

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: 326
Asset Number: 008430
Work Order Number: 444049277

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

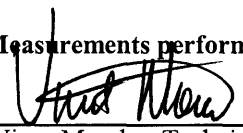
Condition as Returned: SEE ATTACHED DATA

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

Work Order:	444049277	Mfr.	DURO-SENSE	Technician	Vmorales
Asset No.	8430	Model	Type K	Technician	Customer
Serial No.	326	Type.	Thermocouple	Cal Date.	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
0.04887mV	1.14	1.25	0.11	0.017
6.18237mv	149.86	151.08	1.22	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: 326

Asset No: 008430

Procedure: CUSTOMER LETTER DATED NOV 16, 2000

Work Order: 444054484

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:\Nona21a1.rpt Rev date 15, August 02

Measurements by: Mark Romero

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order	444054484	Mfr.	Duro-Sense	Technician	Mark Romero
Asset #.	008430	Model	Type K		
Serial #.	326	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
0.00	0.09	0.07	0.02	1.50	0.26	Pass
6.20	150.04	151.44	-1.40	1.50	0.27	Pass

END OF REPORT



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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: 326

Asset No: 008430

Procedure: CUSTOMER LETTER DATED NOV 16, 2001

Work Order: 444051748

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

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*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:\Nona2\al.rpt Rev date 15, August 02

Measurements by: Vince Morales

Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Data Sheet

Work Order 444051748	Mfr. DURO-SENSE	Technician V Morales
Asset #: 8430	Model TYPE K	Procedure Customer
Serial #: 326	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	
6.18	149.86	151.11	-1.25		0.35	



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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: 326

Asset No: 008430

Procedure: CUSTOMER LETTER DATED NOV 16, 2000

Work Order: 444056984

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

Measurements by: Mark Romero
Metrology Technician

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order:	444056984	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	008430	Model	Type K		
Serial No:	326	Type	Thermocouple	Cal Date	22-Jan-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
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
0.00	0.09	0.05	0.04	2.20	0.03	Pass
6.20	150.03	151.46	-1.43	2.20	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: 326

Asset No: 008430

Procedure: TEMPERATURE, JAN/04

Work Order: 444060008

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:	444060008	Mfr.	Duro-Sense	Technician	blt
Asset No:	008430	Model	Type K		
Serial No:	326	Type	Thermocouple	Cal Date	23-Jul-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
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
-0.003	0.096	-0.08	0.18	2.2	0.27	Pass
6.176	150.06	150.84	-0.78	2.2	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: 326

Asset No: 008430

Procedure: THERMOCOUPLE-GENERAL, JAN/03

Work Order: 444062748

Date Issued: Feb 2, 2005

Calibration Date: Feb 2, 2005

****Calibration Due:** Aug 2, 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/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.

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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
010814	HART SCIENTIFIC	1529	THERMOCOUPLE THERMOMETER	Apr 16, 05
009137	HART SCIENTIFIC	1575	THERMOMETER	Mar 20, 05
010281	HART SCIENTIFIC	5628	SPRT	Jun 24, 08

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:	444062748	Mfr.	Duro-Sense	Technician	blt
Asset No:	008430	Model	Type K		
Serial No:	326	Type	Thermocouple	Cal Date	2-Feb-05
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
	0.009	0.20	-0.19	2.2	0.19	Pass
	150.14	150.70	-0.57	2.2	0.30	Pass
END OF REPORT						