatly, we need the temperature of medium measured in order to compensate for the measurement accuracy. There's a temperature sensor inside part types of sensor.

If there's no inner temperature sensor or in some special situation, user can set the current temperature manually. The difference between set value and actual value will cause the error of the test result.

＊Velocity of sound calibration

Velocity of sound、temperature and medium are correlative. The default set of velocity of sound is which in the pure air. In the actual condition, the medium may be other gas and the velocity of sound in this gas is different from that in the pure air. Velocity of sound calibration is to reduce the error caused by different velocity of sound.

The steps: Measure the actual distance from sensor to a surface firstly. Select velocity of sound calibration, and then the instrument will get a distance value by the velocity of sound in the air. If there's difference between them, input the actual value manually, and then FBSON series ultrasonic level meter will correct velocity of sound by comparing the difference between the value input and measured.

＊Measurement span calibration

The accuracy may be different because of the sensor's installation position, so it needs a span calibration after installed.

The steps: Measure the distance from the sensor to surface measured after velocity of sound calibration. If there's difference between the measurement value and actual value, input actual value manually in the span calibration mode, and then the ultrasonic level meter will correct the zero-error by comparing the difference between the value input and measured.

＊Near end dead zone

Near end dead zone is mostly to remove the interference from mixed wave caused by sensor. Increase the value of near end dead zone can overcome some measurement error.

Note: Can't decrease the value of near end dead zone because that the default value is the minimum.

＊Echo loss

FBSON series ultrasonic level meter will emerge echo loss state when it's evaluation is that the measurement value is uncertainty. For example: electromagnetism noise is too high, grounding problem, or the sensor doesn't face to the surface measured vertically, all the conditions above will emerge echo loss state. Settlement method see the trouble shooting.

If the durative time of the state exceeds the setup, the panel will display a symbol of (＊), at the same time the display data and mA output will be constrained to display by set value of safe level within the set response time. As long as the meter get the certain echo, the system will exit the echo loss state, at the same time the display and mA output will return back to the normal value.

＊Magnetism-control pen

The function of the magnetism-control pen is to set parameters of the integrative ultrasonic level meter through the menu; With the magnetic terminal to click the key SET、⇑ and ⇓ on the nameplate to change the setup.
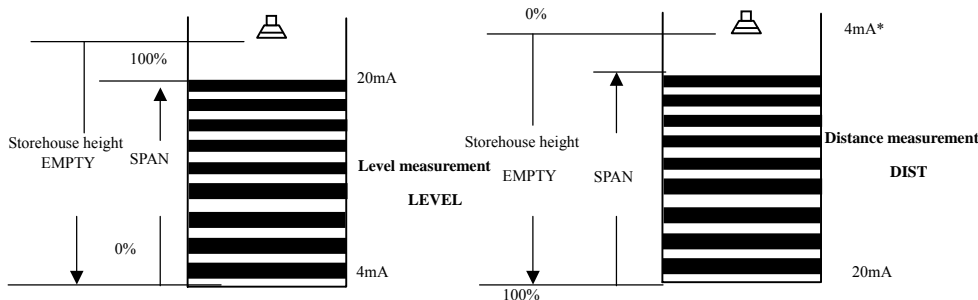
＊ *mA output*

FBSON series ultrasonic level meter can afford 4～20mA current signal output. Output according to the setup below.

When operating:

In level measurement mode, 0 and 100％ is percentage to measurement span when operating mode; In distance measurement mode, 0 and 100％ is percentage to storehouse height.

When echo loss time exceeds safe time, the mA output is set according to method below:

100%		20mA
Storehouse height		
EMPTY	SPAN	**Level measurement**
		LEVEL
0%		4mA

0%		4mA*
Storehouse height		**Distance measurement**
EMPTY	SPAN	**DIST**
100%		20mA

Safe protection mode (SAFE)	State 4~20
Maximum(MAX)	20
Minimum(MIN)	4
Hold(HOLD)	hold

★Trouble shooting

Phenomenon	Causation	Settlement
Can't operate	Power connection problem	Check the power cable
The meter operating but no display	Display screen or sensor trouble	Check sensor has sound wave oscillation or not. If no, the sensor has trouble, or else the display screen has trouble
The meter operating, but temperature display is 85℃ and changeless	Temperature sensor trouble	Replace the sensor
The meter operating, the screen displays (*), and enter into echo loss state	1. Go beyond measurement span; 2. The medium vibrates intensively or has heavy dust; 3. Has intensity interference from heavy power equipments, for example, electric motor; 4. The sensor doesn't face to the surface correctly 5. Has unwanted objects in the space measured, for example stay bar, feed-in tap, and so on	1. Consider to replace level meter which has longer span; 2. The meter will recover normal measurement automatically after the medium measured is stable; 3. Use electromagnetism shield 4. Calibrate sensor again 5. Select new suited place to install
Big error occurs after the level meter worked period time	May be the sensor is damaged	The highest operating temperature is 80℃, so the meter will be ineffective if the temperature exceeds 80℃ The endure pressure is 2 Kg, so the meter will be ineffective if the pressure exceeds 2 Kg If the sensor is not anticorrosive, it will be ineffective if operating in the corrosive atmosphere
Unreasonable value occurs when near end measurement	The surface measured enters into the near end dead zone	Check the sensor is too near to the surface measured or not. If the distance is less than the near end dead zone, it should heighten the sensor with pipe to avoid the near end dead zone
Unreasonable value occurs in the far end of the span	The surface measured exceeds the span	The level meter's span is calibrated by static level, so the actual span will not reach the rated span in some condition such as solid grain、powder、anomaly level、small area, and so on. In this condition it needs a level has longer span

a) Guarantee description

■ The guarantee period is one year according provision of "three responsibilities;

■ The meter will be maintained for free if it's because of the product's

quality in the period of guarantee;

■ The service will be charged if it belongs to the conditions as followings:

a) Exceeds the guarantee period;

b) Damaged because user don't operate by operation instruction;

c) It's not maintained in the after service spot appointed by our company;

d) Because of act of god;

e) In the guarantee period but it's not because of production quality.

※ Service Tenet

★Better Control not only fetch in foreign advanced technology to design product, but also fetch in foreign advance concept on sale, service and market management. Better Control insists on the principle of region distribution and serving locally to serve all the customer wholeheartedly. Please contact with local filiale, branch or agent of Better Control if you want to order.