

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:** 331  
**Asset Number:** 008426  
**Work Order Number:** 444049281

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

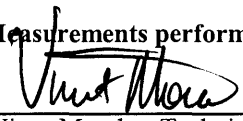
**Condition as Returned:** SEE ATTACHED DATA

**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>	444049281	<b>Mfr.</b>	DURO-SENSE	<b>Technician</b>	Vmorales
<b>Asset No.</b>	8426	<b>Model</b>	Type K	<b>Technician</b>	Customer
<b>Serial No.</b>	331	<b>Type.</b>	Thermocouple	<b>Cal Date.</b>	July 15, 2002

**Remarks:** (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
0.04247mV	1.14	1.08	-0.06	0.017
6.17060mV	149.87	150.01	0.14	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:** 331

**Asset No:** 008426

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

**Work Order:** 444052325

**Date Issued:** Feb 14, 2003

**Calibration Date:** Feb 13, 2003

**\*\*Calibration Due:** Aug 13, 2003

**Calibration Location:** Bldg. 64

**Environment:** Temp. 73.0°F Hum. 45 %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/NC SL 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
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Oct 30, 03
008920	HART SCIENTIFIC, INC	17660-A-120-6-W	PLATINUM RTD	Jul 06, 03
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Jul 06, 03

Approved by: Walt Hill

Metrology Group Leader

m:\Nona2\la1.rpt Rev date 15, August 02

Measurements by: Mark Romero

Metrology Technician

Southwest Research Institute  
Calibration laboratory  
Measurement Record

Work Order:	444052325	Mfr.	DURO-SENSE	Technician	Mark Anthony Romero
Asset No.	008426	Model	Type K		
Serial No.	331	Type.	Thermocouple	Cal Date.	13-Feb-03
Remarks:	Readings are provide without regard to "Pass" or "Fail". It is up to the user to determine if the readings meet their requirements.				

Function/Range	Test Point	TI Reading	Difference	Test Limits+/-	Uncertainty
Temperature	Deg C	Deg C	Deg C	Deg C	Deg C
0	0.08	0.13	-1.00		1.2
150	150.04	150.30	0.26		1.2
END OF REPORT					



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Institute Calibration Laboratory  
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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:** 331

**Asset No:** 008426

**Procedure:** CUSTOMER LETTER DATED NOV 16, 2000

**Work Order:** 444055170

**Date Issued:** Sep 5, 2003

**Calibration Date:** Sep 2, 2003

**\*\*Calibration Due:** Mar 2, 2004

**Calibration Location:** Bldg. 64

**Environment:** Temp. 75.0°F Hum. 48 %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:** Per memo dated Nov. 16, 2000.

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Oct 30, 03
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Feb 05, 04
008920	HART SCIENTIFIC, INC	17660-A-120-6-W	PLATINUM RTD	Feb 07, 04

Approved by: Walt Hill  
Metrology Group Leader  
m:\Nona2\al.rpt Rev date 15, August 02

Measurements by: Mark Romero  
Metrology Technician

Southwest Research Institute  
Calibration Laboratory  
Calibration Report

Work Order:	444055170	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	008426	Model	Type K		
Serial No:	331	Type	Thermocouple	Cal Date	2-Sep-03
Remarks: Accuracy taken from IEC 584-2 (1982). Verification complies with customer 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	0.17	-0.08	1.50	0.03	Pass
6.14	149.92	150.05	-0.13	1.50	0.03	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:** 331

**Asset No:** 008426

**Procedure:** CUSTOMER LETTER DATED NOV 16, 2000

**Work Order:** 444058756

**Date Issued:** May 5, 2004

**Calibration Date:** May 5, 2004

**\*\*Calibration Due:** Nov 5, 2004

**Calibration Location:** Bldg. 64

**Environment:** Temp. 77.0°F Hum. 43 %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:** Per customer memo dated Nov/2000.

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
005325	XITRON TECHNOLOGIES	2000M	V/A/T CALIBRATOR	Nov 13, 04
008920	HART SCIENTIFIC	5614-17660-A-12	PLATINUM RTD	Sep 09, 04
009137	HART SCIENTIFIC	1575	THERMOMETER	Sep 05, 04

Approved by: Walt Hill

Metrology Group Leader

m:\a2la1.rpt Rev date 15, August 02

Measurements by: Mark Romero

Metrology Technician

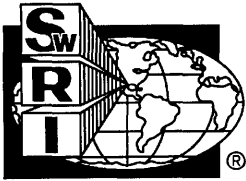
Southwest Research Institute  
Calibration Laboratory  
Calibration Report

Work Order:	444058756	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	008426	Model	Type K		
Serial No:	331	Type	Thermocouple	Cal Date	5-May-04

Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.  
Verification complies with customer 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
0.00	0.10	0.00	0.10	2.20	0.03	Pass
6.14	150.05	150.22	-0.17	2.20	0.03	Pass
END OF REPORT						





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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:** 331

**Asset No:** 008426

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

**Work Order:** 444061750

**Date Issued:** Dec 3, 2004

**Calibration Date:** Dec 3, 2004

**\*\*Calibration Due:** Jun 3, 2005

**Calibration Location:** Bldg. 64

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

**\*As Found:** SEE REMARKS

**\*As Left:** SEE REMARKS

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. 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:** Cal at 0.0 and 150 Deg C only

### Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009137	HART SCIENTIFIC	1575	THERMOMETER	Mar 20, 05
010281	HART SCIENTIFIC	5628	SPRT	Jun 24, 08
010329	FLUKE	525A	TEMPERATURE/PRESSURE CALIBRATOR	Sep 24, 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:	444061750	Mfr.	Duro-Sense	Technician	blt
Asset No:	008426	Model	Type K		
Serial No:	331	Type	Thermocouple	Cal Date	3-Dec-04
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
	° C	° C	° C	° C	° C	Result
	0.107	0.10	0.01	2.2	0.19	Pass
	149.91	150.52	-0.61	2.2	0.30	Pass

END OF REPORT