



# DST500 Digi-Stem® Thermometer

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## User Manual



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WD1033 Rev D

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# DST500 INSTRUCTION MANUAL

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## 1. **Application and Key Features**

The Wahl DST500 is designed for temperature monitoring applications where a high degree of accuracy and ease of use are desirable. To achieve this objective the DST500 incorporates the following features:

- High reliability, 4-wire, 100 ohm,  $.00385\Omega/\Omega/^\circ\text{C}$ , thin-film platinum RTD sensor per DIN EN 60751, Class A.
- High accuracy 24-bit Delta-Sigma Analog/Digital Converter.
- Probe Error checking: Checks for open wire, open sensor, shorted sensor, incorrect wiring.
- Programmable R0: Allows programming of the sensing probes specific R0 value into the meter for accurate temperature calibration.

## 2. **Installation – Caution! See important information regarding Lithium Batteries on the enclosed document #WD1053, before proceeding!**

Your unit was shipped assembled and ready for out-of-box usage. Units with long probes or remote cables may be shipped unassembled. Prior to installation verify the display is operational and remove the protective film from the window. In the event the display is not operational, check that the battery is seated properly by following the battery installation procedure, section 3. Extremely rough handling conditions during shipment may have dislodged the battery.

### 2.1. Meter Mounting – Fixed Probe

Fixed probes may be mounted by the threaded fitting or sanitary clamp into the process. Apply thread sealing compound or Teflon tape to the threaded fitting as required. Units with swivel nut fittings or adjustable angle stems may be adjusted after installation for best viewing angle.

**Caution!** Do not rotate Digi-Stems with adjustable angles more than  $360^\circ$  in one direction as wire breakage may occur. See section 2.5 for adjustment procedure.

**Caution!** Do not use the Digi-Stem enclosure to tighten meter. Use a wrench on the coupling nut for tightening.

### 2.2. Meter Mounting – Remote Probe

An optional mounting bracket is available for mounting remote meters to walls, panels, pipes, etc. The mounting bracket may be attached by the top or rear surface with user provided mounting screws, clamps, etc. The mounting bracket is available in 2 styles, p/n DSA3030, without ground lug and DSA3031, which includes a grounding lug for grounding of the meter when the probe will not be grounded.

2.2.1. For remote mounting:

2.2.2. Mount the bracket with the Digi-Stem mounting screw towards the bottom (Fig. 1). The Digi-Stem's coupling nut should be inserted from the top, with the display facing out and secured with the Digi-Stem mounting screw.

2.2.3. For remote cables with a connector at the meter end, disconnect the cable connector from the meter connector, insert the meter's

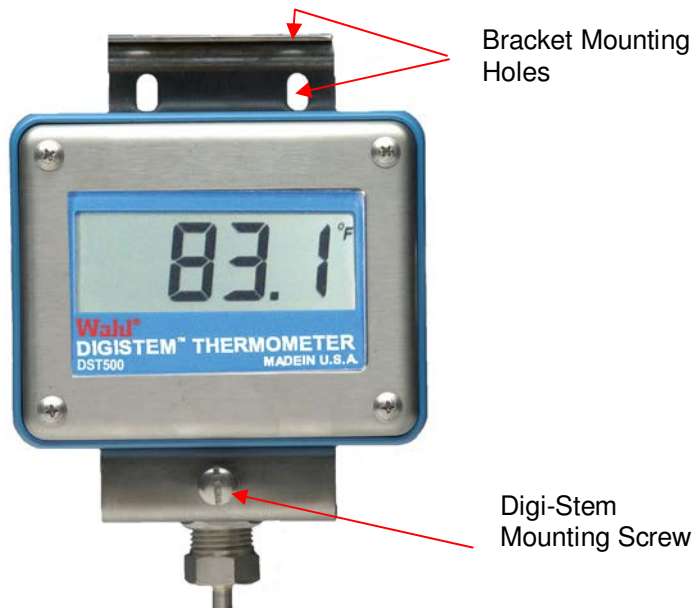
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coupling nut through the top hole of the mounting bracket and secure with the large slotted screw. Re-connect the cable and secure.

2.2.4. For remote cables without connectors, it is recommended to install the meter prior to installing the probe. This will prevent the probe cable from twisting during the threading of the probe fitting into the meter housing. Before connecting the probe to the meter, insert the meter's coupling nut through the top hole of the mounting bracket and secure with the large slotted screw. Apply thread sealing compound or Teflon tape to the cables ½" NPT meter fitting, feed the wires up through the coupling nut and into the meter housing and thread the probe's meter fitting into the Digi-Stem's probe coupling nut and secure.

**Caution!** Do not use the Digi-Stem enclosure or bracket as a wrench. Hold the coupling nut with one wrench and tighten the remote cable nut with another wrench.

**Note:** If battery power is on, the unit will display "CbL4" when the cable is disconnected, indicating an open sensor. It will self-correct when the cable is reconnected.



*Fig. 1*

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## 2.3. Wire Connections – Remote probes w/o connector or uninstalled fixed probe.

2.3.1. Loosen the four Phillips head screws in the front cover until the cover is removed.

**Note:** The screws are held captive by retaining washers and should not be removed completely.

2.3.2. Remove the 4-pin pluggable terminal strip connector (J1) from the PCB mating connector and connect probe wires as follows (Fig. 3).

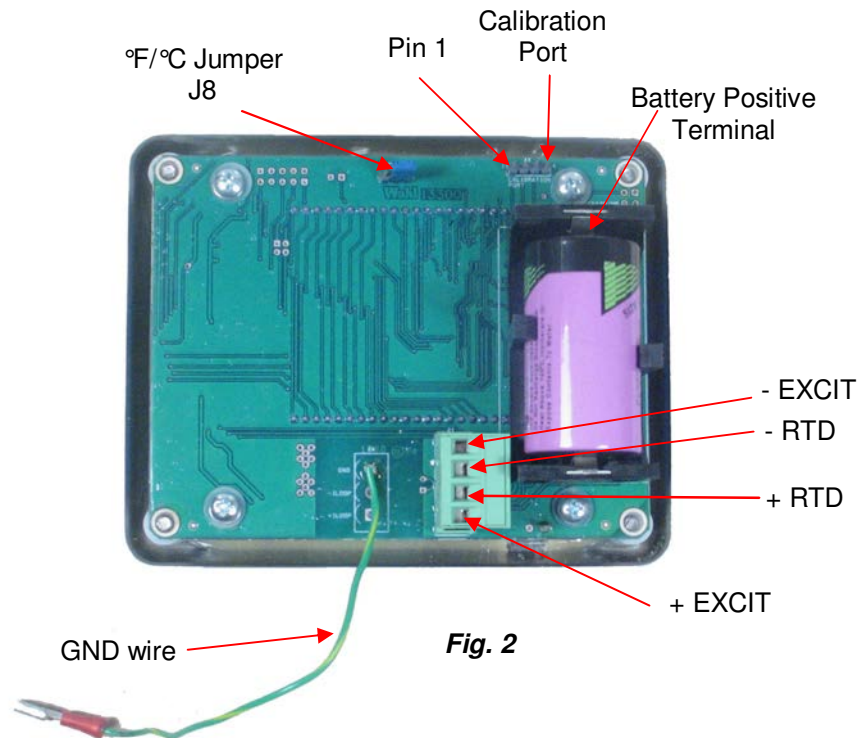
J1 – DST500 Probe Wiring

Pin #	Label	Fixed Probe	Remote Probe
1	+ EXCIT	WHITE	BROWN
2	+ RTD / TC	WHITE	WHITE
3	- RTD / TC	BLACK	BLUE
4	- EXCIT	BLACK	BLACK

2.3.3. Re-connect pluggable terminal strip to PCB connector J1.

2.3.4. Install battery with polarity as indicated on battery holder.

2.3.5. Replace cover on Digi-Stem enclosure and secure with four screws tightened to a force of 4 to 5 in-lbs. of torque.



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## 2.4. Ventilation

2.4.1. The DST500 should be installed in an area of adequate air exchange so that the specified ambient conditions are not exceeded.

## 2.5. Adjustable Angle Probe – Adjustment

2.5.1. For rotational adjustment, loosen the two long Phillips head screws on the ends of the bracket and rotate the bracket around the coupling nuts. Tighten screws when position is set to the desired location.

**Caution!** Do not rotate Digi-Stems with adjustable angles more than 360° in one direction as wire breakage may occur.

2.5.2. Angular adjustment, loosen the two short phillips head screws in the center slots and pivot the bracket to the desired angle. Tighten screws.

## 3. Battery Installation/Replacement

The DST500 uses a single 3.6V Lithium Thionyl Chloride battery, Wahl Catalog # DSA3060. Low battery is indicated by “LOW BATT” displaying in the lower right corner of the display. (Fig.3) This indicates approximately 4-6 weeks of battery life left. Actual time will vary dependent on Display Update Rate Setting.

3.1. For installation or replacement, loosen the four phillips-head screws in the front cover until the cover is removed.

**Note:** The screws are held captive by retaining washers and should not be removed completely.

3.2. Remove old battery and dispose of in accordance with local, state and federal regulations.

3.3. Insert new battery, Wahl Catalog # DSA3060, with polarity as indicated on battery holder. Positive terminal should be at the top of the PCB.

3.4. Replace cover on Digi-Stem enclosure and secure with four screws tightened to a force of 4 to 5 in-lbs. of torque.



*Fig. 3*

## 4. Operation

4.1. Scale Selection °F/°C - Temperature scale is user selectable via jumper J8 (Fig. 2) on the Printed Circuit Board (PCB). The scale is indicated in the upper right corner of the display (Fig. 3).

4.2. Making measurements - With the batteries installed and probe connected the meter automatically updates the display with the most recent

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measurement. Factory default for measurement sample/display rate is 1 per second.

- 4.3. Error Codes - During normal operation, the DST500 continually performs diagnostic testing on the sensor lines. Errors are indicated by the following error codes:

DST500 Display Error Codes

Error Code	Description
HI	Reading is above meters usable range
LO	Reading is below meters usable range or sensor is shorted
CbL1	Indicates cable 1 is open (J1 pin 1)
CbL2	Indicates cable 2 is open (J1 pin 2)
CbL3	Indicates cable 3 is open (J1 pin 3)
CbL4	Indicates cable 4 is open (J1 pin 4), or open sensor
- - -	Indicates Low Battery Shutdown Mode

### 5. Calibration

As with all electronic RTD thermometers, there are two main components to the system. The first component is the electronics, which measures the resistance of the sensing element and then converts this resistance value to a temperature indication. The second component is the probe, also referred to as the sensor. The probes sensor resistance changes as its temperature changes. This change is in conformance to the DIN EN 60751 Class A standard. As in all manufactured goods, there are slight variations in the finished parts. A key variable of RTD sensors is its resistance at 0°C, referred to as “R0” value. Once this value is measured, it may be programmed into the meter to correct the temperature conversion algorithm. Programming and/or calibration require the use of the DSTPROG or DSTCAL software package. These packages include the USB cable, USB/DST Interface Box and DST calibration cable. DSTPROG programming software includes the ability to set the Sample Rate and R0 value. DSTCAL includes this plus calibration of the meter and/or calibration of the system (probe with meter). The DST500 uses the following methods for calibration. For more details on the calibration, see the DSTPROG/DSTCAL software manual, WD1037.

- 5.1. Ohm Meter calibration – Ohm Meter calibration is a 2-point calibration, which calibrates the DST500 electronics. It requires a NIST traceable precision resistance source with a known accuracy of  $\pm 0.03$  ohms at 50.00 and 280.00 ohms. Resistors used should have a temperature coefficient of  $<5.0$ -ppm.
- 5.2. Probe (system) calibration - Probe calibration is a single point calibration that is performed by placing the probe into an ice bath and following the on screen prompts of the DSTCAL software. The DST500 and software will measure the probes R0 value and program it into the DST500

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memory. After the system calibration is completed, the calibration should be checked at the temperatures of interest to the end user, using calibrated accurate standards and calibration baths.

5.2.1. DST500 calibration adjustment - Calibration is accomplished via the DSTCAL software package and associated hardware interface. Method 1 may also be performed with the DSTPROG software. An optional cable extension, p/n 13500-04 is available for convenience in calibrating fixed probes. The optional cable extension is not required for remote cables as the remote cable itself serves this purpose.

The two methods of calibrating a meter with probe as a system are:

- 5.2.2. Method 1- Calibration using external ohmmeter and ice bath  
The first method uses an ice bath and high accuracy ohmmeter along with the DSTCAL software.  
For fixed or remote probes:  
1) Disconnect the probe from the meter and place the probe in an ice bath or 0°C circulating bath. Allow stabilization.  
2) Using a high accuracy ohmmeter, measure the probes R0 value. (resistance at 0°C)  
3) Connect the meter to the PC via the 13506 Interface Module.  
4) Enter the probes measured R0 value into the R0 box, under the Module Calibration Data section. Press "Set" to program the DST500 memory with this value.  
NOTE: For this method, with fixed probes, the 13500-04 extension cable is not required.
- 5.2.3. Method 2 - Calibration using DST500 and ice bath  
The second method is to use the DST500 meter to acquire the R0 value. For fixed probes, this method is made easier, by using the 13500-04 extension cable.  
1) For fixed probes, disconnect probe from meter, and install the 13500-04, extension cable between the probe connector and the meter PCB connector. This allows the meter to be placed on a bench, rather than dangling above the ice bath. Place the probe in an ice bath. Allow stabilization.  
For remote probes, place the probe in an ice bath. Allow stabilization.  
2) Connect the meter to the PC via the 13506 Interface Module.  
3) Select and run the "Probe (system) Calibration" program and follow the on-screen prompts. A running average of R0 is displayed in the R0 box. Press "Capture R0" to freeze the reading then press "Yes" to store the measured value into the DST500 memory.




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NOTES: 1) When using this method, the DST500 meter may display erratic readings during the measurement of the probes resistance. This is normal and does not affect the measurement.

2) During the acquisition process, the software continues to take samples after the 10<sup>th</sup> sample. This running average allows the user to verify the probes stability. If this reading continues to change in the same direction, then stability has not been achieved.

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## 6. Specifications




### Meter Specifications and Accessories

DST500 & DSX500 RTD METER SPECIFICATIONS		
Model	DST500	DSX500
	<i>Meter with Local Display</i>	<i>Meter with Local Display and 4-20mA Transmitter</i>
<b>Meter Range</b>	-328° to 1472°F (-200° to 800°C)	
<b>Scale</b>	User Selectable for °F or °C	
<b>Meter Accuracy</b>	± 0.1°F/C, over 1-year period (@ Tamb = 23°C ± 5°C)	
<b>Meter and Probe Accuracy</b>	Temp < 300°F (148.8°C) = ± 0.3°F (± 0.2°C), Temp > 300°F (148.8°C) = ± 0.25% of reading	
<b>Display</b>	1.0" 4-digit LCD display with icons for °F, °C and Low Battery	1.0" 4-digit LCD display with icons for °F and °C
<b>Display Resolution</b>	0.1°F/C, 1°F above 999.9°F	
<b>Sample/Display Rate</b>	2 seconds standard, adjustable in .25 second intervals from .25 to 10 seconds	
<b>Ambient Operating Environment</b>	-40° to 158°F (-40° to 70°C), 10% to 100% RH non-condensing, Vibration - MIL STD 202G	
<b>Ambient Temperature Coefficient</b>	Maximum of 0.003%/°C over Ambient Operating Temperature Range from 23°C ± 5°C	
<b>Enclosure</b>	Stainless Steel and Polycarbonate (NEMA 4X), Weight: 2 lbs. (1kg) Dimensions: 5.3" W x 4.3" H x 2.7" D (13.5 x 10.9 x 6.9 cm).	
<b>Sensor/Probe</b>	<ul style="list-style-type: none"> <li>• Sensor - 4-wire RTD, R0 = 100Ω, Alpha = .00385 Ω/Ω/°C</li> <li>• 304 or 316 Stainless Steel Probe construction</li> <li>• Fixed Stem Probes or Remote probes with rugged IP68 connection system</li> </ul>	
<b>CE Approval</b>	Yes	CE approved with loop power cable installed indoors and < 30m
<b>Battery / Power Supply</b>	One Lithium Thionyl Chloride "C" battery	Loop Powered 10-36VDC
<b>Battery Life</b>	4 years nominal at 2 second update interval	N/A
<b>4-20mA Output</b>	No	Yes
<b>Output Accuracy</b>	N/A	± 0.2°F/0.1°C
<b>Output Scaling</b>	N/A	Factory or user programmable with DST Software Kit
<b>Output Connection</b>	N/A	1/2" NPT Female

Specifications subject to change without notice

DST/DSX500 Series Software and Accessories	
<b>DSTCAL</b>	DST/DSX500 Series Calibration Software Kit
<b>DSTPROG</b>	DST/DSX500 Series Programming Software Kit
<b>12360-002</b>	DST/DSX500 Series Interconnect Calibration Cable: 2 meter length - 4 conductor
<b>13500-04</b>	DST/DSX500 Series Fixed Probe Calibration Cable
DST/DSX500 Series Meter Accessories and NIST Traceable Certificate of Calibration	
<b>DSA3030</b>	Wall Mount Bracket (for Remote Mount units)
<b>DSA3031</b>	Wall Mount Bracket (for Remote Mount units) with Grounding Lug
<b>DSA3032</b>	Security Screw Kit (Screws, washers, security wire seal, instructions. Installed when purchased with meter)
<b>DSA3033</b>	Security Wire Seals, 10/pack, Toolless, 8", SS Wire
<b>DSA3060</b>	Spare Lithium Thionyl Chloride "C" Battery
<b>DS-M</b>	Calibration & Firmware Upgrades (Upgrades if applicable, included in price)
<b>DST5NIST</b>	NIST Traceable Certificate of Calibration of System & Firmware Upgrades* - Standard Set Test Points
<b>DST5NIST-1</b>	NIST Traceable Certificate of Calibration of System & Firmware Upgrades* - User Specified Test Points
<b>DSX5NIST</b>	NIST Traceable Certificate of Calibration of Transmitter Unit/System & Firmware Upgrades*
<b>13146</b>	90 Degree Elbow for Fixed units, Specify "B" Back Angle, "L" Left Angle, "R" Right Angle
<b>13510</b>	Adjustable Stop Kit - for mounting on side of evaporation pans




13146 90° Elbow

\*Upgrades if applicable, are included in price

Complete Calibration Services Available

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**7. Service**

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