

# MRC Temperature Probes

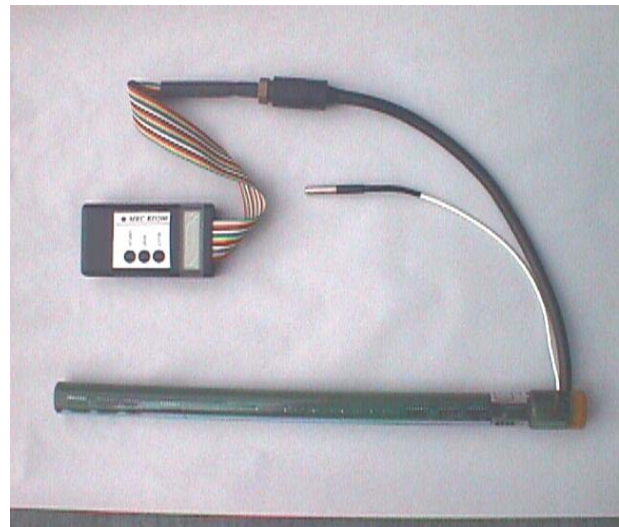
## For Pavement, Sub-Grade and Soil Temperature Monitoring

Take the guesswork out of the freeze-thaw cycle in pavement structures and sub-grades by using MRC's Temperature Probes. Manufactured exclusively by Measurement Research Corporation, the MRC Temperature Probe provides the data for decisive management of roadway truck traffic and the minimization of pavement damage.

MRC Temperature Probes have been in use by local, state and federal government agencies since 1986, and includes all of the FHWA/SHRP LTPP test sites in the US and Canada. They are used for load restriction monitoring and frost depth measurements. They are also being used in research projects ranging from pavement and subgrade temperature profile measurements used with FWD data in the on going SHRP LTPP study to global warming research and permafrost studies. They are even being used in Skagit County, WA to help optimize dairy shipments while British Columbia, Canada is building a district wide coverage of remote access units for thermal mapping applications as well as spring load restriction control. Other applications have included monitoring temperatures at specified depths in toxic fuel and waste sites, at housing construction sites where settlement due to permafrost exists, in conjunction with non-destructive testing, (NDT) and at airports (aprons) to detect maximum runway apron loads during freeze-thaw weather conditions. Other more esoteric applications include snow depth and water elevation in streams and rivers.

The Measurement Research Temperature Probe was developed in 1982 as a direct result of the need for local agencies to monitor annual cyclic changes in pavement subgrade

temperatures, specifically the freeze-thaw-phenomena. This information has provided data for decisive management of roadway load restrictions resulting in minimization of pavement damage caused by spring thaw cycles. Emphasis was placed on providing a rugged, easy to use system that would result in the direct sampling of temperatures below the pavement at specific critical depths.



The temperature accuracy is 0.1 °C and the probe can have any number of sensors and can be built to any length. All orders are custom built and MRC has build probes from 6 inches to 30 feet in length with as many a 30 sensors. The probe sensors can also be calibrated to an accuracy of 0.01 °C if desired. All probes have only four electrical leads.

The probes are 1.1 inch in outside diameter and are encapsulated in a clear PVC tube filled with a clear epoxy. They are virtually indestructible and can be installed within a separate tube or directly into the ground. There is also a choice of a top mounted

connector, which allows for the moving of a single probe to multiple locations or a side mount lead wire for permanent installations.

MRC Temperature Probes are designed to perform under severe environmental conditions over a range of -30 to +75 degrees C. These units use a thermistor as the temperature-sensing element. The standard probe is 1.1" in diameter and 48" long with 11 sensors located at 0, 3, 6, 9, 12, 18, 24, 30, 36, 42, and 48 inches. All probe assemblies are potted within a clear, schedule 40 PVC pipe, allowing for a completely encapsulated environment and ensuring a long installation life. The TP101 is accurate to  $\pm 0.1$  Degrees C. The sensors are directly accessible through an underwater, four-pin connector and desired amount of cable and can be connected to any Data Logger. Communication cable may be either top or side mounted. On request, probe assemblies may be ordered without the standard connector, (open leads) for interface to your specific data logging hardware or with the connecting cable either side or top mounted.

Each probe is made up of one or more 12 by 1 inch circuit boards, consisting of electronic switching circuitry that enables each thermistor to be read sequentially from the top of the probe. One inch thermistor spacing on each board is possible, allowing for individual custom probe design. Current maximum length per probe is 20 feet. Longer lengths are obtained by plugging one assembly into the other via end-mounted connector plugs. If

insufficient depth is encountered at the time of installation, each board is designed with a six inch cut off point.

Terminal cables are soldered to the top board of the probe and each assembly is then tested thoroughly before potting. Each assembly is then potted in epoxy within a one inch diameter clear schedule 40 PVC pipe. The probes take a three day epoxy cure allowing for a completely encapsulated environment and ensuring a long installation life. Current in place installations have exceeded 15 years without failure.

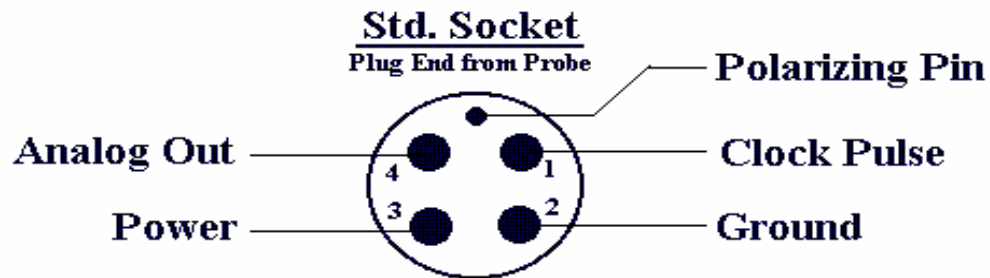
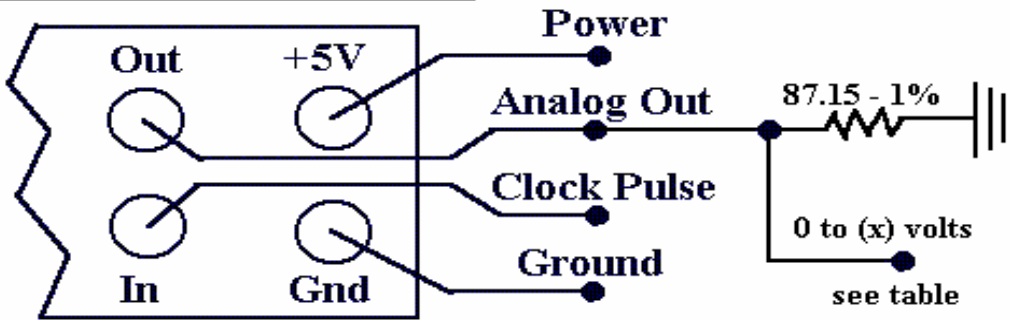
The thermistors are directly accessible through a four conductor electrical lead. Each thermistors data point is read sequentially on a single lead by supplying TTL level clock pulses to a second lead wire. The clock circuitry is reset by turning the power on and off. The third and fourth leads are the 5 volt power and the electrical ground. The last sensor on each temperature probe is a fixed Vishay precision resistor which is used as a calibration reference point between the probe and the datalogger.

Custom modifications or options include longer and shorter probe lengths, varying the spacing of the thermistors and the addition of up to three external, stainless steel encapsulated thermistor "pigtailed". Please call and let us know what your individual applications needs are. Almost all of our probes are custom built.

**TP101/105 (Temperature Probe)**

- Std. Dimensions:* .....1.1" diameter, 48" length
- Accuracy:* TP101 ..... $\pm 0.1^\circ$  C @ -30 to +75° C - YSI 440032
- Accuracy:* TP105 ..... $\pm 0.2^\circ$  C @ -30 to +75° C
- Operating Temp* .....-30 to +75 Deg. C
- Operating Humidity* .....0 to 100%
- Power Requirements* .....15uA Stand-By - 380uA w/Clock Pulse High
- Interconnection* .....Underwater connector or open leads

## End of Temperature Probe



Power = +5 volts PRECISION POWER - 0.05% \*  
(Controls accuracy of temperature sensors)

\* If the voltage is being monitored and used in the scaling any 5 volt source will work

Reset = Toggle power on/off

Calibration Scale = See YSI Specifications

### YSI Specifications - 440032

#### Resistance Versus Temperature -40° to +60° C

|            |            |            |            |            |
|------------|------------|------------|------------|------------|
| Temp° Res  | Temp° Res  | Temp° Res  | Temp° Res  | Temp° Res  |
| -40 884.6K | -20 271.2K | 00 94.98K  | +20 37.30K | +40 16.15K |
| -39 830.9K | -19 256.5K | +01 90.41K | +21 35.70K | +41 15.52K |
| -38 780.8K | -18 242.8K | +02 86.09K | +22 34.17K | +42 14.92K |
| -37 733.9K | -17 229.8K | +03 81.99K | +23 32.71K | +43 14.35K |
| -36 690.2K | -16 217.6K | +04 78.11K | +24 31.32K | +44 13.80K |
| -35 649.3K | -15 206.2K | +05 74.44K | +25 30.00K | +45 13.28K |
| -34 611.0K | -14 195.4K | +06 70.96K | +26 28.74K | +46 12.77K |
| -33 575.2K | -13 185.2K | +07 67.66K | +27 27.54K | +47 12.29K |
| -32 541.7K | -12 175.6K | +08 64.53K | +28 26.40K | +48 11.83K |
| -31 510.4K | -11 166.6K | +09 61.56K | +29 25.31K | +49 11.39K |
| -30 481.0K | -10 158.0K | +10 58.75K | +30 24.27K | +50 10.97K |
| -29 453.5K | -09 150.0K | +11 56.07K | +31 23.28K | +51 10.57K |
| -28 427.7K | -08 142.4k | +12 53.54K | +32 22.33K | +52 10.18K |
| -27 403.5K | -07 135.2k | +13 51.12K | +33 21.43K | +53 9807   |
| -26 380.9K | -06 128.5K | +14 48.84K | +34 20.57K | +54 9450   |
| -25 359.6K | -05 122.1K | +15 46.67K | +35 19.74K | +55 9109   |
| -24 339.6K | -04 116.0K | +16 44.60K | +36 18.96K | +56 8781   |
| -23 320.9K | -03 110.3K | +17 42.64K | +37 18.21K | +57 8467   |
| -22 303.3K | -02 104.9K | +18 40.77K | +38 17.49K | +58 8166   |
| -21 286.7K | -01 099.80 | +19 39.99K | +39 16.80K | +59 7876   |

## **ORDER INFORMATION**

**Pricing available on request.**

Please call (253) 851-3200 or email [patty@mrc-corp.com](mailto:patty@mrc-corp.com) for desired configuration, number of probes and availability. State probe length, cable length, number of temperature data points and spacing needed.