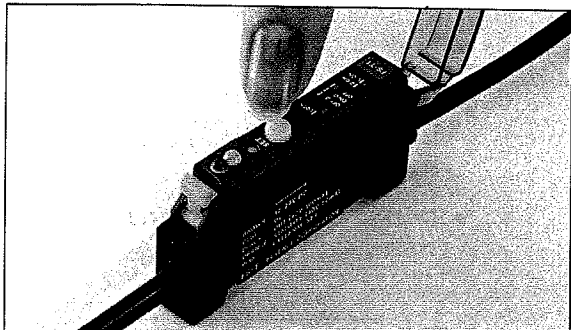


One-touch Calibration Fiberoptic Sensor FS-T1(P)/T2(P)/T0

Instruction Manual

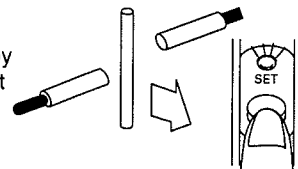


A "P" following the model number indicates PNP-output type.

MAJOR FEATURES AND FUNCTIONS

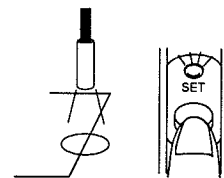
1. Fully-automatic calibration

- Easy calibration
You can complete calibration simply by pressing a button as you pass a target through the optical axis.



2. Positioning calibration

- Sensitivity can be adjusted at the position where a target is to be stopped.



3. Simple wiring

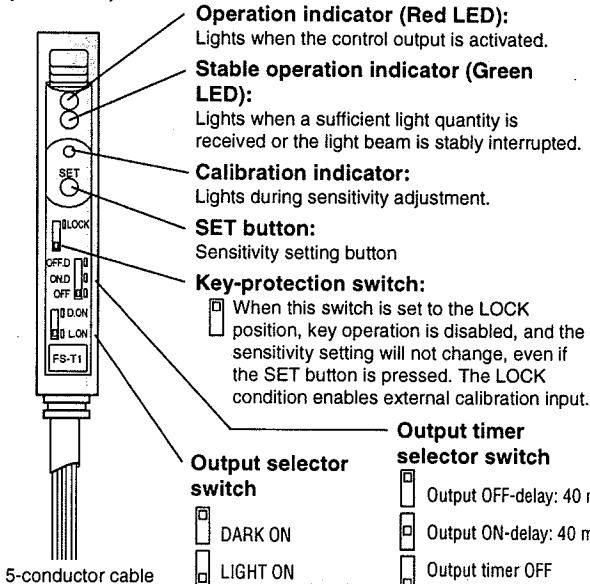
- The expansion unit needs no power supply cable.
- Up to 16 expansion units can be connected to a single main unit.

⚠ WARNING

- The FS-T1(P)/T2(P) are intended for target detection. Do not use these products in a safety circuit for protecting the human body.
- The FS-T1(P)/T2(P) are not explosion-proof. Do not use these products in an atmosphere where inflammable gas, liquid or powder is present.

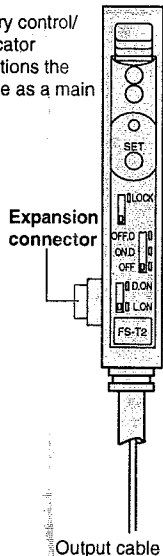
PART NAMES AND FUNCTIONS

FS-T1(P) (Main unit)

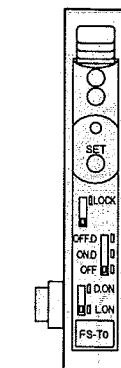


FS-T2(P) (Expansion unit for one-line bus system)

Every control/indicator functions the same as a main unit.



FS-T0 (Expansion unit for zero-line bus system)



- * There is no control output cable for the FS-T0.
- * Use the QL-R01/FS-R0 (Output port unit) as the main unit. The FS-T1(P)/M1(P)/V1(P) cannot be used as the main unit.

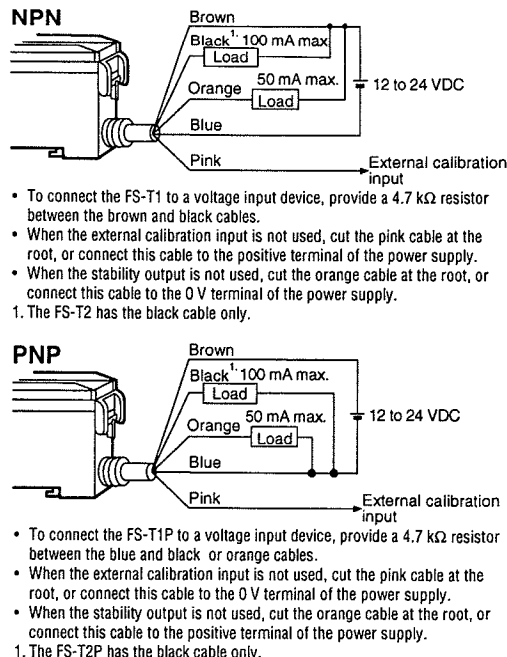
Accessories

- Instruction Manual (X 1)
- Sticker [included in the FS-T2(P) only]
- Mounting bracket (x 1) [included in the FS-T1(P) only]
- End unit (x 2) [included in the FS-T2(P) only]

SPECIFICATIONS

Model	NPN output	FS-T1	FS-T2	FS-T0
	PNP output	FS-T1P	FS-T2P	-
Light source	Red LED			
Response time	250 μs			
Operation mode	LIGHT ON/DARK ON (switch-selectable)			
Indicators	Output indicator: Red LED, Stable operation indicator: Green LED, Calibration indicator: Orange			
Timer function	ON-delay: 40 ms, OFF-delay: 40 ms, Timer OFF (switch-selectable)			
External calibration input signal	Non-voltage input (contact, solid-state)			
Output	Control output	NPN or PNP open-collector 100 mA max. (40 V max.) Residual voltage: 1 V max.		
	Stability output	NPN or PNP open-collector 50 mA max. (40 V max.) ² Residual voltage: 1 V max.		
Protection circuit	Reverse polarity protection, Over-current protection, Surge absorber			
Power supply voltage	12 to 24 VDC ±10%, Ripple (P-P) 10% max.			
Current consumption	35 mA max.			
Ambient illumination	Candescant lamp: 10,000 lx max. Sunlight: 20,000 lx max.			
Ambient temperature	-10 to +55°C (14 to 131°F), No freezing			
Relative humidity	35 to 85%, No condensation			
Vibration	10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions for two hours			
Shock immunity	500 m/s ² in X, Y and Z directions, three times each			
Housing material	Body/Cover: Polycarbonate			
Weight (including 2 m cable)	Approx. 75 g	Approx. 40 g	Approx. 20 g	

CONNECTIONS

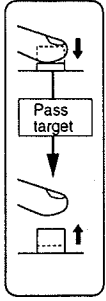


SETTING SENSITIVITY

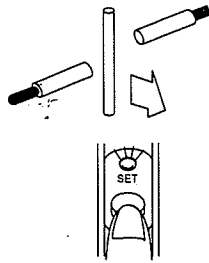
Select the sensitivity setting procedure according to the target condition.

For sensitivity adjustment using a moving target

● Fully-automatic Calibration

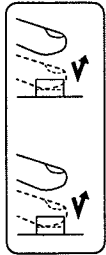


1. Pass a target through the optical axis while pressing the SET button.
2. Confirm that the calibration indicator (yellow LED) flashes.
3. Release the SET button. The calibration indicator (yellow LED) goes off.

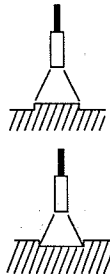


To detect a minute difference

● Two-point Calibration

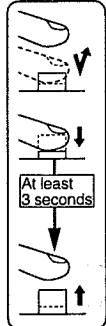


1. With a target in place, press the SET button and release it. The calibration indicator (yellow LED) lights.
2. With the target removed, press the SET button and release it. The calibration indicator (yellow LED) goes off.

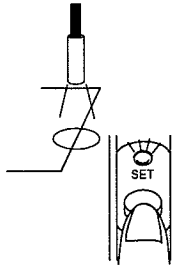


For target positioning

● Positioning Calibration

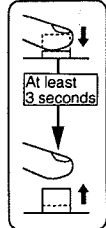


1. With no target, press the SET button and release it. The calibration indicator (yellow LED) lights.
2. Place a target in the position where it is to be stopped.
3. Press the SET button and wait for the calibration indicator to flash.
4. Release the SET button.

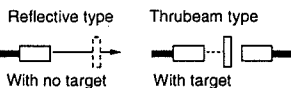
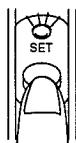


For stable detection unaffected by dust

● Maximum Sensitivity Setting



1. Under the following conditions press the SET button until the calibration indicator (yellow LED) flashes.
2. Release the SET button. The calibration indicator (yellow LED) goes off.



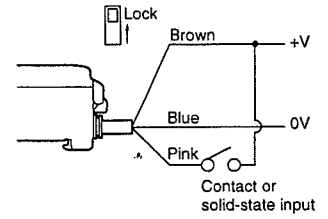
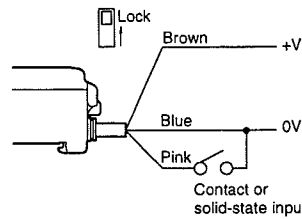
For sensitivity adjustment using an external signal

● External Calibration Function [For FS-T1(P)/T2(P) only]

1. Set the key-protection switch to LOCK. [Setting this switch to LOCK disables sensitivity adjustment with the SET button. (Key-protection)]
2. Connect the pink cable to a switch or PLC.

NPN

PNP



The minimum input time is 20 ms.

3. Activate the external calibration input using the SET button. (You can perform all the setting procedures described on the left.)

While the external calibration input is activated, the stability output remains on.

CUE: Calibration input during detection

You can re-adjust sensitivity during detection without stopping the line operation. The sensor continues operation with the previous sensitivity setting until sensitivity readjustment is completed.

CUE: External calibration with several units

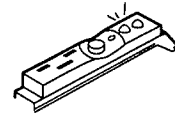
When several units are connected, the sensitivity of all the FS-T2(P) expansion units can be simultaneously set using the external calibration input through the FS-T1(P) main unit. You can select a unit to be externally calibrated by setting its key-protection switch to the LOCK position.

CUE: When the sensitivity difference is insufficient:

After calibration is completed, the stable operation indicator (green LED) flashes if the sensitivity difference is insufficient. (When the external calibration function is used, the stability output remains on for another 3 seconds after the calibration input is turned off.)



Sensitivity is set and registered even when the sensitivity difference is insufficient. Be sure to confirm that detection is properly performed.

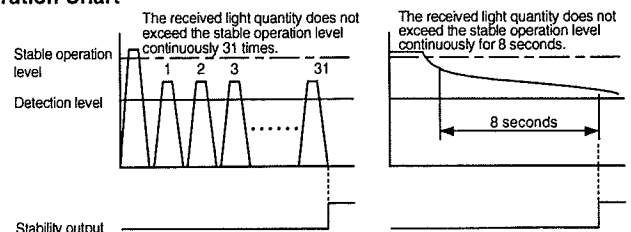


● Self-diagnostic Function

When the received light quantity exceeds the detection level but does not exceed the stable operation level "31 times continuously" or "for 8 seconds continuously", the stability output is activated.

Reset: When the stability output is activated, clean the front surface of the fiber unit or re-align the optical axis so that the stable operation indicator (green LED) lights again. The stability output is reset when detection is done while the stable operation indicator (green LED) is turned on.

Operation Chart

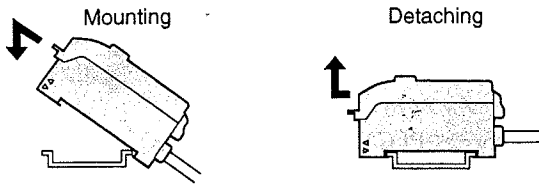


When several units are connected, the stability outputs of all the units are output from the FS-T1(P) main unit based on OR logic.

MOUNTING AMPLIFIER

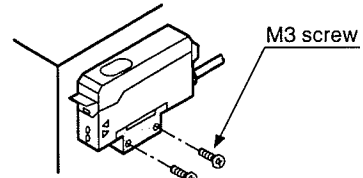
■ Mounting/Detaching the amplifier to/from a DIN rail or the mounting bracket.

Hook the claw located at the amplifier cable side onto the DIN rail, and then hook the front side claw to the rail while pressing the amplifier forward. To detach the amplifier, unhook the front claw by lifting the amplifier front side while pressing it forward.



■ Side mounting

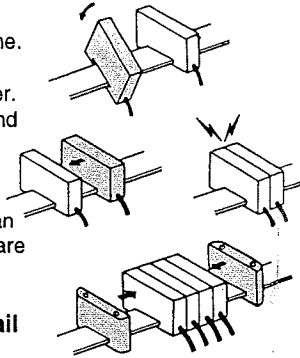
Using the side holes of the supplied mounting bracket, fix the amplifier with the screws. [For FS-T1(P) only]



MOUNTING SEVERAL AMPLIFIERS

■ Mounting several units

1. Mount amplifiers to a DIN rail one by one.
2. Slide one expansion unit toward another. Align the front claws of the amplifiers and push the amplifiers together until they click.
3. Fix the amplifiers together by pushing an end unit onto each end (The end units are included in the expansion unit).



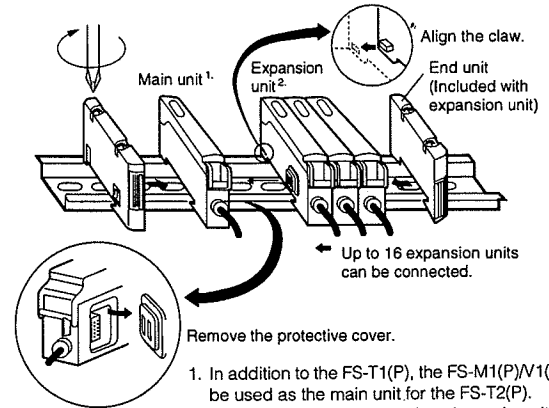
■ Detaching amplifiers from DIN rail

1. Remove the end units.
2. Slide the expansion units apart, and detach them individually. (Do not detach multiple amplifiers connected together with end units.)



- When several units are connected, confirm the ambient temperature. (See "Specifications" on p. 1.)
- To connect several units, be sure to use a DIN rail and end units.
- To mount or detach several units, be sure to turn the power off.

- Do not remove the protective cover of the expansion connector on the outermost unit.



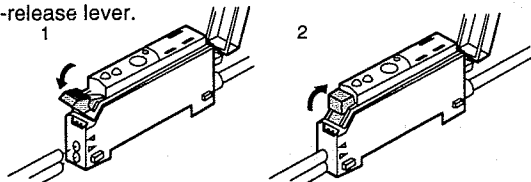
1. In addition to the FS-T1(P), the FS-M1(P)/V1(P) can also be used as the main unit for the FS-T2(P).
2. The QL-R01/FS-R0 is used as the main unit for the FS-T0. In addition to the FS-T2(P), the FS-M2(P) can also be used as the expansion unit.

The following sticker is included in the expansion unit. Apply this sticker near the sensor.



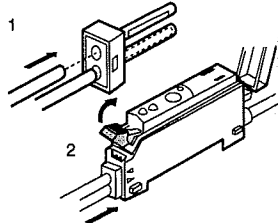
CONNECTING FIBER UNIT

Tilt the quick-release lever, insert the fiber unit until it stops, and then lift the quick-release lever.



- To connect a fiber unit with a small diameter, use the adaptor included with the FU series.

Attach the adaptor to the fiber unit, fully insert the adaptor into the mounting holes of the amplifier, and then lift the quick-release lever.

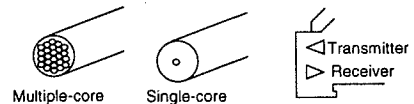


If the fiber unit is improperly connected, the sensor cannot meet the specifications.

- The required adaptor is included in each model of the FU series. If an inadequate adaptor is used, the fiber unit cannot be properly installed.

Type	Shape	Applicable fiber unit
Adaptor A (OP26500)	For 1.3mm diameter	FU-10/32/35FA/35FZ/35FG/4F/4FZ/43/52TZ/63 (T/Z)/66 (Z)/78/91/93 (Z)
Adaptor B (OP26501)	For 1mm diameter	FU-16 (Z)/18/31/37/38/38V/48/50/51TZ/59/68/75F/76F/79/95/95 (Z/H)

To connect the coaxial reflective type fiber unit to the amplifier, connect the single-core fiber to the transmitter side, and connect the multiple-core fiber to the receiver side. (Connect the fibers according to the marking on the amplifier lateral side.)



● Mutual Interference Suppression Function

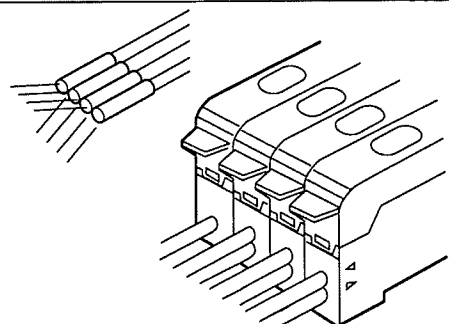
Up to four sensors can be connected without being affected by light beams from the adjacent units.

When several units are connected, the FS-T series alternates the light emission timing with up to four sensors so that the adjacent sensors' light beams do not affect detection.

- The FS-T series can be used together with the FS-M series (manual-calibration type).



When only a single unit is used, the mutual interference suppression function cannot be used.

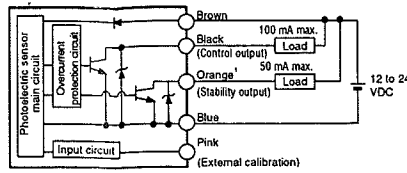


HINTS ON CORRECT USE

- To extend the cable length, use a cable with at least a 0.3mm² cross-section area. Limit the length of cable extension to no more than 100m. (To connect several units, contact Keyence for further information.)
- If the amplifier cable is placed together with power lines or high-voltage lines in the same conduit, detection error may occur due to noise interference, or the sensor may be damaged. Isolate the amplifier cable from these lines.
- When using a commercially available switching regulator, ground the F.G. terminal and ground terminal.
- Do not use the FS-T outdoors, or in a place where extraneous light can enter the light receiving surface directly.
- During maximum sensitivity setting, the detecting distance may vary due to the difference in characteristics of each unit.
- If the wiring is incorrect, the unit may heat up, or the sensitivity setting may fluctuate. (See "Connections" on p.1.)
- When the stability output is not used, cut the orange cable at the root, or connect this cable to the 0V (Positive with PNP model) terminal of the power supply.*
- * When cutting the cables at the root, be sure not to contact other cables.
- When the external calibration input is not used, cut the pink cable at the root, or connect this cable to the positive (0V with PNP model) terminal of the power supply*
- * When cutting the cables at the root, be sure not to contact other cables.

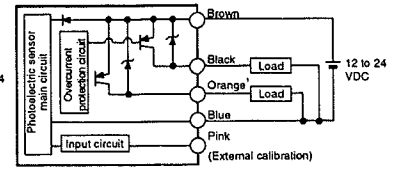
I/O CIRCUIT

NPN FS-T1



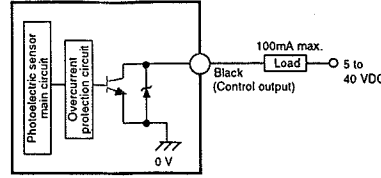
- When the stability output is not used, cut the orange cable at the base, or connect this cable to the 0V terminal of the power supply.

PNP FS-T1P



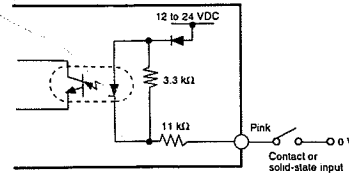
- When the stability output is not used, cut the orange cable at the base, or connect this cable to the positive terminal of the power supply.

FS-T2

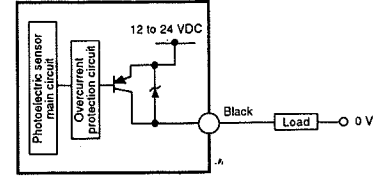


- Power to the FS-T2 is supplied through the FS-T1/M1.

(External calibration input circuit)

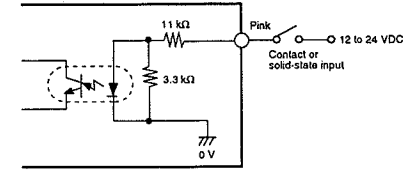


FS-T2P



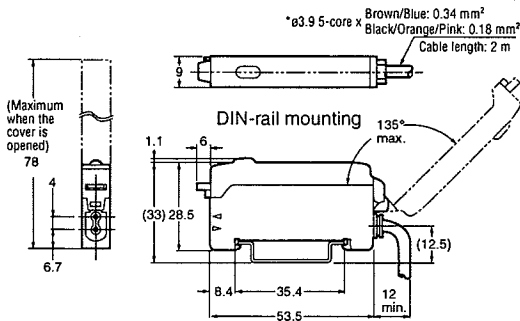
- Power to the FS-T2P is supplied through the FS-M1P/T1P.

(External calibration input circuit)

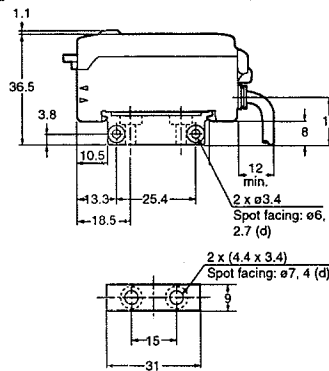


DIMENSIONS

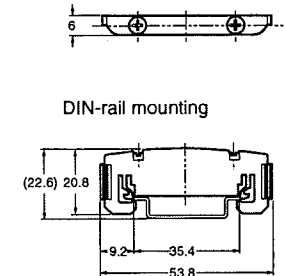
FS-T1(P)



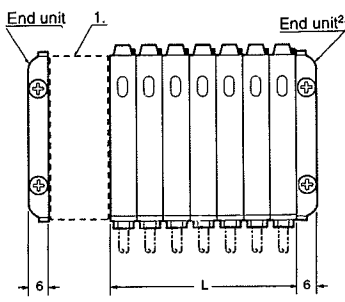
When the mounting bracket [included in the FS-T1(P)] is attached:



End unit [Included in the FS-T2(P)]



When several units are connected:

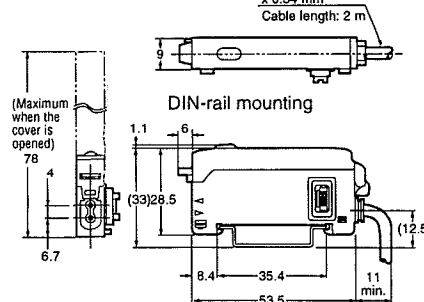


No. of units	L
1	9
2	18
3	27
4	36
5	45
6	54
7	63
8	72
9	81
10	90
11	99
12	108
13	117
14	126
15	135
16	144

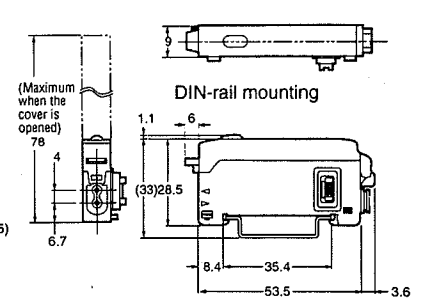
- The FS-T1(P)/M1(P)/R0 is mounted in [].
- When using expansion units, be sure to use the end unit [accessory to the FS-R0, T2(P), M2(P)].

When expanding an FS-R3, refer to the FS-R3 dimensional drawing.

FS-T2(P)



FS-T0



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