

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

Page: 1 of 24

**LABORATORY LOCATION: NORTHLAB SEAMS (M) SDN BHD**  
**(PERMANENT LABORATORY) NO. 43G - 45G, JALAN SS 25/2**  
**TAMAN BUKIT EMAS, 47301 PETALING JAYA**  
**SELANGOR, MALAYSIA**

The standard used for assessment of this laboratory is MS ISO/IEC 17025:2005

**FIELD OF CALIBRATION: DIMENSIONAL**

**SCOPE OF ACCREDITATION:**

<b><u>Instrument calibrated/ Measurement parameter</u></b>	<b><u>Range</u></b>	<b><u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u></b>
1) Plain Plug Gauge/Pin Gauge (diameter only)	0 mm to 10 mm	0.7 $\mu$ m
	10 mm to 50 mm	1.1 $\mu$ m
	50 mm to 100 mm	1.5 $\mu$ m
	100 mm to 150 mm	1.9 $\mu$ m
2) Plain Ring Gauge	0 mm to 50 mm	1.4 $\mu$ m
	50 mm to 100 mm	1.5 $\mu$ m
	100 mm to 150 mm	1.6 $\mu$ m
3) Plain Gap Gauge	0.5 mm to 10 mm	2.5 $\mu$ m
	10 mm to 150 mm	3 $\mu$ m
	150 mm to 300 mm	5 $\mu$ m
4) Screw Gauge & Thread Ring Gauge	M2 to M38	1.2 $\mu$ m
	M38 to M100	3.0 $\mu$ m
5) Feeler Gauge	0 mm to 1 mm	0.5 $\mu$ m
6) Thickness Gauge	0 mm to 20 mm	2.5 $\mu$ m
7) Other Limit Gauge – Height, Depth & Length	0 mm to 300 mm	(2 + 10 * Length in m) $\mu$ m
8) Dial Gauge	0 mm to 10 mm	0.6 $\mu$ m
	10 mm to 30 mm	0.7 $\mu$ m
	30 mm to 50 mm	0.8 $\mu$ m
	50 mm to 80 mm	1.0 $\mu$ m
	80 mm to 100 mm	1.5 $\mu$ m

\* The uncertainties are based on an estimated confidence probability of not less than 95% unless otherwise stated.

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: DIMENSIONAL**

**SCOPE OF ACCREDITATION:**

<b><u>Instrument calibrated/ Measurement parameter</u></b>	<b><u>Range</u></b>	<b><u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u></b>
9) Dial Test Indicator	0 mm to 5 mm	0.5 $\mu\text{m}$
10) Digital Indicator	0 mm to 100 mm	1 $\mu\text{m}$
11) Linear Gauges	0 mm to 100 mm	1 $\mu\text{m}$
12) Dial Thickness Gauge	0 mm to 20 mm (0.001 mm resolution)	3 $\mu\text{m}$
13) External Micrometer	25 mm traverse for frame up to 600 mm	2 $\mu\text{m}$
14) Thread Micrometer	0 mm to 100 mm	1 $\mu\text{m}$
15) Internal Micrometer including Stick Micrometer	25 mm traverse for stick length up to 900 mm	4 $\mu\text{m}$
16) Depth Micrometer	0 mm to 300 mm	3 $\mu\text{m}$
17) Dial / Digimatic & Vernier Caliper	0 mm to 1000 mm	16 $\mu\text{m}$
18) Dial / Digimatic & Vernier Height Gauge	0 mm to 1000 mm	16 $\mu\text{m}$
19) Precision Vernier Depth Gauge	0 mm to 300 mm	10 $\mu\text{m}$
20) Caliper Gauge	0 mm to 50 mm	5 $\mu\text{m}$
21) Height Setting Micrometer & Riser Block	0 mm to 300 mm 0 mm to 600 mm	0.8 $\mu\text{m}$ 1.5 $\mu\text{m}$

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: DIMENSIONAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
22) Caliper Checker	0 mm to 360 mm	1.2 $\mu$ m
	0 mm to 670 mm	1.6 $\mu$ m
23) Calibration Tester	0 mm to 25 mm, (0.001 mm resolution)	1.0 $\mu$ m
	0 mm to 30 mm, (0.0001 mm resolution)	0.2 $\mu$ m

**Signatories:**

- |                           |                              |
|---------------------------|------------------------------|
| 1. Tan Wei Leng           | I/C No. : 790901 - 08 - 5371 |
| 2. Sreejith Radhakrishnan | PP No.: A6574600             |
| 3. Ching John             | I/C No. : 760123 -10 - 5825  |
| 4. Jeffrey T. Pereira     | I/C No. : S 1534875 / E      |
| 5. Ng Chan Tong           | I/C No. : 611230-71-5507     |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: DIMENSIONAL**

**SITE CALIBRATION- CATEGORY I**

**SCOPE OF ACCREDITATION:**

<b><u>Instrument calibrated/ Measurement parameter</u></b>	<b><u>Range</u></b>	<b><u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u></b>
Measuring Projector	0 – 300 mm	4 $\mu$ m
Measuring Microscopes	200 mm X 100 mm	4 $\mu$ m
Surface Plate	length up to 600 mm	1.6 $\mu$ m
	over 600 mm to 1000mm	1.9 $\mu$ m
	over 1000 mm to 1500 mm	2.0 $\mu$ m
	over 1500 mm to 2000 mm	2.2 $\mu$ m

**Signatories:**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| <b>1. Tan Wei Leng</b>           | <b>I/C No. : 790901 - 08 - 5371</b> |
| <b>2. Sreejith Radhakrishnan</b> | <b>I/C No. : A 6574600</b>          |
| <b>3. Ching John</b>             | <b>I/C No. : 760123 -10 - 5825</b>  |
| <b>4. Jeffrey T. Pereira</b>     | <b>I/C No. : S 1534875 / E</b>      |
| <b>5. Ng Chan Tong</b>           | <b>I/C No. : 611230-71-5507</b>     |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD(S) OF CALIBRATION: FORCE MEASUREMENT**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Push / Pull Gauge	0 kgf to 10 kgf	0.1 % of Full Scale
	10 kgf to 30 kgf	0.2 % of Full Scale
	30 kgf to 50 kgf	0.25 % of Full Scale
Tension Gauge	0 kgf to 50 kgf	1 % of Full Scale
Torque Gauges	0 lbf.in to 10 lbf.in	0.035 lbf.in
	10 lbf.in to 60 lbf.in	0.15 lbf.in
	60 lbf.in to 100 lbf.in	0.26 lbf.in
	8 lbf.ft to 100 lbf.ft	0.12 lbf.ft
	100 lbf.ft to 200 lbf.ft	0.52 lbf.ft
	200 lbf.ft to 400 lbf.ft	1.5 lbf.ft
	400 lbf.ft to 600 lbf.ft	1.9 lbf.ft
	600 lbf.ft to 1000 lbf.ft	3.0 lbf.ft

**Signatories:**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| <b>1. Tan Wei Leng</b>           | <b>I/C No. : 790901 - 08 - 5371</b> |
| <b>2. Sreejith Radhakrishnan</b> | <b>I/C No. : A 6574600</b>          |
| <b>3. Ching John</b>             | <b>I/C No. : 760123 -10 - 5825</b>  |
| <b>4. Jeffrey T. Pereira</b>     | <b>I/C No. : S 1534875 / E</b>      |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: MASS**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Weighing Balances / Scales	0 g to 200 g	0.0003 g
	200 g to 1200 g	0.003 g
	1200 g to 6000 g	0.1 g
	6 kg to 30 kg	0.01 kg
	30 kg to 60 kg	0.01 kg
	60 kg to 150 kg	0.02 kg

**Signatories:**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| <b>1. Tan Wei Leng</b>           | <b>I/C No. : 790901 - 08 - 5371</b> |
| <b>2. Sreejith Radhakrishnan</b> | <b>I/C No. : A 6574600</b>          |
| <b>3. Ching John</b>             | <b>I/C No. : 760123 -10 - 5825</b>  |
| <b>4. Jeffrey T. Pereira</b>     | <b>I/C No. : S 1534875 / E</b>      |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELDS OF CALIBRATION: PRESSURE**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Pneumatic Pressure Instruments	0 bar to 8 bar	0.0018 bar
	8 bar to 10 bar	0.014 bar
	10 bar to 20 bar	0.024 bar
Hydraulic Pressure Instruments	1 bar to 400 bar	0.23 bar
	400 bar to 700 bar	0.36 bar
	700 bar to 1200 bar	0.60 bar
Vacuum Instruments	-0.97 bar to 0 bar	0.001 bar
Pneumatic Pressure Instruments	0 inH <sub>2</sub> O to 1 inH <sub>2</sub> O	0.0081 inH <sub>2</sub> O
	1 inH <sub>2</sub> O to 10 inH <sub>2</sub> O	0.13 inH <sub>2</sub> O

**Signatories:**

- 1. A. Murugappan** I/C No. : S 1427507 / Z
- 2. Tan Wei Leng** I/C No. : 790901 - 08 - 5371
- 3. Ching John** I/C No. : 760123 -10 - 5825
- 4. Jeffrey T.Pereira** I/C No. : S 1534875 / E
- 5. Kwan Yee Hong** I/C No. : 780516-14-5877

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: PRESSURE**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Pneumatic Pressure Instruments	0 inH <sub>2</sub> O to 1 inH <sub>2</sub> O	0.0081 inH <sub>2</sub> O
	1 inH <sub>2</sub> O to 10 inH <sub>2</sub> O	0.13 inH <sub>2</sub> O
	0 bar to 2 bar	0.005 bar
	2 bar to 10 bar	0.009 bar
	10 bar to 20 bar	0.023 bar
Hydraulic Pressure Instruments	20 bar to 400 bar	0.47 bar
	400 bar to 700 bar	0.65 bar
Vacuum	-0.97 bar to 0 bar	0.001 bar

**Signatories:**

- 1. A. Murugappan** I/C No. : S 1427507 / Z
- 2. Tan Wei Leng** I/C No. : 790901 - 08 - 5371
- 3. Ching John** I/C No. : 760123 -10 - 5825
- 4. Jeffrey T.Pereira** I/C No. : S 1534875 / E
- 5. Kwan Yee Hong** I/C No. : 780516-14-5877

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: TEMPERATURE**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>	
Temperature Sensors with Indicators	-15 to 30 °C	0.24 °C	
	30 to 200 °C	0.26 °C	
	200 to 450 °C	0.29 °C	
	450 to 600 °C	3.4 °C	
	600 to 800 °C	4.3 °C	
	800 to 1100 °C	1.8 °C	
	1100 to 1200 °C	3.3 °C	
PT100 & Thermocouple Sensors without Indicators	-15 to 30 °C	0.26 °C	
	30 to 200 °C	0.27 °C	
	200 to 450 °C	0.98 °C	
	450 to 600 °C	3.7 °C	
	600 to 800 °C	4.5 °C	
	800 to 1100 °C	2.3 °C	
	1100 to 1200 °C	3.6 °C	
Temperature Indicators using Electrical Simulation	PT 100 (3926)	-200 to 0 °C	0.6 °C
		0 to 630 °C	0.63 °C
	PT 100 (385)	-200 to 0 °C	0.59 °C
		0 to 400 °C	0.62 °C
		400 to 800 °C	0.74 °C
	PT 100 (3916)	-200 to -190 °C	0.67 °C
		-190 to 0 °C	0.59 °C
		0 to 360 °C	0.62 °C
	Thermocouple Type B	600 to 1820 °C	1.2 °C
	Type E	-250 to 1000 °C	0.79 °C
	Type J	-210 to 1200 °C	0.39 °C
	Type K	-210 to 1372 °C	0.51 °C
	Type N	-200 to 1300 °C	1.1 °C
	Type R	-20 to 1767 °C	1.5 °C
	Type S	-20 to 1767 °C	1.4 °C
	Type T	-250 to 400 °C	1 °C

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: TEMPERATURE**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Temperature Calibrators using Electrical Measurement		
PT 100 (3926)	-200 to 0 °C 0 to 630 °C	0.36 °C 0.59 °C
PT 100 (385)	-200 to 0 °C 0 to 400 °C 400 to 800 °C	0.67 °C 0.82 °C 1.1 °C
PT 100 (3916)	-200 to 0 °C 0 to 150 °C 150 to 360 °C	0.36 °C 0.36 °C 0.58 °C
Thermocouple		
Type B	600 to 1820 °C	1.5 °C
Type E	-250 to 1000 °C	1.6 °C
Type J	-210 to 1200 °C	0.73 °C
Type K	-210 to 1372 °C	0.84 °C
Type N	-200 to 1300 °C	1.2 °C
Type R	-20 to 1767 °C	2.8 °C
Type S	-20 to 1767 °C	2.7 °C
Type T	-250 to 400 °C	2.0 °C
Dry Block Calibrators	-15 °C to 450 °C 450 to 600 °C 600 to 1200 °C	0.2 °C 3.4 °C 5 °C
Liquid-in-Glass Thermometer (partial immersion)	-15 °C to 60 °C 60 °C to 150 °C 150 °C to 200 °C	0.26 °C 0.28 °C 0.39 °C

**Signatories:**

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| <b>1. A. Murugappan</b>              | <b>I/C No.: S 1427507 / Z</b>      |
| <b>2. Tan Wei Leng</b>               | <b>I/C No.: 790901 – 08 – 5371</b> |
| <b>3. Kwan Yee Hong</b>              | <b>I/C No. : 780516-14-5877</b>    |
| <b>4. Neela Lohit Pavani</b>         | <b>I/C No. : E 6557219</b>         |
| <b>5. Ramakrishna Pillai Sandeep</b> | <b>I/C No. : F 0674249</b>         |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: TEMPERATURE**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>	
Temperature Sensors with Indicators	-15 °C to 50 °C	0.24 °C	
	50 °C to 450 °C	0.29 °C	
	450 °C to 600 °C	3.5 °C	
	600 to 800 °C	4.3 °C	
	800 to 1100 °C	1.8 °C	
	1100 to 1200 °C	3.3 °C	
PT100 & Thermocouple Sensors without Indicators	-15 °C to 50 °C	1.1 °C	
	50 °C to 450 °C	1.1 °C	
	450 °C to 600 °C	3.8 °C	
	600 to 800 °C	4.5 °C	
	800 to 1100 °C	2.4 °C	
	1100 to 1200 °C	3.7 °C	
Temperature Indicators using Electrical Simulation			
PT 100 (3926)	-200 °C to 0 °C	0.59 °C	
	0 °C to 630 °C	0.63 °C	
PT 100 (385)	-200 °C to 0 °C	0.59 °C	
	0 °C to 400 °C	0.62 °C	
	400 °C to 800 °C	0.74 °C	
PT 100 (3916)	-200 °C to -190 °C	0.67 °C	
	-190 °C to 0 °C	0.59 °C	
	0 °C to 360 °C	0.62 °C	
Thermocouple			
	Type B	600 °C to 1820 °C	1.3 °C
	Type E	-250 °C to 1000 °C	0.9 °C
	Type J	-210 °C to 1200 °C	0.52 °C
	Type K	-210 °C to 1372 °C	0.67 °C
	Type N	-200 °C to 1300 °C	0.87 °C
	Type R	-20 °C to 1767 °C	1.6 °C
	Type S	-20 °C to 1767 °C	1.5 °C
Type T	-250 °C to 400 °C	1.3 °C	

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: TEMPERATURE**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Temperature Baths	-15 °C to 450 °C	0.2 °C
	450 °C to 600 °C	3.4 °C
	600 °C to 1200 °C	5 °C
Temperature Controlled Enclosures	-15 °C to 200 °C	1.1 °C
	200 °C to 450 °C	2.4 °C
	450 °C to 1200 °C	5.9 °C
Humidity controlled enclosure	5 °C to 60 °C	1.1 °C
	<u>5 °C to 20 °C</u>	
	20 %R.H to 50 %R.H	3.5 %R.H
	50 %R.H to 80 %R.H	4.2 %R.H
	80 %R.H to 95 %R.H	4.6 %R.H
	<u>20 °C to 40 °C</u>	
	20 %R.H to 50 %R.H	1.9 %R.H
	50 %R.H to 80 %R.H	2.5 %R.H
	80 %R.H to 95 %R.H	2.8 %R.H
	<u>40 °C to 60 °C</u>	
	20 %R.H to 50 %R.H	1.2 %R.H
	50 %R.H to 80 %R.H	1.6 %R.H
	80 %R.H to 95 %R.H	1.9 %R.H

**Signatories:**

- |                                      |                                    |
|--------------------------------------|------------------------------------|
| <b>1. A. Murugappan</b>              | <b>I/C No.: S 1427507 / Z</b>      |
| <b>2. Tan Wei Leng</b>               | <b>I/C No.: 790901 – 08 – 5371</b> |
| <b>3. Kwan Yee Hong</b>              | <b>I/C No. : 780516-14-5877</b>    |
| <b>4. Neela Lohit Pavani</b>         | <b>I/C No. : E 6557219</b>         |
| <b>5. Ramakrishna Pillai Sandeep</b> | <b>I/C No. : F 0674249</b>         |

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Measuring Instruments		
DC Voltage	0 mV to 330 mV	0.008% of rdg
	0.33 V to 3.3 V	0.006% of rdg
	3.3 V to 33 V	0.006% of rdg
	30 to 330 V	0.0066% of rdg
	330 to 1020 V	0.0066% of rdg
AC Voltage	1 mV to 33 mV	
	10 Hz to 45 Hz	0.48% of rdg
	45 Hz to 10 kHz	0.24% of rdg
	10 kHz to 20 kHz	0.3% of rdg
	20 kHz to 50 kHz	0.36% of rdg
	50 kHz to 100 kHz	0.52% of rdg
	100 kHz to 500 kHz	1.4% of rdg
	33 mV to 330 mV	
	10 Hz to 45 Hz	0.31% of rdg
	45 Hz to 10 kHz	0.065% of rdg
	10 kHz to 20 kHz	0.12% of rdg
	20 kHz to 50 kHz	0.2% of rdg
	50 kHz to 100 kHz	0.34% of rdg
	100 kHz to 500 kHz	0.92% of rdg
	0.33 V to 3.3 V	
	10 Hz to 45 Hz	0.18% of rdg
	45 Hz to 10 kHz	0.037% of rdg
	10 kHz to 20 kHz	0.095% of rdg
	20 kHz to 50 kHz	0.17% of rdg
	50 kHz to 100 kHz	0.34% of rdg
	100 kHz to 500 kHz	0.69% of rdg
3.3 V to 33 V		
10 Hz to 45 Hz	0.18% of rdg	
45 Hz to 10 kHz	0.048% of rdg	
10 kHz to 20 kHz	0.1% of rdg	
20 kHz to 50 kHz	0.24% of rdg	
50 kHz to 100 kHz	0.34% of rdg	
33 V to 330 V		
45 Hz to 1 kHz	0.06% of rdg	
1 kHz to 10 kHz	0.092% of rdg	
10 kHz to 20 kHz	0.1% of rdg	

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Measuring Instruments		
AC Voltage (Continue)	330 V to 1020 V	0.067% of rdg
	45 Hz to 1 kHz	0.23% of rdg
	1 kHz to 5 kHz	0.23% of rdg
DC Current	5 kHz to 10 kHz	0.23% of rdg
	0 mA to 3.3 mA	0.017% of rdg
	3.3 mA to 33 mA	0.012% of rdg
	33 mA to 330 mA	0.013% of rdg
	330 mA to 2.2 A	0.037% of rdg
AC Current	2.2 A to 11 A	0.073% of rdg
	11 A to 500A (current coil)	1.1% of rdg
	0.029 mA to 0.33 mA	
	10 Hz to 20 Hz	0.34% of rdg
	20 Hz to 45 Hz	0.2% of rdg
	45 Hz to 1 kHz	0.23% of rdg
	1 kHz to 5 kHz	0.51% of rdg
	5 kHz to 10 kHz	1.5% of rdg
	0.33 mA to 3.3 mA	
	10 Hz to 20 Hz	0.24% of rdg
	20 Hz to 45 Hz	0.13% of rdg
	45 Hz to 1 kHz	0.13% of rdg
	1 kHz to 5 kHz	0.24% of rdg
5 kHz to 10 kHz	0.7% of rdg	
3.3 mA to 33 mA		
10 Hz to 20 Hz	0.24% of rdg	
20 Hz to 45 Hz	0.13% of rdg	
45 Hz to 1 kHz	0.12% of rdg	
1 kHz to 5 kHz	0.24% of rdg	
5 kHz to 10 kHz	0.7% of rdg	
33 mA to 330 mA		
20 Hz to 45 Hz	0.13% of rdg	
45 Hz to 1 kHz	0.12% of rdg	
1 kHz to 5 kHz	0.24% of rdg	
5 kHz to 10 kHz	0.7% of rdg	
0.33 A to 2.2 A		
10 Hz to 45 Hz	0.25% of rdg	
45 Hz to 1 kHz	0.13% of rdg	
1 kHz to 5 kHz	0.88% of rdg	

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD(S) OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Measuring Instruments	2.2 A to 11 A	
	45 Hz to 65 Hz	0.092% of rdg
AC Current	65 Hz to 500 Hz	0.14% of rdg
(Continue)	500 Hz to 1 kHz	0.4% of rdg
	11 A to 500 A (current coil)	1.5% of rdg
Resistance (DMM)	0 $\Omega$ to 11 $\Omega$	0.098% of rdg
	11 $\Omega$ to 33 $\Omega$	0.066% of rdg
	33 $\Omega$ to 110 $\Omega$	0.026% of rdg
	110 $\Omega$ to 330 $\Omega$	0.016% of vdg
	330 $\Omega$ to 1.1 k $\Omega$	0.017% of rdg
	1.1 k $\Omega$ to 3.3 k $\Omega$	0.013% of rdg
	3.3 k $\Omega$ to 11 k $\Omega$	0.017% of rdg
	11 k $\Omega$ to 33 k $\Omega$	0.013% of rdg
	33 k $\Omega$ to 110 k $\Omega$	0.019% of rdg
	110 k $\Omega$ to 330 k $\Omega$	0.016% of rdg
	330 k $\Omega$ to 1.1 M $\Omega$	0.023% of rdg
	1.1 M $\Omega$ to 3.3 M $\Omega$	0.021% of rdg
	3.3 M $\Omega$ to 11 M $\Omega$	0.076% of rdg
	11 M $\Omega$ to 33 M $\Omega$	0.14% of vdg
	33 M $\Omega$ to 110 M $\Omega$	0.59% of rdg
	110 M $\Omega$ to 330 M $\Omega$	0.59% of rdg
Capacitance	0.33 nF to 0.5 nF	2.9% of rdg
	0.5 nF to 1.1 nF	1.6% of rdg
	1.1 nF to 3.3 nF	0.94% of rdg
	3.3 nF to 11 nF	0.69% of rdg
	11 nF to 33 nF	0.64% of rdg
	33 nF to 110 nF	0.4% of rdg
	110 nF to 330 nF	0.4% of rdg
	0.33 $\mu$ F to 1.1 $\mu$ F	0.4% of rdg
	1.1 $\mu$ F to 3.3 $\mu$ F	0.51% of rdg
	3.3 $\mu$ F to 11 $\mu$ F	0.52% of rdg
	11 $\mu$ F to 33 $\mu$ F	0.58% of rdg
	33 $\mu$ F to 110 $\mu$ F	0.69% of rdg
	110 $\mu$ F to 330 $\mu$ F	0.92% of rdg
	330 mF to 1.1 mF	1.2% of rdg
Frequency	0.01 Hz to 12 kHz	0.0003 kHz
	12 kHz to 100 kHz	0.020 kHz

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Oscilloscope Calibrations		
Amplitude	1 mV to 200 mV up to 10 MHz	0.26% of rdg
	30 MHz to 100 MHz	0.31% of rdg
	200 mV to 200V up to 10 MHz 30 MHz to 100 MHz	0.31% of rdg 0.35% of rdg
Frequency	1 mV to 1 V 100 MHz to 200 MHz	1.6% of rdg
	200 MHz to 500 MHz	5.1% of rdg
	500 MHz to 1 GHz	12% of rdg
Frequency	0.1 Hz to 10 MHz	0.007% of rdg
	20 MHz to 100 MHz	0.00083% of rdg
Period	10 ns to 50 ns	0.006% of rdg
	100 ns to 500 ns	0.007% of rdg
	1 $\mu$ s to 500 $\mu$ s	0.007% of rdg
	1 ms to 500 ms	0.007% of rdg
	1 s to 15 s	0.23% of rdg

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Measuring Instruments	0.01 $\Omega$ to 0.1 $\Omega$	12 % of rdg
	0.1 $\Omega$ to 1 $\Omega$	5.8 % of rdg
Resistance (Insulation Resistance)	1 $\Omega$ to 10 $\Omega$	1.2 % of rdg
	10 $\Omega$ to 100 $\Omega$	0.58 % of rdg
	100 $\Omega$ to 1000 $\Omega$	0.12 % of rdg
	1 k $\Omega$ to 10 k $\Omega$	0.12 % of rdg
	10 k $\Omega$ to 100 k $\Omega$	0.12 % of rdg
	100 k $\Omega$ to 1000 k $\Omega$	0.12 % of rdg
	1 M $\Omega$ to 10 M $\Omega$	0.12 % of rdg
	10 M $\Omega$ to 100 M $\Omega$	1.2 % of rdg
Capacitance	100 M $\Omega$ to 25 G $\Omega$	7.6 % of rdg
	10 pF to 110 pF	1.3 % of rdg
	110 pF to 1000 pF	1.3 % of rdg
	1 nF to 10 nF	1.2 % of rdg
	10 nF to 100 nF	1.2 % of rdg
	100 nF to 1000 nF	1.2 % of rdg
	1 $\mu$ F to 10 $\mu$ F	1.2 % of rdg
Inductance	10 $\mu$ H to 100 $\mu$ H	2.3 % of rdg
	100 $\mu$ H to 1000 $\mu$ H	2.3 % of rdg
	1 mH to 10 mH	2.3 % of rdg
	10 mH to 100 mH	2.3 % of rdg
	100 mH to 1000 mH	2.3 % of rdg
	1 H to 10 H	2.3 % of rdg

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Sourcing Instruments	1 mV to 100 mV	0.01 mV
	100 mV to 1V	0.06 mV
DC Voltage	1 V to 10 V	0.47 mV
	10 V to 100 V	0.01 V
	100 V to 1000 V	0.07 V
	1 kV to 40 kV	2.41 % of rdg
AC Voltage	10 mV to 100 mV	$\pm$ (% of range + % of rdg + digits)
	3 Hz to 5 Hz	0.046 + 1.2 + 0.02 $\mu$ V
	5 Hz to 10 Hz	0.046 + 0.4 + 0.02 $\mu$ V
	10 Hz to 20 kHz	0.046 + 0.06 + 0.02 $\mu$ V
	20 kHz to 50 kHz	0.06 + 0.13 + 0.02 $\mu$ V
	50 kHz to 100 kHz	0.09 + 0.7 + 0.02 $\mu$ V
	100 kHz to 300 kHz	0.58 + 4.6 + 0.02 $\mu$ V
	100 mV to 1 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 0.11 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 0.11 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 0.1 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 0.11 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 0.11 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 0.11 mV
	1 V to 10 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 1.3 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 1.3 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 1.3 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 1.3 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 1.3 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 1.3 mV
	10 V to 100 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 16 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 16 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 16 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 16 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 16 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 16 mV
	100 V to 750 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 0.18 V
	5 Hz to 10 Hz	0.035 + 0.4 + 0.18 V
	10 Hz to 20 kHz	0.035 + 0.07 + 0.18 V
	20 kHz to 50 kHz	0.058 + 0.14 + 0.18 V
	50 kHz to 100 kHz	0.092 + 0.7 + 0.18 V
	100 kHz to 300 kHz	0.58 + 4.6 + 0.18 V

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Sourcing Instruments	1 kV to 40 kV	
AC Voltage (Continue)	45 Hz to 65 Hz	0 + 7.01 + 3.5 V
DC Current	1 mA to 10 mA	0.01 mA
	10 mA to 100 mA	0.06 mA
	100 mA to 1 A	1.3 mA
	1 A to 3 A	4.9 mA
	3 A to 200 A	0.73 % of rdg
AC Current	100 mA to 1 A	
	3 Hz to 5 Hz	12 mA
	5 Hz to 10 Hz	4 mA
	10 Hz to 5 kHz	1.7 mA
	1 A to 3 A	
	3 Hz to 5 Hz	0.04 A
	5 Hz to 10 Hz	14 mA
	10 Hz to 5 kHz	7.3 mA
	3 A to 200 A	
	45 Hz to 65 Hz	1.8 % of rdg
RESISTANCE	10 $\Omega$ to 100 $\Omega$	0.016% of rdg
	100 $\Omega$ to 1 k $\Omega$	0.013% of rdg
	1 k $\Omega$ to 10 k $\Omega$	0.013% of rdg
	10 k $\Omega$ to 100 k $\Omega$	0.013 % of rdg
	100 k $\Omega$ to 1 M $\Omega$	0.013 % of rdg
	1 M $\Omega$ to 10 M $\Omega$	0.048 % of rdg
	10 M $\Omega$ to 100 M $\Omega$	1.14% of rdg
Frequency ( 100mv To 750v)	3 Hz to 5 Hz	0.12% of rdg
	5 Hz to 10 Hz	0.058% of rdg
	10 Hz to 40 Hz	0.035% of rdg
	40 Hz to 300 kHz	0.012% of rdg
Capacitance	100 nF to 1000 nF	1.6 % of rdg
	1000 nF to 10 $\mu$ F	1.6 % of rdg
	10 $\mu$ F to 100 $\mu$ F	1.6 % of rdg
	100 $\mu$ F to 1000 $\mu$ F	1.4 % of rdg
	1000 $\mu$ F to 9999 $\mu$ F	12 % of rdg

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Single Phase Power Meter		
a) DC Power	40 mW to 200 mW 0.22 W to 720 W 720 W to 11000 W	0.071 % of rdg 0.047 % of rdg 0.1 % of rdg
b) i. AC Power @ 45Hz to 65Hz	0.04 W to 3.3 W 3.3 W to 11000 W	0.51 % of rdg 0.31 % of rdg
b) ii. Power Factor	0 to 1	0.003

**Signatories:**

**1. A. Murugappan**

**I/C No.: S 1427507 / Z**

**2. RamaKrishna Pillai Sandeep**

**I/C No.: E 6557219**

**3. Neela Lohit Pavani**

**I/C No.: F 0674249**

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Measuring Instruments		
DC Voltage	1 mV to 110 mV	23 $\mu$ V
	110 mV to 1.1 V	0.23 mV
	1.1 V to 15 V	3.4 mV
DC Current	0.1 mA to 2 mA	3.7 $\mu$ A
	2 mA to 22 mA	5.2 $\mu$ A
Resistance	1 m $\Omega$ to 11 $\Omega$	3% of rdg
	11 $\Omega$ to 110 $\Omega$	0.16 $\Omega$
	110 $\Omega$ to 1.1 k $\Omega$	1.1 $\Omega$
	1.1 k $\Omega$ to 11 k $\Omega$	0.012 k $\Omega$
Frequency	0 Hz to 11 Hz	12 mHz
	11 Hz to 110 Hz	35 mHz
	110 Hz to 1100 Hz	0.31 Hz
	1.1 kHz to 11 kHz	3.2 Hz
	11 kHz to 50 kHz	14 Hz
Capacitance	10 pF to 110 pF	1.3% rdg
	110 pF to 1000 pF	1.3% rdg
	1 nF to 10 nF	1.3% rdg
	10 nF to 100 nF	1.3% rdg
	100 nF to 1000 nF	1.3% rdg
	1 $\mu$ F to 10 $\mu$ F	1.3% rdg
Inductance	10 $\mu$ H to 100 $\mu$ H	2.5% rdg
	100 $\mu$ H to 1000 $\mu$ H	2.5% rdg
	1 mH to 10 mH	2.5% rdg
	10 mH to 100 mH	2.5% rdg
	100 mH to 1000 mH	2.5% rdg
	1 H to 10 H	2.5% rdg
Sourcing Instruments		
DC Voltage	1 mV to 100 mV	13 $\mu$ V
	100 mV to 1 V	6.9 $\mu$ V
	1 V to 10 V	0.61 mV
	10 V to 100 V	7.4 mV
	100 V to 1000 V	78 mV
	1 kV to 6 kV	2.4% of rdg
	6 kV to 40 kV	2.4% of rdg

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Sourcing Instruments	10 mV to 100 mV	+/- (% of range + % of rdg + digits)
AC Voltage	3 Hz to 5 Hz	0.046 + 1.2 + 0.02 $\mu$ V
	5 Hz to 10 Hz	0.046 + 0.4 + 0.02 $\mu$ V
	10 Hz to 20 kHz	0.046 + 0.05 + 0.02 $\mu$ V
	20 kHz to 50 kHz	0.06 + 0.13 + 0.02 $\mu$ V
	50 kHz to 100 kHz	0.08 + 0.7 + 0.02 $\mu$ V
	100 kHz to 300 kHz	0.58 + 4.6 + 0.02 $\mu$ V
	100 mV to 1 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 0.11 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 0.11 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 0.11 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 0.11 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 0.11 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 0.11 mV
	1 V to 10 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 1.3 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 1.3 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 1.3 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 1.3 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 1.3 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 1.3 mV
	10 V to 100 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 16 mV
	5 Hz to 10 Hz	0.035 + 0.4 + 16 mV
	10 Hz to 20 kHz	0.035 + 0.07 + 16 mV
	20 kHz to 50 kHz	0.058 + 0.14 + 16 mV
	50 kHz to 100 kHz	0.092 + 0.7 + 16 mV
	100 kHz to 300 kHz	0.58 + 4.6 + 16 mV
	100 V to 750 V	
	3 Hz to 5 Hz	0.035 + 1.2 + 0.18 V
	5 Hz to 10 Hz	0.035 + 0.4 + 0.18 V
	10 Hz to 20 kHz	0.035 + 0.07 + 0.18 V
	20 kHz to 50 kHz	0.058 + 0.14 + 0.18 V
	50 kHz to 100 kHz	0.092 + 0.7 + 0.18 V
	100 kHz to 300 kHz	0.58 + 4.6 + 0.18 V
	1 kV to 40 kV	
	45 Hz to 65 Hz	0 + 7.01 + 3.5 V

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Sourcing Instruments	1 mA to 10 mA	9 uA
	10 mA to 100 mA	7 uA
DC Current	100 mA to 1 A	1.5 mA
	1 A to 3 A	4.8 mA
	3 A to 200 A	0.59% rdg
AC Current	1 mA to 1 A	
	3 Hz to 5 Hz	12 mA
	5 Hz to 10 Hz	4 mA
	10 Hz to 5 kHz	1.7 mA
	1 A to 3 A	
	3 Hz to 5 Hz	0.04 A
	5 Hz to 10 Hz	14 mA
10 Hz to 5 kHz	7.4 mA	
	3 A to 200 A	
	45 Hz to 65 Hz	0.65% rdg
Resistance	0.0001 $\Omega$ to 100 $\Omega$	0.02 $\Omega$
	100 $\Omega$ to 1 k $\Omega$	0.15 $\Omega$
	1 k $\Omega$ to 10 k $\Omega$	1.5 $\Omega$
	10 k $\Omega$ to 100 k $\Omega$	0.01 k $\Omega$
	100 k $\Omega$ to 1 M $\Omega$	0.16 k $\Omega$
	1 M $\Omega$ to 10 M $\Omega$	5.6 k $\Omega$
	10 M $\Omega$ to 100 M $\Omega$	1.4% of rdg

**NO: SAMM 049**

(Issue 6, 25 July 2007 replacement of  
SAMM 049 dated 7 March 2007)

**FIELD OF CALIBRATION: ELECTRICAL**

**SITE CALIBRATION – CATEGORY I**

**SCOPE OF ACCREDITATION:**

<u>Instrument calibrated/ Measurement parameter</u>	<u>Range</u>	<u>Best measurement capability expressed as an uncertainty (<math>\pm</math>) *</u>
Sourcing Instruments		
Frequency ( 100 mv ~ 750 v)	3 Hz to 5 Hz	0.01 Hz
	5 Hz to 10Hz	0.01 Hz
	10 Hz to 40 Hz	0.01 Hz
	40 Hz to 300 kHz	0.04 kHz
Capacitance	100 nF to 1000 nF	1.6% rdg
	1000 nF to 10 $\mu$ F	1.6% rdg
	10 $\mu$ F to 100 $\mu$ F	1.6% rdg
	100 $\mu$ F to 1000 $\mu$ F	1.4% rdg
	1000 $\mu$ F to 9999 $\mu$ F	12% rdg

**Signatories:**

1. A. Murugappan

I/C No.: S 1427507 / Z

2. RamaKrishna Pillai Sandeep

I/C No.: E 6557219

3. Neela Lohit Pavani

I/C No.: F 0674249