



# ENCARDIO RITE

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USERS' MANUAL

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## RESISTANCE TEMPERATURE PROBE

MODEL ETT-10TH



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## 1 INTRODUCTION

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The Encardio-rite model ETT-10TH resistance temperature probe is a low mass waterproof temperature sensor for measurement of temperature between  $-20$  to  $70^{\circ}\text{C}$ . It is specially designed for measurement of surface temperatures of steel or concrete structures. Due to its low thermal mass it has a fast response time. It can also be embedded in concrete for measurement of bulk temperature inside concrete and can work submerged under water.

The probes are fully interchangeable. The temperature readings will not differ by more than  $0.2^{\circ}\text{C}$  over the specified working temperature range. This allows a single indicator to be used with any ETT-10TH probe without re-calibration. Encardio-rite's model EDI-51V vibrating wire indicator can be used with ETT-10TH to show the probe temperature directly in degree Celsius.

The temperature probe consists of a resistance-temperature curve matched thermistor, epoxy encapsulated in copper tubing for faster thermal response and environmental protection. The tube is flattened at the tip; so that it can be fixed to any reasonably flat metal or concrete surface for measurement of surface temperature. The flat tip of the probe can be fixed to most surfaces with the help of easily available two part epoxy adhesives. If desired, the probe can also be bolted down to the surface of the structure.

Temperature probe is provided with a four-core cable used as standard in all Encardio-rite vibrating wire strain gages. The pair of white and green coloured wires are used for the thermistor which is same as for other Encardio-rite vibrating wire sensors with integral thermistor temperature sensor. The pair of red and black wires is left unused. Use of a uniform colour scheme across different sensors makes it easier to make error free connections to junction box or data logger terminal panels.

## 2 INSTALLATION

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It is recommended that the probe integrity is checked before installation specially if the probe is to be used for embedded application. Measure the probe resistance with a multi-meter and check with the temperature derivation chart, at the end of this manual. The measured value should correspond to the prevailing ambient temperature.

For embedded application it should be ensured that once the probe is embedded in concrete, subsequent construction work does not damage the probe cable. If required the embedded length of cable may be routed through suitable conduits to prevent damage.

The temperature probe should be fixed to a relatively flat and clean surface. Use a grinder, sander, wire brush or file to achieve a flat surface. The surface should be cleaned of dust and loose particle by brushing or wiping with a clean cloth. Damp and porous surfaces should be dried first using a hot air gun or blow torch. Metal surfaces should additionally be degreased by using commercially available degreasing solvents or isopropyl alcohol.

For bonding to concrete or steel surfaces use a two part epoxy putty like Loctite ® Metal Set S3 (marketed as Fixmaster Fast Set Steel Epoxy in some countries). See the instructions enclosed with the epoxy pack to prepare the epoxy mixture. Apply the mixed epoxy putty to the under side of the flat surface of the probe, taking care to see that the whole flat area is covered with epoxy. Press the probe firmly on the concrete or metal surface so that epoxy layer is squeezed between the concrete and probe to create a very thin uniform layer. Hold the probe for at least 30 seconds. Make sure that no force is applied to the probe cable and leave the probe as it is for the next 30 minutes, by which time the epoxy will set to a reasonably good strength.

For fixing on smooth metallic surfaces Loctite ® Structural Adhesive 324 with Activator 7075 also gives very good result and has a very fast fixturing time of less than 3 minutes. For more information check the manufacturer's instruction sheet enclosed with the product.

After the probe is set, the cable near the probe should be fixed to the adjacent structure to avoid any stress on the probe jointing. Secure the probe cable to nearby concrete or steel structure by using cable ties, duct tapes or metal shims spot welded over the cable. For concrete applications metal shims may be placed over the probe cable and the ends of the shim can then be screwed down to concrete. Ensure that there is a slight slack in the cable between the probe and the securing point.

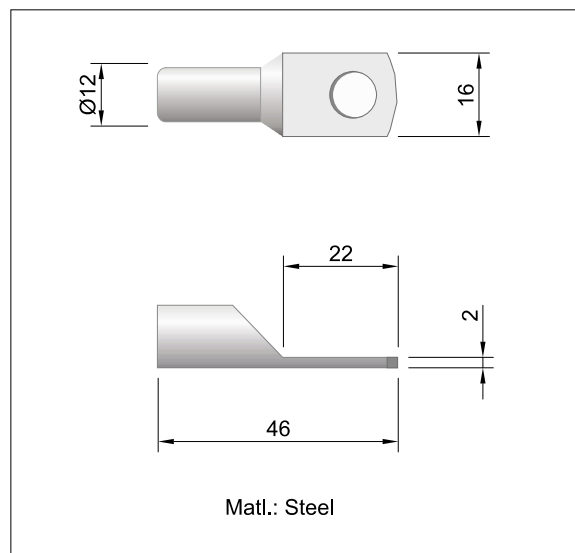
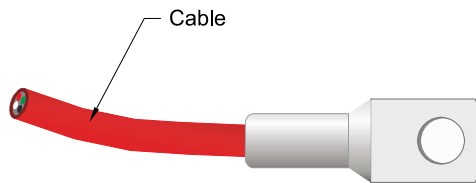
If convenient the temperature probe can also be screwed down to a flat metal surface. Drill a 5 mm diameter hole in the centre of the flat portion of the probe and use a M5 screw and a matching plain washer to tighten the probe to the metal structure. It is recommended that a small amount of heat sink compound be smeared uniformly over the contact area of the probe before fixing. This will ensure a better thermal coupling between the probe and the structure.

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### 3 SPECIFICATIONS

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|                             |   |
|-----------------------------|---|
| Sensor type                 | R-T curve matched NTC thermistor, equivalent to YSI 44005, Dale #1C3001-B3, Alpha #13A3001-B3 |
| Operating temperature range | -20 to 70 °C  |
| Accuracy                    | ± 0.2 °C  |
| Resistance                  | 3000 ohms at 25 °C  |
| Body material               | Tin-plated copper.  |
| Electrical connection       | 4-core PVC sheathed cable.  |
| Wire colour code            | Thermistor wires White and Green, polarity insensitive. Red and Green wires are not used.     |



**Dimensions**  
(All dimensions in mm)

## 4 TEMPERATURE DERIVATION CHART

### Resistance to Temperature Equation:

$$T = \frac{1}{A+B (\text{Ln}R) + C (\text{Ln}R)^3} - 273.2$$

- Where
- T = Temperature in °C
  - LnR = Natural Log of Thermistor Resistance
  - A =  $1.4051 \times 10^{-3}$  (coefficient calculated over the -50 to +150 °C span)
  - B =  $2.369 \times 10^{-4}$
  - C =  $1.019 \times 10^{-7}$

| Resistance<br>Ohms | Temp.<br>° C | Resistance<br>Ohms | Temp.<br>° C | Resistance<br>Ohms | Temp.<br>° C |
|--------------------|--------------|--------------------|--------------|--------------------|--------------|
| 29130              | -20          | 5971               | 10           | 1598               | 40           |
| 27490              | -19          | 5692               | 11           | 1535               | 41           |
| 25950              | -18          | 5427               | 12           | 1475               | 42           |
| 24510              | -17          | 5177               | 13           | 1418               | 43           |
| 23160              | -16          | 4939               | 14           | 1363               | 44           |
| 21890              | -15          | 4714               | 15           | 1310               | 45           |
| 20700              | -14          | 4500               | 16           | 1260               | 46           |
| 19580              | -13          | 4297               | 17           | 1212               | 47           |
| 18520              | -12          | 4105               | 18           | 1167               | 48           |
| 17530              | -11          | 3922               | 19           | 1123               | 49           |
| 16600              | -10          | 3748               | 20           | 1081               | 50           |
| 15720              | -9           | 3583               | 21           | 1040               | 51           |
| 14900              | -8           | 3426               | 22           | 1002               | 52           |
| 14120              | -7           | 3277               | 23           | 965.0              | 53           |
| 13390              | -6           | 3135               | 24           | 929.6              | 54           |
| 12700              | -5           | 3000               | 25           | 895.8              | 55           |
| 12050              | -4           | 2872               | 26           | 863.3              | 56           |
| 11440              | -3           | 2750               | 27           | 832.2              | 57           |
| 10860              | -2           | 2633               | 28           | 802.3              | 58           |
| 10310              | -1           | 2523               | 29           | 773.7              | 59           |
| 9796               | 0            | 2417               | 30           | 746.3              | 60           |
| 9310               | 1            | 2317               | 31           | 719.9              | 61           |
| 8851               | 2            | 2221               | 32           | 694.7              | 62           |
| 8417               | 3            | 2130               | 33           | 670.4              | 63           |
| 8006               | 4            | 2042               | 34           | 647.1              | 64           |
| 7618               | 5            | 1959               | 35           | 624.7              | 65           |
| 7252               | 6            | 1880               | 36           | 603.3              | 66           |
| 6905               | 7            | 1805               | 37           | 582.6              | 67           |
| 6576               | 8            | 1733               | 38           | 562.8              | 68           |
| 6265               | 9            | 1664               | 39           | 543.7              | 69           |
|                    |              |                    |              | 525.4              | 70           |