

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 B57Manufacturer/Model:DURO-SENSE TYPE KDescription:THERMOCOUPLESerial Number:335Asset Number:008429Work Order Number:444049274

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:

IN to Leade Metrolo3

Institute Calibration Laboratory

m:\nona2la.rpt Rev date 8 Jan 01

Maas rements performed by:

Vince Morales, Technician

Page 1 of 1

Southwest Research Institute Calibration laboratory Calibration Sheet.

					Found/Left	
Work Order:	444049274	Mfr.	DURO-SENSE	Technician	Vmorales	
Asset No.	8429	Model	Туре К	Technician	Customer	
Serial No.	335	Туре.	Thermocouple	Cal Date.	July 15, 2002	
Remarks:	(1) The Differe	nce is equal	to TI reading - Test Poir	nt reading.		
(2) If no value is	listed the uncerta	ainty is >4/1				
Results are prov	vided without Pase	s or Fail Dat	a. It is up to the end use	r to determine if results		
meet their need	S.					
(3) Customer re-	quested readings	per letter da	ated November 16, 2000			
(4) Thermocoup	le checked with 1	2 inches of t	the thermocouple expose	ed to the bath.		
(5) Accuracy no	t stated					
(6) Results are p	provided without F	ass or Fail I	Data			

Function/Range	Test Point	TI Reading	Difference (1)	Uncertainty (2)
Туре К	Deg. C	Deg. C	Deg. C	Deg. C
0.04431mV	1.14	1.13	-0.01	0.017
6.12121mV	149.87	150.56	0.69	0.010

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R		HWESIKE 6220 Culebra Institut Institute C Phone: 210-522 Certifica	SEAKCH INSTITU Road, P.O. Drawer 28510 te Quality Systems Calibration Laboratory 2-5215 Fax 210-522-3692 ate of Calibration	
1	Submitted By: DIV20		Work Order:	444051751
	Address: B57		Date Issued:	Jan 15, 2003
	Contact: DARRELL D		Calibration Date:	Jan 14, 2003
Manufa	Description: THEPMOCO		**Calibration Due:	Jul 14, 2003
	Serial No: 335	OI LE	Environment:	Temp. 77.0°F Hum. 31 %RH
	Asset No: 008429		*As Found:	SEE ATTACHED DATA
	Procedure: CUSTOMER	LETTER DATED NOV	16, 2001 *As Left:	SEE ATTACHED DATA
onforms to IS e reproduced istrument des I. S. Governm	SO/IEC 17025, 1999 and ANSI/NCSL , except in full, without the written app scribed above. This certificate shall no nent.	Z540-1-1994 which are equiva proval of the Southwest Resear of be used to claim product ende	alent to relevant requirements of the ISO 9000-1994 ch Institute Calibration Laboratory. The results of the orsement by the American Association for Laborato	series of standards. This certificate may not nis calibration relate only to the individual ry Accreditation (A2LA) or any agency of the
presents an e presents an e an or equal t	valuation includes the file munder test a expanded uncertainty using a coverage 0.25% (4:1) of the test limit unless oth	factor of k=2 to approximate a erwise stated in remarks or an	with the ISO "Guide to the Expression of Oncertain a 95% confidence level. The calibration process pro attachment	vides a Test Uncertainty Ratio (TUR) of less
The client has n the Test Ins ability of the	s sole responsibility for determination strument (TI) reading(s) and limits as r TI.	of in/out of tolerance or compleported. The reported uncertain	iance/noncompliance. An in/out of tolerance opinic inty relates only to the results at the time of calibration	n is provided for your convenience based only on and does not imply any short or long term
*Calibration	interval is determined by the client and ance before the next calibration date.	d does not assure the instrumen	nt will remain within tolerance until this date. Any n	umber of factors may cause the instrument to
tandards	INONE			
tandards	None Used Manufacturer	Model	Description	Cal Due
tandards Asset 005243	None Used Manufacturer HEWLETT-PACKARD	Model 34420A	Description MULTIMETER	Cal Due Dec 11, 03
emarks: tandards Asset 005243 009414 009917	None Used Manufacturer HEWLETT-PACKARD HART SCIENTIFIC, INC HART SCIENTIFIC, INC	Model 34420A 1502A 5612	Description MULTIMETER TEMPERATURE READOUT THERMOMETER	Cal Due Dec 11, 03 Jul 06, 03 Jul 06, 04
tandards tandards Asset 005243 009414 009917	None Used Manufacturer HEWLETT-PACKARD HART SCIENTIFIC, INC HART SCIENTIFIC, INC	Model 34420A 1502A 5612	Description MULTIMETER TEMPERATURE READOUT THERMOMETER	Cal Due Dec 11, 03 Jul 06, 03 Jul 06, 04
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Southwest Research Institute Calibration Laboratory Calibration Data Sheet

		Oulibration Data Office	۱ <u>ــــــــــــــــــــــــــــــــــــ</u>		
Work Order 444051751	Mfr.	DURO-SENSE	Technician	V Morales	
Asset #. 8429	Model	TYPE K	Procedure	Customer	
Serial #. 335	Туре	THERMOCOUPLE	Cal Date	14-Jan-03	
Remarks:					

Readings are provided without reguard to "Pass"or"Fail".It is up to the user to determine it 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	
6.13	149.98	149.91	0.07		0.35	

	SOUTH	IWEST RESE 6220 Culebra Road Institute Qu. Institute Calibra Phone: 210-522-521 Certificate o	ARCH INSTITU , P.O. Drawer 28510 ality Systems ation Laboratory 5 Fax 210-522-3692 f Calibration	ΓΕ™
S Manufae This certificate conforms to IS be reproduced, instrument dess U. S. Governm Uncertainty eve represents an e than or equal to *The client has on the Test Insi stability of the **Calibration i	Submitted By: DIV20 Address: B57 Contact: DARRELL DU cturer Model: DURO-SENSE Description: THERMOCOU Serial No: 335 Asset No: 008429 Procedure: CUSTOMER L edocuments traceability to the National O/IEC 17025, 1999 and ANSI/NCSL Z except in full, without the written appre- cribed above. This certificate shall not l nent. aluation includes the item under test and xpanded uncertainty using a coverage fa o 25% (4:1) of the test limit unless other as sole responsibility for determination of trument (TI) reading(s) and limits as rep T1.	NN TYPE K PLE ETTER DATED NOV 16, 2 Institute of Standards and Technolo 540-1-1994 which are equivalent to oval of the Southwest Research Inst be used to claim product endorseme It is calculated in accordance with the actor of k=2 to approximate a 95% of wise stated in remarks or an attachr 'in/out of tolerance or compliance/r orted. The reported uncertainty rela-	Work Order: Date Issued: Calibration Date: **Calibration Due: Calibration Location: Environment: *As Found: 000 *As Left: gy (NIST) and the International System of U relevant requirements of the ISO 9000-1994 itute Calibration Laboratory. The results of t nt by the American Association for Laborator en ISO "Guide to the Expression of Uncertain confidence level. The calibration process pro- ment.	444054483 Jul 21, 2003 Jul 21, 2003 Jan 21, 2004 Bldg. 64 Temp. 73.0°F Hum. 50 %RH IN TOLERANCE IN TOLERANCE inits (SI). The Laboratory quality system series of standards. This certificate may not his calibration relate only to the individual ry Accreditation (A2LA) or any agency of the ty in Measurement" (GUM). The uncertainty wides a Test Uncertainty Ratio (TUR) of less on is provided for your convenience based only on and does not imply any short or long term
be out of tolera Remarks: Standards W Asset 009137 008920 005325	ince before the next calibration date. None Used Manufacturer HART SCIENTIFIC, INC HART SCIENTIFIC, INC XITRON TECHNOLOGIES	Model 1575 17660-A-120-6-W 2000M	Description THERMOMETER PLATINUM RTD V/A/T CALIBRATOR	Cal Due Jul 30, 03 Jul 30, 03 Oct 30, 03
Approved b Metrology (m:\Nona2lal.r	y: Walt Hill Group Leader pt Rev date 15, August 02	<u> </u>	Measurements Metrology Te	s by: Mark Romero chnician

Southwest Research Institute Calibration Laboratory Calibration Report

Work Order	444054483	Mfr.	Duro-Sense	Technician	Mark Romero
Asset #.	008429	Model	Туре К		
Serial #.	335	Туре	Thermocouple	Cal Date	21-Jul-03
Remarks: Accuracy 16, 2000.	/ taken from IEC 58	4-2 (1982).	Testing and procedure com	ply with custodian mem	o dated Nov.
Eurotice (Dense					

Function/Range	lest Point	II Read	Difference	+/-Limit	+/-Uncertainty	/ Found/Left	_
mV	Deg C	Deg C	Deg C	Deg C	Deg C	Result	-
0.01	0.09	0.30	-0.21	1.50	0.26	Pass	
6.13	150.05	149.68 EN	0.37 D OF REPORT	1.50	0.27	Pass	

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S. R	B	 SOUTHW EST RESEARCH INSTITUTE TM 6220 Culebra Road, P.O. Drawer 28510 Institute Quality Systems Institute Calibration Laboratory Phone: 210-522-5215 Fax 210-522-3692 Certificate of Calibration 						
S Manufac This certificate conforms to ISC be reproduced, c instrument desc U. S. Governme	ubmitted By: Address: Contact: turer Model: Description: Serial No: Asset No: Procedure: documents traceab D/IEC 17025, 1999 except in full, with ribed above. This ent.	DIV20 B57 DARRELL DUI DURO-SENSE THERMOCOUI 335 008429 CUSTOMER LI oility to the National I o and ANSI/NCSL Z5 iout the written appro certificate shall not b	VN TYPE K PLE ETTER DATED NOV nstitute of Standards and Te 40-1-1994 which are equiva val of the Southwest Resear e used to claim product ende	Work Order: Date Issued: Calibration Date: **Calibration Due: Calibration Location: Environment: *As Found: 16, 2000 *As Left: chnology (NIST) and the International System of U Jent to relevant requirements of the ISO 9000-1994 ch Institute Calibration Laboratory. The results of to present by the American Association for Laborator	444057133 Jan 26, 2004 Jul 26, 2004 Bldg. 64 Temp. 77.0°F Hum. 27 %RH IN TOLERANCE IN TOLERANCE inits (SI). The Laboratory quality system series of standards. This certificate may not his calibration relate only to the individual ry Accreditation (A2LA) or any agency of the			
Uncertainty eva represents an ex than or equal to *The client has on the Test Instr stability of the T **Calibration in be out of tolerar Rem arks:	luation includes th panded uncertaint 25% (4:1) of the t sole responsibility rument (TI) readin TI. terval is determin tee before the next None	te item under test and y using a coverage fa est limit unless other v for determination of g(s) and limits as report ed by the client and d t calibration date.	is calculated in accordance ctor of k=2 to approximate a vise stated in remarks or an in/out of tolerance or compl orted. The reported uncertai oes not assure the instrumer	with the ISO "Guide to the Expression of Uncertain 95% confidence level. The calibration process pro attachment. iance/noncompliance. An in/out of tolerance opinio nty relates only to the results at the time of calibrati t will remain within tolerance until this date. Any n	ty in Measurement" (GUM). The uncertainty wides a Test Uncertainty Ratio (TUR) of less on is provided for your convenience based only on and does not imply any short or long term number of factors may cause the instrument to			
Standards U Asset 005325 008920 009137	Ised Manufacturer XITRON TEC HART SCIEN HART SCIEN	HNOLOGIES TIFIC, INC TIFIC INC	Model 2000M 5614-17660-A-12 1575	Description V/A/T CALIBRATOR PLATINUM RTD THERMOMETER	Cal Due Nov 13, 04 Feb 07, 04 Feb 05, 04			
		,						
Approved by Metrology G m\a2la1.rpt Re	Walt Hill roup Leader v date 15, August	<u>447</u>	<u>~</u>	Measurement Metrology Te	s by: Mark Romero chnician			

Southwest Research Institute Calibration Laboratory Calibration Report

Work Order:	444057133	Mfr.	Duro-Sense		Technician	Mark Romerc
Asset No:	008429	Model	Туре І	K		
Serial No:	335	Туре	Thermocouple		Cal Date	26-Jan-04
Remarks: Limits taken	from ASTM E230-	-02 and are bas	ed on brand new u	unused therm	ocouples.	
Function/Range	Test Point	TI Read	Difference	+/-Limit	+/-Uncertainty	Found/Left
Function/Range mV	Test Point Deg C	TI Read Deg C	Difference Deg C	+/-Limit Deg C	+/-Uncertainty Deg C	Found/Left Result
Function/Range mV	Test Point Deg C	TI Read Deg C	Difference Deg C	+/-Limit Deg C	+/-Uncertainty Deg C	Found/Left Result
Function/Range mV 0.00	Test Point Deg C 0.09	TI Read Deg C -0.03	Difference Deg C 0.12	+/-Limit Deg C 2.20	+/-Uncertainty Deg C 0.03	Found/Left Result Pass

END OF REPORT

-0.58

2.20

0.03

Pass

150.48

6.16

149.90

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R		SOUTH	IWESTRESE 6220 Culebra Road Institute Qu Institute Calibb Phone: 210-522-52	CARCH INSTITU 1, P.O. Drawer 28510 tality Systems ration Laboratory 15 Fax 210-522-3692	ΓΕ TM
	®		Certificate (of Calibration	0972-01
Man ufa This certificate conforms to IS be reproduced instrument des U. S. Governn Uncertainty ev	Submitted By: Address: Contact: Incturer Model: Description: Serial No: Asset No: Procedure: e documents traceab SO/IEC 17025, 1999 , except in full, with cribed above. This nent.	DIV20 B57 DARRELL DU DURO-SENSE THERMOCOU 335 008429 CUSTOMER L ility to the National and ANSI/NCSL Z out the written appr certificate shall not	INN TYPE K IPLE ETTER DATED NOV 16, 2 Institute of Standards and Technol. 540-1-1994 which are equivalent to oval of the Southwest Research Ins be used to claim product endorsem d is calculated in accordance with th	Work Order: Date Issued: Calibration Date: **Calibration Due: Calibration Location: Environment: *As Found: 2000 *As Left: ogy (NIST) and the International System of U or relevant requirements of the ISO 9000-1994 titute Calibration Laboratory. The results of the ent by the American Association for Laborator he ISO "Guide to the Expression of Uncertain	444059854 Jul 20, 2004 Jul 20, 2004 Jan 20, 2005 Bldg. 64 Temp. 77.0°F Hum. 44 %RH IN TOLERANCE IN TOLERANCE nits (SI). The Laboratory quality system series of standards. This certificate may not his calibration relate only to the individual ry Accreditation (A2LA) or any agency of the ty in Measurement" (GUM). The uncertainty
represents an enumber for cal *The client has on the Test Ins stability of the **Calibration be out of tolera Rem a rks :	expanded uncertaint ibration data. s sole responsibility trument (TI) readin TI. interval is determine ance before the next None	y using a coverage f for determination o g(s) and limits as rep ed by the client and calibration date.	actor of k=2 to approximate a 95% f in/out of tolerance or compliance/ ported. The reported uncertainty re does not assure the instrument will	confidence level. See Remarks or attached Ca noncompliance. An in/out of tolerance opinic lates only to the results at the time of calibrati remain within tolerance until this date. Any n	alibration Report with the same Work Order on is provided for your convenience based only on and does not imply any short or long term number of factors may cause the instrument to
Standards	Used				
Asset	Manufacturer		Model	Description	Cal Due
009137 008920 005325	HART SCIENT HART SCIENT XITRON TECH	TIFIC TIFIC ANOLOGIES	1575 5614-17660-A-12 2000M	THERMOMETER PLATINUM RTD V/A/T CALIBRATOR	Sep 05, 04 Sep 09, 04 Nov 13, 04
Approved b Metrology (m:\a2la1.rpt R	y: Walt Hill Group Leader ev date 11, May 04	Ţv	Ú	Measurements Metrology Tec	by: Mark Romero chnician

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Southwest Research Institute Calibration Laboratory Measurement Report

Work Order:	444059854	Mfr.	Duro-Sense	Technician	Mark Romero
Asset No:	008429	Model	Туре К		
Serial No:	335	Туре	Thermocouple	Cal Date	20-Jul-04
Remarks: Limits tak	en from ASTM E23	0-02 and are	based on brand new unused	thermocouples.	
Verification complie	s with customer me	mo dated No	v. 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	0.04	0.06	2.20	0.028	Pass
	6.14	150.05	150.00 END C	0.05 DF REPORT	2.20	0.028	Pass

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