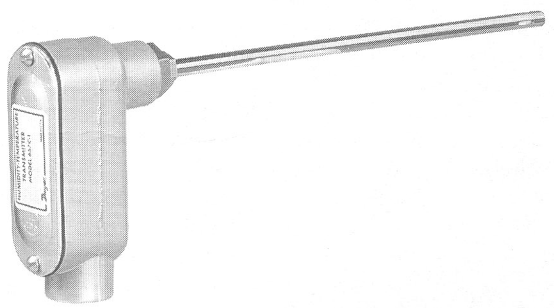
MODEL 657C-1 RELATIVE HUMIDITY/TEMPERATURE TRANSMITTER

Physical Data – Installation and Operating Instructions



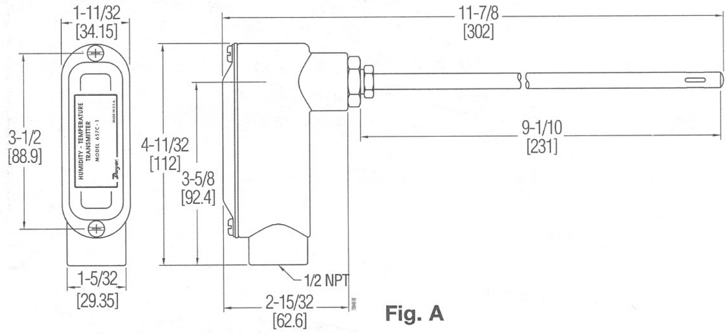


Fig. A

The Dwyer Model 657C-1 Relative Humidity/Temperature Transmitter provides two 4-20 mA channels to produce separate output signals for both relative humidity and temperature. This unit is housed in a die cast aluminum 1/2″ LB conduit enclosure with internal screw terminals. A 5/16″ × 9-1/10″ stainless steel sensing probe extends through a side hub. Sensor can be inserted directly into ducts and secured by optional mounting kits A-158 or A-159. The A-158 kit consists of a split flange which is clamped around the probe and then attached to the duct exterior with sheet metal screws. A rubber gasket is included to seal the connection. The A-159 kit includes a bushing with 1/2″ NPT male threads which is inserted through a hole in the duct. It is then secured from the duct interior with a washer and locknut. Alternatively, it can be threaded into a standard pipe flange mounted outside the duct.

The sensor employed in the 657C-1 features a state-of-the-art integrated polymer film relative humidity sensor and a thin-film platinum temperature sensor. These sensors were designed to provide high reliability and stability over years of continuous service. The relative humidity sensor uses a special polymer film which absorbs water vapor at a precisely known rate which is dependent on the relative humidity of the surrounding air. This film is deposited on a CMOS integrated circuit that measures and conditions the sensor output. The semiconductor and advanced film technology ensure long term stability and accuracy. The temperature sensor couples the highly accurate and predictable temperature characteristics of platinum with a cost effective thin-film technology.

Physical Data

Relative Humidity Range: 0-100%

Accuracy: ±2% (10-90% Rh), ±3% (0-10% and 90-100% Rh)

Operating Temperature Range: 32 to 158°F (0-70°C)

Temperature Measurement Range: 32 to 212°F (0 to 100°C)

Temperature Accuracy: ±1°F (0.5°C)

Output: 2 channels, each 4-20 mA, loop powered on Rh channel

Power Supply: 10-35 VDC

Ambient Operating Temperature Limits: 32 to 158°F (0 to 70°C)

Storage Temperature Limits: –40 to 176°F (–40 to 80°C)

Housing: Die cast aluminum with 1/2″ conduit connection

Sensor Probe: 5/16″ × 9-1/10″ (0.8 × 25.4 cm) stainless steel

Installation

1. Location: Select a clean, dry location for the enclosure where the temperature will not exceed the limits of 32 to 158°F (0-70°C). The transmitter can be located any distance from the receiver provided the total loop resistance does not exceed the limits as explained under "Wire Type and Length."
The probe should be located where conditions are representative of the overall environment being monitored. Avoid locations where stagnation or rapidly fluctuating conditions might occur. Also avoid areas where water mist or condensation exist which could cause erroneous full scale humidity readings.

2. Position: The probe and transmitter are not position sensitive and can be mounted in any orientation required. However, if the formation of condensation within the conduit is possible, locate the Model 657C so that moisture will drain away from the enclosure.

3. Mounting: To mount the probe, use optional kits A-158 Split Flange or A-159 Duct Mounting Gland or equivalent. Be carefull to avoid excess stress on the sensing tube and/or housing which could cause the probe and housing to separate.

Electrical Connection

Caution: Do not exceed the specified supply voltage rating. Permanent damage, not covered by warranty, may result. This unit is not designed for AC voltage operation.

Receiver-Transmitter Connection – The Model 657C-1 transmitter is designed as a two-wire 4-20 mA device with two channels. The channels are common on the negative side of the current loops. Sensor excitation power is derived from the relative humidity channel, so power must always be applied to that channel. If the temperature channel is not used, it can be left disconnected. The basic two-wire connection is shown in Fig. B. Terminal 4 can be used as a tie point since it is not used internally. However, the voltage on the terminal should not exceed the 35 VDC limit. Never connect AC or voltages exceeding 35 VDC to this terminal.

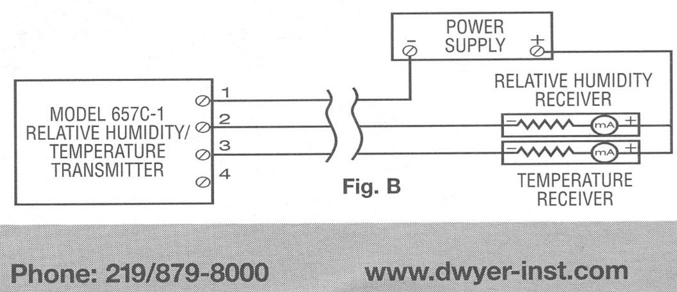


Fig. B

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Power Supply – The transmitter requires a minimum of 10 and a maximum of 35 VDC at its connection for proper operation. Choose a power supply with a voltage and current rating which meets this requirement under all operating conditions. If the power supply is unregulated, make sure voltage remains within these limits under all power line conditions. Ripple on the supply should not exeed 100 mV.

Loop Resistance – The maximum allowable loop resistance depends on the power supply voltage. Maximum loop voltage drop must not reduce the transmitter voltage below the 10 VDC minimum. Maximum loop resistance can be calculated with the following equation. V_{PS} is the power supply voltage.

$$R_{max} = \frac{V_{ps} - 10.0}{20\ mA}$$

Some receivers, particularly loop powered indicators, may maintain a fixed loop voltage to power the device. This voltage drop must also be subtracted from the power supply voltage when calculating the voltage margin for the transmitter. The following equation takes this into account. V_{rec} is the receiver fixed voltage,

$$R_{max} = \frac{V_{ps} - 10.0 - V_{rec}}{20\ mA}$$

Wire Type and Length – Wire selection is often overlooked or neglected and thus can contribute to improper or intermittent operation. Although 4-20 mA current loops are relatively immune to wiring related problems, for some systems, proper wiring can be an important factor in ensuring satisfactory system operation.

Twisted conductors are usually immune to most stray electric and magnetic fields, and to some extent electromagnetic fields such as interference from RF transmitters. Avoid use of flat or ribbon cable which has no regular conductor twist. Where interference is possible, use shielded wire. The shield must not be used as one of the conductors and should be connected to ground at one end only – generally at the power supply. Similarly, the conduit should be connected to protective ground as dictated by applicable code and the signal wiring must not be connected to the conduit at more than one point or as specified by code.

The maximum length of wire connecting the transmitter and receiver is a function of wire and receiver resistances. Wire resistance is negligible in most installations with shorter runs, typically under 100 feet. Generally, wire resistance should contribute no more than 10% to total loop resistance. Where long runs are necessary or unique application conditions exist, wire resistance must be carefully considered. Use the following equations to determine maximum wire length.

For a receiver with a pure resistive load, the maximum wire length is:

$$L_{c\ max} = \frac{V_{ps} - 10V - .02R_r}{0.10R_{co}}$$

For a receiver with a voltage drop specification, the maximum wire length is:

$$L_{c\ max} = \frac{V_{ps} - 10V - V_r}{0.10R_{co}}$$

Where:

L_{Cmax} = Maximum wire length in feet
V_{ps} = Minimum power supply voltage
R_r = Receiver resistance
V_r = Receiver voltage drop
R_{co} = Wire resistance per foot from Table 1

This equation includes a 20% safety factor and accounts for the common lead carrying the current for both temperature and humidity channels.

To determine the maximum wire length, follow this procedure:

1. Determine whether the receiver is purely resistive or has a fixed voltage drop, then select the corresponding equation.
2. Determine the minimum power supply voltage that will be used. If the power supply is unregulated, use the voltage corresponding to the low-line condition.
3. Select the wire size and determine, from Table 1, the resistance per foot for that wire size. If the wire will be exposed to a wide temperature range, use the resistance corresponding to the highest expected temperature.
4. Calculate the maximum length. If the required distance is greater than the calculated value, choose a larger wire size and recalculate the maximum length.

AWG	Ohms/ft. @32°F	Ohms/ft. @68°F	Ohms/ft. @122°F	Ohms/ft. @ 167°F
16	.03983	.04495	.04833	.05256
18	.06332	.06873	.07684	.08360
20	.10069	.10928	.12218	.13291
22	.16010	.17375	.19426	.21132
24	.25459	.27628	.30886	.33596
26	.40486	.43930	.49114	.53445

Table 1 – Wire resistance for various wire sizes

Multiple Receiver Installation

An advantage of the standard 4-20 mA DC output signal used in the Model 657C-1 transmitter is the compatibility with a wide range of receivers. Devices such as the A-701, A-702 and A-705-20 digital readouts, chart recorders and other process control equipment can be easily connected and used simultaneously. It is only necessary that all devices be designed for standard 4-20 mA input, the proper polarity of input connections be observed and the combined receiver resistance or loop voltage not exceed the maximum for the current loop. If any receiver indicates a negative or downscale reading, the signal input leads are reversed

Maintenance

After final installation of the Model 657C-1 transmitter, no routine maintenance is required. These devices are not field repairable and should be returned to the factory if recalibration or other service is required. After first obtaining a Returned Goods Authorization (RGA) number, send the material, freight prepaid, to the following address. Please include a clear description of the problem plus any application information available.

Dwyer Instruments, Inc.
Attn: Repair Department
102 Highway 212
Michigan City, IN 46360

Printed in U.S.A. 2/98

FR 02-443011-00

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