# Honeywell

# TR21, TR22, TR23, and TR24 Wall Modules

## FEATURES

The TR21, TR22, TR23, and TR24 family of wall modules include:

- **Models with setpoint adjustment.**
- **Models with occupied/unoccupied override (bypass) with LED.**
- **Models with 3-position (auto/0/1) or 5-position (auto/0/1/2/3 speed) fan switch.**
- **LONWORKS bus jack on all models except the TR21 and TR21-A models.**
- **Operating range 45° to 99° F (7° to 37° C).**
- **Models (TR22 and TR23) with user-selectable temperature setpoint dials in Fahrenheit, Celsius, and Relative (- to +).**

## SPECIFICATIONS

**Models:** Refer to Table 1 on page 2.

**Construction:** Two-piece construction, cover and internally wired subbase. Field wiring 16 to 22 AWG (1.31-0.33 sq. mm) connects to a terminal block in the subbase.

**Mounting Options:** All modules can be mounted on a standard two by four inch junction box or on a 60 mm diameter junction box.

**Dimensions (H/W/D):** Refer to Fig. 2 on page 3.

**Environmental Ratings:**
- Operating Temperature: 45° to 99° F (7° to 37° C).
- Shipping Temperature: -40° to 150° F (-40° to 66° C).

**Relative Humidity:** 5% to 95% non condensing.

**Temperature Sensor Operating Range:**
45° to 99° F (7° to 37° C).

**Temperature Setpoint Ranges (TR22 and TR23 only):**
The setpoint range is determined by the temperature knob installed:
- 55° to 85° F
- 13° to 29° C
- Relative (- to +)

## GENERAL

The TR21, TR22, TR23, and TR24 are a family of direct wired wall modules for use with:

— Honeywell Excel 600, 500, 100, and 80 (all fully programmable) controllers
— Excel 10 W7750, W7751[a], W7752, and W7753 controllers
— W7761 Controller
— Spyder Unitary Controllers: PUL, PVL

All models have a space temperature sensor. Some models have a temperature dial, setpoint adjustment, LONWORKS® bus jack, override (bypass) with LED, and fan switch. The figure above is the TR23 model.

[a] The TR21, TR22, TR23, and TR24 wall modules are not compatible with W7751A,C,E,G Controllers.

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**Accessories:** 50007298-001 (pack of 12) medium, cover plate; 6-7/8 x 5 in. (175 x 127 mm).

**Approvals:** CE; UL94 plastic enclosure; FCC Part 15, Class B.

## Temperature Sensor

**TR21, TR22, TR23, and TR24 20K Ohm Non-linearized Sensor:**
All models are furnished with a 20K Ohm non-linear NTC temperature sensor that follows a specific temperature resistance curve (See Fig. 1).

Honeywell controllers used with the TR21, TR22, TR23, and TR24 models employ an algorithm that provides readings close to the actual temperature. Sensor accuracy across the range of 55° to 85° F (13° to 29° C) is better than ± 0.36° F (± 0.2° C).

NOTE: The TR21-A wall module model has two 20K Ohm non-linear NTC temperature sensors in parallel, which provide 10K NTC temperature sensing necessary for averaging.
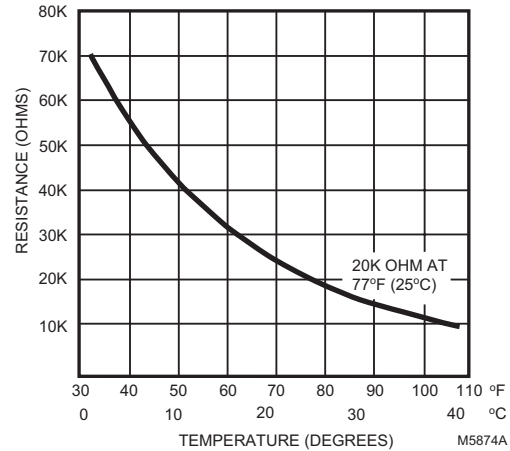


**Fig. 1. Temperature vs. Resistance for Non-linear Sensor.**

## Wall Module Features

Table 1 illustrates the TR21, TR22, TR23, and TR24 wall module features and lists the existing Honeywell models that they replace.

**Table 1. TR21 - TR24 Wall Module Features.[a]**

| Model Number | | Sensor Element Type | Sensor Type | | Selectable Setpoint Adjustment: 55° to 85° F, 13° to 30° C, or Relative (- to +) | Override Button with LED | LON Jack | Fan Switching |
|---|---|---|---|---|---|---|---|---|
| Honeywell Wall Module Model | Replaces Honeywell Model | | Temp | Humidity | | | | |
| TR21 | T7770A1006 | 20K ohms non-linear | ✓ | | | | | n/a |
| TR21-A | T7770A3002 | 10K ohms non-linear for averaging only | ✓ | | | | | |
| TR21-H | n/a | 20K ohms non-linear | ✓ | ✓ | | | ✓ | |
| TR21-J | T7770A2004 | | ✓ | | | | ✓ | |
| TR22 | T7770B1004 T7770B1020 T7770B1046 | | ✓ | | ✓ | | ✓ | |
| TR23 | T7770C1002 T7770C1028 T7770C1044 | | ✓ | | ✓ | ✓ | ✓ | |
| TR23-H | n/a | | ✓ | ✓ | ✓ | ✓ | ✓ | |
| TR23-N [b] | T7770C1051 | | ✓ | | ✓ | ✓ | ✓ | |
| T24 | T7770D1000 | | ✓ | | | ✓ | ✓ | |
| TR22-F5 | n/a | | ✓ | | ✓ | | ✓ | 5 position |
| TR23-F3 | T7770E1023 | | ✓ | | ✓ | ✓ | ✓ | 3 position |
| TR23-F5 | T7770F1005 | | ✓ | | ✓ | ✓ | ✓ | 5 position |

[a] A check mark (✓) indicates the feature is included with the wall module.

[b] The TR23-N has no Honeywell logo on the cover.

NOTE: Refer to the *TR21, TR22, TR23, and TR24 Wall Modules – Installation Instructions*, form 62-0267, for wiring diagrams. Some features may not be available with all controllers.

## Module Dimensions



**Fig. 2. Wall Module Dimensions in inches (mm).**

## Circuit Board

Fig. 3 illustrates the location of the terminal block and other features on the TR21, TR22, TR23, and TR24 models' circuit board. Table 2 on page 4 describes the terminal connections by model number.



△1 COMPONENTS VARY WITH MODEL. SEE TABLE 1.

△2 NUMBER OF TERMINALS VARIES WITH MODEL.

△3 FACTORY USE ONLY. DO NOT ATTEMPT TO ADJUST.

△4 DIP SWITCH S1 IS USED FOR HUMIDITY MODELS (TR21-H AND TR23-H) ONLY.

△5 SECOND SWITCH (2) ON DIP SWITCH S2 IS FOR FACTORY USE ONLY.

**Fig. 3. Wall Module Circuit Board Components.**

**Table 2. TR21, TR22, TR23, and TR24 Wall Module Terminal Connections.[a]**

| Wall Module Model | When Used With Controller Model(s) | Terminal Usage and Number (See Fig. 3 on page 3) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | GND [b] | Sensor | LON +[c] | LON – | SETPT (Setpoint) | Override Return | LED | LED Return | Override / Fan | Override | Humidity | 18-24 Vac[d] |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| TR21 | W7761 | ✓ | ✓ | | | | | | | | | | |
| TR21-A | | ✓ | ✓ | | | | | | | | | | |
| TR21-H | | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | ✓ |
| TR21-J | | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| TR22-F5 | • W7750, W7751, W7752, and W7753 • Excel 600, 500, 100, and 80 | ✓ | ✓ | ✓ | ✓ | ✓ | | | | Fan | | | |
| TR23 | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| TR23-N | | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| T24 | | ✓ | ✓ | ✓ | ✓ | | | | | | | | |
| TR23 | W7753 | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | | |
| TR23-F3 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Fan | ✓ | | |
| TR23-F5 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Fan | ✓ | | |
| TR23-H | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | | ✓ | ✓ | ✓ |
| T24 | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | | |
| TR23 | • W7750, W7751, and W7752 • Spyder: PUL, PVL | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Override | | | |
| TR23-F3 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Override / Fan | | | |
| TR23-F5 | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Override / Fan | | | |
| TR23-H | | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | | Override | | ✓ | ✓ |
| T24 | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | Override | | | |
| TR23-F3 | Excel 600, 500, 100, and 80 **with Fan** | ✓ | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | Override / Fan | | | |
| TR23-F5 | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Override / Fan | | | |
| TR23 | Excel 600, 500, 100, and 80 **without Fan** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Override | | | |
| TR23-H | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Override | | ✓ | ✓ |
| T24 | | ✓ | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | Override | | | |

[a]  A check mark (✓) indicates the terminal is used in this wall module and controller configuration.
[b]  Earth Ground.
[c]  LonWorks terminals (+ and –) are polarity insensitive.
[d]  Power coming from the controller to power the humidity sensor.

## Communications

All wall modules (except the TR21 and TR21-A models) have a LONMARK® bus communications port. If needed, the jack plug must be removed in the field, and terminals 3 and 4 wired according to the installation instructions.

LONMARK bus communication is not applicable when the wall modules are used with Excel 600/500/100/80 Controllers. The LONMARK bus is insensitive to polarity, minimizing installation errors due to mis-wiring.

The recommended wire size for the LONMARK bus is Level IV, 22 AWG (0.34 sq. mm) plenum or non-plenum rated, unshielded, twisted pair, solid conductor wire.

## TR22 and TR23 Setpoint Adjustment

For the TR22 and TR23 Wall Modules with a setpoint adjustment, the controller must be programmed for the values in Table 3.

**Table 3. Setpoint Values.**

| Setpoint Value | Program Setting |
|---|---|
| 55° F (13° C) | 2.773 V |
| 65° F (18° C) | 2.148 V |
| 75° F (24° C) | 1.345 V |
| 85° F (29° C) | 0.43 V |

## Humidity Settings (DIP switch S1)

The humidity sensing control mode is set with this 2-position DIP switch. Refer to Fig. 3 on page 3 for location of DIP switch S1.

NOTE: These switch settings apply only to the TR21-H and TR23-H models.

To change the setting, first disconnect the power, then set **SW1** and **SW2** according to Table 4.

The switch settings are used to indicate the sensing control between the humidity sensor on the wall module and the connected controller model.

**Table 4. DIP Switch S1 Settings.**

| Wall Module Model | Sensing Control | Individual Switches | |
|---|---|---|---|
| | | 1 | 2 |
| TR21-H TR23-H | 0-10 Vdc | OFF | OFF |
| | 0-5 Vdc | OFF | ON |
| | 4-20 mA | ON | OFF |

## DIP Switches S2 and S3

Refer to Fig. 3 on page 3 for location of these DIP switches. To set these DIP switches, refer to the TR21, TR22, TR23, and TR24 Wall Modules – Installation Instructions, form 62-0267.

## TR23 and TR24 Wall Module Override (Bypass) Pushbutton and LED Operation

### When Used With Excel 10 Controllers:

The Excel 10 controllers (W7750, W7751, W7752, and W7753) provide timed occupied and unoccupied temperature setpoints for the Wall Module, see Fig. 4. The override pushbutton is used to change the controller into the modes shown in Table 5 and illustrated in Fig. 5 on page 6. The override (bypass) LED displays the override status of the controller.
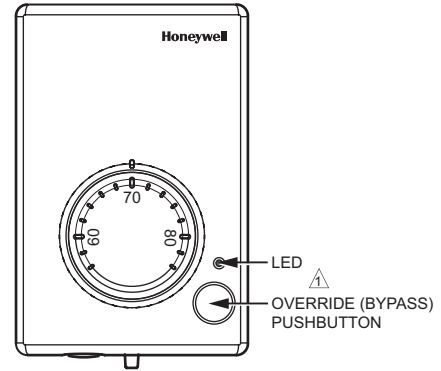


⚠ LED AND OVERRIDE (BYPASS) PUSHBUTTON AVAILABLE ONLY ON THE TR23 AND TR24 MODELS.

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**Fig. 4. LED and Override Pushbutton Locations (TR23-F Wall Module shown).**

**Table 5. Wall Module Operation.**

| Pushbutton Held Down | Controller Model | LED Status |
|---|---|---|
| 0 to 1 second | No override | Off |
| 1 to 4 seconds | Timed occupied override | On |
| 4 to 7 seconds | Unoccupied override | Single blink per second |
| Longer than 7 seconds | No override | Off |
| not applicable | Continuous occupied override[a] | Two blinks per second |

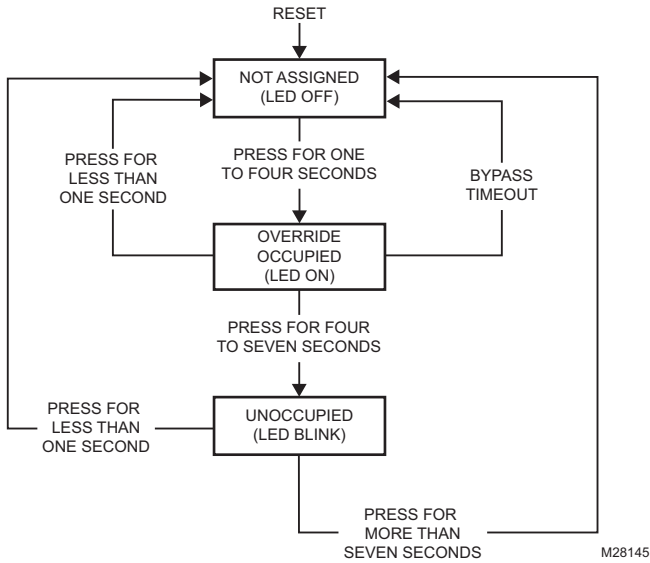[a] Remote function, which is generated from the network.

**Fig. 5. Override Pushbutton Operation.**

## When Used With Excel 600/500/100/80 Controllers:

The application engineer/programmer can program the override (bypass) and LED to operate in any manner desired. The override (bypass) input is a dry contact, normally open, momentary digital input when the wall module does not have a fan switch. When a fan speed switch (basically a series of resistances based on fan switch position) is present, the override button is an analog input. See Table 7 for resistances.

## When Used With T7350 Thermostat:

TR21, TR21-A, TR21-H, TR22, TR23, and TR24 are the models compatible with the T7350 thermostat. When using with the T7350 thermostat be sure to use the relative +/- offset knob only. The Celsius and Fahrenheit knobs will not work properly with the T7350 Thermostat.

# TR22-F5, TR23-F3, and TR23-F5 Wall Module Fan Switch

With the switch in the far left position (Auto), the fan automatically runs at the speed determined by the controller temperature control algorithm.

With the switch in the 0 position, the fan is off. Position 1 is fan speed 1, etc.

The wall module fan speed switch overrides the temperature control algorithm.

## When Used With Excel 10 Controllers:

The Excel 10 Controllers (W7750, W7751, W7752, and W7753) can be programmed so that the fan speed switch and override button function the way that the application engineer/programmer wants. See Table 6 for controller-programming resistances. Switch 1 on Dip Switch S2 adds 10k Ohms resistance when OPEN (for Excel 600-80 controllers) and removes it when CLOSED (for Excel 10 controllers).

**Table 6. Program Settings for Wall Module with Fan Switch using Excel 10 Controllers.**

| For Switch Position | Resistance (Ohms) | Comment |
|---|---|---|
| Auto | 1861 ±119 | Left most position |
| 0 | 2686 ±127 | Fan Off position |
| 1 | 3866 ±139 | |
| 2 | 304 ±130 | |
| 3 | 460 ±146 | Right most position |
| Override button closed | Closed circuit | |

## When Used With Excel 600/500/100/80 Controllers:

Excel 600/500/100/80 Controllers can be programmed so that the fan speed switch and override button function the way that the application engineer/programmer wants. See Table 7 for controller-programming resistances. Switch 1 on Dip Switch S2 adds 10k Ohms resistance when OPEN (for Excel 600-80 controllers) and removes it when CLOSED (for Excel 10 controllers).

**Table 7. Program Setting for Wall Module with Fan Switch using Excel 600/500/100/80 Controllers.**

| For Switch Position | Resistance (Ohms) | Comment |
|---|---|---|
| Auto | 11.861K ±119 | Left most position |
| 0 | 12.686K ±127 | Fan Off position |
| 1 | 13.866K ±139 | |
| 2 | 13.04K ±130 | |
| 3 | 14.60K ±146 | Right most position |
| Override button closed | 10K ±100 | |

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