

# Thermistor Room Temperature Sensors

### TB/TS Temperature Sensors



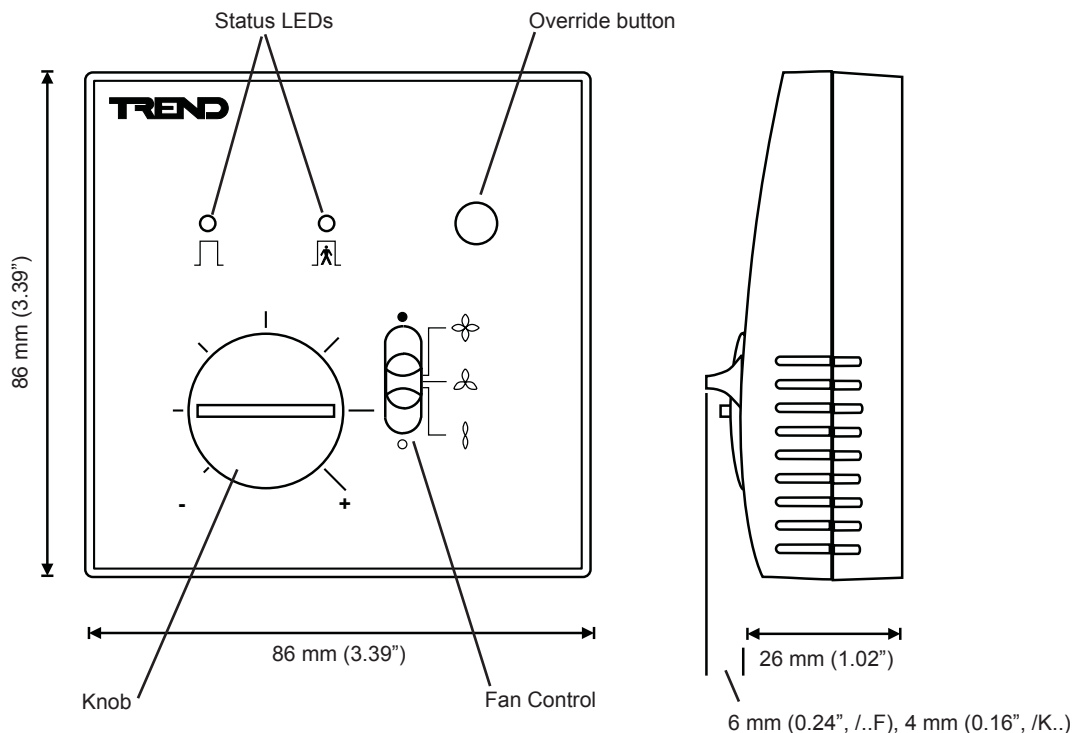
#### Description

The TB/TS Thermistor Temperature Sensor is a wall-mounted thermistor room temperature sensor in a low-profile enclosure designed for good thermal response. It has several options including a low-profile adjustment knob (e.g. setpoint trim), a pushbutton (e.g. occupancy override), two LEDs (e.g. occupancy status indication), and a 5 way switch (e.g. fan control). These options are available in various combinations.

#### Features

- Surface fitting or fits on standard electrical back box
- Optional low profile adjustment knob (1 to 11 k $\Omega$ )
- Optional override button and status LEDs.
- Optional fan control switch (off, low, medium, high, automatic)

#### Physical (TB/TS/KOSF shown)



**FUNCTIONALITY**

**Housing:** The TB/TS is suitable for mounting on a wall, and can either be mounted on a standard pattress or mounted on a flat surface.

**Sensor:** The basic TB/TS sensor provides a standard Trend thermistor sensing element (10 kΩ at 25 °C, 77°F) for space temperature measurement.

**Options:** There are options for Knob input, Override button input, Status Indication output, and Fan Control input.

Factory set links are fitted to the full board which sets the board use for either /O, or /E use. The TB/TS/OS, /KO, /KOS, /KOF, /KOSF are linked for /O use whereas TB/TS/KE, and /KEF are linked for /E.

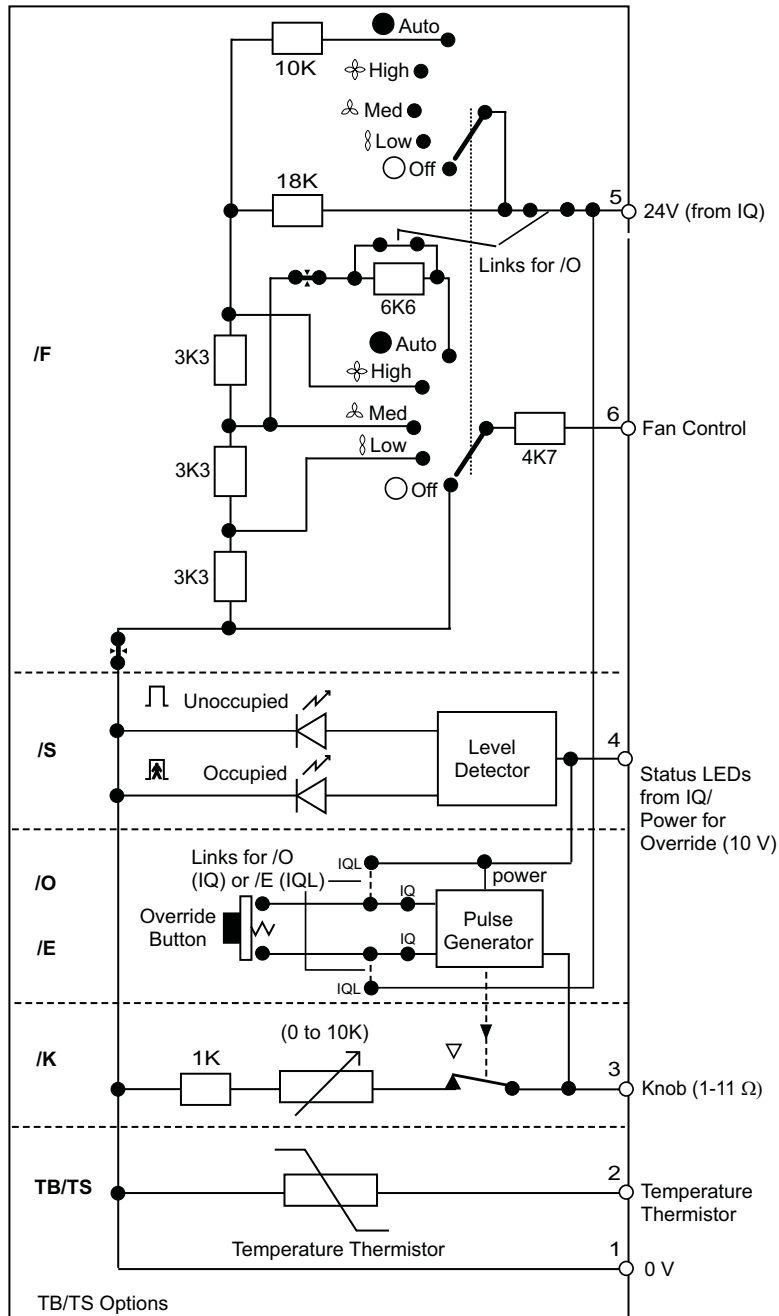
The /O option is intended for use with IQ1, IQ2 IQ3, IQ4, and IQeco controllers.

The /E option is intended for use with IQL controllers. However the IQeco standard strategies allow TB/TS/KEF to be used

There are three printed circuit boards used, the board and hence terminals being used depend on the option set selected:

The schematic diagram below illustrates the full complement of options. The TB/TS uses 2 unidentified terminals as polarity is unimportant, the TB/TS/K uses the half board with a 3 terminal connector, and all the other options use the full board with a six terminal connector.

TB/TS schematic diagram



**FUNCTIONALITY** (continued)

**Knob option (/K):** This option gives a 1 to 11 kΩ potentiometer variable resistance. The minimum resistance of 1 kΩ eliminates the sensor module producing an ‘Out of Limits’ alarm as the controller thermistor input reads 0 V. (This is normally used to detect faulty thermistors).

**Override button option (/O, /E):** These options allow the occupancy status of the area to be toggled or extended manually.

For the /E option the status level detector and LED circuitry is not fitted to the TB/TS board, and the links isolate terminal 5, so that the override button provides a contact closure between terminals 4 and 5.

For the /O option the button does not require any dedicated wiring as it operates by open circuiting the knob wiring for approximately seven seconds. However, this means that the knob output must always be wired even for the /OS option which does not have a knob. Similarly, the override option pulse generator is powered via terminal 4 (Status/Power), so it is also connected for /KO or /KOF options. Connect to 10 Vdc or 24 Vdc; if the sensor has status indication fitted but not used (/KOS, /OS, /KOSF used as /KO or /KOF), the input should be powered from 10 Vdc (e.g. from dummy analogue output for IQs).

The override implementation can be achieved by the IQ control strategy shown. Available in the SET strategy library this differentiates between the operation of the push button and a circuit problem in the adjustment knob. The ‘Out of Limits’ alarm of the input sensor (S2) is used to detect the open circuit condition and this alarm should not be enabled or the alarm will be generated with each operation of the override button. The sequencing order of the sensor and the three logic modules is important as the strategy checks for the ‘Out of limits’ alarm bit of S2 (IQ2 bit 42,2) returning to zero one sequence step after it went into alarm.

The output of the strategy is a pulse lasting one sequence cycle at node 21,2 which can be used within a larger strategy. A further logic module G4 can be used to latch this pulse and generate an occupation status. The gate module is used to avoid the open circuit knob value being passed through to subsequent modules by latching the previous value while the sensor is in alarm.

**Status indication option (/S):** The status indication is driven from pin 4. When the voltage output from the IQ is between 4.5 V and 5 V, the ‘unoccupied’, yellow LED is illuminated, and when it is above 5.5 V the ‘occupied’ green LED is illuminated.

**Fan Control option (/F):** This switch provides either a stepped variable resistance, or a stepped variable voltage corresponding to five switch positions. On the /O option the fan control produces a voltage signal for an IQ controller analogue voltage input between terminals 1 (0V) and 6 with terminal 5 connected to 24 V. On the /E option a set of different switched resistances is produced between terminals 1 and 6. The voltage and resistance levels corresponding to the five switch positions are shown in the table:

Switch Position	TB/TS/ version	IQ1 /IQ2 /IQ3 (/KOF /KOSF)		IQ4 /IQeco (/KOF, /KOSF)		IQL (/KEF)
	Function	Voltage		Voltage		Resistance
		Nominal	Recommended	Nominal	Recommended	
Legend	Terminals	1 (0V) to 6, 5 (24V)		1 (0V) to 6, 5 (24V)		1 to 6
○	Fan Off	0 V		0 V		4k7 ohms
∩	Fan low speed	2.8 V	>2 V	1 V	>0.99 V	8k0 ohms
⊖	Fan medium speed	5.6 V	>4.5 V	2 V	>1.99 V	11k3 ohms
⊕	Fan high speed	8.5 V	>7 V	3 V	>2.99 V	14k6 ohms
●	Automatic	9.7 V	>9 V	4 V	>3.99 v	17k9 ohms

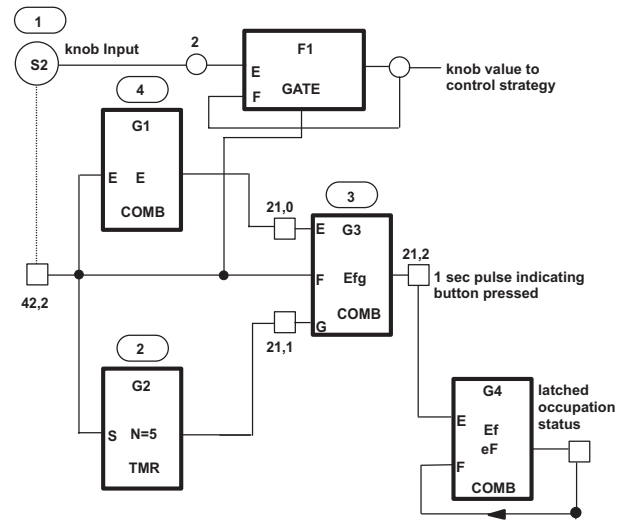
*Note that the IQ recommended limits may need to be changed to suit mains supply voltage and auxiliary supply loading, or a 24 Vdc regulated supply can be used.*

IQLs and IQecos with fixed strategies are pre-configured; all others require configuring. SET has sensor scalings set up for the above output types; Unique sensor reference ‘Fan KO enum’ for both voltage tables, and ‘Fan KE enum’ for resistance table. SET’s strategy library provides a pre-configured strategy (TB TS KOSF) that supports the sensor; options not required can be deleted.

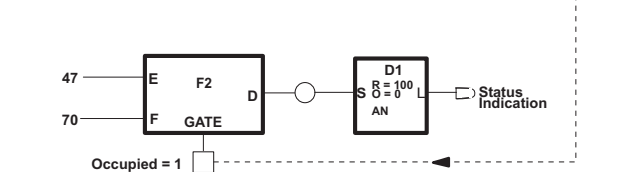
In the IQ status indication strategy shown below, function module F2 is used to select the correct voltage. The output of G4 from the override strategy may be used to select the appropriate status via the function module F2. Pressing the override button causes the selected LED to pulse for about 7.5 seconds. After this period the selected LED will return to steady illumination. This indicates that the button has been pressed and allows time for the IQ strategy to change the output to the status LEDs and select the other LED.

Thus normally the operator will press the button, the current LED will flash and when the strategy has operated (after 5 seconds) the other status LED will be illuminated to confirm the occupancy status change. This strategy is available in the SET strategy library.

**IQ Override Strategy**



**IQ Status Indication Strategy**



*Note: Pulse time and timer settings are for IQs with 1 s cycle time. The nodes only apply to pre-IQ3 strategies.*

**INPUT CHANNELS AND SENSOR SCALING**

IQ1s and IQecos with fixed strategies have the scalings pre-configured. If the SET pre-defined strategy is used the scalings will have been configured.

For all others the input channel must be set to the appropriate input type (see controller documentation for details) and the sensor type module must be set up with the correct scaling.

The recommended method of setting the sensor scaling is to use the 'Unique Sensor Reference' provided in SET, see below for details.

For all other controllers, see Sensor Scaling Reference Card TB100521A, and set up manually in SET.

**Knob:** The input channel used should be set for thermistor (T), and sensor scaling set as below.

Controller	Unique Sensor Reference	Notes
IQ1, IQ2 v2.0 or lower	Set up manually in SET	
IQ2 v2.1 or greater, IQ3, and IQ4	Knob TB 3 deg trim	Guaranteed ±3 trim
	Knob T 3 deg trim	±3 ±20% linear trim
IQeco	(Knob TB 05 deg trim) Type 102 - Potentiometer	-0.5 to + 0.5 deg trim

**Thermistor:** The input channel used should be set for thermistor (T), and sensor scaling set as below.

Controller	Unique Sensor Reference	Notes
IQ1, IQ2 v2.0 or lower	Set up manually in SET	
IQ2 v2.1 or greater, IQ3, and IQ4	Thermistor TBTS	Value in °C
	Thermistor TBTS F	Value in °F
IQeco	(10k Therm DegC TBTS) Type 101 - Thermistor °C	Value in °C
	(10k Therm DegC TBTS) Type 108 - Thermistor °F	Value in °F

**Fan Control:** The input channel should be set for voltage (V), and sensor scaling set as below.

Controller	Unique Sensor Reference	Notes
IQ2 v2.0 of lower	Set up manually in SET	
IQ2 v2.1 or greater, IQ3, and IQ4	Fan Control V	produces range 0 to 9.7
	Fan KO enum	produces fan speed settings for /O sensors as shown on page 3
IQeco	(Fan TBTS KEF) Type 103 - Fan Speed Switch	For TBTS KEF
	(Fan TBTS KOF) Type 111 - TBTS Fan Speed Control	For TBTS KOF, KOSF

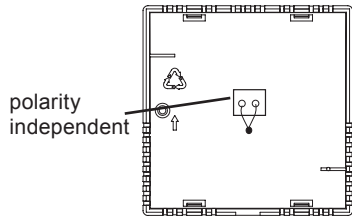
## INSTALLATION

- Choose location
- Mount sensor (via two screws - minimum)
- Connect terminals
- Assemble sensor unit
- Setup Strategy
- Test

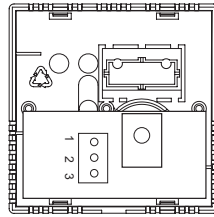
For full installation details see TB/TS Installation Instructions (TG200604), TB/TS/K Installation Instructions (TG200607), TB/TS/KO, /OS, /KOS, /KOF, /KOSF Installation Instructions (TG200606), TB/TS/KE, /KEF Installation Instructions (TG200605).

## CONNECTIONS

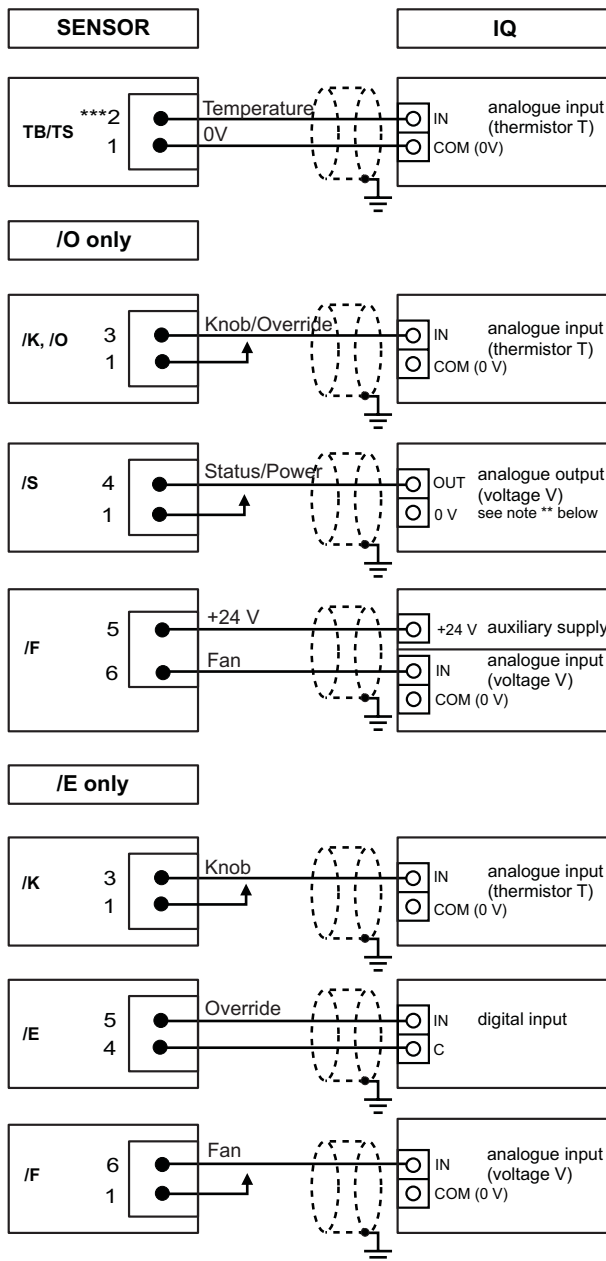
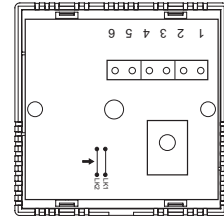
2 terminals (TB/TS)



half board (TB/TS/K)



full board (TB/TS/KO, /OS, /KOS, /KOF, /KOSF, /KE, /KEF)



Note terminal labels are dependent on controller type

Option	Connect Terminals
TB/TS	1, 2***
TB/TS/K	1, 2, 3
TB/TS/KO	1, 2, 3, 4**
TB/TS/OS	1, 2, 3*, 4**
TB/TS/KOS	1, 2, 3, 4**
TB/TS/KOF	1, 2, 3, 4**, 5, 6
TB/TS/KOSF	1, 2, 3, 4, 5, 6
TB/TS/KE	1, 2, 3, 4, 5,
TB/TS/KEF	1, 2, 3, 4, 5, 6

\*Note that the override function operates via the knob connection so that for the /OS option, the Knob connection must be made.

\*\*Note that the override function takes its power from the Status/Power connection so the Status/Power connection (terminal 4) must also be made for /KO and /KOF versions. For these /KO and /KOF versions, connect the Status/Power to 10 Vdc or 24 Vdc. If status indication is fitted but not used (i.e. /OS, /KOS, /KOSF used as /O, /KO, or /KOF), 10 Vdc must be used e.g. from dummy analogue output.


\*\*\* Note that the terminals are not numbered on TB/TS; they are polarity independent. The equivalent numbering on the other TB/TS versions is shown

IQecos with fixed strategies and IQLs must be connected as described in the relevant strategy data sheet or installation instructions.

Note that screened cable is not required for sensor wiring to IQLs. If screened cable is used, the screen must be terminated at the controller to its supply cable earth.

## DISPOSAL

COSHH (Control of Substances Hazardous to Health - UK Government Regulations 2002) ASSESSMENT FOR DISPOSAL OF TB/TS.

RECYCLING.  All plastic and metal parts are recyclable. The printed circuit board may be sent to any PCB recovery contractor.



### WEEE Directive:

At the end of their useful life the packaging, product, should be disposed of by a suitable recycling centre.

Do not dispose of with normal household waste.  
Do not burn.

## COMPATIBILITY

	TB/TS	TB/TS/K	TB/TS/KO	TB/TS/OS	TB/TS/KOS	TB/TS/KOF	TB/TS/KOSF	TB/TS/KE	TB/TS/KEF
IQ1	✓	✓	✓	✓	✓	✓	✓	✗	✗
IQ2	✓	✓	✓	✓	✓	✓	✓	✗	✗
IQ3	✓	✓	✓	✓	✓	✓	✓	✗	✗
IQ4	✓	✓	✓	✓	✓	✓	✓	✗	✗
IQeco31	✓	✓	✓	✗	✓*	✗	✗	✓*	✗
IQeco35/38	✓	✓	✓	✗	✓*	✓	✓*	✓*	✓
IQeco VAV, 39	✓	✓	✓	✗	✓	✗	✗	✓*	✗
IQL11+	✓	✓	✗	✗	✗	✗	✗	✓	✗
IQL13+	✓	✓	✗	✗	✗	✗	✗	✓	✓
IQL15+	✓	✓	✗	✗	✗	✗	✗	✓	✓

\* These versions of TB/TS are not supported by IQeco standard strategies and would have to be specially configured

Note that /KO, /OS, /KOS, /KOF, /KOSF cannot be used by IQ211 (although they can be used by IQ212).

## ORDER CODES

**TB/TS/[OPTIONS]** :Thermistor temperature sensor with options as shown in table. Consists of 2 parts (front panel and backplate) for either flush mounting or mounting on a standard pattress.

[OPTION]	Description
<b>blank</b>	Thermistor Temperature sensor only
<b>K</b>	1 to 11 kohm adjustment knob (e.g. setpoint trim)
<b>O</b>	Pushbutton (e.g. occupancy override); open circuits knob wiring
<b>E</b>	Pushbutton (e.g. occupancy override); volt free contact closure
<b>S</b>	Status LEDs - two LEDs (e.g. indicating occupied/unoccupied)
<b>F</b>	Fan speed select input to give off, low speed, medium speed, high speed, or automatic, either by stepped voltage or switched resistance values

Valid variants TB/TS, TB/TS/K, TB/TS/KO, TB/TS/OS, TB/TS/KOS, TB/TS/KOF, TB/TS/KOSF, TB/TS/KE, TB/TS/KEF

## ACCESSORIES

**TB/TS/BOX 20** :Box of 20 sensors

**TB/TS/K/BOX20** :Box of 20 sensors

**WSA/10/USA** :Pack of 10 wall sensor adaptor plates to facilitate mounting TB/TS on US or Danish electrical back boxes. Each plate complete with 2 plastic covers, 2 back box screws, and two 3.5 mm TB/TS screws.

## SPECIFICATIONS

### ELECTRICAL

Connection	:1 part screw terminals for 0.5 to 2.5 mm <sup>2</sup> cross section area (14 to 20 AWG) cable. 2 terminals for TB/TS, 3 for TB/TS/K, and 6 for all other options
Thermistor	:10 kΩ @ 25 °C (77 °F)
Temperature range	:0 to +40 °C (recommended).
Temperature Accuracy	:of sensor, ±0.44 °C, ±0.79 °F (0 to +40 °C, 32 to 104 °F)
Potentiometer	:1 kΩ to 11 kΩ ±20 %.
Override	
/O	:7s duration pulse (open circuits knob input).
/E	:Volt free contact closure
Status LEDs	:Occupied green LED 5.5 V to 10 V, Unoccupied yellow LED 4.5 V to 5.0 V.
Fan Control	
/O	:5 level switched voltage (0 V to 9.7 V).
/E	:5 level switched resistance 4.7 kΩ to 17.9 kΩ (TB/TS/KEF only).

### MECHANICAL

Flush fitting	:86 mm (3.39") x 86 mm (3.39") x 26 mm (1.02") depth. Add 6 mm (0.24") to depth for /..F, add 4 mm (0.16") for /K.
Enclosure Material	:Flame retardant (V0) ABS.

### ENVIRONMENTAL

EMC	:161326-1:2006
Ambient limits	
Operating Temp	:-10 °C (14 °F) to +50 °C (122 °F)
Operating Humidity	:0 to 90 %RH non-condensing.

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