ΩΞ OMEGA®

User's Guide

DP9800-TC & DP9800-RTD
Temperature Monitor

ΩΞ OMEGA®

OMEGAnet® Online Service omega.com	Internet e-mail info@omega.com

Servicing North America:

U.S.A.:
ISO 9001 Certified
Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
Stamford, CT 06907-0047 USA
Toll Free: 1-800-826-6342   TEL: (203) 359-1660
FAX: (203) 359-7700   e-mail: info@omega.com

Canada:
976 Bergar
Laval (Quebec), H7L 5A1 Canada
Toll-Free: 1-800-826-6342   TEL: (514) 856-6928
FAX: (514) 856-6886   e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada: Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®
Engineering Service: 1-800-872-9436/1-800-USA-WHEN®

Mexico/
Latin America:
En Español: 001 (203) 359-7803   FAX: 001 (203) 359-7807
info@omega.com.mx   e-mail: espanol@omega.com

Servicing Europe:

Benelux:
Managed by the United Kingdom Office
Toll-Free: 0800 099 3344   TEL: +31 20 347 21 21
FAX: +31 20 643 46 43   e-mail: sales@omegaeng.nl

Czech Republic:
Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342   TEL: +420-59-6311899
FAX: +420-59-6311114   e-mail: info@omegashop.cz

France:
Managed by the United Kingdom Office
Toll-Free: 0800 466 342   TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27   e-mail: sales@omega.fr

Germany/ Austria:
Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0800 6397678   TEL: +49 (0) 7056 9398-0
FAX: +49 (0) 7056 9398-29   e-mail: info@omega.de

United Kingdom:
ISO 9001 Certified
OMEGA Engineering Ltd.
One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD United Kingdom
Toll-Free: 0800-488-488   TEL: +44 (0) 161 777-6611
FAX: +44 (0) 161 777-6622   e-mail: sales@omega.co.uk

Contents

Temperature measurements made with the DP9800 are in accordance with IEC584 & IEC751, ITS90 refers.

Information in this publication may be subject to change.

1.   About the DP9800

DP9800 USB DIGITAL THERMOMETER/DATA LOGGER

The DP9800 thermometers can be used in conjunction with a PC to provide accurate, versatile 8 channel temperature measurement, scanning and logging of measured values. It can also be used as a 'stand alone' 8-channel indicator/logger and incorporates a digital display of measured temperature.

The integral, self-calibration checking facility for the thermocouple version is a rapid and convenient method for on-site calibration checking and does not require any additional equipment other than a special, external link. Self-calibration of RTD ranges is equally simple and uses plug-in precision resistors.

The DP9800 is designed to provide exceptional stability with high measurement resolution and represents an ideal crossover between plant practicality and laboratory performance at a very competitive price.

The PC software supplied with the instrument allows control, measure, logging and calibration functions.

2. Installation

Front panel

Rear Panel

DP9800-TC

DP9800-RTD

Supply connection

The DP9800 operates from a 6 to 9V dc supply. A suitable 90 to 250V 50/60Hz adaptor is supplied with the instrument, complete with alternative pin configurations for international supply outlets.

Connect the adaptor output jack to the supply input socket on the rear panel; *an on-off switch is not fitted, simply connect the supply.*

Communication interface

Connect the USB cable supplied between the instrument and the PC.

Sensor connections

DP9800-TC, thermocouple inputs

DP9800-TC

Only the appropriate, miniature (flat pin) , colour coded and polarised thermocouple plug can be used for each input. Any type of thermocouple (eg K,N,T etc) can be connected to any input but each must be terminated in the correct type of plug, colour coded to suit the attached thermocouple type. The particular thermocouple type must be selected for each channel via the PC software.

Any unused input channels are simply ignored; in such cases, the appropriate channel display will indicate an upscale (high value) reading on both the instrument front panel and in the PC control panel.

DP9800-RTD, RTD inputs

DP9800-RTD

The DP9800 uses a 3-wire configuration for each input and connections are made to 'plug-in' terminal blocks. If a 4-wire probe is used, the 4th wire (either red or white) is left unconnected and , if necessary, insulated to avoid any cross-connection contact.
If a 2 wire connection is used, connect the red and white wires as shown in the diagram and link terminals C & B.

Sensor connections can be made with the terminal block in-situ (plugged in to the rear panel) or the block can be unplugged from the instrument if preferred.

Any unused inputs are simply ignored; in such cases, the appropriate channel display will indicate an upscale (high value) reading on both the instrument front panel and in the PC control panel.

5
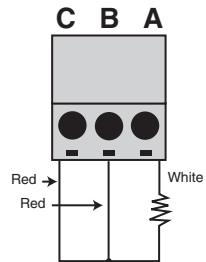
3.   Operation

The DP9800 can be used with or without a PC as required. For the optimum accuracy, especially in the case of the thermocouple version (DP9800-TC), the instrument should be allowed due time to 'settle' in the ambient temperature of its location before use. This is important if it is moved between locations of greatly different ambient temperatures.

a) Stand alone without PC

With power and sensor(s) connected, the instrument can be simply used as a convenient, accurate single or multi-channel digital thermometer. *It can also be used on a stand alone basis even if it has been configured for logging; in this case, the message 'logging' will appear on the display at 'power up'.*

On-board logging can be started without the need for connection to a PC; press the front panel key just before connecting power to the instrument and keep it pressed for a few seconds after power-up until 'logging' appears on the display. Logging commences and up to 512 sets of 8 channel readings can be stored. The logging interval will be whatever value was last selected via the PC software.

Logging will cease when the instrument is powered-down or when 'off' is selected from the PC with communications established. Stored data can be downloaded to file (in .csv format) on the PC by clicking 'download' in the system configuration window.

The single front panel key can be pressed sequentially to select any required channel or, when pressed for 3 seconds, will initiate auto scrolling through all channels. The channel number is displayed along with the temperature indication from the sensor connected to that particular input.
If any additional functions are required, e.g. configuration, logging set-up or calibration, then it is necessary to use a PC running the user software and connected via the USB interface.

b) Use with a PC

For use with a PC, the software supplied with the DP9800 must be installed on the PC and communication established via the USB lead supplied (online, green indicator flashing). System requirements for installing the DP9800 software: Windows XP with at least one USB port. All WINDOWS operating systems prior to XP do not support USB natively and are not recommended.

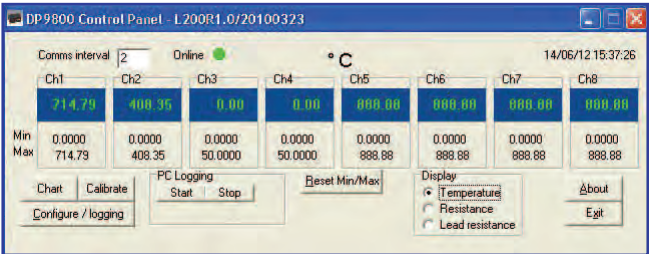Create a folder for the software; logged data will be saved to this folder.

Connect the USB cable supplied between a PC USB port and the DP9800 USB port before running the PC software.

Control panel

In the DP9800 software window, double click on the 'DP9800 Control Panel' icon. The following window is opened:
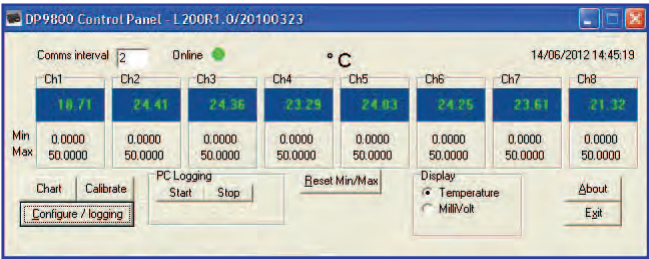
DP9800-TC Control Panel

DP9800-RTD Control Panel

The online indicator flashes green when communications between the DP9800 and the PC are established (see System configuration on next page).

The PC software automatically opens the Control Panel appropriate to either the DP9800-TC or DP9800-RTD as connected. To reset at any time, if needed, click on 'Refresh' in the System Configuration (config/logging) window.

The eight channels readout will display either temperature or millivolts (DP9800-TC) or Ohms (DP9800-RTD) is selected in the 'display' box on the control panel.

Sensor selection

To find out which type of thermocouple is selected for each channel with the DP9800-TC, simply double click on the channel readout; the selection can be simply changed by clicking on the arrow in the 'T/C type' box and clicking on the desired type and then 'send'.

Note: The 'calibration' box in the window, may show y =mx +c with pre-determined values for m&c which are offset correction values allocated during production. These must not be altered and can be ignored.
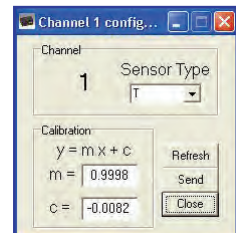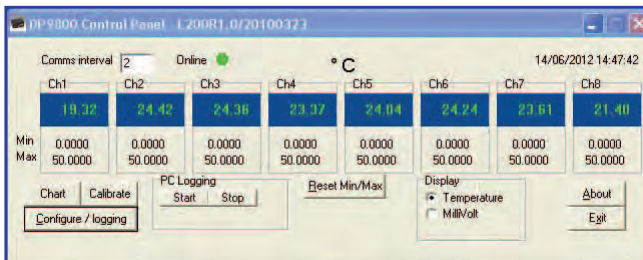
DP9800-TC, configure thermocouple type
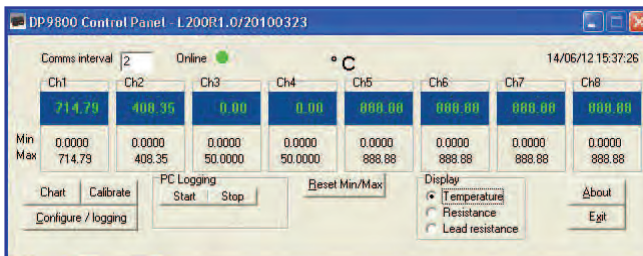
DP9800-RTD Control Panel

Sensor selection is not applicable to the DP9800-RTD which is configured for RTD, 3 wire on all inputs.

System configuration:

Click on 'configure/logging' in the lower, left-hand corner of the window; the following 'system configuration' window is opened (the same window for '-TC' & '-RTD':

DP9800 System configuration

In this window, the Comms Port is selected and instrument settings are made.
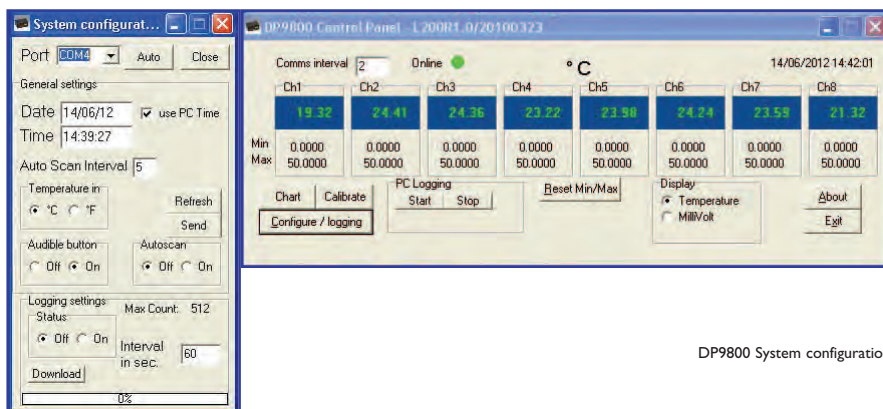
Comms Port – Select the required port if this is not done automatically.

The online indicator flashes green when communications between the DP9800 and the PC are established.

DP9800 settings

i) The DP9800 internal clock date & time are set to user defined values or PC clock if 'use PC Time' is checked. The internal clock can be set by the user; PC or Internet date & time can be set in the DP9800 internal clock by checking the 'PC time' box & clicking 'Send', unchecking 'PC time' & clicking 'Refresh'.

ii) Auto Scan interval can be entered (2 to 10 seconds) and Autoscan switched on or off.

iii) °C or °F are selected.

iv) Instrument button 'beep' can be selected or switched off. When settings are completed, click 'send' and close the system configuration window. Changes to settings can be made at any time.

Chart display

For a chart (analogue) display of the last 40 readings all 8 channels, click on chart; x and y axes are auto-scaled to suit readings. The chart can be opened and closed as required. The chart displays a plot of the last 40 readings taken from all 8 channels by the instrument.
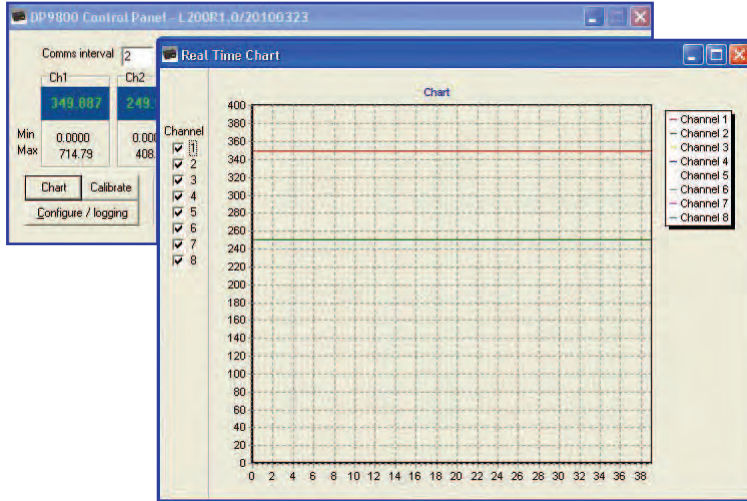
DP9800 Chart

Logging

Logging can be carried out on one of two bases;

c) Real-time PC logging is started by clicking 'Start' in the control panel at any time, and stopped by clicking 'Stop'. Readings are saved in Notepad in '.csv' format, in the same folder as that in which DP9800 software resides.

The value of the display on the main window will be logged on the PC. This could be temperature millivolts or resistance depending on the display setting in the main window.
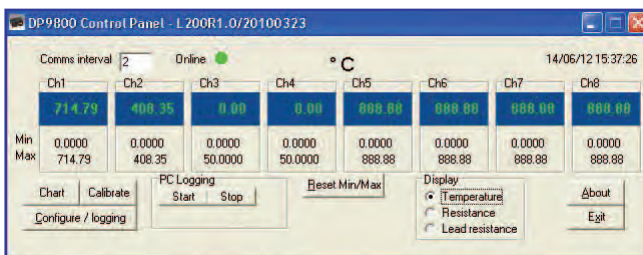
DP9800-TC Control Panel shown; logging key is the same for DP9800-RTD

d) DP9800 on-board logging is set up by clicking 'Configure/logging' in the control panel. The following 'logging control' window is opened.
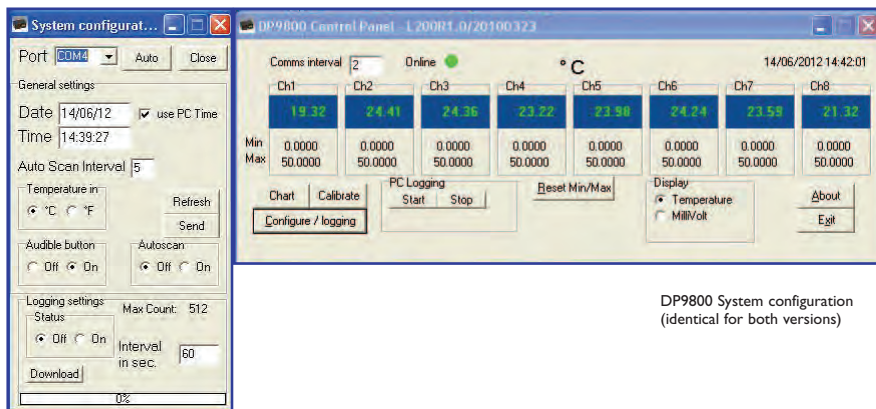
DP9800 System configuration
(identical for both versions)

The logging interval for each chanel is set up (common) and sent to the instrument by clicking 'send'.

Logging is started by selecting 'on' in the 'status' box and clicking 'send'. It is stopped by selecting 'off' and clicking 'send'.

Logged readings are downloaded to file in '.csv' format in the PC by clicking 'download'. Downloading takes approximately 2.5 minutes; status is indicated in the window. The file will be created in the same folder as used for the PC software.

The PC connection is not required during logging, only when configuring the logging regime.

Alternatively, logging will commence immediately when the front panel key is pressed at the same time as the instrument is powered up. Logging will cease when the instrument is powered down.

The DP9800 can be used 'manually' during logging, ie. channels can be selected individually (or auto-scanned) via the front panel key for temperature readings.

When the on-board, logged values memory is full (512 sets of 8 readings), those readings stored first will be overwritten by new values.

Calibration Checking

The DP9800 is designed to be highly accurate and highly stable as indicated in the specification. Self-calibration is performed during each A/D (analogue to digital) conversion cycle for example; routine re-calibration is basically unnecessary. **However, a calibration checking facility is incorporated in the DP9800-TC and this allows the user to easily and conveniently ascertain if re-calibration is necessary.** This feature will also provide validation of calibration without the need to submit the instrument to a certified laboratory, an expensive and time consuming procedure. All that is required in terms of additional equipment for this purpose is a calibrated DVM (digital voltmeter).

Caution. Re-calibration of the DP9800-TC requires highly accurate calibration equipment; normal thermocouple instrument calibrators are not sufficiently accurate for this purpose. Please contact our Technical Sales Department for guidance on re-calibration.

It is important to allow due time for all items to stabilise at the ambient temperature before proceeding; this is especially important if any items have been moved from a location with a different ambient temperature.

The DP9800-PT simply requires the use of 2 precision resistors to achieve the same level of calibration accuracy. However, these resistors are of exceptionally close tolerance; please contact our Technical Slaes Department for guidance.

1. **Quick calibration check – thermocouple version (DP9800-TC)**

    PC software must be running and the USB lead connected between DP9800 and PC with communications established (online indicator in the the control panel flashing green).

    a) Connect the 'Ref' link supplied to the 'Ref' output on the rear panel and to any of the input sockets as required (it is logical to start with input 1)

b) In the main control panel, click 'millivolt' in the display box (just below ch6 readout) The DP9800 display will show the corresponding temperature for a 10mV input to the relevant channel; they can be ignored during this procedure.
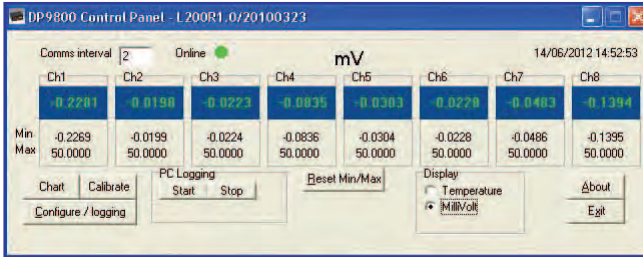
DP9800-TC, milliVolts

c) Observe the readout value of the chosen channel input. If the calibration of the instrument is correct, the readout will indicate 10.00(00).
Note: The 'ref' value is 10.00mV; the least significant two digits indicated in the control panel display are 1µV and 0.1µV respectively i.e. a display of say, 10.0085 indicates an 'error' of 8.5µV in 10.00mV which is negligible and well within specification. In fact, any digits following 10.00(x,y) can be ignored.

d) Repeat a) and c) above as required for other inputs

e) Disconnect the 'ref' link from the jack and the channel input socket.

f) Click 'temperature' in the Display box to resume normal measurement.

In the unlikely event of re-calibration being deemed necessary please contact Omega or refer to the re-calibration procedure later in this section if suitable equipment and skills are available.

Note: Untrained personnel must not attempt re-calibration of the DP9800. Please contact Omega for more information.

2. Re-calibration – thermocouple version (DP9800-TC)

To be conducted only by authorised & trained personnel using the appropriate equipment. Unauthorised re-calibration may invalidate the instrument warranty and would invalidate any applicable calibration certificate.

The PC software must be running and the USB lead connected between the DP9800 and the PC with communications established (online indicator in the Control Panel flashing green);
Note: The next step will 'clear' the resident calibration data; this is a good time to check that everything is in place for re-calibration.

Click on 'calibrate' in the lower, left-hand area of the window. The following 'calibrate' window appears.
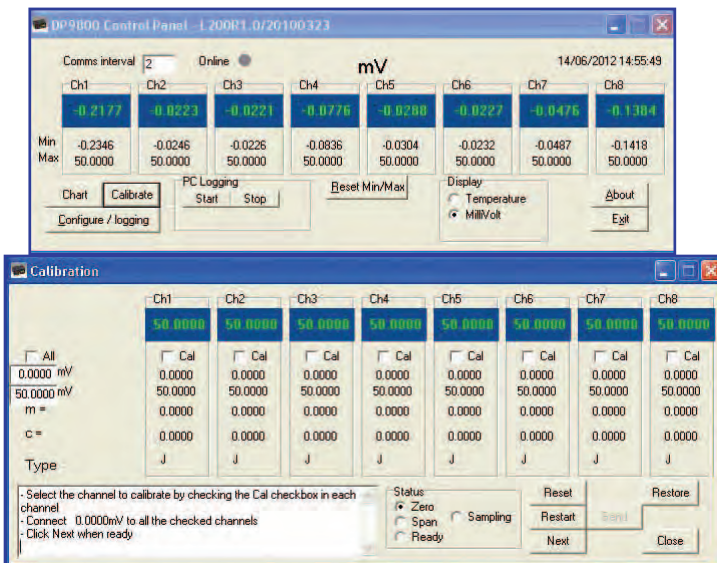
DP9800-TC, calibration

The CJC display value is for instrument set-up and for information only, it can be ignored.

Clear the existing calibration data by clicking 'Reset' for the selected channel in the 'calibration' window.

Zero & Span Calibration DP9800-TC

a) Link all eight thermocouple inputs in parallel and apply 0.0000mV signal to them. A 6½ digit DVM preferably UKAS certified should be used to check the applied voltage.

b) Click on the 'All' box to the left of the 'calibration' window (selects all channels for calibration). If preferred, individual channels can be calibrated by selecting and clicking on the appropriate tick box.

c) In the main control panel, click millivolt in the Display box (just below Ch6 readout).

d) Click 'reset' and 'restart' (this clears the existing calibration data and prepares the selected channel for calibration).

e) Click 'next' when ready.

f) Then follow the procedure as instructed in the dialogue screen to the lower left of the 'calibration' window for span calibration. A 50.0000mV signal is applied to the input(s). Click next when ready and follow the procedure instructed.

g) When the 50mV calibration is completed, click 'send' to complete the procedure.

h) Close the 'calibration' window.

i) Remove the mV source from the input connection(s) and re-connect sensors as required.

j) Click 'temperature' in the 'Display' box in the main Control Panel to resume temperature measurement.

Note: m & c values are allocated by the software which computes any measurement offset values to ensure precise calibration. These are not for user adjustment.

Factory calibration values can be restored if required by clicking on 'Restore' in the calibration window.

3. Quick calibration check – RTD version (DP9800-RTD)

The PC software must be running and the USB lead connected between the DP9800 and the PC.

With communications established (online indicator in the Control Panel flashing green);

a) Connect the 100.000 Ohm precision resistor between terminals A & B on input 1 (or other input to choice). Link terminals B & C with copper wire if a third wire is not fitted to the resistor.
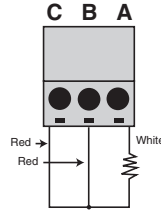
b) In the main Control Panel, click 'resistance' in the display box (just below ch6 readout). The DP9800 display will show the corresponding temperature for a 100 Ohm input (0°C) to the relevant channel; this can be ignored during this procedure.

DP9800-RTD Control Panel

c) Select the desired channel for calibration by clicking the appropriate check box.

d) Observe the readout value of the chosen channel. If the calibration of the instrument is correct, the readout will indicate 100.000 Ohms (the least significant digit is 1m Ohm and can be ignored.

Active input filtering is applied at a level determined by the software; time must be allowed for the reading to settle (up to 5 minutes). This is important during calibration procedures.

e) Repeat a) and c) above as required for other channels.

f) Repeat a) to d) above using the 350.00 Ohm precision resistor.

4. Re-calibration of RTD version (DP9800-RTD)

To be conducted only by authorised and trained personnel using the appropriate equipment. Unauthorised re-calibration may invalidate the instrument warranty and would invalidate any applicable calibration certificate.

The PC Software must be running and the USB lead connected between the DP9800 and the PC, with communications established (on-line indicator in the control panel flashing green).

Note: The next step will 'clear' the resident calibration data; this is a good time to check that everything is in place for re-calibration.

Click on 'calibrate' in the lower left-hand area of the window. The following 'calibrate' window appears:

DP9800-RTD, calibration

Clear the existing calibration data by clicking 'Reset' for the selected channel in the calibration window.

Zero & Span calibration DP9800-RTD

a) Connect a 100.00 Ohm precision resistor to input 1 as indicated in 3a) and enter this value in the top R box to the left.

b) Click on the ch1 check box to select ch1 for calibration.

c) In the main control panel, click 'resistance' in the display box (just below ch6 readout).

d) Click 'reset' and 'restart' (this clears the existing calibration data and prepares the selected channel for calibration).

e) Click 'next' when ready.

f) Then follow the procedure as instructed in the dialogue screen to the lower left of the 'calibration' window. Connect a 350.00 Ohm precision resistor in to input 1, in place of the 100.00 Ohm resistor and enter this value in the lower R box.

g) Click 'next' when ready and follow the procedure as instructed.

h) When the 350.00 Ohm calibration is completed, channel 1 is calibrated.

i) Click 'send'

j) Repeat steps a) to j). for the other channels, clicking the checkbox for each channel as selected.

k) When finished, click 'send' to send the calibration data to the instrument.

l) Close the 'calibration' window.

m) Re-connect the sensors as required and click 'temperature' in the 'display' box in the main 'control panel' to resume temperature measurement.

Other values of calibration resistor can be used if preferred; the chosen value must be entered in the R box as appropriate.

Note: m & c values are allocated by the software which computes any measurement offset values to ensure precise calibration. These are not for user adjustment.

> **Factory calibration values can be restored if required by clicking on 'Restore' in the calibration window.**

4. Specifications

at an ambient temperature of 20°C

Input / Ranges

Thermocouple to IEC 584

	Type J	-200°C to 750°C
	Type K	-200°C to1200°C
	Type T	-200°C to 350°C
	Type E	-200°C to 900°C
	Type N	0°C to 1300°C
	Type R	0°C to 1760°C
	Type S	0°C to 1760°C
	Type B	250°C to 1800°C

RTD(Pt100) to IEC751, 3 wire   -200°C to 850°C

Note: all inputs are non-isolated and sensors must be of insulated construction.

Accuracy

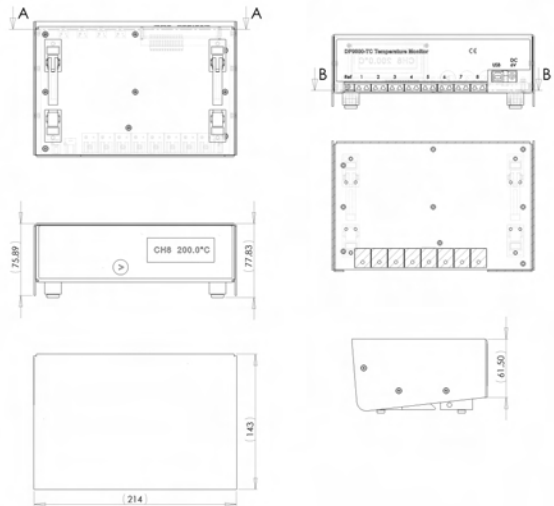|	
Thermocouples J K T E & N	better than +/- 0.1°C +/-0.1% of span -100°C to span (Zero to span Type N) +/-0.15% of span -101 to -200°C (J K T & E)
Thermocouples R S & B	better than+/-0.1°C +/-0.15% of span
RTD	better than +/- 0.05°C +/- 0.1% of span
Linearisation	±0.05°C
Zero drift	±0.01% of span per °C
Span drift	±0.01% of span per °C
Display	LCD, backlight
Display resolution	Thermocouple ranges 0.1°C RTD range 0.01°C
User interface	Front panel key for channel No. or auto-scan selection. PC software for all other functions.
Indication	Channel No., measured temperature (°C or °F)
Reference junction compensation for thermocouples	Automatic, accurate reference junction compensation is incorporated for thermocouple ranges
Self calibration	User facility incorporated. The instrument auto-calibrates on every A/D cycle *
Sensor open circuit detection & indication	Upscale indication *Independent alarms should be used for Process safety if required*
Ambient operating temperature	0 to 50°C
Storage temperature	-20°C to 70°C
Display	LCD with backlight

Input Terminations	8 x thermocouple: mini connectors 8 x RTD, terminal blocks
PC Interface	USB
Power supply	6Vdc (5.5-9.0V) via universal mains adaptor (supplied) 120-250V 50/60Hz
Logging interval	5 seconds to 1 hour
On-board memory	512 sets of readings
PC software	Supplied as standard on CD-ROM Remote control & measure:- Log readings to file Download to PC Logging, calibration

The integral, self-calibration facility for the thermocouple version is a rapid and convenient method for on-site calibration and does not require any additional equipment other than the special, external link (optional). Self-calibration of RTD ranges is quickly and conveniently performed using plug-in precision resistors (optional).

Traceable calibration can be achieved by the user conveniently and without recourse to a accredited Laboratory if there is access to a certified DVM; this can be used to measure the DP9800 internally generated calibrated Voltage via the 'cal port' presented externally to the instrument case. Considerable time and cost saving are achieved by this method.

Ordering

Thermocouple input x8	DP9800-TC
RTD x 8 input	DP9800-RTD
Calibration kit	DP9800-CALT (external link for thermocouple model). Included with DP9800-TC
	DP9800-CALP (precision resistor set for RTD model)
Custom calibration	details on application
Standard accessories	The DP9800 is supplied with a power supply adaptor, USB lead, PC software CD and instruction manual. The DP9800-TC is supplied with a 'ref' link.

Specifications may be subject to change.

5. Suggested application

Probe comparison calibration

Temperature sensors may need to be routinely checked and/or calibrated in accordance with specified procedures. There are various ways of achieving such compliance which typically involve sending the sensors to an accredited laboratory for certification, an expensive and time consuming procedure.

A practical, highly cost effective alternative method is to use an in-house, portable temperature calibration system from Omega; this provides a rapid and simple method of sensor checking and traceable calibration 'on the bench'.

This comprises a thermal reference (dry block) calibrator, a certified reference thermocouple or thermometer (RTD), a calibrated DP9800 8 channel indicator/logger and PC software: this, when used with any Windows PC represents a complete solution for on-site accreditation which allows direct comparison of the probes (up to seven at a time) with the certified reference sensor. A simple calculation of difference temperature (if any) between the logged values indicated by the reference and each test probe at a given, stable temperature (chosen by the user) in the dry block calibrator gives the error value for each sensor at particular temperatures. The procedure can be repeated for alternative temperatures set on the dry block as required (e.g. 100, 125, 150°C).

The system can even be used independently of a PC if desired; rather than working with logged data, readings for each probe can be taken manually by means of the DP9800 front panel key and differences calculated by the user. This is an equally valid procedure.

The design of the dry block ensures that all sensors located in its 'well' will be at exactly the same temperature. The necessary calculations can be performed in a spreadsheet by applying formulae to the relevant cells and the logged values imported into the worksheet.

On this basis, the plant probes are traceably calibrated in-house for full compliance with specified testing and validation procedures.

PC	MULTI-CHANNEL INDICATOR/LOGGER	UP TO 7 PLANT TEMPERATURE SENSORS	DRY BLOCK CALIBRATOR
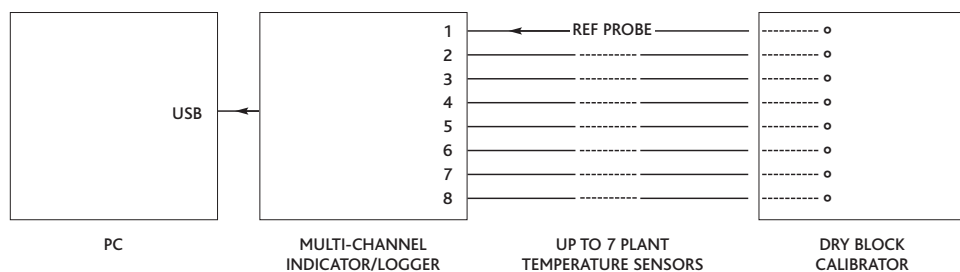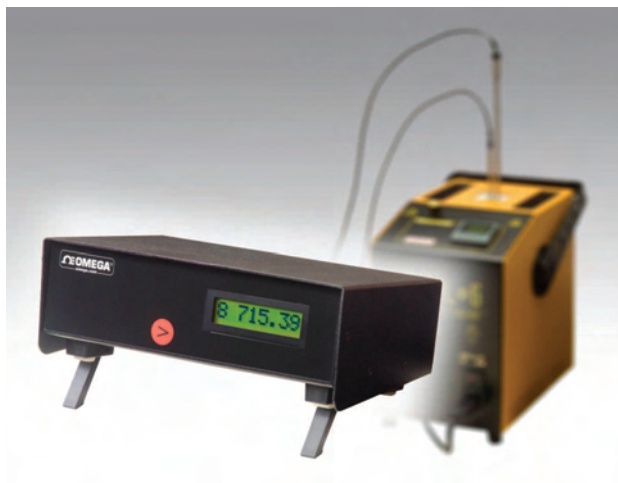
WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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