

Fluke Singapore Calibration Laboratory


Certificate of Calibration

Model : HART-1529**Serial Number : B31822****Description : CHUB-E4 THERMOMETER**

Fluke South East Asia Pte Ltd declares that the above described instrument met its tolerance limit stated in the report at the time of calibration. Fluke further declares that the Calibration System complies with the requirements of ISO/IEC 17025. The standards and Instruments used in this calibration are regularly calibrated at scheduled interval to maintain the required accuracy level and are traceable to National Metrology Centre(NMC), Singapore.

ISO/IEC 17025 states that Testing and Calibration laboratories that comply with ISO/IEC 17025:2005 International Standard will therefore also operate in accordance with ISO 9001.

It is recommended that this instrument be recalibrated 12 months from date of this calibration. However, the user or owner may choose to adopt another suitable calibration interval from this instrument's specification that meet their requirement. This certificate is issued with 3 set(s) of report with this report number: 2622537-2. Please refer to report for traceability information.


Anthony Ng

07-Sep-2016

Laboratory Manager



The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme.


Eang Lian Siang

Calibrated By

Calibration Date : 07-Sep-2016

Report of Calibration

This instrument was submitted by;
Nanyang Technological University, 50 Nanyang Ave, Singapore 639798


Report No. :	2622537-2	Temperature :	23 +/- 1 °C
Report Type :	AS-FOUND	Relative Humidity :	55 +/- 10 %
		Calibration date :	05-Sep-2016
Model (UUT) :	HART-1529		
Serial No. :	B31822		
Description :	CHUB-E4 THERMOMETER		
Procedure :	Hart 1529:(1 yr) 2CH-PRT/THR VER RS-232 749A MU		
Revision :	1.1 (Man.ref:1529 rev.180601)		

- (1) This instrument was checked and tested in accordance with the recommended procedure and environmental conditions stated in its instruction manual.
- (2) The data taken in the "AS-FOUND" condition of this instrument are recorded on the following pages of the report. This instrument was originally received in a "Functional" condition.
- (3) The data format of this report is explained as follows with respect to the type of instrument under test;
 - (a) UUT INDICATED : Records either the nominal value measured by the UUT, or the nominal value of the stimulus provided by the UUT.
 - (b) SYSTEM ACTUAL : Records the stimulus provided by the Calibration System, or the actual value measured by the Calibration System.
 - (c) MODIFIER : Usually records the frequency parameter of the point under test, or any special test condition called out in the test.
 - (d) MEASURED UNCERTAINTY : States the expanded measurement uncertainty of the test done.
 - (e) UUT TOL : States the allowable test tolerance of the UUT.
 - (f) UUT ERROR : Records the difference in value between the UUT Indicated and the System Actual.
 - (g) ERROR (%TOL) : Compares the UUT Error with the UUT Tol, express in %.
- (4) The data recorded are traceable to National Standards through working standards stated on page 2 of this report.



Cert No: LA-1997-0126-C

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme.


Anthony Ng 05-Sep-2016
Laboratory Manager

Calibrated By : Eang Lian Siang



Model : HART-1529
Serial No. : B31822

Page 1 of 4 (ref: 160905-13:52:03)

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Report of Calibration

Traceability Information

<u>Model</u>	<u>Report Number</u>	<u>Cal. Date</u>	<u>Due Date</u>
749A-A82011	2016023	28-Jul-2016	28-Jul-2017

Model : HART-1529

Serial No. : B31822

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Report of Calibration

TEST	UUT RANGE	UUT INDICATED	SYSTEM ACTUAL	MODIFIER	MEASURE'T UNCERT'Y	UUT TOL±	UUT ERROR	ERROR (%TOL)
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PRT Calibration Test - CH1.

1	0.000246Ω	0Ω			1.0E-004	500E-6Ω	0.000246Ω	49
2	24.99856Ω	24.998506Ω			2.6E-004	625E-6Ω	5.4e-5Ω	9
3	99.994572Ω	99.994868Ω			1.0E-003	.0025Ω	-0.000296Ω	12
4	200.01287Ω	200.01339Ω			2.0E-003	.005Ω	-0.00052Ω	10
5	400.037126Ω	400.03628Ω			4.0E-003	.01Ω	0.000846Ω	8

PRT Calibration Constants;

CO = 0.0006

C100 = 0.018

C400 = 0.0206

Thermistor Calibration Test - CH1.

6	1.86e-7kΩ	0kΩ			1.0E-002	.5Ω	1.86e-7kΩ	0
7	4.00044572kΩ	4.0003427kΩ			4.3E-002	.5Ω	0.00010302kΩ	21
8	10.000294kΩ	10.000227kΩ			1.0E-001	1Ω	6.7e-5kΩ	7
9	40.004086kΩ	40.004595kΩ			4.1E-001	4Ω	-0.000509kΩ	13
10	100.003514kΩ	100.00583kΩ			1.2E+000	10Ω	-0.002316kΩ	23
11	499.870672kΩ	499.96023kΩ			6.5E+000	150Ω	-0.089558kΩ	60

Thermistor Calibration Constants;

COK = -0

C10K = 0.0007

C100K = 0.0031

PRT Calibration Test - CH2.

12	-8.4e-5Ω	0Ω			6.9E-005	500E-6Ω	-8.4e-5Ω	17
13	24.998372Ω	24.998506Ω			2.6E-004	625E-6Ω	-0.000134Ω	21
14	99.99459Ω	99.994868Ω			1.0E-003	.0025Ω	-0.000278Ω	11
15	200.01292Ω	200.01339Ω			2.0E-003	.005Ω	-0.00047Ω	9
16	400.037896Ω	400.03628Ω			4.0E-003	.01Ω	0.001616Ω	16

PRT Calibration Constants;

CO = 0.0004

C100 = 0.0156

C400 = 0.0203

Model : HART-1529

Serial No. : B31822

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Report of Calibration

TEST	UUT RANGE	UUT INDICATED	SYSTEM ACTUAL	MODIFIER	MEASURE'T UNCERT'Y	UUT TOL±	UUT ERROR	ERROR (%TOL)
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Thermistor Calibration Test - CH2.

17	0kΩ		0kΩ		1.0E-002	.5Ω	0kΩ	0
18	4.000436kΩ		4.0003427kΩ		4.2E-002	.5Ω	9.33e-5kΩ	19
19	10.000412kΩ		10.000227kΩ		1.0E-001	1Ω	0.000185kΩ	19
20	40.004474kΩ		40.004595kΩ		4.0E-001	4Ω	-0.000121kΩ	3
21	100.003538kΩ		100.00583kΩ		1.1E+000	10Ω	-0.002292kΩ	23
22	499.872128kΩ		499.96023kΩ		6.6E+000	150Ω	-0.088102kΩ	59

Thermistor Calibration Constants;

COK = 0
 C10K = 0.0007
 C100K = 0.0031

The reported expanded measurement uncertainty (MU) was estimated at a level of confidence of approximately 95% with a coverage factor of $k = 2$.
 All MU figures are expressed in base units of the test. i.e. V, A, Ω, etc...; NOT IN mV, mA, kΩ, etc...
 Unit for the MU is the same as test unit, unless otherwise specify.

End of Test

Model : HART-1529

Serial No. : B31822

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Report of Calibration

This instrument was submitted by;
Nanyang Technological University, 50 Nanyang Ave, Singapore 639798


Report No. :	2622537-2	Temperature :	23 +/- 1 °C
Report Type :	AS-FOUND	Relative Humidity :	55 +/- 10 %
Model (UUT) :	HART-1529	Calibration date :	07-Sep-2016
Serial No. :	B31822		
Description :	CHUB-E4 THERMOMETER		
Procedure :	Hart 1529:(1 yr) 2CH-TC VER RS-232 MU		
Revision :	1.0 (Man.ref:1529 rev.180601)		

- (1) This instrument was checked and tested in accordance with the recommended procedure and environmental conditions stated in its instruction manual.
- (2) The data taken in the "AS-FOUND" condition of this instrument are recorded on the following pages of the report. This instrument was originally received in a "Functional" condition.
- (3) The data format of this report is explained as follows with respect to the type of instrument under test;
 - (a) UUT INDICATED : Records either the nominal value measured by the UUT, or the nominal value of the stimulus provided by the UUT.
 - (b) SYSTEM ACTUAL : Records the stimulus provided by the Calibration System, or the actual value measured by the Calibration System.
 - (c) MODIFIER : Usually records the frequency parameter of the point under test, or any special test condition called out in the test.
 - (d) MEASUREMENT UNCERTAINTY : States the expanded measurement uncertainty of the test done.
 - (e) UUT TOL : States the allowable test tolerance of the UUT.
 - (f) UUT ERROR : Records the difference in value between the UUT Indicated and the System Actual.
 - (g) ERROR (%TOL) : Compares the UUT Error with the UUT Tol, express in %.
- (4) The data recorded are traceable to National Standards through working standards stated on page 2 of this report.



Cert No: LA-1997-0126-C

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council - Singapore Laboratory Accreditation Scheme.


Anthony Ng
Laboratory Manager

07-Sep-2016

Calibrated By : Eang Lian Siang



Model : HART-1529

Serial No. : B31822

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Report of Calibration

Traceability Information

<u>Model</u>	<u>Report Number</u>	<u>Cal. Date</u>	<u>Due Date</u>
5700A-5645303	241558	13-May-2016	13-Sep-2016
TC-J-F10004	TL004179	05-Feb-2015	05-Feb-2017

Model : HART-1529

Serial No. : B31822



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Report of Calibration

TEST	UUT RANGE	UUT INDICATED	SYSTEM ACTUAL	MODIFIER	MEASURE'T UNCERT'Y	UUT TOL±	UUT ERROR	ERROR (%TOL)
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Thermocouple Calibration Test - CH3.

1	-5e-5mV	0mV	VIN		6.2E-007	5uV	-5e-5mV	1
2	49.99382mV	50mV	VIN		9.1E-007	5uV	-0.00618mV	124
3	99.98901mV	100mV	VIN		1.2E-006	10uV	-0.01099mV	110
4	-0.17°C	0°C	RJC		6.0E-002	.35°C	-0.17°C	49

Thermocouple Calibration Constants;

CO = -0.001

C100 = 0.3858

CRJ = 0.183

Thermocouple Calibration Test - CH4.

5	-0.00031mV	0mV	VIN		1.1E-006	5uV	-0.00031mV	6
6	49.99486mV	50mV	VIN		1.0E-006	5uV	-0.00514mV	103
7	99.98989mV	100mV	VIN		1.3E-006	10uV	-0.01011mV	101
8	-0.189°C	0°C	RJC		6.2E-002	.35°C	-0.189°C	54

Thermocouple Calibration Constants;

CO = -0.0002

C100 = 0.3763

CRJ = 0.172

The reported expanded measurement uncertainty (MU) was estimated at a level of confidence of approximately 95% with a coverage factor of $k = 2$.

All MU figures are expressed in base units of the test. i.e. V, A, Ω , etc...; NOT IN mV, mA, $k\Omega$, etc...

Unit for the MU is the same as test unit, unless otherwise specify.

End of Test

Model : HART-1529

Serial No. : B31822

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Report of Calibration

This instrument was submitted by;
Nanyang Technological University, 50 Nanyang Ave, Singapore 639798

Report No. :	2622537-2	Temperature :	23 +/- 1 °C
Report Type :	AS-LEFT	Relative Humidity :	55 +/- 10 %
Model (UUT) :	HART-1529	Calibration date :	07-Sep-2016
Serial No. :	B31822		
Description :	CHUB-E4 THERMOMETER		
Procedure :	Hart 1529:(1 yr) 2CH-TC VER RS-232 MU		
Revision :	1.0 (Man.ref:1529 rev.180601)		

- (1) This instrument was checked and tested in accordance with the recommended procedure and environmental conditions stated in its instruction manual.
- (2) The data taken in the "AS-LEFT" condition of this instrument are recorded on the following pages of the report. This instrument was originally received in a "Functional" condition.
- (3) The data format of this report is explained as follows with respect to the type of instrument under test;
 - (a) UUT INDICATED : Records either the nominal value measured by the UUT, or the nominal value of the stimulus provided by the UUT.
 - (b) SYSTEM ACTUAL : Records the stimulus provided by the Calibration System, or the actual value measured by the Calibration System.
 - (c) MODIFIER : Usually records the frequency parameter of the point under test, or any special test condition called out in the test.
 - (d) MEASURED UNCERTAINTY : States the expanded measurement uncertainty of the test done.
 - (e) UUT TOL : States the allowable test tolerance of the UUT.
 - (f) UUT ERROR : Records the difference in value between the UUT Indicated and the System Actual.
 - (g) ERROR (%TOL) : Compares the UUT Error with the UUT Tol, express in %.
- (4) The data recorded are traceable to National Standards through working standards stated on page 2 of this report.



Cert No: LA-1997-0126-C

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Anthony Ng 07-Sep-2016
Laboratory Manager

Calibrated By : Eang Lian Siang



Model : HART-1529
Serial No. : B31822

Page 1 of 3 (ref: 160907-15:36:26)

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Report of Calibration

Traceability Information

<u>Model</u>	<u>Report Number</u>	<u>Cal. Date</u>	<u>Due Date</u>
5700A-5645303	241558	13-May-2016	13-Sep-2016
TC-J-F10004	TL004179	05-Feb-2015	05-Feb-2017

Model : HART-1529

Serial No. : B31822



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Report of Calibration

TEST	UUT RANGE	UUT INDICATED	SYSTEM ACTUAL	MODIFIER	MEASURE'T UNCERT'Y	UUT TOL±	UUT ERROR	ERROR (%TOL)
Thermocouple Calibration Test - CH3.								
1		0.00073mV	0mV	VIN	6.3E-007	5uV	0.00073mV	15
2		50.00037mV	50mV	VIN	9.1E-007	5uV	0.00037mV	7
3		100.00123mV	100mV	VIN	1.2E-006	10uV	0.00123mV	12
4		-0.214°C	0°C	RJC	6.0E-002	.35°C	-0.214°C	61

Thermocouple Calibration Constants;

CO = -0.0003

C100 = 0.3976

CRJ = 0.183

Thermocouple Calibration Test - CH4.

5		0.00016mV	0mV	VIN	8.8E-007	5uV	0.00016mV	3
6		49.99994mV	50mV	VIN	1.1E-006	5uV	-6e-5mV	1
7		99.99999mV	100mV	VIN	1.3E-006	10uV	-1e-5mV	0
8		-0.19°C	0°C	RJC	6.2E-002	.35°C	-0.19°C	54

Thermocouple Calibration Constants;

CO = 0

C100 = 0.3865

CRJ = 0.172

The reported expanded measurement uncertainty (MU) was estimated at a level of confidence of approximately 95% with a coverage factor of $k = 2$.

All MU figures are expressed in base units of the test, i.e. V, A, Ω , etc...; NOT IN mV, mA, k Ω , etc...

Unit for the MU is the same as test unit, unless otherwise specify.

End of Test

Model : HART-1529

Serial No. : B31822

Page 3 of 3 (ref: 160907-15:36:26)

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