SF300(N) Intelligent tuning fork switch

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1 About this manual

Thank you for choosing our products.

This manual is for Chinese native language professionals in the Chinese market. From the date of publication of this manual, we no longer provide the English manual randomly for the products supplied to the Chinese market. For customers with special needs, you can also contact our authorized local dealer or agent for English manual.

Through this manual, we strive to enable you to accurately understand the tuning fork bit switch measurement principle, related concepts, technical terms and the correct methods and conditions for installation and application.

Symbols and meanings used in this manual :

Graphic Symbol	Meaning
⚠️ warning!	Incorrect or inconsistent with relevant specifications and operations and use that violate the requirements of this manual can cause damage to instrumentation and equipment
✏️ attention!	Important concepts, definitions or methods
☝️ careful!	Improper or careless operation and application can cause the instrument not to run properly or even damage
⏚	Grounding mark

2. Working principle

SF300 the (n) intelligent tuning fork switch works, the fork is excited by a piezoelectric crystal to make the fork in a resonant state. when the fork is in contact with the material, the resonant frequency will change significantly. An internal electronic unit is converted to a relay or PNP switch output after processing by detecting the fork frequency.

SF300(n) intelligent tuning fork switch is equipped with a variety of durable stainless steel tuning fork body, can carry on the material level inspection to the storage tank or the pipeline, suitable for all kinds of liquid, powder, granular solid, can be installed on the pipe or storage tank by thread, flange, or through sanitary connectors installed in food industry facilities.

3 Product characteristics

- The operation is not affected by flow, foam, turbulence, floating foam, vibration, solid content, hanging material, liquid characteristics and medium changes.
- Digital tube display fork frequency value, instrument self-check information, easy to test function, timely detection of circuit damage, fork wear, material adhesion and other failures
- Easy to set: the most commonly used two parameters sensitivity, alarm delay can be set by a single key quickly
- Long and short two kinds of tuning fork shape, wide application.
- No moving parts or gaps, almost no need for routine maintenance.
- no need for site calibration, easy installation.

- The short fork body's "fast drop" tuning fork shape design, makes the system response faster, suitable for viscous liquid.
- Multiple output modes:
  - Relay output
  - PNP output
  - Frequency output
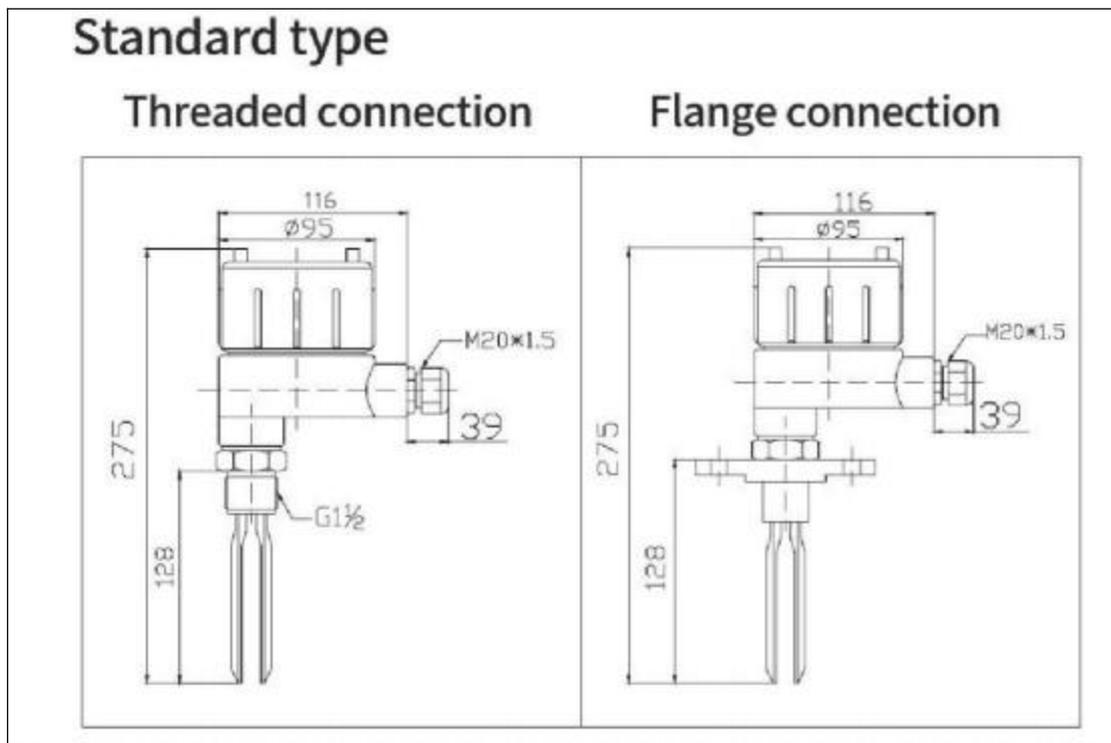- Equipped with flameproof shells

4 Technical parameters

- **Supply voltage:**
    ~30 VDC
    110~220 VAC(relay output only)
- **Output**
    Relay DPDT 8A 250VAC
    PNP output :50 mA ,24V
    Frequency output: equal to fork vibration frequency (24 V)
- Temperature :-30~70℃
- **Medium operating temperature:**
    Short fork :-30~ 150℃
    Long fork :-30~250℃
- **Density range:**
    Liquid ≥600 kg/m³
    Solid powder density⁚   ≥100 kg/m³
- Liquid viscosity :0.2~ 10,000 cp
- Switch delay :0~255 seconds adjustable
- **Alarm mode (user set):**
    wET wet alarm (fork contact material alarm)
    dry Dry Alarm (Fork Out of MaterialAlarm)
- Lag (water): ± 1 mm
- **Switch point (water):**
    short fork: distance from the end of the tuning fork (vertical):13 mm
    Long fork: a dot on the side of the fork
- Maximum operating pressure : ≤1 Mpa
- **Connection mode:**
    Thread :3/4" NPT
    Threads: G1/2
    Flange (user specified)
    Sanitary Connectors: Fittings :2"(51 mm) Tri-Clamp Connector , 1" BSPP (G) O-ring Seal Material:
- **Shell Material: Die-cast Aluminum Alloy**
- **Fork material:**
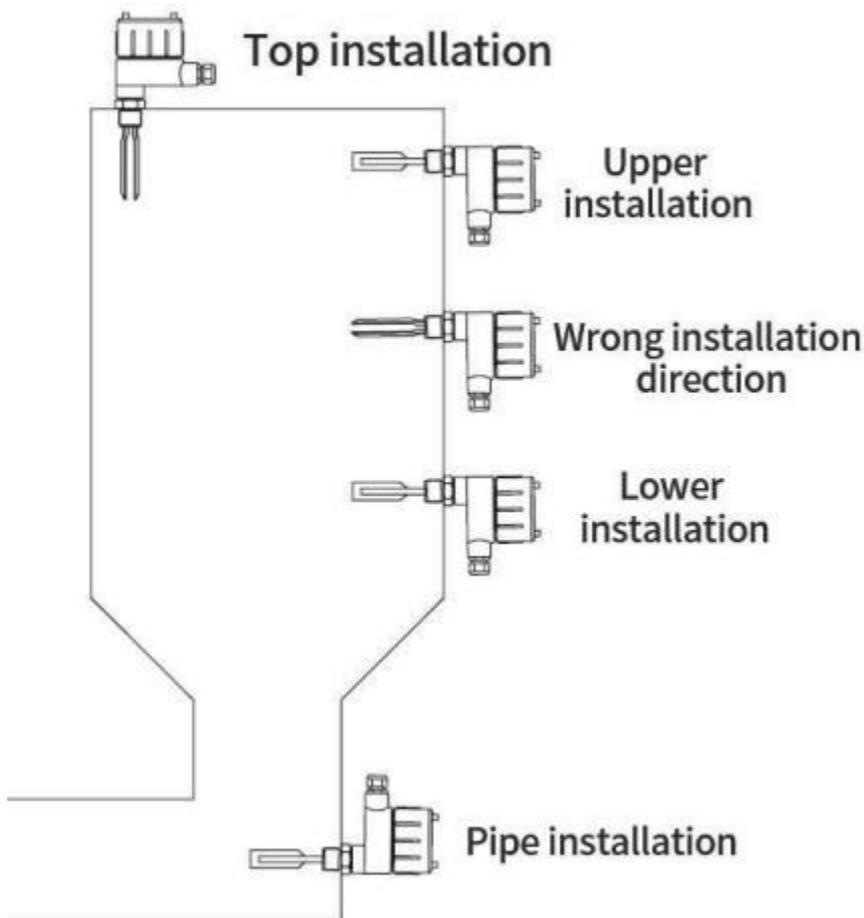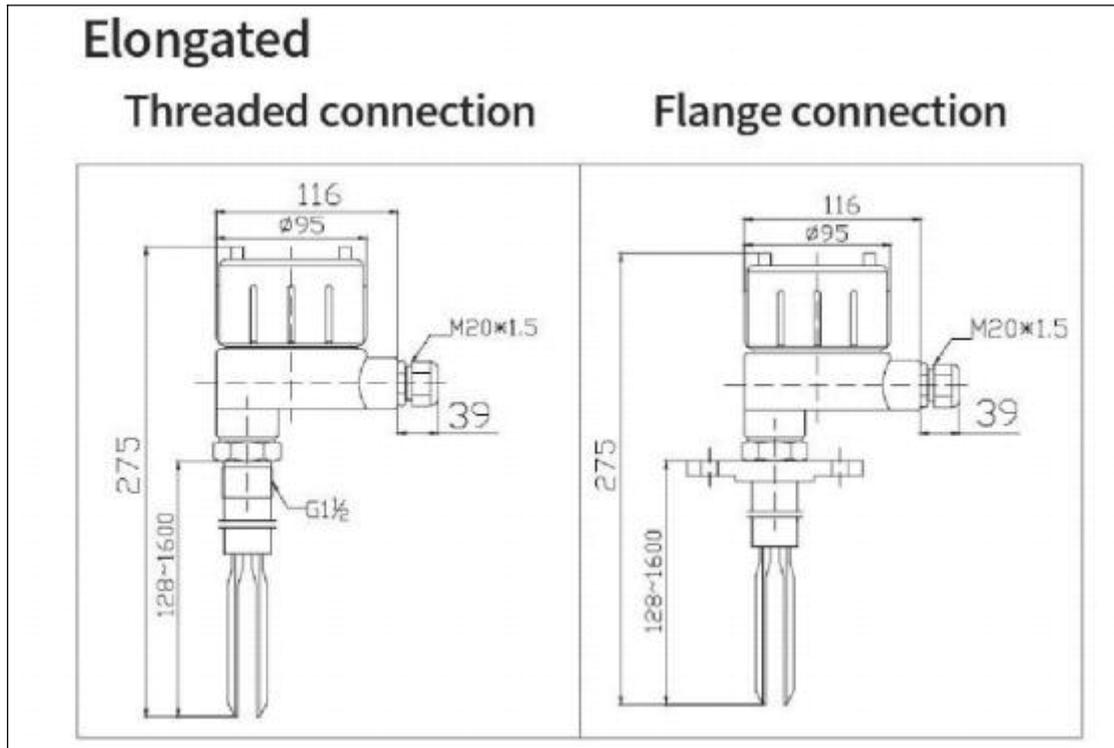   316 stainless steel
    316 stainless steel, Teflon surface

- **Shell Protection Level: IP65**
- Explosion-proof class: EX d II CT6.
- **Fork vibration frequency:**
     Short fork :1400±50 HZ
   Long fork :330±50 HZ
- Environmental Vibration Level: Acceleration not greater than 1 g

5 Shape structure and installation precautions

Length of fork extension

Short fork	mm 50
Standard Long Fork	mm 128
Long-length fork	~ 1600 mm

Standard type

Threaded connection   Flange connection

Elongated

Threaded connection

116
Ø95
M20×1.5
39
275
128~1600
G1½

Flange connection

116
Ø95
M20×1.5
39
275
128~1600

Top installation

Upper installation

Wrong installation direction

Lower installation

Pipe installation

⚠ **warning!** Ensure that the liquid is within the specified temperature and pressure range.

⚠ **warning!** When installing, do not use the hand to grasp the fork strands or tap the fork strands, so as not to force deformation of the fork body, or even damage the internal piezoelectric crystal.

☝ **carefull** Installation, do not allow the way up, that is, fork up the way.

☝ **carefull** Horizontal installation, two fork stocks must be at the same height, can not one up and down.

☝ **carefull** Instrument installation position, must try to avoid direct impact or spatter of materials. If it can not be avoided, the protective cover can be installed above the instrument installation to prevent the material from hitting the fork body.

☝ **carefull** Pay attention to prevent the bonding of materials caking (such as solid powder, concentrated pulp, asphalt, etc.), affecting the vibration of the fork. When such a situation may occur, a long fork with large fork spacing should be selected, and the installation position of the fork body and the tank wall should have sufficient space.

☝ **carefull** To detect the solid level, the installation position must be carefully considered. Due to the rest angle of the material, and the influence of the feed position, the material level surface is usually not a plane. when installed horizontally, the fork end is recommended at 1/3 radius of the inner wall of the container. When installed vertically, the distance between the installation center and the inside of the container is equal to 1/3 radius inside the container.

Recommended　fork

Operating conditions	Recommended fork
A low viscosity liquid, such as an aqueous solution.	Short fork, long fork
High viscosity liquid	Short fork
Ultra-low density liquid	Short fork
Solid particle material	Long fork
Strong vibration	Short fork

Recommended Installation Direction

Operating conditions	Recommended Direction
General situation	Vertical down installation, horizontal installation, fork down tilt installation can be.
Block or particle in material	Install vertically down, tilt down
High viscosity liquid	Only vertically

6 Electrical connections

- Relay output type products, using all 9 terminals.
- PNP or frequency output type, only use 3 terminals.

Relay output wiring

| 1	L+	AC Fire Line Terminal (DC Type 24 V Positive Terminal)
2	N‐	AC zero terminal (DC model 24 V negative terminal)
3	PE	Protective grounding, this terminal is connected to the housing, the normal use timing shell has been grounded, so no special wiring is required. For an AC model powered by 220 V, if the housing is not properly grounded (e.g. in‐house testing), the terminal must be connected to a nearby grounding metal or protective ground wire
4	C1	Common ends of the first contact set of DPDT relays
5	NC	A normally closed end DPDT the first set of contacts of a relay
6	NO	A regular start to the first set of contacts of a DPDT relay
7	C2	Common ends of the second set of contacts of DPDT relays
8	NC	A normally closed end of the second contact of a DPDT relay
9	NO	Constant Beginnings of Contact Group II of DPDT Relay

PNP output connection:

1	L+	24 V DC positive
2	N‐	24 V DC negative
3	PE	
4	C1	
5	NC	
6	NO	PNP output
7	C2	
8	NC	
9	NO	

attention! PNP output type, the menu parameter out can be set to 1, using the PNP output line, direct output frequency signal, amplitude 24 V.. frequency is equal to the fork vibration frequency.

7 Display and Key Operation
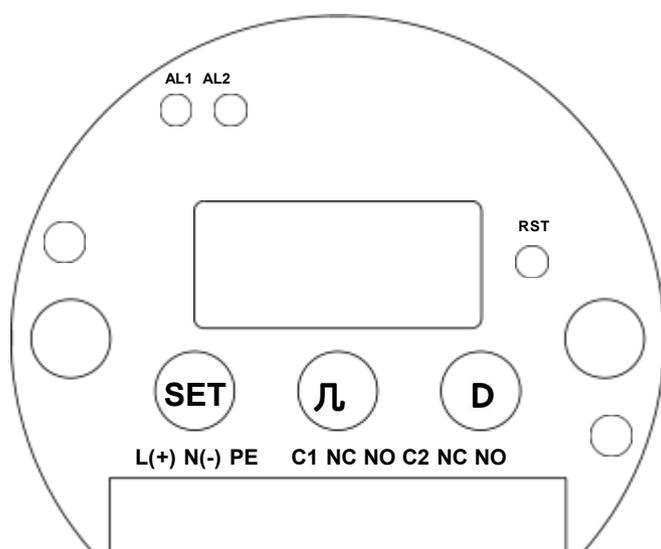
7.1 LED Alarm Lamp (AL1):

● (Off): AL1 indicator goes out
● Instrument alarm time (On): AL1 indicator light is always on.

7.2 Screen display:

● normal operation, display fork vibration frequency value.
● Change instrument menu parameter Diag to 1, can circuit display frequency and fork body temperature.
● Change the instrument menu parameter Diag to 2, can circuit display frequency, calibration point, sensor voltage, current and other diagnostic information.

7.3 Press Release:

SET key	Click to display alarm mode and alarm frequency	Long press into the menu to modify all parameters
t key	Click to display current sensitivity settings	Long press to modify current sensitivity
➡ key	Click to display current alarm delay settings	Long start to modify current alarm delay

7.4 Sensitivity setting

attention! this function is valid only when switching quantity output (parameter out=0) and frequency output (out=1).

conventional tuning fork switches typically provide a sensitivity rotary dial switch, set with a screwdriver rotation, with a range of 0~9(or 0~ 15). This product uses t key, replace sensitivity adjustment knob, quickly view and modify sensitivity (0~ 15).

Principle of sensitivity adjustment:

Field liquid medium: water or aqueous solution	Sensitivity set to 8(factory default)
Field Liquid Medium: Less Density than Water	Adjust sensitivity to greater than 8(factory default), The smaller the density, Higher sensitivity (maximum 15)
Field liquid medium with greater density than water	Adjust the sensitivity to less than 8, The greater the density, Lower sensitivity adjustment (min 0)

- **Check Sensitivity:**
  - ■ Click on t middle up button, the screen automatically display SENS sensitivity for 2 seconds, and then return to normal frequency display.
- **Modified sensitivity:**
  - ■ Long press the middle up t button for 6 seconds, the screen automatically SET SENS 2 seconds, and then the screen display sensitivity value.
  - ■ click up t key once, sensitivity + 1, maximum 15, after more than 15 automatically become 0.
- **Save and exit**

■ Press t middle up button for 6 seconds, or click the SETbutton

● **Do not save direct exit:**
  ■ **Exit automatically after 20 seconds without operation**
  ■ **click ➡ do not save exit.**

7.5 Alarm Delay Set

attention! this function is valid only when switching quantity output (parameter out=0) and frequency output (out=1).

In the case of strong vibration, turbulence, two-phase flow and splash interference, alarm delay can be increased to avoid false alarm.

● **View Alarm Delay:**
  ■ Click the ➡ button, the screen automatically display dLy alarm delay of 2 seconds, and then restore the frequency display.
  ■ Alarm delay, set at 0

● **Modified Alarm Delay:**
  ■ Long press ➡ key for 6 seconds, the screen automatically SET dLy 2 seconds, and then the screen display delay value.
  ■ Click ➡ key once, delay + 1, maximum 255 seconds, more than 255, automatically become 0.

● **Save and exit**
  ■ Press ➡ for 6 seconds or click SET.

● **Do not save direct exit:**
  ■ **Exit automatically after 20 seconds without operation**
  ■ **click t do not save exit.**

7.6 Alarm Mode

attention! this function is valid only when switching quantity output (parameter out=0) and frequency output (out=1).

● **Check the alarm mode and alarm frequency (with sensitivity determination):**
  ■ Click on the SET button, the screen automatically display alarm mode, and alarm point frequency of 2 seconds, and then return to normal frequency display.

    wEt indicates wet alarm, that is, when the fork is in contact with the material, the instrument alarm.

dry indicates dry alarm, that is, when the fork and material are separated, the instrument alarm.

.   **Change alarm mode**

When leaving the factory, the default alarm mode of the instrument is wet alarm (wEt), if you need to change to dry alarm (dry), the operation steps are as follows:

1.   Long press SET key more than 5 seconds, the instrument into menu mode, screen display Loc, prompt for protection password.

2.   Click the t   key, modify the current parameter, use the ➡ key to move the cursor, change the Loc parameter to 132

3． After the input is completed, click the SET key to confirm the save, the instrument is unlocked, and other parameters can be modified at this time.

4． Click the SET button to flip down the menu. Turn all the way to ALm1, and then click t   to start modifying.

5． Replace current parameter Alm1 with 1（dry alarm,

6． Click SET to save the current parameter

7． Finally long press SET key more than 5 seconds, the instrument return to the running state, modification completed.

7.7 User menu

more parameters that can be set through the menu. There are 3 modes when the instrument is running.

.   Operating mode: Display frequency values

.   Menu mode: flip menu

.   Modify mode: Modify current menu parameter values

Operation	Key	Current Operating Mode
Enter the menu	Press SET for 5 seconds	Operating mode
Exit menu	Press SET for 5 seconds	Menu Mode
Flip to the next menu parameter	Click SET button	Menu Mode
Turn to the previous menu parameter	Click ➡ button	Menu Mode
Modify current parameters	Click t button	Menu mode, modify mode
Move the current cursor	Click ➡ button	Modifying mode
Confirmation of preservation	Click SET button	Modifying mode
Do not save modify exit menu	Exit menu with no buttons for 20 seconds	Menu mode or modified mode

Flowchart

Running   mode

Press SET ↧ long for 5 seconds
Menu   Mode

↧   click SET key
Flip   menu

↧   click ↑ key
Modifying   mode

↧   click ↑ or ➡ keys
Modify numbers or move cursor

↧   click SET key
Save   Data

Press SET ↧ long for 5 seconds
Back to Run mode

User menu table Loc=132

Menu Name	Parameters	Remarks
Loc	Password lock	Loc= 132, the password lock opens, otherwise the parameter modification can not be saved
dAmp	damping	0~5 for frequency output only
Alm1	Alarm mode	wEt 0 ： Wet Alarm 1 ： dry alarm dry
SEN	Sensitivity 0~ 15	The instrument automatically calculates the alarm frequency according to the following three parameters: Sensitivity, Fork Air Frequency F0, Frequency F1, in fork water sensitivity default is 8(in water) 15 indicates highest alarm frequency (for low density media) 0 indicates lowest alarm frequency (for high density media)
D ly	Alarm delay 0~255	
Diag	Diagnostic information	0 ： does not display diagnostic information 1 ： display fork frequency, alarm frequency and temperature 2 ： full diagnostic information

Advanced User Menu Table Loc=9132

Parameters	Parameters	Remarks
Loc	Password lock	Loc=9132, the password lock opens and the advanced menu is displayed
O ut	Output mode	0： switch (for relays, PNP) 1 ： frequency output (Type PNP instrument can be set as frequency output mode)
Air	Air calibration	Make sure the fork is in the air and automatically record the current frequency to parameter F0. when you click SET to confirm the save
Watr	Calibration in water	Make sure the fork is half immersed in water, the immersion position is the preset alarm point, click SET key to confirm the save, automatically record the current frequency value to the parameter F1.
F0	Frequency of vibration of fork in air	Can be modified manually
F1	When the fork is submerged in water, Frequency of vibration	Can be modified manually

7.8 Menu Protection

The instrument uses the Loc code lock menu to prevent the parameter from being modified by mistake, only when Loc= 132 or 9132, can modify the instrument parameter. Site users usually use 132 to enter menu modification, maintenance personnel and manufacturers can use 9132 to enter advanced menu, recalibrate or configure.

After the user modifies the parameters, it is suggested that the Loc password lock menu be changed to other numbers to prevent the instrument parameters from being changed by mistake.

8   Common fault handling on site

8.1 Common interference or fault handling methods

Fault phenomena	Cause of failure	Processing methods
The air frequency is much higher than	Damage to piezoelectric crystals (Long forks usually have a	Contact manufacturer for maintenance

normal	maximum of 1400 hz) A short fork is usually up to 400 hz)	
Always call the police: Air frequency slightly below alarm frequency	1. Wear deformation of fork 2. Not recalibrated after fork replacement	Recalibrate water once
Always call the police: The frequency display value is always 0, or far below the alarm frequency.	1. There are lap adhesions between the two strands of the fork or between the fork and the tank wall. 2. Circuit or piezoelectric crystal may be damaged	1. Check material for lapjoint 2. After cleaning the fork, retest with water 3. If there is no bonding and the frequency is 0, contact the manufacturer for maintenance.
Frequent false positives	The external strong vibration is mistaken as a fork vibration signal	The sensitivity numbers can be lowered to reduce the possibility of the instrument being misreported after vibration
Frequent false positives	Turbulence, two-phase flow, fluid fluctuations	Increase alarm delay or increase alarm error

8.2 Display of fault diagnosis information

At the time of leaving the factory, the instrument only shows the fork frequency, and when the fault occurs, the diag parameter can be changed to 2, so that the instrument cycle shows all the diagnostic information for maintenance service personnel to analyze. The steps are as follows:

1.   Long press SET key more than 5 seconds, the instrument into menu mode, screen display Loc, prompt for protection password.

2.   Click the t   key, modify the current parameter, use the ➡ key to move the cursor, change the Loc parameter to 132

3.   After the input is completed, click the SET key to confirm the save, the instrument is unlocked, and other parameters can be modified at this time.

4.   Click the SET button to flip down the menu. Turn all the way to diag, and then click t to start modifying.

5.   Change the current parameter diag to 2（display full diagnostic information）

6.   Click SET to save the current parameter

7.   Finally long press SET key more than 5 seconds, the instrument return to the running state, modification completed.

Diagnostic information

Parameters	Diagnostic content	Remarks
Freq	Current fork frequency	Long fork frequency range :0~400 Hz Short fork frequency range :0~ 1500 Hz
F0	Frequency of fork in air when factory calibration	Code value for long forks :350 Hz Short fork type :1400 Hz
F1	When factory calibration, fork switch position just submerged in water frequency	Hz 300 for long forks Short fork type :1000~ 1200 Hz The switch position of the long fork body is marked with 2 circular concave points Switch position of short fork body is 13 mm up fork end
tHrE	Alarm point frequency	Sensitivity =8, alarm frequency =F1 The greater the sensitivity number, the greater the frequency value of the alarm point The greater the sensitivity number, the smaller the alarm point frequency value
Temp	Temperature inside instrument shell	-45~85℃
Volt	Sensor operating voltage	Normal V 12
Curr	Sensor Current	Normal 0.001 A~0.002 A
O ut	Current output mode: 0： switch output (relay, PNP) 1： frequency output	frequency output, the fork body temperature sensor of the instrument stops working.
Alm1	Alarm mode	0=wEt： Wet alarm 1=dry： Dry alarm
dAmp	Damping 0~5 adjustable	Only for frequency output mode O ut=1 p.m.
Hyst	Alarm return	

8.

8.3 Recalibration

serious wear of the fork body, or the replacement of the fork body, the replacement of the piezoelectric crystal will usually cause a small deviation of the working frequency. at this time, it is recommended that the instrument be recalibrated to ensure works normally. The steps are as follows:

1. Long press SET key more than 5 seconds, the instrument into menu mode, screen display Loc, prompt for protection password.

2. Click the t key, modify the current parameter, use the ➡ key to move the cursor, change the Loc parameter to 9132

3. After the input is completed, click the SET key to confirm the save, the instrument is

unlocked, and other parameters can be modified at this time.

4. Click the SET button to flip down the menu. Turn all the way to Air, and then click t to start modifying.

5. Make sure the fork is in the air and not in contact with any material.

6. click SET key to confirm that the meter automatically saves the current frequency to the F0 parameters.

7. Click the SET button to flip down the menu. Turn to the Watr, and then click on the t key to start the modification.

8. Ensure that the fork is in water and the fork is immersed into the water to the specified position (short fork from fork end 13 mm, long fork dot position).

9. click SET key to confirm that the meter automatically saves the current frequency to the F1 parameters.

10. Finally long press SET key more than 5 seconds, the instrument returns to the running state, recalibration completed.

8.4 Instrument software reset

1. Long press SET key more than 5 seconds, the instrument into menu mode, screen display Loc, prompt for protection password.

2. Click the t   key, modify the current parameter, use the ➡ key to move the cursor, change the Loc parameter to 9 149

3. After the input is completed, click on the SET key to confirm, the instrument automatically reset.

9 Application examples

Prevent overflow

The overflow caused by overloading will cause harm to human body and environment, lead to production loss and increase cleaning cost. The device is a limit switch used to provide an overflow signal at any time.

Pump protection

The short fork minimizes the length of the inserted wet side and can be easily installed at any angle in the pipe or container, thereby reducing installation costs. because the short fork extension length is only 50 mm(depending on the type of connection), the equipment can even be installed on small caliber pipes, which is an ideal choice for reliable pump control to prevent the pump from turning dry.

High and low level alarm

The product is an ideal choice for storing the highest and lowest liquid level detection for various liquid storage tanks. Sturdy and durable equipment can operate continuously at

temperatures up to 150 ℃ (or 250 ℃ when using long forks) and at operating pressures up to 1 Mpa.. It is customary to install a separate high level alarm switch so that additional backup switches can be provided in case of failure.

Leak detection

Flanges, gaskets, seals, corrosive liquids　–　they can all leak under adverse conditions. Most users' on-site storage tanks and containers are installed on the bottom plate or located in the protective body to prevent liquid leakage. The product can detect any leakage quickly and accurately, so it can significantly reduce the cost.

High Temperature Material Testing

The maximum working temperature of the long fork is 250 degrees Celsius, so it can be used in high temperature materials.

Density switch detection

the short fork has high oscillation frequency and high resolution. with constant temperature and viscosity, the density has a unique curve relationship with the vibration frequency of the fork. Therefore, if the temperature range of the field medium is small and the viscosity does not change significantly, the frequency output mode can be used to transmit the fork vibration frequency to the control room for density switch detection.

1 0 days regular maintenance

For instruments properly installed in a good working environment, maintenance is usually not required, but should be cleaned regularly when the tested material is likely to contaminate and adhere to the fork. prevent adhesion deposition from affecting normal operation. When cleaning, be sure not to knock, fork body, lest damage the internal piezoelectric crystal.

For the fork with Teflon treatment on the surface, do not wipe the Teflon surface with a wipe containing sharp hard impurities, so as not to destroy the surface Teflon layer.

1 1 Storage and transport

- Storage temperature :- 10~55℃
- Storage environment humidity : ≤90%
- Products in the transport process, to prevent rain, avoid strong vibration and collision, handling should be careful to light, not inverted.

1 2 Ordering information

Typical Model: SF300D 1G RD 1NA X1F1A0000Q4

Model	Product description
SF300(N)	Intelligent vibration tuning fork switch
Code	Process connection and fork material
D	316 stainless steel
F	316 stainless steel PFA coating
Code	Process Connection Size and Type
0D	3/4" NPT "
1G	G 1 1/2"
5K	DN40,PN 10/ 16
5L	DN40,PN25/40
5M	DN40,PN64
2K	DN50,PN10/ 16
2L	DN50,PN25/40
2M	DN50,PN64
2N	DN50,PN100
7K	DN65,PN10/ 16
7L	DN65,PN25/40
7M	DN65,PN64
7N	DN65,PN100
3K	DN80,PN10/ 16
3L	DN80,PN25/40
3M	DN80,PN64
3N	DN80,PN100
4K	DN100,PN10/ 16
4L	DN100,PN25/40
4M	DN100,PN64
4N	DN100,PN100
XX	Customer designation
Code	Electronic unit
PN	PNP 3-wire switch
RD	DPDT 24 V DC power relay
RA	110~220 VAC AC, relay DPDT
Code	Surface finish
1	Standard Surface Finish
2	Manual polishing
Code	Product Certification
NA	No hazardous site certification
ED	flameproof certification

Code	Shell housing
X1	Aluminum alloy, M20x1.5 electrical connection 2, glass window
X2	Aluminum alloy, M20x1.5 electrical connection 1, glassless window
Code	Fork
F1	Long fork
F2	Short fork
Code	Length of tuning fork
A0000	Standard length, long fork 128 mm(with threads), short fork 50 mm(without threads)
EXXXX	User specified length in mm
Code	Calibration certificate
Q4	Functional Test Certificate
Q8	Material Report
P1	Hydrostatic pressure test

13. After-sales service

This product shall be properly installed and operated in accordance with the methods specified in this usage instructions. The company ensures after-sales service, the warranty period is 1 year.