Panasonic **INSTRUCTION MANUAL**

Long Sensing Range · Hot Melt Glue Detector

NPN output type | PNP output type

TH-12CS TH-12CPS

MJE-THCS No.0034-97V

Thank you very much for purchasing Panasonic products. Read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference.

WARNING

- Never use this product as a sensing device for personnel protection.
- In case of using sensing devices for personnel protection, use products which meet laws and standards, such as OSHA, ANSI or IEC etc., for personnel protection applicable in each region or country.

1 OUTLINE

- This sensor detects hot melt adhesive on product boxes without contact. Long range detection upto a maximum distance of 300mm is possible.
- The optimum sensitivity can be easily obtained by the teaching-method using flowing sample objects.
- The sensor enables not only detection of hot melt glue, but also evaluates its length and quantity.
- Since sensitivity of eight channels can be stored, product changeover is smooth. The channel you need can be selected either on the front panel or with the external channel call inputs.
- **TH-12CS** comprises of sensor head **TH-12** and controller **TH-C2** as a set. **TH-12CPS** comprises of sensor head **TH-12** and controller **TH-C2P** as a set.

2 SPECIFICATIONS

● Sensor head

Item \ Model No.	TH-12
Applicable controller	**TH-C2**, **TH-C2P**
Sensing range	10 to 300mm (Note)
Sensing object	ϕ6mm (equivalent 3×10mm) or more hot melt glue (emissivity 0.9) at +100℃ or more, under ambient temperature of +25℃
Ambient temperature	0 to +50℃ (No dew condensation), Storage: -10 to +60℃
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH
Material	Enclosure: Polycarbonate, Indicator: Polycarbonate, Lens: Silicone
Cable	0.2mm² 5-core shielded cable, 2m long
Weight	120g approx.
Accessories	**MS-TH-2** (Sensor head mounting bracket): 1 set **TH-B2** (Heat shield): 1 pc., **OS-TH12** (Slit mask): 1 pc.

Note: Teaching is possible for this detection range. However, the detection range varies with the size of the sensing object and its temperature, ambient temperature, etc.

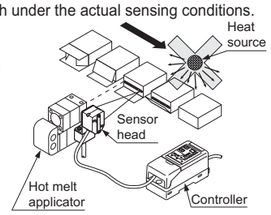
● Controller

Item \ Type / Model No.	NPN output type TH-C2	PNP output type TH-C2P
Applicable sensor head	TH-12	
Supply voltage	12 to 24V DC±10% Ripple P-P 10% or less	
Current consumption	100mA or less	
Output (Output 1, Output 2)	NPN open-collector transistor ・Maximum sink current: 100mA ・Applied voltage: 30V DC or less (between output and 0V) ・Residual voltage: 1V or less (at 100mA sink current) 0.4V or less (at 16mA sink current)	PNP open-collector transistor ・Maximum source current: 100mA ・Applied voltage: 30V DC or less (between output and +V) ・Residual voltage: 2V or less (at 100mA source current)
Output operation	Output 1: ON when hot melt adhesive is detected (Max. 1 sec. approx.) Output 2: OFF when the evaluated result is NG (Max. 1 sec. approx.)	
Short-circuit protection	Incorporated	
Response time (operation frequency)	Sensing distance 200mm or less: 1ms or less (1 to 200Hz) Sensing distance 300mm or less: 1.5ms or less (1 to 100Hz)	
Warm-up time	40 sec. approx.	
Sensitivity setting	Teaching method (Push-button operation)	
Level storage function	Sensitivity levels of eight channels can be stored.	
Sensitivity level set-up function	10 level selection	
Length evaluation function	Length evaluation from ±10% to ±90% of taught standard length	
External channel select function	Incorporated	
Timer function	Incorporated with approx. 40ms fixed OFF-delay timer, switchable either effective or ineffective	
Ambient temperature	0 to +50℃ (No dew condensation), Storage: -10 to +60℃	
Ambient humidity	35 to 85% RH, Storage: 35 to 85% RH	
Material	Enclosure: Heat-resistant ABS, Terminal cover: Heat-resistant ABS Front cover: Polycarbonate	
Cable	0.3mm² 8-core cabtyre cable, 2m long	0.3mm² 8-core cabtyre cable, 1m long
Weight	200g approx.	140g approx.

3 CAUTIONS

Make sure to use sensor head (**TH-12**) and controller (**TH-C2**, **TH-C2P**) as a set. Combination with other products is not possible.

- Do not use the **TH** series during the warm-up time (40 sec. approx.) after the power supply is switched on. Further, do not touch any key during the warm-up time, as this may erase the sensitivity settings stored in the controller.
- Since the **TH** series employs a differential method for sensing, if the length of the box or its traveling speed is different from that at the time of teaching, proper sensing may not be possible. Make sure to teach under the actual sensing conditions.
- Do not place any heat source such as an incandescent lamp around the sensor head or the hot melt glue application area. It may cause a malfunction.
- If some thermal reflector (glossy object, etc.) exists near the hot melt glue application area, the reflected heat may cause an error. In this case, install a heat shield, etc., to make sure that the reflected heat does not reach the sensor head.



- Make sure that sunlight, or light from an incandescent lamp or fluorescent lamp does not enter the sensor head directly. In addition, also take care against reflected sunlight or reflected light from an incandescent lamp.
- Wipe the lens of the sensor head clean with a cloth damped with ethanol if hot melt glue, dirt, etc, sticks to it.
- Make sure to detect the hot melt glue with the sensing object moving. Stationary hot melt glue cannot be detected.
- The time duration for detecting hot melt glue should be 1 sec. or less. If this time duration exceeds 1 sec., output 1 automatically turns OFF. Take care that, in this case, it may take approx. 40 sec. max., after being brought to the no-detection state, for the sensor to return to the stable sensing condition.
- Make sure that the power supply is off while wiring.
- Take care that wrong wiring will damage the sensor.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this product, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Extension from the controller up to total 100m, or less, is possible with 0.3mm², or more, cable.
- The cable of the sensor head must not be extended.
- Make sure that stress by forcible bend or pulling is not applied directly to the sensor cable joint.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- Avoid dust, dirt, and steam.
- Take care that the sensor does not come in direct contact with water, oil, grease, organic solvents, such as, thinner etc., strong acid or alkaline.
- This sensor is suitable for indoor use only.
- In case the power supply is switched off in a mode other than the RUN mode, take care that operation commences in the channel selection mode when the power supply is switched on again.
- When the power supply is switched on, output 2 is momentarily output and output 2 indicator lights up. However, this does not indicate any malfunction.
- In case there are marked changes in the ambient temperature, carry out the teaching periodically to obtain stable detection.
- The response of the sensor head output 1 indicator is slower than that of the controller output 1 indicator.

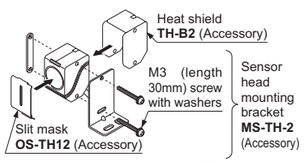
4 MOUNTING

● Mounting sensor head

・The tightening torque should be 0.5N·m or less.

・Use the attached heat shield (**TH-B2**), if the sensor head is installed near a hot melt applicator.

・When length evaluation, etc., of a short hot melt glue is to be done, install the attached slit (**OS-TH12**). However, if the slit is used, the sensing range reduces.



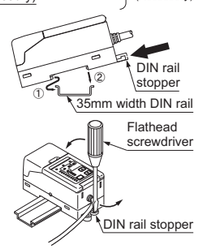
● Mounting controller

Using DIN rail

① Push the DIN rail stopper in the direction of the arrow to lock it. Hook the front (non-stopper) side of the bottom slot on the 35mm width DIN rail.
(When pushing in the stopper, lightly press the stopper groove downwards.)

② Now, press down the rear side of the bottom slot on the 35mm width DIN rail to fit it.

※ For removing, insert a flathead screwdriver into the hole of the DIN rail stopper and pull it out.

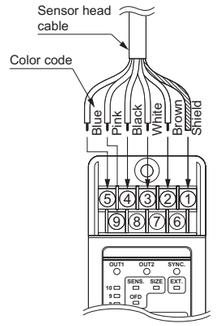


Using screws

・Use two M4 pan head screws. The tightening torque should be 1.2N·m or less.

5 WIRING

● Sensor head wiring diagram

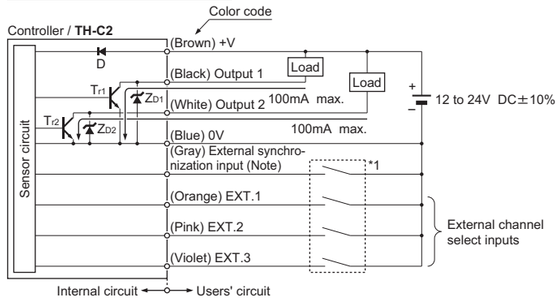


Terminal No.	Color code
①	Shield
②	Brown
③	White
④	Black
⑤	Blue
⑥	Not connected (Note)
⑦	Not connected (Note)
⑧	Not connected (Note)
⑨	Pink

Note: Do not make any connection to terminals ⑥ to ⑧.
If connected, the internal circuit may get damaged.

● I/O circuit diagram

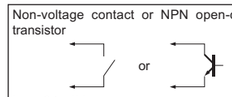
NPN output type / TH-C2



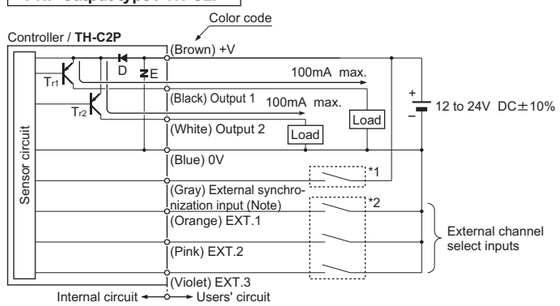
Note: The external synchronization input is active Low.

Symbols... D: Reverse supply polarity protection diode
Z_{D1}, Z_{D2}: Surge absorption zener diode
T_{r1}, T_{r2}: NPN output transistor

*1



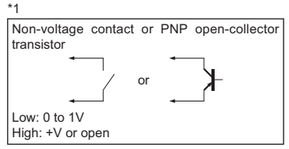
PNP output type / TH-C2P



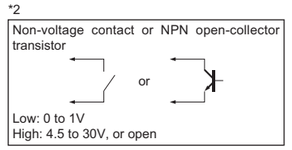
Note: The external synchronization input is active High.

Symbols... D: Reverse supply polarity protection diode
E: Surge absorption varistor
T_{r1}, T_{r2}: PNP output transistor

*1



*2



● Specifying channel with external channel select inputs

・The external channel select inputs (EXT.1, EXT.2, and EXT.3) can change the channel number on **TH-12CS** or **TH-12CPS** as given in the table below.

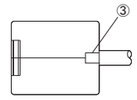
Input / Channel No.	EXT.1 (Orange)	EXT.2 (Pink)	EXT.3 (Violet)
1	L	H	H
2	H	L	H
3	L	L	H
4	H	H	L
5	L	H	L
6	H	L	L
7	L	L	L
8	H	H	H

L: Low (0 to 1V)
H: High (4.5 to 30V, or open)

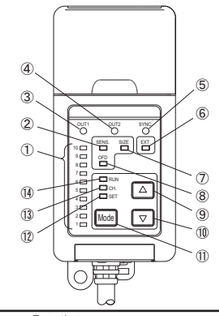
Notes: 1) The channel can be specified from the front panel only when all external channel select inputs (EXT.1, EXT.2, and EXT.3) are High (corresponding to Channel No. 8).
2) The external channel select inputs take precedence over the front panel channel selection (except for Channel No. 8).
3) If channel specification is changed from front panel operation to external channel select inputs and Channel No. 8 is to be selected by the external channel select inputs, make sure to specify a channel other than No. 8 before setting all the external channel select inputs (EXT.1, EXT.2, and EXT.3) to High.
If this operation is not done, channel specification by front panel operation gets precedence.

6 FUNCTIONAL DESCRIPTION

● Sensor head / TH-12

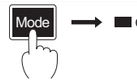
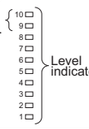
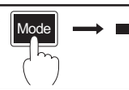
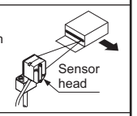
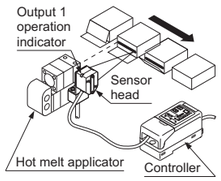
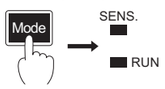


● Controller / TH-C2, TH-C2P



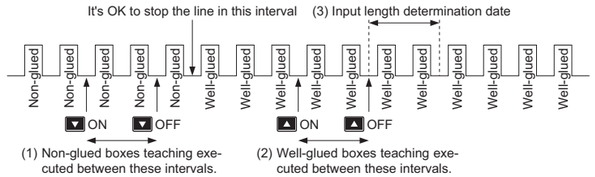
	Description	Function
①	Level indicators (2-color LEDs)	・**In RUN mode** Indicate the sensing level in real time. ・**In CH. selection mode (CH.)** Indicate the teaching state of each channel. (Refer to '**7 SENSITIVITY SETTING**'.) ・**In teaching mode (SET)** Indicate the sensing level during teaching, in real time. After the teaching, the level indicators blink in green to indicate the allowable ambient temperature range for actual use. (Refer to '**7 SENSITIVITY SETTING**'.) When the teaching fails, all level indicators blink in red continuously. ・**In sensitivity level set-up mode (SENS.)** Indicate the sensitivity level (operating threshold level) in ten steps. (Refer to '**8 EXPLANATION OF FUNCTIONS**'.) ・**In length evaluation mode (SIZE)** Indicate the relative tolerance of the evaluated bead length in ten steps. (Refer to '**8 EXPLANATION OF FUNCTIONS**'.) ・**In OFF-delay timer set-up mode (OFD)** Timer ON: The indicators numbered 1 to 4 light up. Timer OFF: All indicators go off.
②	Sensitivity level set-up mode indicator (SENS.) (Green)	・Lights up in the sensitivity level set-up mode (SENS.). ・Lights up all three modes, RUN, CH., and SET, when teaching has been done. ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
③	Output 1 operation indicator (OUT1) (Red)	・Lights up when the output 1 is ON. (If the detection time is small, it is possible that the indicator on the sensor head may not light up synchronously with the controller indicator or may not light up at all.)
④	Output 2 operation indicator (OUT2) (Red)	・Lights up when the evaluated results is NG. (Refer to '**8 EXPLANATION OF FUNCTIONS**'.)
⑤	External synchronization input indicator (SYNC.) (Red)	・Lights up when the external synchronization input is ON (Low). (**TH-12CS**) ・Lights up when the external synchronization input is ON. (High). (**TH-12CPS**)
⑥	External channel selection indicator (EXT.) (Green)	・Lights up when either EXT.1, EXT.2, or EXT.3 is Low. ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
⑦	Length evaluation mode indicator (SIZE) (Green)	・Lights up in length evaluation mode (SIZE). ・Lights up in RUN mode also when the length evaluation is active at the selected channel. (The synchronization signal should be input white teaching the **TH** series to effect the length evaluation.) ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
⑧	OFF-delay timer set-up mode indicator (OFD) (Green)	・Lights up in OFF-delay timer set-up mode (OFD). ・Lights up in RUN mode also when the OFF-delay is set at the selected channel. ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
⑨	UP key	・Increments level in each set-up mode. ・Prompts the **TH** series to learn well-glued articles during teaching in SET mode.
⑩	DOWN key	・Decrements level in each set-up mode. ・Prompts the **TH** series to learn non-glued articles during teaching in SET mode.
⑪	Mode key	・Selects each set-up mode.
⑫	Teaching mode indicator (SET) (Green)	・Lights up in teaching mode (CH.). ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
⑬	Channel selection mode indicator (CH.) (Green)	・Lights up in channel selection mode (CH.). ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.
⑭	RUN mode indicator (RUN) (Green)	・Lights up in RUN mode. ・Blinks during the warm-up time (40 sec. approx.) immediately after the power supply is switched on.

7 SENSITIVITY SETTING

Step		Operation
Starting up	①	Switch on the power supply ・During the warm-up time (40 sec. approx.), several indicators on the panel blink. The RUN mode indicator then lights up. ・Do not operate the keys during the warm-up time (40 sec. approx.).
Channel selection	②	Press the Mode key once to enter into the channel selection mode (CH.).  ・The level indicators indicate the teaching condition of each channel. (The **TH** series has eight channels numbered from No. 1 to 8.) Lights up green : Teaching done Turns off : Teaching not done Lights up red : Selected No. 9 and 10 are unassigned. 
	③	Select the channel. (Note 1) ・Select the channel with UP and DOWN keys. (The channel selection is available from No. 1 to 8.) ・The selected channel indicator lights up red. 
Beam alignment	④	Press the Mode key again to enter into the teaching mode (SET). 
	⑤	Align the beam axis. ・Fix the sensor head after aligning its front face along the direction in which the hot melt glue passes. 
	⑥	The box on which hot melt glue has been applied is made to pass the sensor head. ・When hot melt glue is detected, output 1 operation indicators of the sensor head and the controller light up in red. *: In case the detection time is short, it is possible that the sensor head indicator may not light up or light up at the same time as the controller indicator. ・Moreover, if you desire to perform the beam alignment accurately, carry out the alignment while confirming the detection level from the controller's level indicators. 
Teaching	⑦	Teach in the teaching mode (SET). ・Make sure to perform the teaching when the box is moving. ・To effect either presence or length evaluation, the external signal synchronized with travelling boxes must be input during teaching. Non-glued articles must be taught earlier than well-glued articles. (Refer to '**8 EXPLANATION OF FUNCTIONS**'.) ・Either, 2-level teaching in which, both, well-glued and non-glued articles are taught, or 1-level teaching, in which only well-glued articles are taught, is possible. ・However, the 2-level teaching is recommended, unless you have only well-glued articles, because of its much more stable detection. **2-level teaching** **<Teaching timing> reference** (1) 5 to 7 non-glued boxes will pass through consecutively. After 3 or 4 boxes have gone through, continuously press the DOWN key for a moment while 2 or 3 are passing through. (Note 2)  (2) 5 to 7 well-glued boxes will pass through consecutively. After 3 or 4 boxes have gone through, continuously press the UP key for a moment while 2 or 3 boxes are passing through. Doing so will confirm the sensitivity setting.  (3) If using the presence / absence detection function or the length evaluation function, in order to input the length determination data, make sure to let 2 or 3 boxes (well-glued) go through even after releasing the UP key. **Result of teaching** The temperature and the amount of thermal radiation from hot melt glue limit the operating ambient temperature range. The level indicators indicate this after the teaching. a) If use is possible over the ambient temperature range (0 to +50℃), all the ten level indicators blink (green) twice after the teaching. b) If use is possible over the ambient temperature range [0 to (ambient temperature during teaching +10℃)], all the ten level indicators blink (green) continuously after the teaching. c) If use is possible over the ambient temperature range [0 to (ambient temperature during teaching +5℃)], five level indicators blink (green) continuously after the teaching. d) If teaching is not done properly, all the level indicators blink continuously (red). In this case, press the Mode key to change once to some other mode, then set to the teaching mode (SET) and repeat the procedure from '⑤ Align the beam axis'. (Note 3) (4) If the Mode key is pressed to set to RUN mode, the sensitivity level is set to Level 5 and length evaluation level is set to Level 10 automatically (presence / absence detection).  *: 'SENS.' (sensitivity level set-up mode indicator) of the taught channel lights up in RUN mode too. **1-level teaching** (1) Carry out the step (2), (3) and (4). Then the teaching is completed.

Notes: 1) Channel selection is possible from the front panel only when all external channel select inputs, EXT.1, EXT.2, and EXT.3, are High.
2) When carrying out 2-level teaching, make sure to continuously press the DOWN key. If the DOWN key is not continuously pressed, 1-level teaching is carried out.
3) If the teaching is repeatedly unsuccessful, some other heat source may exist around the sensor head or near the hot melt glue application area. Check the surroundings and screen the sensor head from extraneous heat radiation.
4) The set date is not erased even when power is switched off.

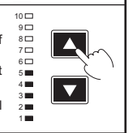
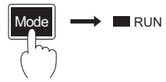
<Teaching timing>



8 EXPLANATION OF FUNCTIONS

● **Sensitivity level set-up function (SENS.)**

・This function enables adjustment of the sensitivity level (operating threshold level) in ten steps after the teaching. It enables fine sensitivity adjustment to accept only adequate hot melt glue.

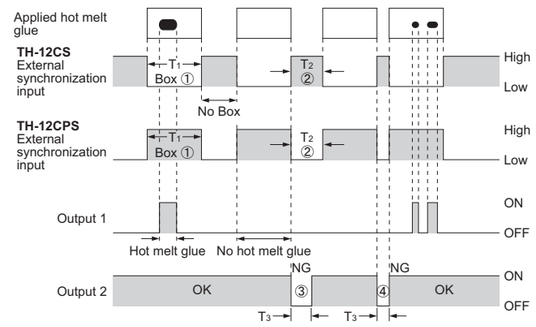
Step	Operation
①	Refer to '**7 SENSITIVITY SETTING**' and teach the **TH** series. ・If the sensitivity has already been set, start from Step ②. ・To adjust the sensitivity stored in another channel, select the channel by referring to '**7 SENSITIVITY SETTING**'.
②	Press the Mode key for 3 sec. or more.  ・After that, the Mode key enables you to select the SENS., SIZE, and OFD modes in rotation. Select 'SENS.', the sensitivity level set-up mode.
③	Adjust the sensitivity level with UP and DOWN keys.  ・After teaching, the sensitivity level is set to Level 5, i.e., the center of well-glued and non-glued levels. ・As the sensitivity level is increased, it becomes more difficult to detect a hot melt glue or less quantity. *: If decreasing the sensitivity level, there are instances when the level cannot be decreased beyond a certain point.
④	Press the Mode key for 3 sec. or more to return to the RUN mode. 

● **Presence / absence detection function・Length evaluation function (SIZE)**

Presence / absence detection function

・This function examines the presence of even a small quantity of hot melt glue during the external synchronization signal input period and if it is detected, the result is OK. Otherwise the result is NG and output 2 is turned OFF (1 sec. approx.)

<Time chart>



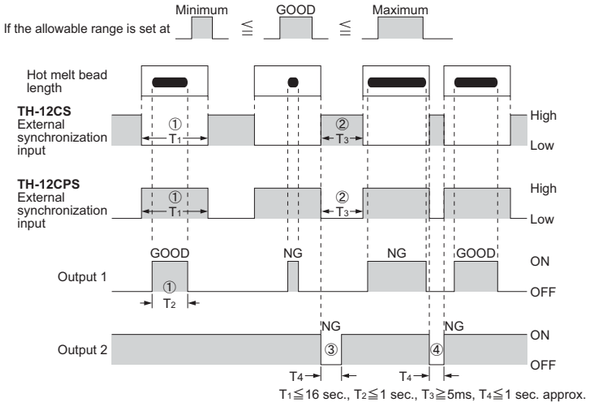
$T_1 \leqq 16$ sec., $T_2 \geqq 5$ms, $T_3 \leqq 1$ sec. approx.

① T_1, the external synchronization input time at Low level, should be 16 sec. or less.
② T_2, the OFF time duration between two synchronization input pulses, should be 5ms or more.
③ Output 2 is output when the external synchronization input rises to High level. (In case of **TH-12CPS**, the external synchronization input operation is reversed.)
④ If the next external synchronization signal is input while output 2 is being output, in case of output 2 becomes ON at that instant.

Length evaluation function

・This function examines the length of hot melt bead applied on every box. It measures if the time duration of detecting hot melt glue is longer or shorter than the criterion predetermined with well-glued articles. If the result is NG, output 2 is turned OFF for 1 sec. approx. As the evaluation is boxes into the controller, the **TH** series can adapt to a change in line speed.

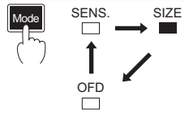
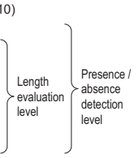
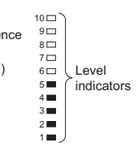
<Time chart>



$T_1 \leqq 16$ sec., $T_2 \leqq 1$ sec., $T_3 \geqq 5$ms, $T_4 \leqq 1$ sec. approx.

① T_1, the time duration of the external synchronization input pulse, is 16 sec. max. Further, the upper limit of the hot melt glue detection time T_2 is 1 sec. and the time taken for stable operation of the length evaluation function is 200ms max.
② T_3, the time duration between two synchronization input pulses (box passage signal), should be 5ms or more.
③ Output 2 is output when the external synchronization input rises to High level. (In case of **TH-12CPS**, the external synchronization input operation is reversed.)
④ If the next external synchronization signal is input while output 2 is being output, in case of output 2 becomes ON at that instant.

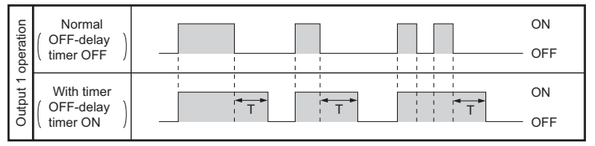
・In case the length evaluation function is used, do not change the sensitivity level from Level 5 (condition immediately after teaching).

Step	Operation
①	Refer to '**7 SENSITIVITY SETTING**' and teach the **TH** series. ・If teaching has already been done, carry out the operations from Step ②. ・If a different channel is being set, select the channel by refering to '**7 SENSITIVITY SETTING**'. ・While teaching, non-glued articles must be taught before well-glued articles. ・While teaching the **TH** series, make sure to input the external synchronization signal (box passage signal). ・In case output 2 is used, input the external synchronization signal (box passage signal) even at the time of teaching.
②	Press the Mode key for 3 sec. or more.  ・After that, the Mode key enables you to select the SENS., SIZE, and OFD modes in rotation. Select 'SIZE', the length evaluation mode.
③	Press the UP key and DOWN key to set the length evaluation level for presence / absence detection function and length evaluation function.  ・Normally, it is set to presence / absence detection function. (Level 10) **In case of using presence / absence detection function** Set to Level 10 (presence / absence detection level). **In case of using length evaluation function** Set to Level 1 to 9 (length evaluation level). Level indicators  ・The allowable range of the bend length (detection time duration) is set as a (±) percentage relative to the reference bead length of well-glued articles. ・The level indicators represent ±10% each. ・The allowable range for length evaluation can be adjusted from ±10% to ±90% ±100% results in an operation which is the same as presence / absence detection function. [e.g.] In the right figure, the allowable range is set at ±50%. If the reference bead duration of well-glued articles is 0.1 sec.; 0.05 sec. (0.1 sec. × 50%)≦GOOD≦0.15 sec. (0.1 sec. × 150%) is formulated as the criterion for accepting articles. 
④	Press the Mode key for 3 sec. or more to return to RUN mode. 

● **OFF-delay timer function (OFD)**

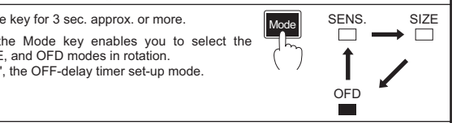
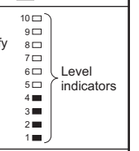
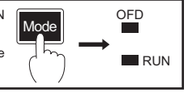
・The controller is equipped with an approx. 40ms fixed OFF-delay timer. Since it extends the output duration of output 1 by a fixed time interval, it is convenient to detect short hot melt beads on a quick production line or to send the signal to a device having a slow response time.

<Time chart>



T = 40ms approx.

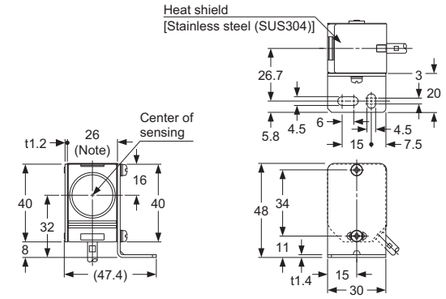
Note: The OFF-delay timer is effective only for output 1.

Step	Operation
①	Refer to '**7 SENSITIVITY SETTING**' and select the channel. ・If the channel is not to be changed, start from Step ②.
②	Press the Mode key for 3 sec. approx. or more.  ・After that, the Mode key enables you to select the SENS., SIZE, and OFD modes in rotation. Select 'OFD', the OFF-delay timer set-up mode.
③	Press the UP key.  ・The level indicators numbered from 1 to 4 light up in green to notify that the OFF-delay timer is set. ・When the DOWN key is pressed, the OFF-delay timer turns OFF. (All level indicators go off.)
④	Press the Mode key for 3 sec. or more to return to RUN mode.  ・The 'OFD' indicator always lights up even in the RUN mode once the OFF-delay timer is set.

9 DIMENSIONS (Unit: mm)

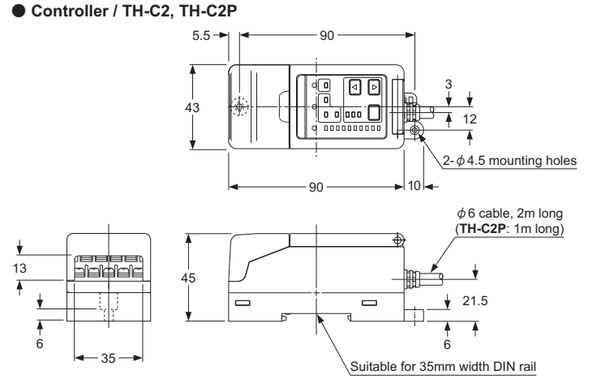
● **Sensor head / TH-12**

Assembly dimensions with attached mounting bracket and heat shield



Note: 25mm when the heat shield is not used.

● **Controller / TH-C2, TH-C2P**



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