Kele

DESCRIPTION
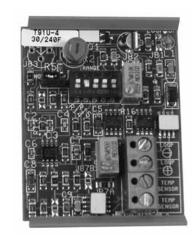
The **Model T91U** is a field-rangeable, two-wire 4-20 mA RTD transmitter used with Type 91 1000Ω platinum RTD sensors. The transmitter is available in six standard ranges, or it can be set for any range between -30° to 250°F (-34° to 121°C) with a minimum span of 40°F (22°C).

To adjust the **Model T91U**, set the DIP switches to match the desired range, and use the zero and span pots to fine tune. A high accuracy digital ohmmeter and decade box are required.

The **Model T91U** has a special 20 mA loop calibration test signal to provide easy system verification. Simply move the bottle plug jumper from norm to 20, and the transmitter will output a constant 20 mA. The loop-up LED provides power indication for the 4-20 mA output.
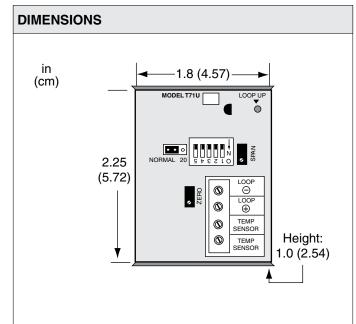
FEATURES

- *DIP switch-rangeable*
- *Loop calibration test signal*
- *Low cost*
- *Snap-track mounting*
- *Loop-powered LED indication*
- *Fits into card slot of ST-U91 housing*
- *18-month warranty*
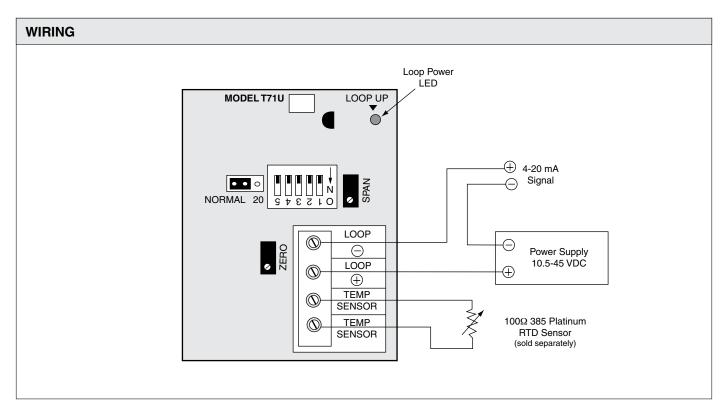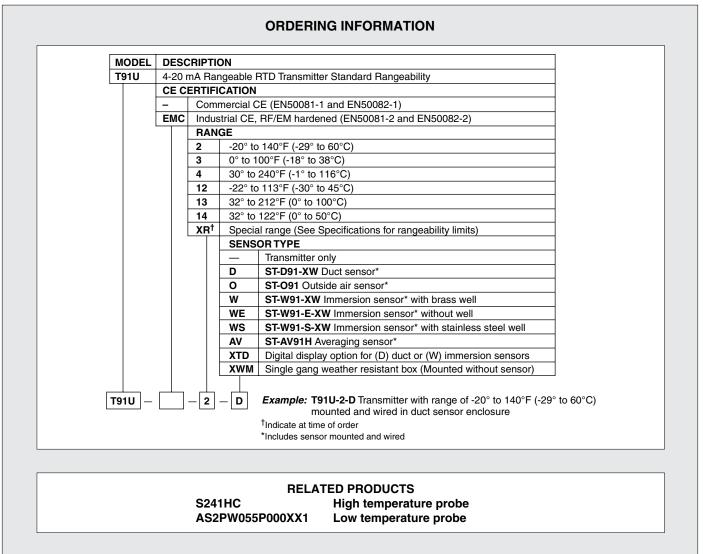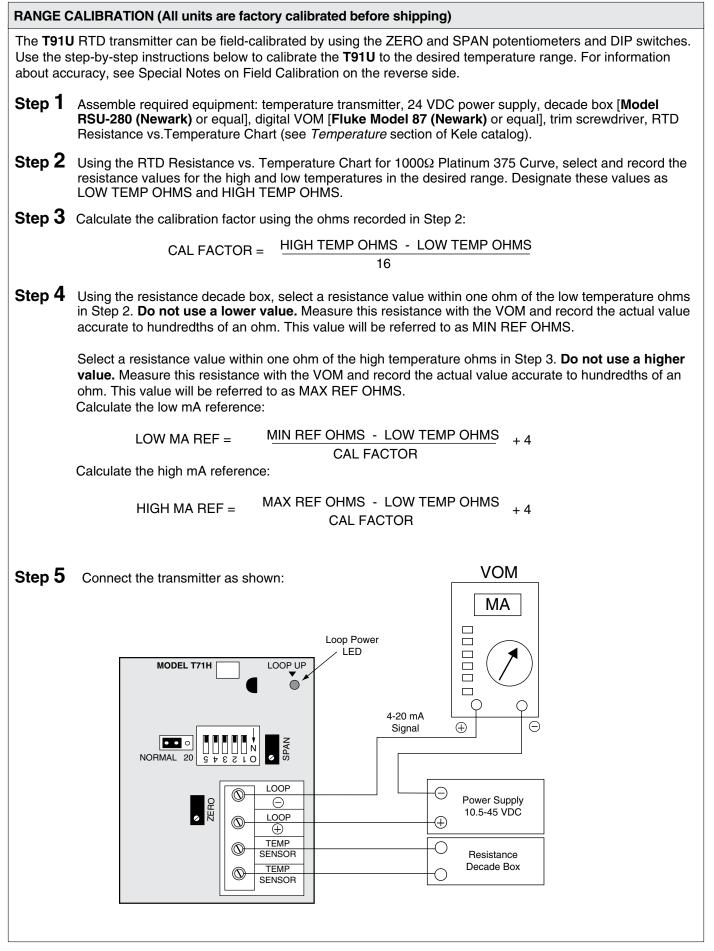- *CE approved (commercial and industrial)*

CE

DIMENSIONS

in (cm)

1.8 (4.57)

MODEL T71U   LOOP UP

NORMAL 20   SPAN

2.25 (5.72)

ZERO   LOOP ⊖
              LOOP ⊕
              TEMP SENSOR
              TEMP SENSOR

Height: 1.0 (2.54)

SPECIFICATIONS

Sensor input	1000Ω platinum TCR 0.00375 Ω/Ω/°C	Supply voltage	10.5-42 VDC (one power supply may power multiple units)
Configuration	Two-wire, loop-powered	Max impedance	675Ω @ 24 VDC/375Ω with display
Rangeability limits	**Zero:** -30° to 250°F (-34° to 121°C)	Ambient temp	0° to 140°F (-18° to 60°C)
	Span: 40° to 280°F (22° to 156°C)	Humidity	0% to 95% noncondensing
Agency	CE (EN50081-1, EN50082-1)	Accuracy	0.1°F or 0.2% of span
Optional	CE (EN50081-2, EN50082-2) Industrial RF/EM hardened	Dimensions	1"H x 1.8"W x 2.25"L (2.5 x 4.6 x 5.7 cm)
Output	4-20 mA	Display option (XTD)	3-1/2 digit LCD, NEMA 4 (IP65)
Output limit	25 mA (sensor leads open)		
Loop calibration output	20 mA ±0.2%		

WIRING

ORDERING INFORMATION

MODEL	DESCRIPTION			
T91U	4-20 mA Rangeable RTD Transmitter Standard Rangeability			
	CE CERTIFICATION			
	–	Commercial CE (EN50081-1 and EN50082-1)		
	EMC	Industrial CE, RF/EM hardened (EN50081-2 and EN50082-2)		
		RANGE		
		2	-20° to 140°F (-29° to 60°C)	
		3	0° to 100°F (-18° to 38°C)	
		4	30° to 240°F (-1° to 116°C)	
		12	-22° to 113°F (-30° to 45°C)	
		13	32° to 212°F (0° to 100°C)	
		14	32° to 122°F (0° to 50°C)	
		XR†	Special range (See Specifications for rangeability limits)	
			SENSOR TYPE	
			—	Transmitter only
			D	**ST-D91-XW** Duct sensor*
			O	**ST-O91** Outside air sensor*
			W	**ST-W91-XW** Immersion sensor* with brass well
			WE	**ST-W91-E-XW** Immersion sensor* without well
			WS	**ST-W91-S-XW** Immersion sensor* with stainless steel well
			AV	**ST-AV91H** Averaging sensor*
			XTD	Digital display option for (D) duct or (W) immersion sensors
			XWM	Single gang weather resistant box (Mounted without sensor)

T91U	—	☐	—	2	—	D

Example: **T91U-2-D** Transmitter with range of -20° to 140°F (-29° to 60°C) mounted and wired in duct sensor enclosure

†Indicate at time of order
*Includes sensor mounted and wired

RELATED PRODUCTS

S241HC	**High temperature probe**
AS2PW055P000XX1	**Low temperature probe**

RANGE CALIBRATION (All units are factory calibrated before shipping)

The **T91U** RTD transmitter can be field-calibrated by using the ZERO and SPAN potentiometers and DIP switches. Use the step-by-step instructions below to calibrate the **T91U** to the desired temperature range. For information about accuracy, see Special Notes on Field Calibration on the reverse side.

Step 1 Assemble required equipment: temperature transmitter, 24 VDC power supply, decade box [**Model RSU-280 (Newark)** or equal], digital VOM [**Fluke Model 87 (Newark)** or equal], trim screwdriver, RTD Resistance vs. Temperature Chart (see *Temperature* section of Kele catalog).

Step 2 Using the RTD Resistance vs. Temperature Chart for 1000Ω Platinum 375 Curve, select and record the resistance values for the high and low temperatures in the desired range. Designate these values as LOW TEMP OHMS and HIGH TEMP OHMS.

Step 3 Calculate the calibration factor using the ohms recorded in Step 2:

$$\text{CAL FACTOR} = \frac{\text{HIGH TEMP OHMS } - \text{ LOW TEMP OHMS}}{16}$$

Step 4 Using the resistance decade box, select a resistance value within one ohm of the low temperature ohms in Step 2. **Do not use a lower value.** Measure this resistance with the VOM and record the actual value accurate to hundredths of an ohm. This value will be referred to as MIN REF OHMS.

Select a resistance value within one ohm of the high temperature ohms in Step 3. **Do not use a higher value.** Measure this resistance with the VOM and record the actual value accurate to hundredths of an ohm. This value will be referred to as MAX REF OHMS.
Calculate the low mA reference:

$$\text{LOW MA REF} = \frac{\text{MIN REF OHMS } - \text{ LOW TEMP OHMS}}{\text{CAL FACTOR}} + 4$$

Calculate the high mA reference:

$$\text{HIGH MA REF} = \frac{\text{MAX REF OHMS } - \text{ LOW TEMP OHMS}}{\text{CAL FACTOR}} + 4$$

Step 5 Connect the transmitter as shown:

Step 6 Set DIP switches 1-5 by following these two steps:

(6a) **Set DIP switches 1 and 2 according to desired ZERO setting.**

DESIRED ZERO	SWITCH 1	SWITCH 2
-30° to 30°F (-34° to -1°C)	Off	Off
30° to 90°F (-1° to 32°C)	Off	On
90° to 150°F (32° to 66°C)	On	Off
150° to 210°F (66° to 99°C)	On	On

```
  1    0
←ON  OFF→

5  ▢■
4  ■▢      Example setting
3  ■▢       is 0 to 100F
2  ▢■
1  ▢■
1 2 3 4 5
```

Note: If the desired ZERO is very close to a range boundary and after Step 7 you cannot adjust the ZERO to the desired setting, change the switch setting to the next range and readjust the potentiometer.

(6b) **Set DIP switches 3, 4, and 5 according to desired SPAN (HIGH TEMP - LOW TEMP) setting:**

DESIRED SPAN (Hi-Lo) = Span	SWITCH 3	SWITCH 4	SWITCH 5
40° to 90°F (22° to 50°C)	On	On	On
90° to 120°F (50° to 67°C)	On	On	Off
120° to 150°F (67° to 83°C)	On	Off	On
150° to 180°F (83° to 100°C)	On	Off	Off
180° to 200°F (100° to 111°C)	Off	On	On
200° to 230°F (111° to 128°C)	Off	On	Off
230° to 250°F (128° to 139°C)	Off	Off	On
250° to 280°F (139° to 156°C)	Off	Off	Off

Note: If the desired SPAN is very close to a range boundary and you cannot adjust the SPAN to the desired setting, change the switch setting to the next range and readjust the potentiometer.

Examples: **Desired Range:**

0° to 100°F (-18° to 38°C)	Set switches 1-5; 00110
-20° to 140°F (-29° to 60°C)	Set switches 1-5; 00100
30° to 240°F (-1° to 116°C)	Set switches 1-5; 00010
-10° to 90°F (-23° to 32°C)	Set switches 1-5; 00110

Preset: T91U-2 (00100), T91U-3 (00110), T91U-4 (00010)

Special Notes on Field Calibration
The accuracy of a field-calibrated RTD transmitter is highly dependent on the accuracy of the ohmmeter used to measure the sensor substitution resistances (MIN and MAX REF OHMS). **The percent accuracy of the calibrated RTD transmitter is not the same as the percent accuracy of the ohmmeter.**

OHMMETER ACCURACY (% of reading)	TRANSMITTER ACCURACY	
	Low Temp	High Temp
1%	±4°F	±7°F
0.5%	±2°F	±3.5°F
0.25%	±1°F	±1.8°F
0.1%	±0.4°F	±0.7°F
0.05%	±0.2°F	±0.36°F

A Fluke Model 87 should provide an accuracy of approximately ±1.4°F at low temperatures and ±1.9°F at high temperatures.
A Fluke Model 8060 should provide an accuracy of approximately ±0.4°F at low temperatures and ±0.6°F at high temperatures.