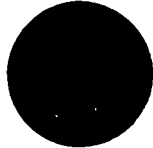


**T.O. 33K5-4-282-1**

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**TECHNICAL MANUAL**  
**CALIBRATION PROCEDURE**  
**FOR**   
**DIGITAL THERMOMETER**  
**HH99A SERIES**

**(OMEGA)**

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**30 OCTOBER 1997**

## CALIBRATION CHECK FORM

Date Calibrated \_\_\_\_\_ Work Order \_\_\_\_\_ Cal By \_\_\_\_\_

Procedure No./Date: CL-26, MAY 99 Unit Under Test: MICROPROCESSOR THERMOMETER

Mfg: OMEGA Model: HH22 SN \_\_\_\_\_ AN \_\_\_\_\_

STEP	FUNCTION OR RANGE	APPLIED	TOLERANCE		MEASURED VALUES		P/F
			MIN	MAX	AS FOUND	RELEASED	
4.1	TEMPERATURE						
	CALIBRATION						
	TYPE J-TC	T1	°C				
	-210 TO 760 DEG.C						
	-7.890mV	-200°C	-199.2	-200.8°C			
	-2.431mV	-50°C	-49.3	-50.7°C			
	5.269mV	100°C	99.3	100.7°C			
	16.327mV	300°C	299.1	300.9°C			
	39.132mV	700°C	698.7	701.3°C			
4.1.8	AMBIENT ROOM						
	TEMPERATURE						
		( )°F	+/- (1% + 1 °F)				
	TEMPERATURE						
	CALIBRATION						
	TYPE J-TC	T2	°C				
	-210 TO 760 DEG.C						
	-7.890mV	-200°C	-199.2	-200.8°C			
	-2.431mV	-50°C	-49.3	-50.7°C			
	5.269mV	100°C	99.3	100.7°C			
	16.327mV	300°C	299.1	300.9°C			
	39.132mV	700°C	698.7	701.3°C			



3/22/00	OOT	
8/22/01	—	AA939
7/15/01	OOT	42030
12/15/99	—	37102
3/31/99	OOT	33572
12/09/97	OOT	27653
3/26/96	OOT	20159
5/24/95		18257
2/8/95		16279

MR  
 VM  
 OOT —  
 AA939  
 42030

## DIGITAL THERMOMETER

## HH99A SERIES

(OMEGA)

**1 CALIBRATION DESCRIPTION:**

Table 1.

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Temperature P/N HH99A-E (Type E)	Range: -112.0 to 1022 °F, -80.0 to 550 °C	Compared with a Thermocouple Calibrator
P/N HH99A-J (Type J)	Range: -112.0 to 1382 °F, -80.0 to 750 °C	
P/N HH99A-K (Type K)	Range: -112.0 to 1999 °F, -80.0 to 1100 °C	Compared with a Millivolt source
P/N HH99A-N (Type N)	Range: 0 to 1999 °F, 0 to 1300 °C	
P/N HH99A-T1 (Type T)	Range: -112.0 to 752 °F, -80.0 to 400 °C	
	Accuracy: $\pm(1.0\% \text{ of rdg} + 1 \text{ }^\circ\text{C})$	Compared with a Thermocouple Calibrator
P/N HH99A-T2 (Type T)	Range: -40 to 199.9 °F, -40 to 199.0 °C	
	Accuracy: $\pm(0.4\% \text{ of rdg} + 1 \text{ }^\circ\text{C})$	
P/N HH21, HH23	Range: (Type J) -346 to 1400 °F, -210 to 760 °C (Type K) -328 to 2502 °F, -200 to 1372 °C (Type T) -328 to 752 °F, -200 to 400 °C	
	Accuracy: $\pm(0.1\% \text{ of rdg} + 1.0 \text{ }^\circ\text{F})$ $\pm(0.1\% \text{ of rdg} + 0.6 \text{ }^\circ\text{C})$	
P/N HH22	Range: (Type J) -346 to 1400 °F, -210 to 760 °C, (Type K) -328 to 2502 °F, -200 to 1372 °C	
	Accuracy: $\pm(0.1\% \text{ of rdg} + 1.0 \text{ }^\circ\text{F})$ , $\pm(0.1\% \text{ of rdg} + 0.6 \text{ }^\circ\text{C})$	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Temperature	P/N HH26J	
	Range: -112 to 1400 °F or -80 to 760 °C	
	Accuracy: $\pm(1\% \text{ rdg} + 2 \text{ °F})$ $\pm(1\% \text{ rdg} + 1 \text{ °C})$	
	P/N Tegam 820J 821J	
	Range: -210 to 760 °C or -346 to 1400 °F	
	Accuracy: $\pm(0.1 \text{ rdg} + 0.6 \text{ °C})$ $\pm(0.1\% \text{ rdg} + 1 \text{ °F})$	
	P/N Tegam 820K 821K	
	Range: -200 to 1372 °C or -328 to 2502 °F	
	Accuracy: $\pm(0.1\% \text{ rdg} + 0.6 \text{ °C})$ $\pm(0.1\% \text{ rdg} + 1.0 \text{ °F})$	
	P/N Tegam 821T	
	Range: -200 to 400 °C or -328 to 752 °F	
	Accuracy: $\pm(0.1\% \text{ rdg} + 0.6 \text{ °C})$ $\pm(0.1\% \text{ rdg} + 1.0 \text{ °F})$	
	P/N HH-25KF (Type K)	
	Range: -40.0 to 199.9 °F, -120 to 1999 °F	
	Accuracy: $\pm(0.5\% + 1.0 \text{ °F})$ $\pm(1\% + 2 \text{ °F})$	
	P/N HH-25KC (Type K)	
	Range: -40.0 to 199.9 °C, -85 to 1100 °C	
	Accuracy: $\pm(0.5\% + 0.5 \text{ °C})$ $\pm(1\% + 1 \text{ °C})$	
	P/N HH-25TF (Type T)	
	Range: -112.0 to 199.9 °F, 200 to 752 °F	
	Accuracy: $\pm(0.4\% + 1.1 \text{ °F})$ $\pm(1\% + 2 \text{ °F})$	
	P/N HH-25TC (Type T)	
	Range: -80.0 to 199.9 °F, -200 to 400 °C	
	Accuracy: $\pm(0.4\% + 0.6 \text{ °C})$ $\pm(1\% + 1 \text{ °C})$	

Table 1. (Cont.)

Test Instrument (TI) Characteristics	Performance Specifications	Test Method
Temperature	P/N HH-25KC (Type K)	Range: -120 to 1999 °F, -85 to 1100 °C  Accuracy: $\pm(1\% + 2\text{ °F})$ $\pm(1\% + 1\text{ °C})$
	P/N HH-26J (Type J)	Range: -112 to 1400 °F, -80 to 760 °C  Accuracy: $\pm(1\% + 2\text{ °F})$ $\pm(1\% + 1\text{ °C})$
	P/N HH-26K (Type K)	Range: -120 to 1999 °F, -85 to 1100 °C  Accuracy: $\pm(1\% + 2\text{ °F})$ $\pm(1\% + 1\text{ °C})$

**2 EQUIPMENT REQUIREMENTS:**

Item	Item Name	Minimum Use Specifications	Calibration Equipment	Sub- Item
2.1	THERMOCOUPLE CALIBRATOR	Range: -112 to 2000 °F -40 to 1300 °C  Accuracy: $\pm 0.7\text{ °F} \pm 0.3\text{ °C}$	Fluke 2190A W/Y2003	
2.2	THERMOCOUPLE WIRE	As required	Local Purchase	
2.3	STANDARD THERMOMETER	Range: 25 to 140 °F  Accuracy: $\pm 0.5\text{ °F}$	Princo 77	
2.4	DC VOLTAGE STANDARD *	Range: 0 to 1 VDC  Accuracy: N/A	Fluke 332D	
2.5	NANOVOLTMETER *	Range: 0 to 1 VDC  Accuracy: $\pm 0.01\%$	Keithley 181	
2.6	ICE BATH *	Range: 32 °F	Local Manufacture	

\* Used only when calibrating P/N HH99A-N

### **3 PRELIMINARY OPERATIONS:**

3.1 Review and become familiar with entire procedure before beginning calibration process.



Unless otherwise designated, and prior to beginning the Calibration Process, ensure that all test equipment voltage and/or current outputs are set to zero (0) or turned off, where applicable. Ensure that all equipment switches are set to the proper position before making connections or applying power.

3.2 Remove the Thermocouple Input Module from the rear of the Thermocouple Calibrator, and set switches to correct position for thermocouple type being used.

3.3 Observing polarity, connect a Thermocouple Lead Wire between the output of the Thermocouple Calibrator and input of the TI.

3.4 Connect Thermocouple Calibrator to 115 V/60 Hz power source, set POWER switch to ON, and allow a 30 minute warm-up.

3.5 For Type N Thermocouple, use ITS-90 Thermocouple Reference Tables to obtain millivolt equivalent of temperatures selected for calibration of TI, and perform calibration as per para 4.2.

3.6 Use only that portion of the procedure applicable to TI being calibrated.

### **4 CALIBRATION PROCESS:**

#### **NOTE**

Unless otherwise specified, verify the results of each test and take corrective action whenever the test requirement is not met, before proceeding.

#### **4.1 TEMPERATURE CALIBRATION:**

4.1.1 Set TI MODE switch to measure °C, and POWER switch to ON.

4.1.2 Select 5 evenly spaced calibration points across the range of TI being calibrated.

4.1.3 Set Thermocouple Calibrator to °C, and adjust output to the first calibration point selected in step 4.1.2. (For Type N Thermocouple Millivolt setup must be used.)

4.1.4 TI must indicate within the applicable accuracy limits listed in Table 1.

4.1.5 Repeat steps 4.1.3 and 4.1.4 for each of the remaining calibration points selected in step 4.1.2.

4.1.6 Disconnect all test equipment from the TI, and connect Temperature Probe to TI input jacks.

4.1.7 Set TI MODE switch to °F.

4.1.8 Place TI Probe and Standard Thermometer as close together as possible, and exposed to ambient room temperature.

4.1.9 Allow 15 minutes for temperature stabilization.



4.1.10 The TI display and Standard Thermometer must agree within the applicable accuracy limits listed in Table 1.

4.1.11 Repeat steps 4.1.1 through 4.1.10 for second input on P/N HH21, HH23, and Tegam 820.

4.1.12 Set TI POWER switch to OFF. Disconnect and secure all equipment.

## 4.2 TEMPERATURE CALIBRATION: (Type N Thermocouple)

4.2.1 Construct an Ice Bath using distilled water, and maintain in a slushy condition throughout the calibration process.

4.2.2 Connect equipment as shown in Figure 1.

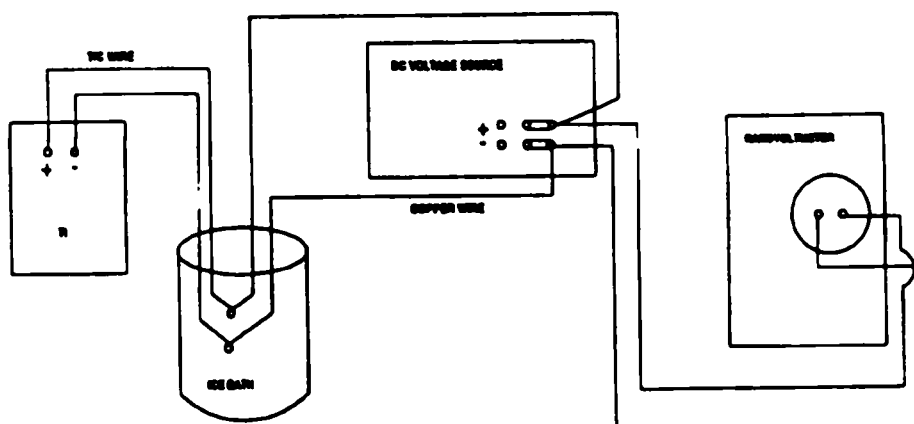


Figure 1.

4.2.3 Connect test equipment to 115 VAC/60 Hz power source, set POWER switches to ON and allow a 30 minute warm-up.

4.2.4 Set TI MODE switch to °C, and POWER switch to ON.

4.2.5 Select 5 evenly spaced calibration points across the range of TI.

4.2.6 Using ITS-90 Thermocouple Reference Tables, find the millivolt equivalent of the calibration points selected in step 4.2.4.

4.2.7 Adjust DC Voltage Standard until the Nanovoltmeter indicates the millivolt value of the first calibration point selected in step 4.2.4.

4.2.8 TI must display the applied temperature, within the applicable accuracy limits listed in Table 1.

4.2.9 Repeat steps 4.2.6 and 4.2.7 for remaining calibration points selected in step 4.2.4.

4.2.10 Disconnect all test equipment from the TI, and connect Temperature Probe to TI input jacks.

4.2.11 Set TI MODE switch to °F.

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**4.2.12 Place TI Probe and Standard Thermometer as close together as possible, and exposed to ambient room temperature.**

**4.2.13 Allow 15 minutes for temperature stabilization.**

**4.2.14 The TI display and Standard Thermometer must agree within the applicable accuracy limits listed in Table 1.**

**4.2.15 Set TI POWER switch to OFF. Disconnect and secure all equipment.**

**CALIBRATION PERFORMANCE TABLE**

**Not Required**