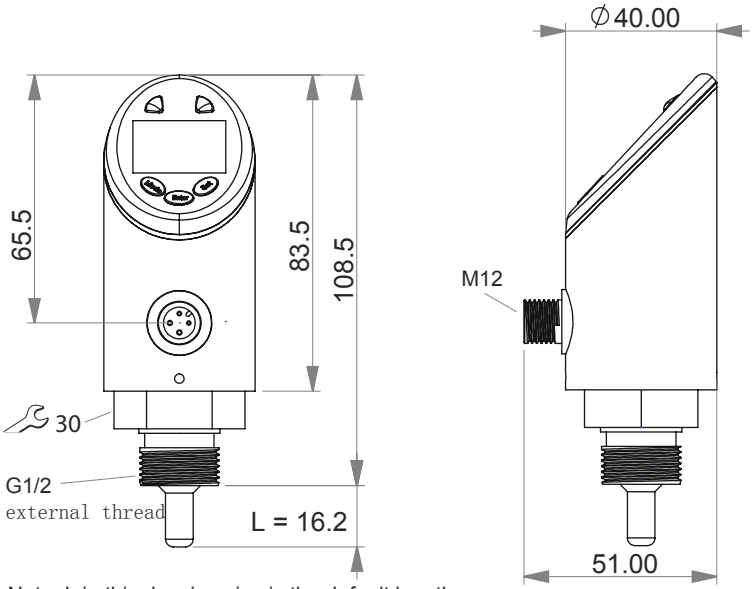
IO-Link sensor

TBH-G1/2E-LI6D-SC Temperature sensor with display



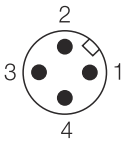
Note: L in this drawing size is the default length



- IO-Link Smart temperature sensor
- 4-digit large digital tube display, mirroring, semi-transparent design
- The upper part of the housing can be rotated 300°
- Normally open/normally closed, PNP/NPN/push-pull, hysteresis/window configurable
- Switching signal /analog signal , switching signal /IO-Link can be set
- The display panel adopts an integrated molded shell
- The shell body is made of stainless steel
- The interface is M12 A code 4 pins
- Key lock function, simple key menu operation
- Sensor parameters can be set via buttons and IO-Link
- The starting and ending points of the analog signal can be set

Model	TBH-G1/2E-LI6D-SC
Operating voltage	24VDC ± 10%
Operating current	< 100mA
Temperature parameters	
Measuring range	-50℃ - 150℃ (-58℉ - 302℉)
Interface type	M12 A code 4 pins
Measuring element	PT1000
Temperature measurement accuracy	0.5℃
Output parameters	
OUT1 Signal	Switching signal or IO-Link (automatic wake-up)
OUT2 Signal	Switching signal or 4-20mA or 20-4mA
Switching signal output type	NPN/PNP/Push-Pull, NO/NC, Hysteresis/Window programmable
Switching signal output current	250mA
Switch point SP setting range	-49.8℃ - 150℃
Release point rP setting range	-50℃ - 149.8℃
Switching signal output resolution	0.1℃
Analog signal output maximum load	500Ω
Analog signal output accuracy	0.5%F.S
Minimum interval between analog signal start and end points	10℃
IO-Link	
Vendor ID	1317 (0x0525)
Device ID	198417(0x030711)
Number of interfaces	1
IO-Link protocol version	V1.1
IO-Link input bytes	2 bytes (16Bit)
Frame type	TYPE_2_2
Transmission rate	COM2 38.4kbit/s
Minimum cycle time	2400us
ISDU(Indexing Service)	Support
Block parameter operations	Not support
Data storage(DS)	Not support
Working temperature	-40 - 80℃
Protection level	IP65

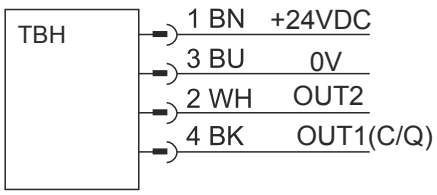
IO-Link M12 interface



1 = +24VDC
2 = OUT2
3 = 0V
4 = OUT1(C/Q)

Note: OUT1: switching signal or IO-Link
OUT2: switching signal or analog signal

Wiring diagram

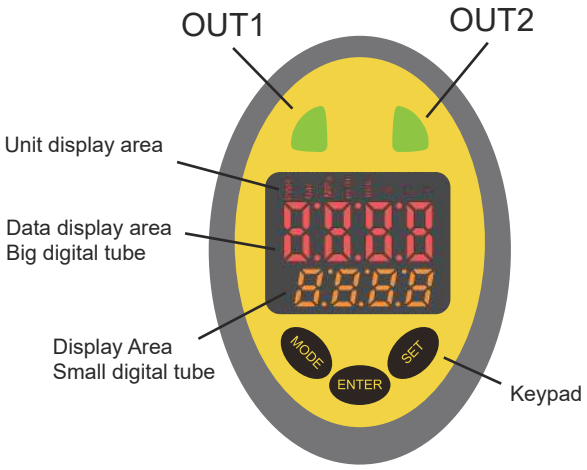


User Manual

Status Indicator

PWR	Red On: Power supply is normal; Off: Power supply is abnormal; Flashing: IO-Link is communicating normally
℃ ℉	Red On: represents the unit of the current digital tube display data Off: not the current unit
OUT1 OUT2	Green On: Enable output on the corresponding digital signal pin Off: Disable output on the corresponding digital signal pin Note:This LED indicates the output status and is not an alarm light.
Big digital tube	Red Displays the sensor measurement data "- - - -" is displayed to indicate invalid data
Small digital tube	Orange Display error code Err means sensor abnormality or data abnormality Display Loc Indicates that the key lock is turned on

Note: The display area adopts a semi-transparent design.
It can be seen when the LED is on,
but not when it is off;
other unused units are not visible on the sensor.



Enlarged view of unit display area

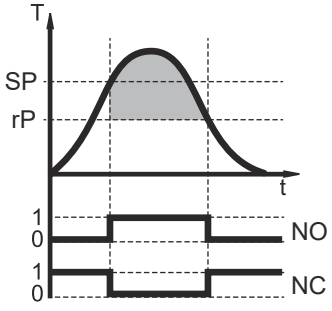
PWR bar MPa m^3/h m/s % ℃ ℉

IO-Link process data mapping

BYTE	BYTE0								BYTE1							
BIT	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
DATA	Tbit13	Tbit12	Tbit11	Tbit10	Tbit9	Tbit8	Tbit7	Tbit6	Tbit5	Tbit4	Tbit3	Tbit2	Tbit1	Tbit0	OUT2	OUT1

Note: Tbit represents 14-bit temperature data,Temperature data is a signed number in °C,ranging from -500 to 1500, which means the actual temperature is magnified 10 times.
OUT1 and OUT2 represent the output status;
Use the right shift instruction to remove OUT1 and OUT2 to obtain 14-bit temperature data (Note: when the temperature data is invalid, the data is -4096)

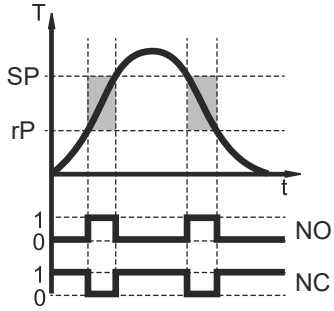
Description of switching signal data and analog signal data output



Hysteresis Mode

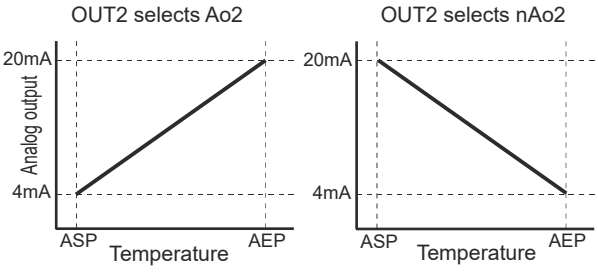
This ensures a stable switching state, independent of temperature fluctuations affecting the set point.

The switching range can be set by the user via the switch point (SP) and release point (rP)



Windowed Mode

Determine whether the temperature is within a specific range (window), and trigger the output switch under the corresponding conditions to generate an alarm signal.
The switch range can be set by the user through the upper window limit (SP)
and the lower window limit (rP)



Analog signal correspondence

When selecting analog output,
users can determine the corresponding relationship by setting the analog starting point (ASP)
and analog end point (AEP)
The minimum distance between ASP and AEP is 10℃;
AEP should be larger than ASP;

Note: 1. When setting SP, it must be greater than rP. You can set the SP value first and then rP.
If the set SP is less than rP, rP will drop to the maximum value allowed.
2. When setting AEP, it must be greater than ASP. You can set AEP first and then ASP.
If the set AEP is less than ASP, ASP will drop to the maximum value allowed.

User Manual

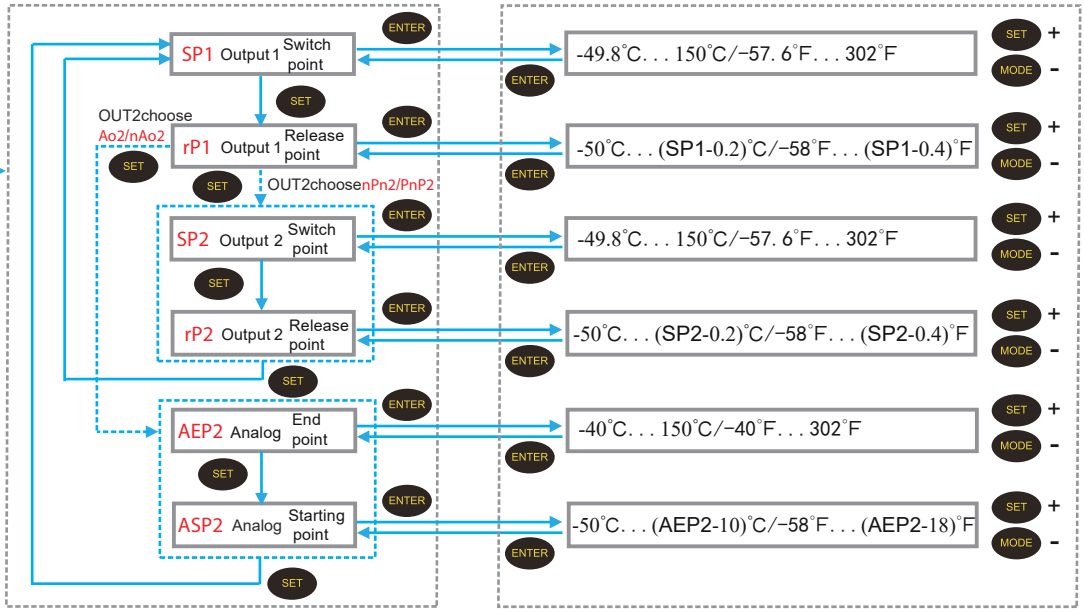
Key Operation

Simple menu operation



MODE >2s

MODE Return Save



Normal display mode

- In this mode, press the MODE button for more than 2 seconds to enter the first level menu
- In this mode, press the ENTER key + SET key simultaneously for more than 6 seconds to turn the key lock on or off.
  When turned on, the small digital tube display area will displayLoC

First level menu

- In this menu, press SET to switch options.
- Press MODE to return and save the parameters.
- Press ENTER to enter the next menu level

Second level menu

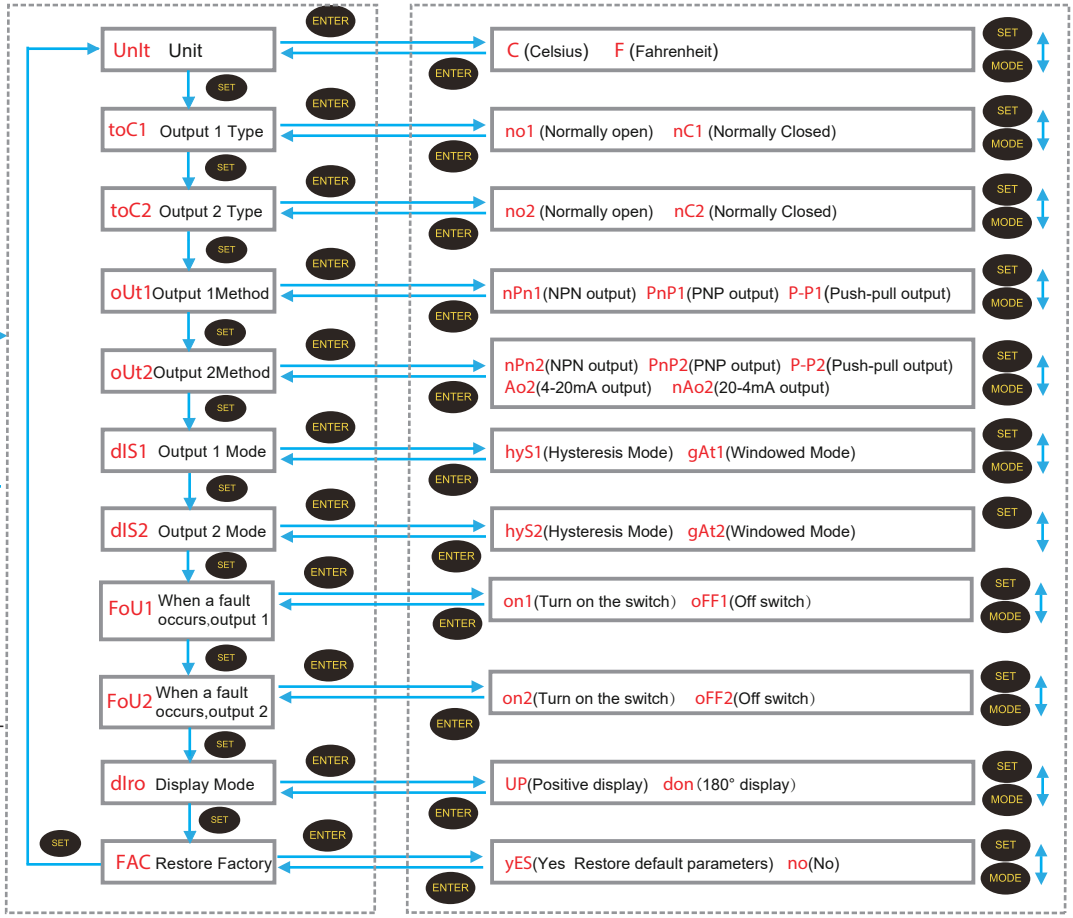
- Press the SET button to increase the setting value.
- Long press to increase the value.
  Press the MODE button to decrease the setting value.
  Long press to decrease the value.
- Press ENTER to confirm and return to the previous menu.
  Note: Confirmation does not mean saving

Programming menu operation



MODE + SET >2s

MODE Return Save



Normal display mode

- In this mode, press the MODE and SET keys simultaneously for more than 2 seconds to enter the first level programming menu
- In this mode, press the ENTER key + SET key simultaneously for more than 6 seconds to turn the key lock on or off.
  When turned on, the small digital tube display area will displayLoC

First level menu

- In this menu, press SET to switch options.
- Press MODE to return and save the parameters.
- Press ENTER to enter the next menu level

Second level menu

- In this menu, press SET or MODE to switch options.
- Press ENTER to confirm the option and return to the previous level.

Note: After entering the simple or programming menu, if there is no key operation within 3.5 minutes, it will automatically return to the normal display mode without changing the setting parameters;
For the switch output mode, NPN controls the 0V switch, providing a low level without a high level; PNP controls the 24V switch, providing a high level without a low level;
P-P push-pull is a combination of NPN and PNP;

Temperature sensor model naming rules

TBH-18M N- LI 6 D-SC / Lxxx

Temperature Sensor
TBH:Smart

Mechanical interface
18M: M18x1.5 internal thread
G1/2: G1/2 external thread
(length can be customized)
12M: Split electronic compartment
(adaptable probe required)

Probe material
N:304 Stainless steel
E:316L Stainless steel

Output signal
LI: 4...20 mA + 1 switch signal,configurable to 2 switch signals IO-LINK(Smart)
LU: 0...10V+1 switch signal,configurable to 2 switch signals IO-LINK(Smart)
DPN: 2 switch signals, normally open/normally closed IO-LINK(Smart)

Customized extension probe
Lxxx: Probe length mm
(Only G1/2 can be customized)

Electrical Interface
SC:M12 Connectors

Display
D:Temperature digital tube display
Alarm LED display

Supply voltage
6:24VDC±10%

Note: When measuring liquid temperature greater than 100℃, please use the split type (12M), separate the probe from the sensor, place the sensor at room temperature, and insert the probe into the high-temperature pipe.
Split type This model represents the temperature sensor, and a separate probe is required.

FAC Default Parameters

Parameter list	FAC Default Value
SP1	60°C
rP1	50°C
SP2	60°C
rP2	50°C
AEP2	100°C
ASP2	0°C
UnIt	°C
toC1	no1
toC2	no2
oUt1	PnP1
oUt2	PnP2
dIS1	hyS1
dIS2	hyS2
FoU1	oFF1
FoU2	oFF2 *
diro	UP
loc	0:unlock

* When[oUt2]selects analog signal output,
In case of an internal fault,
The output signal will run according to the parameter settings in[FoU2]

	FoU2=ON	FoU2=OFF
[oUt2] =Ao2	20mA	4mA
[oUt2] =nAo2	4mA	20mA

IO-Link parameters

Parameter data/ Request data/Indexing Service（ISDU indexed service data unit）

Index	Subindex	Parameter name	length	Permissions	Describe
0x02 2	0	System Commands	1Byte	Write	0x80 128 Device reset 0x82 130 Factory reset
0x10 16	0	Manufacturer's name	8Byte	Read	Sentinel
0x11 17	0	Manufacturer Description	41Byte	Read	Sentinel Industrial Ethernet manufacturer
0x12 18	0	Product name	14Byte	Read	TBH-xxx-xxx-SC
0x13 19	0	Product ID	8Byte	Read	19841701
0x14 20	0	Product Description	26Byte	Read	Temperature sensor io-link
0x15 21	0	Serial-Number	10Byte	Read	1984170101
0x16 22	0	Hardware version	8Byte	Read	HW-V0.01
0x17 23	0	Software version	8Byte	Read	FW-V0.01
0x18 24	0	Apply Tags	maximum 32Byte	Read Write	ApplicationSpecificTag is used to mark the device in the application This item is defined in the IODD file and is included in DataStorage(DS)
0x19 25	0	Function Label	maximum 32Byte	Read Write	FunctionTag is a special tag for device functions, including This item is not defined in the IODD file and can be set directly through Index
0x1A 26	0	Local Tags	maximum 32Byte	Read Write	LocationTag is a special tag used for local devices, including DS This item is not defined in the IODD file and can be set directly through Index
0x24 36	0	Device status	1Byte	Read	0:The device is operating normally; 1:Maintenance is required; 2:Incorrect operating environment or parameters; 3:The device is temporarily invalid; 4:The device fails to operate;

Index	Subindex	Parameter name	length	Permissions	Ranges
0x1F4 500	0	Unit	1Byte	Read Write	0: ℃ Celsius 1: ℉ Fahrenheit
0x1F5 501	0	toC1 Output 1 Type	1Byte	Read Write	0: NO Normally open 1: NC Normally Closed
0x1F6 502	0	toC2 Output 2 Type	1Byte	Read Write	0: NO Normally open 1: NC Normally Closed
0x1F7 503	0	oUt1 Output 1 method	1Byte	Read Write	0: NPN output 1: PNP output 2: P-P push-pull output
0x1F8 504	0	oUt2 Output 2 method	1Byte	Read Write	0: NPN output 1: PNP output 2: P-P push-pull output 3: Ao (4-20mA) 4: nAo (20-4mA)
0x1F9 505	0	diS1 Output 1 Mode	1Byte	Read Write	0: hyS hysteresis mode 1: gAt window mode
0x1FA 506	0	diS2 Output 2 Mode	1Byte	Read Write	0: hyS hysteresis mode 1: gAt window mode
0x1FB 507	0	diro Display Mode	1Byte	Read Write	0: UP positive display 1: don180° display
0x1FC 508	0	Lock Key lock	1Byte	Read Write	0: Unlocked 1: Key locked
0x1FD 509	0	When FoU1 fails, output mode 1	1Byte	Read Write	0: oFF1(Off switch） 1: on1(Turn on the switch）
0x1FE 510	0	When FoU2 fails, output mode 2	1Byte	Read Write	0: oFF2(Off switch） 1: on2(Turn on the switch）
0x258 600	0	SP1 Output 1 Switch point	2Byte	Read Write	-498 to 1500 Note: Unit ℃ SP1 should be greater than rP1 otherwise it will be rejected
0x259 601	0	rP1 Output 1 Release Point	2Byte	Read Write	-500 to 1498 Note: Unit ℃ rP1 should be less than SP1 otherwise it will be rejected
0x25A 602	0	SP2 Output 2 Switch point	2Byte	Read Write	-498 to 1500 Note: Unit ℃ SP2 should be greater than rP2 otherwise it will be rejected
0x25B 603	0	rP2 Output 2 Release Point	2Byte	Read Write	-500 to 1498 Note: Unit ℃ rP2 should be less than SP2 otherwise it will be rejected
0x25C 604	0	ASP2 Analog Starting point	2Byte	Read Write	-500 to 1400 Note: Unit ℃ ASP2 should be smaller than AEP2 otherwise it will be rejected
0x25D 605	0	AEP2 Analog End point	2Byte	Read Write	-400 to 1500 Note: Unit ℃ AEP2 should be greater than ASP2 otherwise it will be rejected

Error code

32785 / 0x8011：Invalid index
32786 / 0x8012：Invalid subindex
32819 / 0x8033：The length of the written parameter exceeds the defined length
32820 / 0x8034：The length of the written parameter is less than the defined length
32816 / 0x8030：The written parameter exceeds the settable range