

SCX5 Multi-functional Tuning Fork Level Switch Operation Manual

- Flameproof-enclosures -

WORKING PRINCIPLE

The piezoelectric component is used to drive the tuning fork and feedback signal, which produces the resonance on the fork. When the fork comes into contact with a material, it relies on the damping effect by covering the testing material on the tuning fork which changes the frequency of the tuning fork. The frequency is judged by the micro-processor in the circuit. The signal display and output status are determined based on the conditions set by the user.

FEATURES

- All-in-one design, 3/4" thread is suitable to the installation of a small tube.
- A maximum length of 3m for the ultra-extension type.
- Sensitivity adjustment is available for different density of media. ($\rho > 0.5 \text{ g/cm}^3$ or $\rho > 0.7 \text{ g/cm}^3$)
- High/low failure safe mode, safe and reliable.
- Self-diagnosis mechanism can detect the fork abrasion.
- Switch delay function
- Alarm indicators based on the failure status or output status selected according to the customer's habits
- Test button is available for test after the installation is completed
- Calibration of the operating points for different density of media as required by the customer
- This product can be installed in the wall of vessels located in Zone 1 and containing Zone 0 inside with Ex marking Ex db IIC T6...T2 Ga/Gb.

SPECIFICATION

Item	8-16mA Type	Dual-Relay or Dual-Transistor Type	3-wire NPN or PNP Type
Power supply	11–36 VDC	19–253 VAC 50/60Hz : 20–72 VDC	10–55 VDC
Power consumption	Max. 600 mW	Max. 1.3 W	Max. 830 mW
Input protection	Reverse protection function	–	Reverse protection function
OVP	Overvoltage category III	Overvoltage category III	Overvoltage category III
Max. measurement error	Max. $\pm 1 \text{ mm}$	Max. $\pm 1 \text{ mm}$	Max. $\pm 1 \text{ mm}$
Repeatability	0.5 mm	0.5 mm	0.5 mm
Hysteresis band	Approx. 2 mm	Approx. 2 mm	Approx. 2 mm
Storage temperature	$-40 \sim 85 \text{ }^{\circ}\text{C}$	$-40 \sim 85 \text{ }^{\circ}\text{C}$	$-40 \sim 85 \text{ }^{\circ}\text{C}$
Ambient temperature	$-40 \sim 60 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 60 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 60 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}
Operating temperature	※ Refer to the temperature ranges below and select the applicable process temperature range on the required explosion-proof temperature class.		
SCX500* Standard type	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}
SCX502* High temp. type	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 150 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}
SCX509* Super high temp. type	$-40 \sim 220 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 220 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}	$-40 \sim 220 \text{ }^{\circ}\text{C}$ (see table) ^{Note1}
Material viscosity	Max. 10,000 mm ² /s (10,000 cSt)	Max. 10,000 mm ² /s (10,000 cSt)	Max. 10,000 mm ² /s (10,000 cSt)
Particle size in liquid	Max. $\phi 5 \text{ mm}$	Max. $\phi 5 \text{ mm}$	Max. $\phi 5 \text{ mm}$
General cable	$\phi 6\text{--}10 \text{ mm}$	$\phi 6\text{--}10 \text{ mm}$	$\phi 6\text{--}10 \text{ mm}$
Operating pressure	Max. 200 bar	Max. 200 bar	Max. 200 bar
Protection grade	IP67	IP67	IP67
Output / Load	8 or 16 mA	Relay: 6A / 250Vac, 6A / 28Vdc Transistor: 400mA, 60Vac/Vdc	350 mA, 55 Vdc

Note 1: Refer to the "Process temperature range" table.

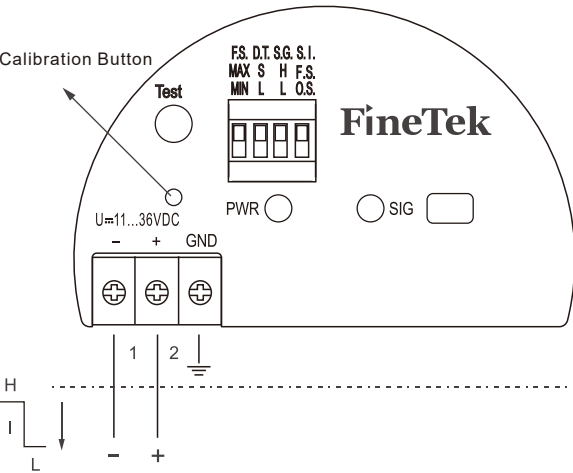


IECEX Ex db IIC T6...T2 Ga/Gb

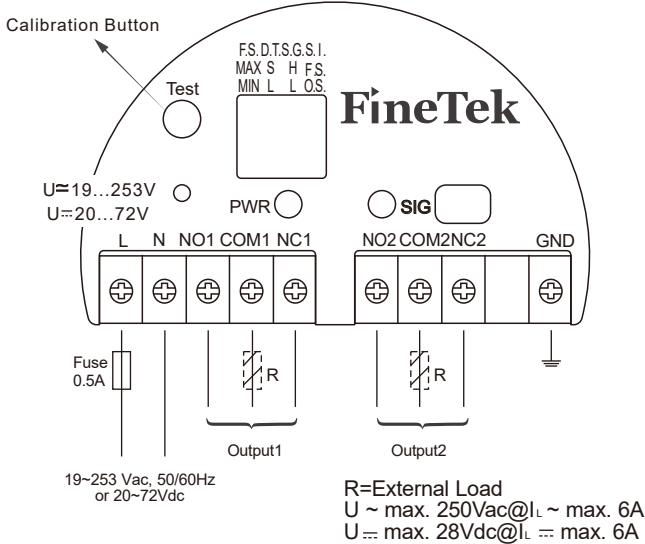
PANEL AND ELECTRICAL

Designed for PLC control systems to monitor output signals transitioning from high

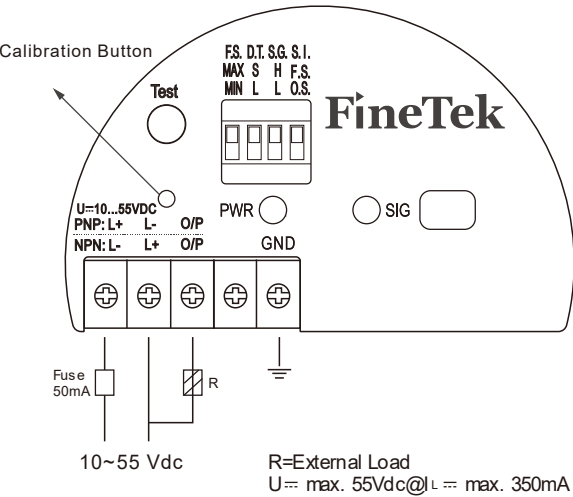
8-16mA Type



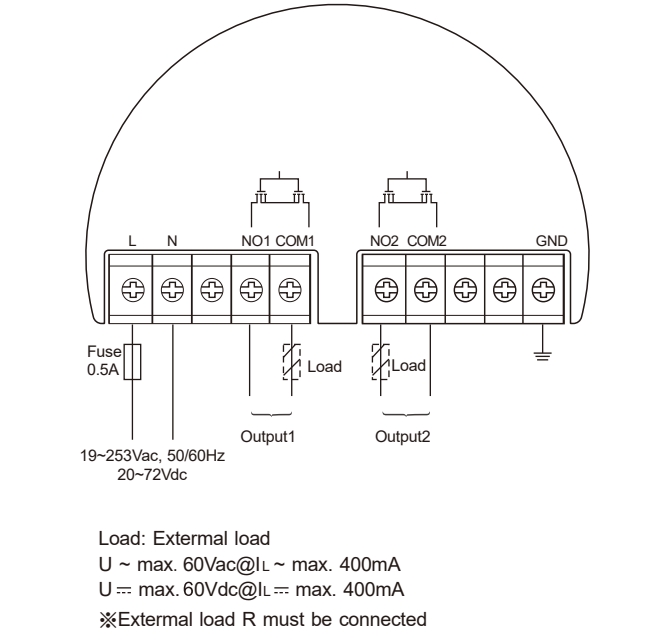
Dual-Relay or Dual-Transistor Type



3-wire NPN or PNP Type

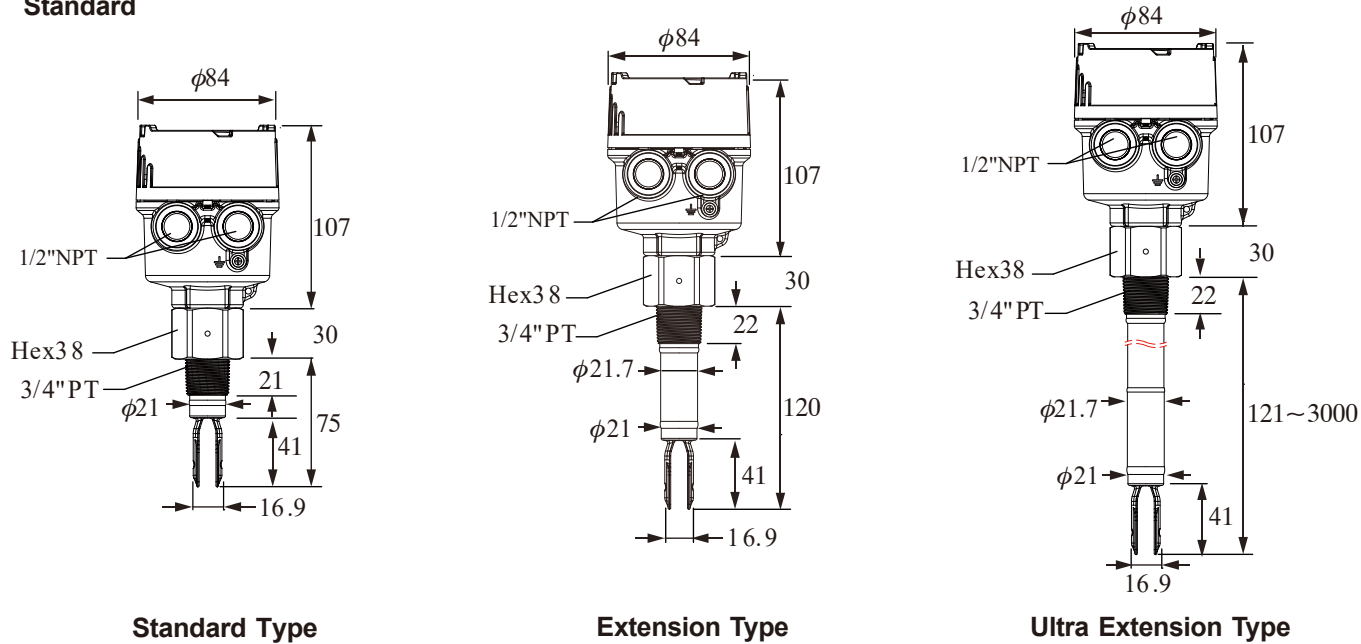


Two NPN/PNP output

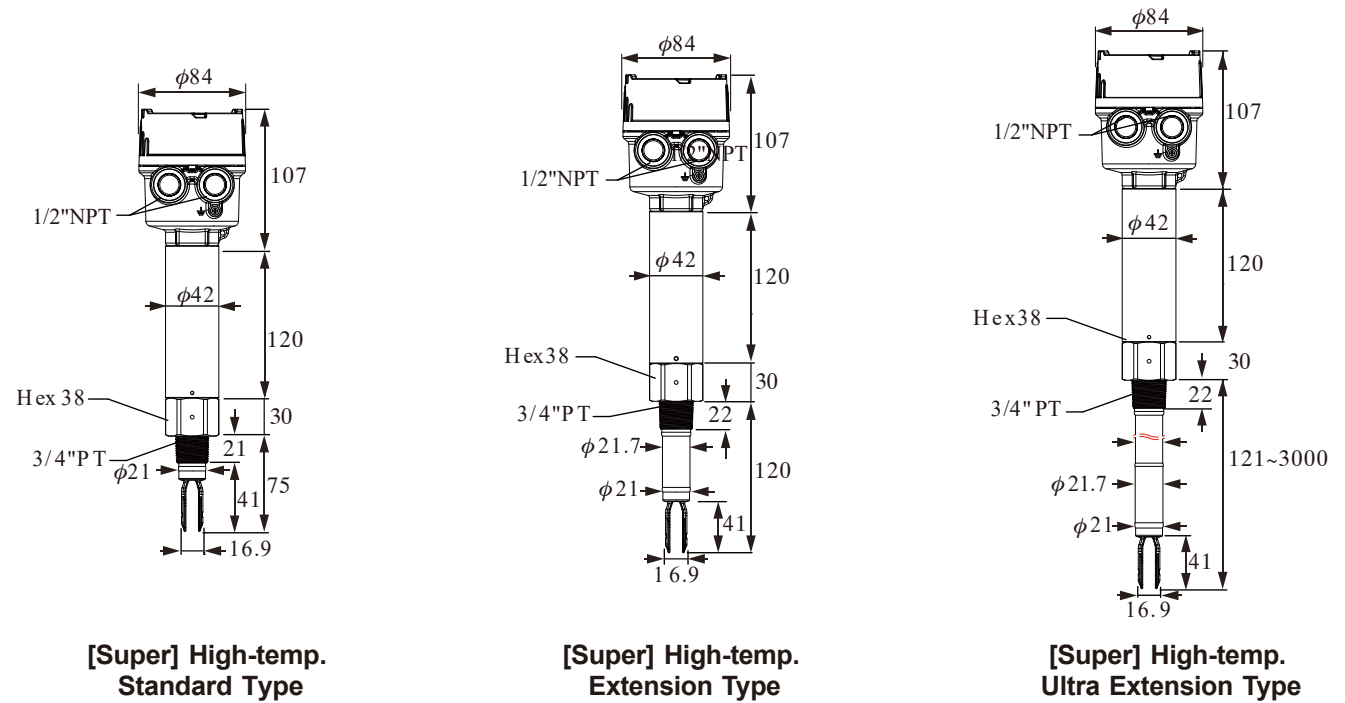


DIMENSIONS
(Unit:mm)

Standard



High temperature type
Or Super high temperature type



DESCRIPTION OF FEATURES

Abbr.	Function	Options description	Notes
Test	Test Bottom	Reverse the signal output	It is for the test after the installation is completed.
F.S.	Fail Safe	MAX: High MIN: Low	It is for the high and low Fail-Safe mode.
D.T.	Delay Time	S: Default setting L: Delay for 5 second	Covered by material: Approx. 0.5s Not covered by material: Approx. 1.s Switch to L to set it as 5 seconds for being covered or not covered by the material.
S.G.	Specific Gravity	H: ≥0.7 g/cm³ L: ≥0.5 g/cm³	The switch to set the material density.
S.I.	Signal Indicator	F.S.: Fail-Safe mode O.S.: Output mode	Turn ON/OFF the red indicator based on the output status or the fail-safe status.

OUTPUT STATUS

☀ :ON ✖ :Blinking ○ :OFF I_L :Load current

8/16 mA Output Type

The SCX5 is a two-wire, loop-powered device capable of outputting 8/16 mA current signals. It supports Max./Min. operation modes and provides corresponding indicator and output statuses based on the functional settings and whether the sensor is covered by material.

Failure mode	Material level	Output signal	LED indicators
MAX		+ 2 ~16mA 1	☀ O.S. ✖ F.S. ○
		+ 2 ~8mA 1	☀ O.S. ○ F.S. ✖
MIN		+ 2 ~16mA 1	☀ O.S. ✖ F.S. ○
		+ 2 ~8mA 1	☀ O.S. ○ F.S. ✖
Instrument failure		+ 2 <3.6mA 1	☀ ✖

~16mA=16mA ±5%
~8mA=8mA ±5%
Connectable load
• R=(U-11V):16.8mA
• U=connection voltage: DC 11~36V
Example: PLC with 250Ω with 2-wire version
250Ω=(U-11V)/16.8mA 4.2[Ω/A]=U-11V
U=15.2V

3-wire NPN or PNP Type

SCX5 supports Max. and Min. operation modes. According to the selected function settings and whether the sensor is covered by material, the corresponding indicators and output statuses are displayed. The detailed operating status is shown in the figure below.

Failure mode	Material level	Output signal	LED indicators
MAX		□ — I _L □	☀ O.S. ✖ F.S. ○
		□ <100μA □	☀ O.S. ○ F.S. ✖
MIN		□ — I _L □	☀ O.S. ✖ F.S. ○
		□ <100μA □	☀ O.S. ○ F.S. ✖
Instrument failure		□ <100μA □	☀ ✖
Over Load(I _L >350mA)		□ <100μA □	✖ ☀

I_L:Load current
R : External load
U = max. 55Vdc@I_L = max. 350mA

Dual-Relay or Dual-Transistor Type

SCX5 Provides Max./Min. operation modes, and has the corresponding indicators and output status according to the functional settings and whether it is covered by the material. The working status is detailed in the figure below.

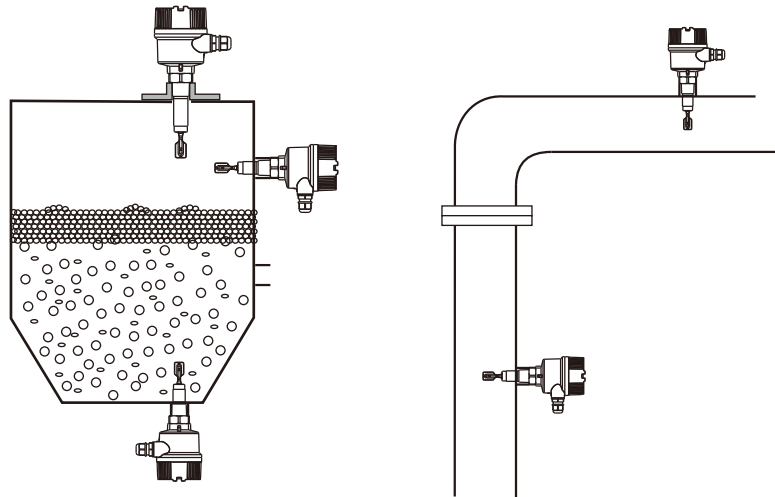
Failure mode	Material level	Output signal	LED indicators	
			PWR	SIG
MAX		NO1 C OM1 NC1 NO2 COM2 NC2	☀	O.S. ✖ F.S. ○
		NO1 C OM1 NC1 NO2 COM2 NC2	☀	O.S. ○ F.S. ✖
MIN		NO1 C OM1 NC1 NO2 COM2 NC2	☀	O.S. ✖ F.S. ○
		NO1 C OM1 NC1 NO2 COM2 NC2	☀	O.S. ○ F.S. ✖
Instrument Failure		NO1 C OM1 NC1 NO2 COM2 NC2	☀	✖

Failure mode	Material level	Output signal	LED indicators	
			PWR	SIG
MAX		NO1 I _L COM1 NO2 I _L COM2	☀	O.S. ✖ F.S. ○
		NO1 <100μA COM1 NO2 <100μA COM2	☀	O.S. ○ F.S. ✖
MIN		NO1 I _L COM1 NO2 I _L COM2	☀	O.S. ✖ F.S. ○
		NO1 <100μA COM1 NO2 <100μA COM2	☀	O.S. ○ F.S. ✖
Instrument Failure		NO1 <100μA COM1 NO2 <100μA COM2	☀	✖

※ When output is off, there will be no error current status.

PRODUCT APPLICATION

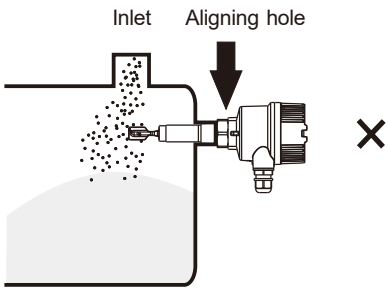
The product can detect the high/low level of the medium in the tank or the tube, which is applicable to various liquids, such as in the food or pharmaceuticals industry.



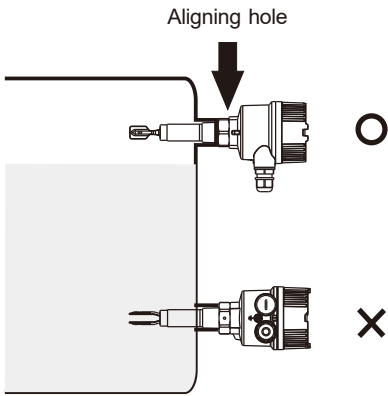
INSTALLATION INSTRUCTIONS

Horizontal Installation:

1. Don't install it near or around the material inlet.

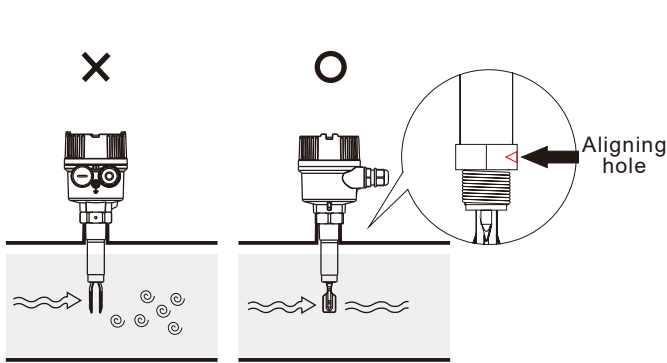


2. When installing, adjust the cable gland to face downward. If the aligning hole is not installed upward, the floating material in the bin may squeeze the tuning fork, which will possibly cause product failure.

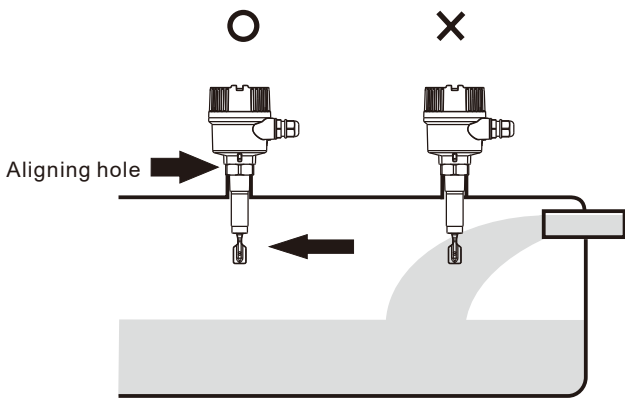


Vertical Installation:

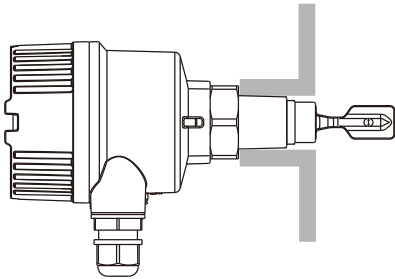
1. It is installed in the tube filled with liquid, and it shall keep consistent with the liquid's flowing direction in the middle between two triggers.



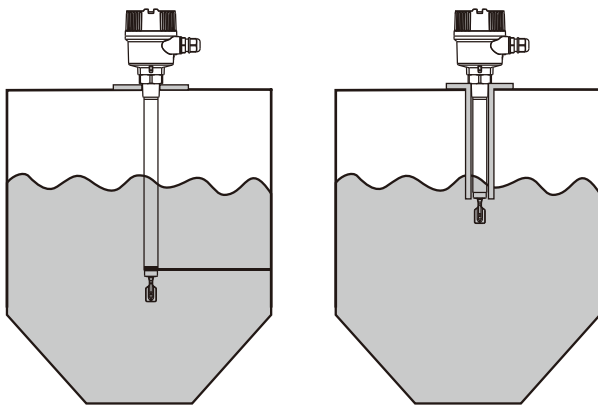
2. Don't install it near or around the material inlet.



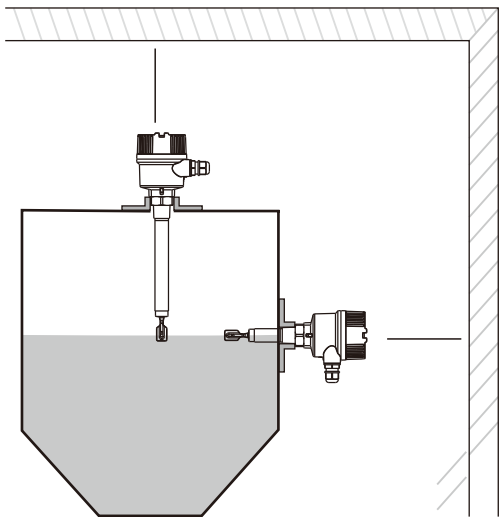
3. When installing the standard tuning fork, please make sure it is in flush with the sidewall.



4. The protective tube should be installed when the liquid fluctuates frequently.



5. When installing, enough space should be left for wiring and calibration.

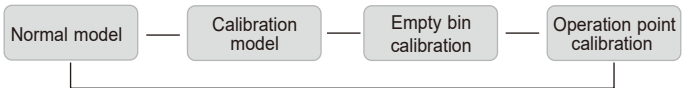


DESCRIPTION OF TEST BUTTON

This button is mainly provided for the user to check whether the output operation works normally after the installation is completed. When the button is pressed, the output and indicator (ON<->OFF) will be reversed. Once the button is released, it will recover the original status.

FUNCTION OF SELF-SET OPERATING POINT POSITION

SCX5 provides a self-setting function that allows the user to customize the operating point position according to application requirements.



Settings

- 1. Press and hold the Calibration Button for 3 seconds. When the red and green LED indicators flash alternately every 0.5 second, the device enters Calibration Mode. Press the Calibration Button again to enter Empty Bin Calibration Mode.

[Empty Bin Calibration]

- 2. Calibration status: The red LED indicator flashes every 0.5 second, and the output current switches to operate every 0.5 second.
- 3. This mode is to calibrate the vibration frequency of the tuning fork in the air. Thus, it shall press "Calibration Button" when the tuning fork doesn't sense any material. In this case, it will write the vibration frequency in the air, and enter the operation point calibration mode.

[Operation Point Calibration]

- 1. Calibration status: The red LED indicator flashes every 0.25 second, and the output current switches to operate every 0.25 second.
- 2. Cover the material to the desired operating point position under this mode, and then press "Calibration Button". It will be adjusted to the corresponding operating point position according to the H/L setting of the S.G.

Process temperature range

SCX500* Standard type : -40 °C to +150 °C without temperature adapter
SCX502* High temperature type : -40 °C to +150 °C with a temperature adapter of 120 mm
SCX509* Super high temperature type: -40 °C to +220 °C with a temperature adapter of 120 mm

Order code	SCX500* Standard type			
IIC Temperature class	T3	T4	T5	T6
Ambient temperature	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 55℃
Process temperature	-40 ~ 150℃	-40 ~ 123℃	-40 ~ 88℃	-40 ~ 73℃

Order code	SCX502* High temperature type			
IIC Temperature class	T3	T4	T5	T6
Ambient temperature	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃
Process temperature	-40 ~ 150℃	-40 ~ 123℃	-40 ~ 88℃	-40 ~ 73℃

Order code	SCX509* Super high temperature type				
IIC Temperature class	T2	T3	T4	T5	T6
Ambient temperature	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃	-40 ~ 60℃
Process temperature	-40 ~ 220℃	-40 ~ 188℃	-40 ~ 123℃	-40 ~ 88℃	-40 ~ 73℃

Grounding

- The SCX5 must be connected to the equipotential bonding system, for example via the external grounding terminal on the housing.
- Ensure that the grounding conductor is properly connected. For external grounding, use an M4 crimp terminal (cross-section > 4 mm²) together with a spring washer, locking washer, and clamp bracket. Tighten to a torque of 0.4 Nm to 0.6 Nm to prevent loosening or rotation.

Maintenance

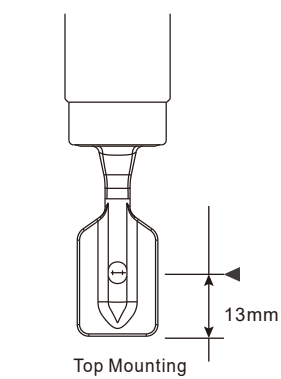
To ensure proper functionality of the device, periodic inspections are recommended with attention to the following items:

- Secure and stable mounting of the device
- Absence of mechanical damage or corrosion
- No worn, cracked, or otherwise damaged cables
- No loose connections at power lines or equipotential bonding connections
- Cable connections are correct and clearly identified
- Parts of the SCX5 that are in contact with flammable media during operation must be included in the plant's periodic overpressure testing program
- Use only cleaning agents that do not damage the housing, nameplate, or sealing elements

FORK TRIGGER POINT

The position of the SCX5 fork trigger point depends on the mounting position as shown in the figure below: (When the testing medium is water, S.G.=1 g/cm3, 'emperature 23°C, and working pressure 0 Bar). If the testing medium has an S.G lower than 1g/cm3, th^e trigger point would rise. Similarly, the trigger point will move downward while the S.G is larger than that of water. The moving range is depended on the S.G

※Operating point position: ◀



Simple troubleshooting

Abnormal conditions	Possible causes	Solutions
The PWR indicator is OFF or the switch does not operate	The device is not powered	Check the terminal pins and wiring, and repair if necessary
	The power supply does not meet product specifications	Verify the power supply specifications and ensure the power is switched ON
The indicator operates normally, but there is no switch output	Incorrect switch output wiring	Check the product wiring diagram and correct the connections
	Fail-safe (F.S.) High / Low setting is incorrect	Check the wiring and F.S. setting
	D.T. delay setting is set to L (action delay)	Press the Test button to verify switch operation and adjust the F.S. dial correctly
Material contact indication is shown, but no material is present	The material specific gravity is too low (approximately 0.5–0.7 g/cm³ or lower)	Set the S.G. DIP switch to L. If the problem persists, contact your local sales representative
Material departure indication is shown, but material is present	The tuning fork is stuck or coated with material	Inspect the tuning fork and remove any material deposits
	The tuning fork is worn, deformed, or the internal mechanism is damaged	Contact your local sales representative
SIG indicator flashes	Load circuit overcurrent activates the protection mechanism (dual transistor output type only)	Check the load circuit. The protection will be automatically reset once the current returns to normal

Warning: Explosion-Proof Maintenance Restrictions

Warning

This product is explosion-proof equipment (Ex db IIC T6...T2 Ga/Gb). Any maintenance involving internal disassembly, component replacement, or opening of the enclosure must be performed by authorized personnel or the local authorized service center. Unauthorized disassembly will void the explosion-proof protection and may result in a risk of explosion. ※Tip: Users should provide the product model, serial number, and a detailed description of the fault to authorized personnel to facilitate prompt service.

Warning – High temperature at cable entry

- During operation, the temperature at the cable entry point of the equipment may exceed 70 °C, and the temperature at the internal branching point may exceed 80 °C.
- The installer shall ensure that cables and cable glands suitable for a minimum service temperature of 105 °C are used.
- Failure to use appropriately rated cables and cable glands may result in damage to the wiring insulation and may compromise the safety of the installation.

Installation Instructions (Electrical Connection)

- Cable Selection
When installing the equipment, the installer shall ensure that the cables used are suitable for the operating conditions. Due to the elevated temperatures that may occur at the cable entry and internal connection points, only cables and cable glands with a temperature rating of at least 105 °C shall be used.
- Cable Glands
Only certified cable glands suitable for the applicable explosion protection type and with an appropriate temperature rating shall be used. The cable gland shall be installed in accordance with the manufacturer's instructions and relevant installation standards.

Key Notes for Users

- Strictly follow warnings: All warnings, cautions, and "Do Not" instructions must be observed.
- Do not attempt internal repairs: Users are only allowed to perform the simple troubleshooting steps listed above.
- Contact information: Keep local authorized service center phone numbers, emails, and references readily available.
- Maintain safety and compliance: Following these instructions ensures the product continues to meet explosion-proof standards.
- Electrostatic charging hazard - Clean only with a damp cloth.
- The flameproof joints are not intended to be repaired.

The probe forms a process separation element between the hazardous area (Zone 0) and the internal parts of the equipment.

The probe material is:

- Stainless steel SUS304 or SUS316 or SUS316L.
- The minimum probe wall thickness is 1 mm.
- To maintain the explosion protection integrity, the probe shall not be subjected to mechanical damage, corrosion, or any modification that may reduce its thickness.



FineTek Co.,Ltd.

No.16, Tzu chian g St., Tu cheng I n d u s t r i a l P a r k, New Taipei City 23678, Taiwan .
Tel: 886-2-22696789 Fax: 886-2-22686682
Email: info@fine-tek.com http://www.fine-tek.com



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