

Southwest Research Institute  
6220 Culebra Road  
San Antonio, TX 78238  
(210) 522-5215  
Department of Quality Assurance  
Calibration Laboratory

## Certificate of Calibration

17 July 2002

**Issued to:** DARRELL DUNN DIV20 B57  
**Manufacturer/Model:** DURO-SENSE TYPE K  
**Description:** THERMOCOUPLE  
**Serial Number:** 327  
**Asset Number:** 008431  
**Work Order Number:** 444049278

This certifies the above item was calibrated in compliance with MIL-STD-45662A and ANSI/NCSL Z540-1-1994. Standards used in this calibration, described in the referenced calibration procedure with associated uncertainties or tolerances, are traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to traceability is on file and is available for examination upon request. This certificate is not to be reproduced, except in full, without the written approval of the Southwest Research Institute Department of Quality Assurance Calibration Laboratory.

The uncertainty of the calibration was sufficient to determine that the item met the manufacturer's published specifications unless stated otherwise below.

**Ambient Conditions:** Temperature: 74.0 Degrees Fahrenheit Humidity: 55 % RH

**Calibration Date:** 15 Jul 02 **Calibration Procedure:** CUSTOMER LETTER DATED NOV 16, 2001

**Condition as Received:** SEE ATTACHED DATA

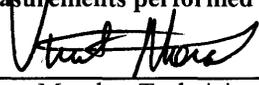
**Condition as Returned:** SEE ATTACHED DATA

**Remarks:**

**Approved by:**

  
\_\_\_\_\_  
Walt Hill, Metrology Group Leader  
Institute Calibration Laboratory

**Measurements performed by:**

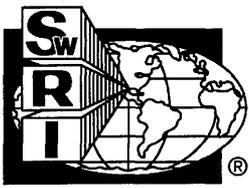
  
\_\_\_\_\_  
Vince Morales, Technician

Southwest Research Institute  
 Calibration laboratory  
 Calibration Sheet.

Found/Left

<b>Work Order:</b> 444049278	<b>Mfr.</b> DURO-SENSE	<b>Technician</b> Vmorales
<b>Asset No.</b> 8431	<b>Model</b> Type K	<b>Technician</b> Customer
<b>Serial No.</b> 327	<b>Type.</b> Thermocouple	<b>Cal Date.</b> July 15, 2002
<b>Remarks:</b> (1) The Difference is equal to TI reading - Test Point reading. (2) If no value is listed the uncertainty is >4/1 Results are provided without Pass or Fail Data. It is up to the end user to determine if results meet their needs. (3) Customer requested readings per letter dated November 16, 2000 (4) Thermocouple checked with 12 inches of the thermocouple exposed to the bath. (5) Accuracy not stated (6) Results are provided without Pass or Fail Data		

Function/Range	Test Point	TI Reading	Difference (1)	Uncertainty (2)
Type K	Deg. C	Deg. C	Deg. C	Deg. C
0.04679mV	1.14	1.19	0.05	0.017
6.16791mV	149.88	150.70	0.82	0.010



# SOUTHWEST RESEARCH INSTITUTE™

6220 Culebra Road, P.O. Drawer 28510  
Institute Quality Systems  
Institute Calibration Laboratory  
Phone: 210-522-5215 Fax 210-522-3692

## Certificate of Calibration

**Submitted By:** DIV20

**Address:** B57

**Contact:** DARRELL DUNN

**Manufacturer Model:** DURO-SENSE TYPE K

**Description:** THERMOCOUPLE

**Serial No:** 327

**Asset No:** 008431

**Procedure:** CUSTOMER LETTER DATED NOV 16, 2001

**Work Order:** 444051750

**Date Issued:** Jan 15, 2003

**Calibration Date:** Jan 14, 2003

**\*\*Calibration Due:** Jul 14, 2003

**Calibration Location:** N/A

**Environment:** Temp. 77.0°F Hum. 31 %RH

**\*As Found:** SEE ATTACHED DATA

**\*As Left:** SEE ATTACHED DATA

This certificate documents traceability to the National Institute of Standards and Technology (NIST) and the International System of Units (SI). The Laboratory quality system conforms to ISO/IEC 17025, 1999 and ANSI/NCCL Z540-1-1994 which are equivalent to relevant requirements of the ISO 9000-1994 series of standards. This certificate may not be reproduced, except in full, without the written approval of the Southwest Research Institute Calibration Laboratory. The results of this calibration relate only to the individual instrument described above. This certificate shall not be used to claim product endorsement by the American Association for Laboratory Accreditation (A2LA) or any agency of the U. S. Government.

Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of  $k=2$  to approximate a 95% confidence level. The calibration process provides a Test Uncertainty Ratio (TUR) of less than or equal to 25% (4:1) of the test limit unless otherwise stated in remarks or an attachment.

\*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

\*\*Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

**Remarks:** None

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
005243	HEWLETT-PACKARD	34420A	MULTIMETER	Dec 11, 03
009917	HART SCIENTIFIC, INC	5612	THERMOMETER	Jul 06, 04
009414	HART SCIENTIFIC, INC	1502A	TEMPERATURE READOUT	Jul 06, 03

Approved by: Walt Hill  
Metrology Group Leader  
m:\Nona21a1.rpt Rev date 15, August 02

Measurements by: Vince Morales  
Metrology Technician

Southwest Research Institute  
 Calibration Laboratory  
 Calibration Data Sheet

Work Order 444051750	Mfr. DURO-SENSE	Technician V Morales
Asset #. 8431	Model TYPE K	Procedure Customer
Serial #. 327	Type THERMOCOUPLE	Cal Date 14-Jan-03
Remarks: Readings are provided without regard to "Pass" or "Fail". It is up to the user to determine if the readings meet their requirements. Customer requested readings per letter dated November 16, 2000		

Test Point	Standard Read	TI Read	Difference	Test Limits +/-	Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	
0.00	0.00	0.00	0.00		0.35	
6.17	149.85	150.66	-0.81		0.35	



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## Certificate of Calibration

**Submitted By:** DIV20  
**Address:** B57  
**Contact:** DARRELL DUNN  
**Manufacturer Model:** DURO-SENSE TYPE K  
**Description:** THERMOCOUPLE  
**Serial No:** 327  
**Asset No:** 008431  
**Procedure:** CUSTOMER LETTER DATED NOV 16, 2000

**Work Order:** 444054479  
**Date Issued:** Jul 21, 2003  
**Calibration Date:** Jul 21, 2003  
**\*\*Calibration Due:** Jan 21, 2004  
**Calibration Location:** Bldg. 64  
**Environment:** Temp. 73.0°F Hum. 50 %RH  
**\*As Found:** IN TOLERANCE  
**\*As Left:** IN TOLERANCE

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Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. The calibration process provides a Test Uncertainty Ratio (TUR) of less than or equal to 25% (4:1) of the test limit unless otherwise stated in remarks or an attachment

\*The client has sole responsibility for determination of in/out of tolerance or compliance/noncompliance. An in/out of tolerance opinion is provided for your convenience based only on the Test Instrument (TI) reading(s) and limits as reported. The reported uncertainty relates only to the results at the time of calibration and does not imply any short or long term stability of the TI.

\*\*Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

**Remarks:** None

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Jul 30, 03
008920	HART SCIENTIFIC, INC	17660-A-120-6-W	PLATINUM RTD	Jul 30, 03
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Oct 30, 03

Approved by: Walt Hill  
Metrology Group Leader  
m:\Non21a1.rpt Rev date 15, August 02

Measurements by: Mark Romero  
Metrology Technician

Southwest Research Institute  
Calibration Laboratory  
Calibration Report

Work Order	444054479	Mfr.	Duro-Sense	Technician	Mark Romero
Asset #.	008431	Model	Type K		
Serial #.	327	Type	Thermocouple	Cal Date	21-Jul-03
Remarks: Accuracy taken from IEC 584-2 (1982). Testing and procedure comply with custodian memo dated Nov. 16, 2000.					

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
0.01	0.09	0.19	-0.10	1.50	0.26	Pass
6.14	150.04	150.91	-0.87	1.50	0.27	Pass

END OF REPORT



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Certificate #  
0972-01

## Certificate of Calibration

**Submitted By:** DIV20  
**Address:** B57  
**Contact:** DARRELL DUNN  
**Manufacturer Model:** DURO-SENSE TYPE K  
**Description:** THERMOCOUPLE  
**Serial No:** 327  
**Asset No:** 008431  
**Procedure:** CUSTOMER LETTER DATED NOV 16, 2000

**Work Order:** 444056985  
**Date Issued:** Jan 26, 2004  
**Calibration Date:** Jan 22, 2004  
**\*\*Calibration Due:** Jul 22, 2004  
**Calibration Location:** Bldg. 64  
**Environment:** Temp. 76.0°F Hum. 45 %RH  
**\*As Found:** IN TOLERANCE  
**\*As Left:** IN TOLERANCE

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Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. The calibration process provides a Test Uncertainty Ratio (TUR) of less than or equal to 25% (4:1) of the test limit unless otherwise stated in remarks or an attachment.

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\*\*Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

**Remarks:** None

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Nov 13, 04
008920	HART SCIENTIFIC, INC	5614-17660-A-12	PLATINUM RTD	Feb 07, 04
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Feb 05, 04

Approved by: Walt Hill  
Metrology Group Leader

Measurements by: Mark Romero  
Metrology Technician

Southwest Research Institute  
 Calibration Laboratory  
 Calibration Report

Work Order:	444056985	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	008431	Model	Type K	Cal Date	22-Jan-04
Serial No:	327	Type	Thermocouple		

Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
0.01	0.09	0.05	0.04	2.20	0.03	Pass
6.18	150.04	150.96	-0.92	2.20	0.03	Pass

END OF REPORT



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## Certificate of Calibration

0972-01

**Submitted By:** DIV20

**Address:** B57

**Contact:** DARRELL DUNN

**Manufacturer Model:** DURO-SENSE TYPE K

**Description:** THERMOCOUPLE

**Serial No:** 327

**Asset No:** 008431

**Procedure:** TEMPERATURE, JAN/04

**Work Order:** 444060007

**Date Issued:** Jul 23, 2004

**Calibration Date:** Jul 23, 2004

**\*\*Calibration Due:** Jan 23, 2005

**Calibration Location:** Bldg. 64

**Environment:** Temp. 73.0°F Hum. 45 %RH

**\*As Found:** IN TOLERANCE

**\*As Left:** IN TOLERANCE

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Uncertainty evaluation includes the item under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor of k=2 to approximate a 95% confidence level. See Remarks or attached Calibration Report with the same Work Order number for calibration data.

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\*\*Calibration interval is determined by the client and does not assure the instrument will remain within tolerance until this date. Any number of factors may cause the instrument to be out of tolerance before the next calibration date.

**Remarks:** Calibrated at 0 and 150 Deg C

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Nov 13, 04
009137	HART SCIENTIFIC	1575	THERMOMETER	Sep 05, 04

Approved by: Walt Hill  
Metrology Group Leader  
m:\a2la1.rpt Rev date 11, May 04

Measurements by: Bob Trollinger  
Metrology Technician

Southwest Research Institute  
Calibration Laboratory  
Measurement Report

Work Order:	444060007	Mfr.	Duro-Sense	Technician	blt
Asset No:	008431	Model	Type K	Cal Date	23-Jul-04
Serial No:	327	Type	Thermocouple		
Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.					

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
0.004	0.096	0.09	0.01	2.2	0.27	Pass
6.176	150.06	150.83	-0.77	2.2	0.27	Pass
END OF REPORT						



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## Certificate of Calibration

0972-01

**Submitted By:** DIV20

**Address:** B57

**Contact:** DARRELL DUNN

**Manufacturer Model:** DURO-SENSE TYPE K

**Description:** THERMOCOUPLE

**Serial No:** 327

**Asset No:** 008431

**Procedure:** THERMOCOUPLE-GENERAL, JAN/03

**Work Order:** 303062799

**Date Issued:** Feb 7, 2005

**Calibration Date:** Feb 7, 2005

**\*\*Calibration Due:** Aug 5, 2005

**Calibration Location:** Bldg. 64

**Environment:** Temp. 73.0°F Hum. 40 %RH

**\*As Found:** IN TOLERANCE

**\*As Left:** IN TOLERANCE

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**Remarks:** None

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009137	HART SCIENTIFIC	1575	THERMOMETER	Mar 20, 05
010281	HART SCIENTIFIC	5628	SPRT	Jun 24, 08
010814	HART SCIENTIFIC	1529	THERMOCOUPLE THERMOMETER	Apr 16, 05

Approved by: Walt Hill  
Metrology Group Leader

m:\a2la1.rpt Rev date 11, May 04

Measurements by: Bob Trollinger  
Metrology Technician

Southwest Research Institute  
Calibration Laboratory  
Measurement Report

Work Order:	303062799	Mfr.	Duro-Sense	Technician	blt
Asset No:	008431	Model	Type K	Cal Date	7-Feb-05
Serial No:	327	Type	Thermocouple		
Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.					
Limited Cal - tested at 0.0 and 150 C					

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
	°C	°C	°C	°C	°C	Result
	0.126	0.01	0.11	2.2	0.19	Pass
	150.05	150.76	-0.71	2.2	0.30	Pass
END OF REPORT						