



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: **Southwest Research Institute**
6220 Culebra Road
San Antonio, Tx 78238

Date: **October 23, 2000**
Calib No.: **51313**
Cust. P.O.: **X975701**

CALIBRATION CERTIFICATE


This will certify that your **material used to manufacture Type 'K' T/C Assy # MTC-B-0632-U-36-48-TEX** was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on **October 23, 2000** against our standard, which is traceable to the National Institute of Standards Technology.

Ambient Temperature: **75.90°F**
Furnace Atmosphere: **Air**
Humidity: **41.00%**
Temperature Points: **See Below**
Lot #: **MAT660L**

CALIBRATION RESULTS ARE AS FOLLOWS:

Standard	Corrections			
	<u>Inside End</u>	<u>Inside End</u>	<u>Outside End</u>	<u>Outside End</u>
32°F	+0.2°F	0.000 MV	+0.3°F	0.000 MV
500°F	+0.6°F	10.539 MV	+0.7°F	10.539 MV
1000°F	+1.2°F	22.232 MV	+1.3°F	22.232 MV
1500°F	+1.7°F	33.867 MV	+1.8°F	33.867 MV
2000°F	+2.0°F	44.824 MV	+2.1°F	44.824 MV

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSI/NCSL Z540-1-1994, AMS 2750C, ASTM E 220-96, ASTM E 230-96, ASTM E 207-96
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.8.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001	We hereby certify that the above is a true copy of our records. DURO-SENSE CORPORATION  Quality Control Department
Leeds and Northrup K-5: Model 7555	
Precision Potentiometer S/N: 1752900	
Eppley Standard Cell: Model 100 - S/N 700851	
Cage Code: 58042	
Master Std. Thermocouple: Type 'S'	
N.I.S.T. Test Numbers: 263035	



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: **Southwest Research Institute**
6220 Culebra Road
San Antonio, Tx 78238

Date: **October 23, 2000**
Calib No.: **51313**
Cust. P.O.: **X975701**

CALIBRATION CERTIFICATE

This will certify that your **RTD Assy # RPL-1-125-PD-316-3-6"-B-48"-D300-CU-D301-CU** was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on **October 23, 2000** against our standard, which is traceable to the National Institute of Standards Technology.

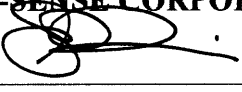
Ambient Temperature: **75.90°F**
Furnace Atmosphere: **Air**
Humidity: **41.00%**
Temperature Points: **See Below**

CALIBRATION RESULTS ARE AS FOLLOWS:

Standard		Corrections	
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
322	32°F	+0.2°F	100 OHM
	212°F	+0.2°F	138.51 OHM
	500°F	+0.4°F	197.71 OHM
	1000°F	+0.6°F	293.30 OHM

<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
323	32°F	+0.2°F	100 OHM
	212°F	+0.2°F	138.51 OHM
	500°F	+0.3°F	197.71 OHM
	1000°F	+0.8°F	293.30 OHM

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSI/NCSS Z540-1-1994, AMS 2750C, ASTM E 220-96, ASTM E 230-96, ASTM E 207-96
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.8.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001	We hereby certify that the above is a true copy of our records. DURO-SENSE CORPORATION  Quality Control Department
Leeds and Northrup K-5: Model 7555	
Precision Potentiometer S/N: 1752900	
Eppley Standard Cell: Model 100 - S/N 700851	
Cage Code: 58042	
Master Std. Thermocouple: Type 'S'	
N.I.S.T. Test Numbers: 263035	



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: **Southwest Research Institute**
6220 Culebra Road
San Antonio, Tx 78238

Date: **October 23, 2000**
Calib No.: **51313**
Cust. P.O.: **X975701**

CALIBRATION CERTIFICATE

This will certify that your **RTD Assy # RPL-1-125-PD-316-3-6"-B-48"-D300-CU-D301-CU** was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on **October 23, 2000** against our standard, which is traceable to the National Institute of Standards Technology.

Ambient Temperature: **75.90° F**
Furnace Atmosphere: **Air**
Humidity: **41.00%**
Temperature Points: **See Below**

CALIBRATION RESULTS ARE AS FOLLOWS:

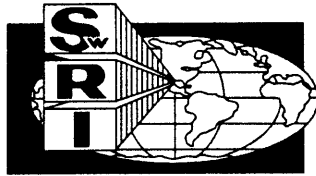
Standard		Corrections	
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
324	32° F	+0.1° F	100 OHM
	212° F	+0.2° F	138.51 OHM
	500° F	+0.5° F	197.71 OHM
	1000° F	+0.8° F	293.30 OHM
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
325	32° F	+0.2° F	100 OHM
	212° F	+0.1° F	138.51 OHM
	500° F	+0.4° F	197.71 OHM
	1000° F	+0.7° F	293.30 OHM

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSI/NCSL Z540-1-1994, AMS 2750C, ASTM E 220-96, ASTM E 230-96, ASTM E 207-96
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.8.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001
Leeds and Northrup K-5: Model 7555
Precision Potentiometer S/N: 1752900
Eppley Standard Cell: Model 100 - S/N 700851
Cage Code: 58042
Master Std. Thermocouple: Type 'S'
N.I.S.T. Test Numbers: 263035

**We hereby certify that the above
is a true copy of our records.
DURO-SENSE CORPORATION**

Quality Control Department




CNWRA *A center of excellence in earth
sciences and engineering*

6220 Culebra Road · San Antonio · Texas, U.S.A. 78228-5166

MEMORANDUM

Date: November 16, 2000

From: Darrell S. Dunn 


To: SwRI Calibration Laboratory

Subject: Calibration of Thermocouples and RTDs

I would like to check the calibration of the Duro-Sense Corporation thermocouples (serial numbers 326 to 335) and RTDs (serial numbers 322 to 325) using temperatures of 0 and 150 °C. The calibration check for the thermocouples should be conducted with 12 inches of the thermocouple exposed to controlled temperature bath. The output of the thermocouples in mV should be recorded at these temperatures. Similarly, the entire length of the RTDs should be exposed to the controlled temperature bath and the resistance of the RTDs should be recorded at these temperatures.

Following calibration at 0 and 150 °C, the thermocouples and RTDs need to be appropriately marked. A 6 month interval for checking the calibration of the thermocouples and RTDs is suggested. The vendor documentation is attached for your reference. Please call me at extension 6090 if you have any questions.

Sincerely,



Darrell S. Dunn



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: Southwest Research Institute
6220 Culebra Road
San Antonio, Tx 78238

Date: October 23, 2000
Calib No.: 51313
Cust. P.O.: X97570I

CALIBRATION CERTIFICATE


This will certify that your material used to manufacture Type 'K' T/C Assy # MTC-B-0632-U-36-48-TEX was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on October 23, 2000 against our standard, which is traceable to the National Institute of Standards Technology.

Ambient Temperature: 75.90°F
Furnace Atmosphere: Air
Humidity: 41.00%
Temperature Points: See Below
Lot #: MAT660L

CALIBRATION RESULTS ARE AS FOLLOWS:

Standard	Corrections			
	<u>Inside End</u>	<u>Inside End</u>	<u>Outside End</u>	<u>Outside End</u>
32°F	+0.2°F	0.000 MV	+0.3°F	0.000 MV
500°F	+0.6°F	10.539 MV	+0.7°F	10.539 MV
1000°F	+1.2°F	22.232 MV	+1.3°F	22.232 MV
1500°F	+1.7°F	33.867 MV	+1.8°F	33.867 MV
2000°F	+2.0°F	44.824 MV	+2.1°F	44.824 MV

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSI/NCSL Z540-1-1994, AMS 2750C, ASTM E 220-98, ASTM E 230-98, ASTM E 257-98
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.0.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001	We hereby certify that the above is a true copy of our records. DURO-SENSE CORPORATION  Quality Control Department
Leeds and Northrup K-5: Model 7555	
Precision Potentiometer S/N: 1752900	
Eppley Standard Cell: Model 100 - S/N 700851	
Cage Code: 58042	
Master Std. Thermocouple: Type 'S'	
N.I.S.T. Test Numbers: 263035	



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: Southwest Research Institute
6220 Culebra Road
San Antonio, Tx 78238

Date: October 23, 2000
Calib No.: 51313
Cust. P.O.: X97570I

CALIBRATION CERTIFICATE


This will certify that your **RTD Assy # RPL-1-125-PD-316-3-6"-B-48"-D300-CU-D301-CU** was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on **October 23, 2000** against our standard, which is traceable to the National Institute of Standards Technology.

Ambient Temperature: **75.90°F**
Furnace Atmosphere: **Air**
Humidity: **41.00%**
Temperature Points: **See Below**

CALIBRATION RESULTS ARE AS FOLLOWS:

Standard		Corrections	
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
322	32°F	+0.2°F	100 OHM
	212°F	+0.2°F	138.51 OHM
	500°F	+0.4°F	197.71 OHM
	1000°F	+0.6°F	293.30 OHM
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
323	32°F	+0.2°F	100 OHM
	212°F	+0.2°F	138.51 OHM
	500°F	+0.3°F	197.71 OHM
	1000°F	+0.8°F	293.30 OHM

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSINC-SL Z540-1-1994, AMS 2750C, ASTM E 220-88, ASTM E 230-88, ASTM E 207-88
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.8.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001	We hereby certify that the above is a true copy of our records. DURO-SENSE CORPORATION  Quality Control Department
Leeds and Northrup K-5: Model 7555	
Precision Potentiometer S/N: 1752900	
Eppley Standard Cell: Model 100 - S/N 700851	
Cage Code: 58042	
Master Std. Thermocouple: Type 'S'	
N.I.S.T. Test Numbers: 263035	



DURO-SENSE CORPORATION
20801 Higgins Court, Torrance, CA 90501
Phone: (310) 533-6877 Fax: (310) 533-0330

TO: **Southwest Research Institute**
6220 Culebra Road
San Antonio, Tx 78238

Date: **October 23, 2000**
Calib No.: **51313**
Cust. P.O.: **X97570I**

CALIBRATION CERTIFICATE


This will certify that your **RTD Assy # RPL-1-125-PD-316-3-6"-B-48"-D300-CU-D301-CU** was/were calibrated I.A.W. calibration procedure 26.00 Rev. A on **October 23, 2000** against our standard, which is traceable to the National Institute of Standards Technology.

Ambient Temperature: **75.90°F**
Furnace Atmosphere: **Air**
Humidity: **41.00%**
Temperature Points: **See Below**

CALIBRATION RESULTS ARE AS FOLLOWS:

Standard		Corrections	
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
324	32°F	+0.1°F	100 OHM
	212°F	+0.2°F	138.51 OHM
	500°F	+0.5°F	197.71 OHM
	1000°F	+0.8°F	293.30 OHM
<u>SERIAL #</u>	<u>STANDARD</u>		<u>OHM</u>
325	32°F	+0.2°F	100 OHM
	212°F	+0.1°F	138.51 OHM
	500°F	+0.4°F	197.71 OHM
	1000°F	+0.7°F	293.30 OHM

Calibration procedure I.A.W. ISO 10012-1:1992(E), ANSI/NCSL Z540-1-1994, AMS 2750C, ASTM E 220-98, ASTM E 230-98, ASTM E 207-98
The calibration of thermocouples is subject to change during use. The amount of change depends on factors such as temperature, time, and condition of use.
Total Uncertainty of Readings is Less Than .01%. Accuracy I.A.W. industry standards noted in calibration procedure 26.0.
This certificate shall not be reproduced except in full, without the written approval of the laboratory.

N.I.S.T. Recertification Date: January 24, 2001	We hereby certify that the above is a true copy of our records. DURO-SENSE CORPORATION  Quality Control Department
Leeds and Northrup K-5: Model 7555	
Precision Potentiometer S/N: 1752900	
Eppley Standard Cell: Model 100 - S/N 700851	
Cage Code: 58042	
Master Std. Thermocouple: Type 'S'	
N.I.S.T. Test Numbers: 263035	



SOUTHWEST RESEARCH INSTITUTE™

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

SwRI Cal-Lab		By:mar	
Cal: Apr 01, 03	Due: Apr 01, 04		
As: 009261	Sn: 293376W		

Certificate of Calibration

Submitted By: DIV20

Address: B57

Contact: DARRELL DUNN

Manufacturer Model: DURO-SENSE TYPE K, SET OF 15

Description: THERMOCOUPLE

Serial No: 293376W

Asset No: 009261

Procedure: THERMOCOUPLE GENERAL, JAN/03

Work Order: 444053019

Date Issued: Apr 2, 2003

Calibration Date: Apr 1, 2003

****Calibration Due:** Apr 1, 2004

Calibration Location: Bldg. 64

Environment: Temp. 76.0°F Hum. 45 %RH

***As Found:** IN TOLERANCE

***As Left:** IN TOLERANCE

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/NCSL 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: SET OF 15 THERMOCOUPLES NUMBERED 1 TO 18. THERMOCOUPLES #4, #5, AND #6 DAMAGED DURING CUSTOMER USE AND REMOVED FROM SET.

Standards Used

Asset	Manufacturer	Model	Description	Cal Due
009137	HART SCIENTIFIC, INC	1575	THERMOMETER	Jul 06, 03
008920	HART SCIENTIFIC, INC	17660-A-120-6-W	PLATINUM RTD	Jul 06, 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 Data Sheet

Work Order	444053019	Mfr.	Duro-Sense	Technician	Mark A. Romero
Asset #.	009261	Model	Type K		
Serial #.	293376W	Type	Thermocouple	Cal Date	1-Apr-03
Remarks: Set of 15 thermocouples numbered 1 to 18. Thermocouples #4, #5, and #6 damaged during customer use and removed from set. <i>Expected test limits are due to extension wire hooked up to thermocouple.</i> Accuracy comply with IEC 584-2 (1982)					

Function/Range	Test Point	TI Read	Difference	Test Limits +/-	Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	
Thermocouple # 1						
0.021	0.09	0.54	-0.45	2.20	0.26	Pass
Thermocouple # 2						
0.019	0.09	0.49	-0.40	2.20	0.26	Pass
Thermocouple # 3						
0.020	0.09	0.50	-0.41	2.20	0.26	Pass
Thermocouple # 7						
0.021	0.09	0.55	-0.46	2.20	0.26	Pass
Thermocouple # 8						
0.020	0.09	0.52	-0.43	2.20	0.26	Pass
Thermocouple # 9						
0.020	0.09	0.50	-0.41	2.20	0.26	Pass
Thermocouple # 10						
0.021	0.09	0.55	-0.46	2.20	0.26	Pass
Thermocouple # 11						
0.021	0.09	0.53	-0.44	2.20	0.26	Pass
Thermocouple # 12						
0.005	0.09	0.12	-0.03	2.20	0.26	Pass
Thermocouple # 13						
0.022	0.09	0.56	-0.47	2.20	0.26	Pass
Thermocouple # 14						
0.020	0.09	0.52	-0.43	2.20	0.26	Pass
Thermocouple # 15						
0.021	0.09	0.53	-0.44	2.20	0.26	Pass
Thermocouple # 16						
0.021	0.09	0.54	-0.45	2.20	0.26	Pass
Thermocouple # 17						
0.020	0.09	0.50	-0.41	2.20	0.26	Pass
Thermocouple # 18						
0.019	0.09	0.49	-0.40	2.20	0.26	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Data Sheet

Work Order	444053019	Mfr.	Duro-Sense	Technician	Mark A. Romero
Asset #.	009261	Model	Type K		
Serial #.	293376W	Type	Thermocouple	Cal Date	1-Apr-03
Remarks: Set of 15 thermocouples numbered 1 to 18. Thermocouples #4, #5, and #6 damaged during customer use and removed from set. <i>Expected test limits are due to extension wire hooked up to thermocouple.</i> Accuracy comply with IEC 584-2 (1982)					

Function/Range	Test Point	TI Read	Difference	Test Limits +/-	Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	
Thermocouple # 1						
6.206	149.95	151.67	-1.72	2.20	0.27	Pass
Thermocouple # 2						
6.216	149.95	151.92	-1.97	2.20	0.27	Pass
Thermocouple # 3						
6.211	149.95	151.80	-1.85	2.20	0.27	Pass
Thermocouple # 7						
6.207	149.95	151.71	-1.76	2.20	0.27	Pass
Thermocouple # 8						
6.211	149.95	151.80	-1.85	2.20	0.27	Pass
Thermocouple # 9						
6.215	149.95	151.91	-1.96	2.20	0.27	Pass
Thermocouple # 10						
6.209	149.95	151.74	-1.79	2.20	0.27	Pass
Thermocouple # 11						
6.211	149.95	151.80	-1.85	2.20	0.27	Pass
Thermocouple # 12						
6.140	149.95	150.05	-0.10	2.20	0.27	Pass
Thermocouple # 13						
6.200	149.95	151.53	-1.58	2.20	0.27	Pass
Thermocouple # 14						
6.211	149.95	151.79	-1.84	2.20	0.27	Pass
Thermocouple # 15						
6.203	149.95	151.60	-1.65	2.20	0.27	Pass
Thermocouple # 16						
6.201	149.95	151.54	-1.59	2.20	0.27	Pass
Thermocouple # 17						
6.211	149.95	151.79	-1.84	2.20	0.27	Pass
Thermocouple # 18						
6.220	149.95	152.03	-2.08	2.20	0.27	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Data Sheet

Work Order	444053019	Mfr.	Duro-Sense	Technician	Mark A. Romero
Asset #.	009261	Model	Type K		
Serial #.	293376W	Type	Thermocouple	Cal Date	1-Apr-03
Remarks: Set of 15 thermocouples numbered 1 to 18. Thermocouples #4, #5, and #6 damaged during customer use and removed from set. <i>Expected test limits are due to extension wire hooked up to thermocouple.</i> Accuracy comply with IEC 584-2 (1982)					

Function/Range	Test Point	TI Read	Difference	Test Limits +/-	Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	
Thermocouple # 1						
15.425	375.31	376.95	-1.64	2.20	0.29	Pass
Thermocouple # 2						
15.448	375.31	377.50	-2.19	2.20	0.29	Pass
Thermocouple # 3						
15.433	375.31	377.15	-1.84	2.20	0.29	Pass
Thermocouple # 7						
15.442	375.31	377.36	-2.05	2.20	0.29	Pass
Thermocouple # 8						
15.421	375.31	376.86	-1.55	2.20	0.29	Pass
Thermocouple # 9						
15.439	375.31	377.29	-1.98	2.20	0.29	Pass
Thermocouple # 10						
15.430	375.31	377.08	-1.77	2.20	0.29	Pass
Thermocouple # 11						
15.426	375.31	376.97	-1.66	2.20	0.29	Pass
Thermocouple # 12						
15.301	375.31	373.99	1.32	2.20	0.29	Pass
Thermocouple # 13						
15.397	375.31	376.29	-0.98	2.20	0.29	Pass
Thermocouple # 14						
15.419	375.31	376.81	-1.50	2.20	0.29	Pass
Thermocouple # 15						
15.417	375.31	376.76	-1.45	2.20	0.29	Pass
Thermocouple # 16						
15.403	375.31	376.44	-1.13	2.20	0.29	Pass
Thermocouple # 17						
15.424	375.31	376.94	-1.63	2.20	0.29	Pass
Thermocouple # 18						
15.441	375.31	377.34	-2.03	2.20	0.29	Pass
END OF REPORT						



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 #

0972-01

Certificate of Calibration

Submitted By: DIV20

Address: B57

Contact: DARRELL DUNN

Manufacturer Model: DURO-SENSE TYPE K, SET OF 14

Description: THERMOCOUPLE

Serial No: 293376W

Asset No: 009261

Procedure: THERMOCOUPLE GENERAL, JAN/03

Work Order: 444057985

Date Issued: Mar 25, 2004

Calibration Date: Mar 22, 2004

**Calibration Due: Mar 22, 2005

Calibration Location: Bldg. 64

Environment: Temp. 77.0°F Hum. 50 %RH

*As Found: IN TOLERANCE

*As Left: IN TOLERANCE

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: Set of 14 thermocouples numbered 1 to 18. TC #4, #5, #6, and #15 damaged during customer use and removed from set.

Standards Used

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

SwRI Cal Lab By: mar
CAL: Mar 22, 04 DUE: Mar 22, 05
AN: 009261 SN: 293376W
Set of 14 thermocouples
numbered 1 to 18. TC #4, #5, #6,
and #15 damaged during
customer use and removed from
set.

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:	444057985	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	009261	Model	Type K		
Serial No:	293376W	Type	Thermocouple	Cal Date	22-Mar-04

Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.
Set of 14 thermocouples numbered 1 to 18. Thermocouples #4, #5, #6, and #15 damaged during customer use and removed from set.

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
Thermocouple # 1						
0.011	0.10	0.27	0.17	2.20	0.03	Pass
Thermocouple # 2						
0.012	0.10	0.31	0.21	2.20	0.03	Pass
Thermocouple # 3						
0.012	0.10	0.31	0.21	2.20	0.03	Pass
Thermocouple # 7						
0.012	0.10	0.33	0.23	2.20	0.03	Pass
Thermocouple # 8						
0.016	0.10	0.41	0.31	2.20	0.03	Pass
Thermocouple # 9						
0.016	0.10	0.41	0.31	2.20	0.03	Pass
Thermocouple # 10						
0.013	0.10	0.34	0.24	2.20	0.03	Pass
Thermocouple # 11						
0.016	0.10	0.42	0.32	2.20	0.03	Pass
Thermocouple # 12						
0.002	0.10	-0.04	-0.14	2.20	0.03	Pass
Thermocouple # 13						
0.016	0.10	0.41	0.31	2.20	0.03	Pass
Thermocouple # 14						
0.018	0.10	0.45	0.35	2.20	0.03	Pass
Thermocouple # 16						
0.018	0.10	0.45	0.35	2.20	0.03	Pass
Thermocouple # 17						
0.018	0.10	0.46	0.36	2.20	0.03	Pass
Thermocouple # 18						
0.012	0.10	0.32	0.22	2.20	0.03	Pass

Southwest Research Institute
Calibration Laboratory
Calibration Report

Work Order:	444057985	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	009261	Model	Type K		
Serial No:	293376W	Type	Thermocouple	Cal Date	22-Mar-04

Remarks: Limits taken from ASTM E230-02 and are based on brand new unused thermocouples.
Set of 14 thermocouples numbered 1 to 18. Thermocouples #4, #5, #6, and #15 damaged during customer use and removed from set.

Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result
Thermocouple # 1						
6.201	150.05	151.55	1.50	2.20	0.03	Pass
Thermocouple # 2						
6.201	150.05	151.56	1.51	2.20	0.03	Pass
Thermocouple # 3						
6.201	150.05	151.55	1.50	2.20	0.03	Pass
Thermocouple # 7						
6.211	150.05	151.79	1.74	2.20	0.03	Pass
Thermocouple # 8						
6.204	150.05	151.63	1.58	2.20	0.03	Pass
Thermocouple # 9						
6.199	150.05	151.50	1.45	2.20	0.03	Pass
Thermocouple # 10						
6.203	150.05	151.60	1.55	2.20	0.03	Pass
Thermocouple # 11						
6.207	150.05	151.69	1.64	2.20	0.03	Pass
Thermocouple # 12						
6.126	150.05	149.71	-0.34	2.20	0.03	Pass
Thermocouple # 13						
6.197	150.05	151.45	1.40	2.20	0.03	Pass
Thermocouple # 14						
6.204	150.05	151.62	1.57	2.20	0.03	Pass
Thermocouple # 16						
6.198	150.05	151.48	1.43	2.20	0.03	Pass
Thermocouple # 17						
6.205	150.05	151.66	1.61	2.20	0.03	Pass
Thermocouple # 18						
6.209	150.05	151.76	1.71	2.20	0.03	Pass

END OF REPORT