Issue date: 06 April 2025
Valid Until: -

NO: SAMM 641

LABORATORY LOCATION/ CENTRAL OFFICE:	Biomedical Calibration Lab (BMCL), Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam ME 004 Jabatan Kejuruteraan Elektrik Politeknik Primier Sultan Abdul Aziz Shah Seksyen U1, Persiaran Usahawan, 40150 Shah Alam, Selangor , 40150, SELANGOR MALAYSIA
ACCREDITED SINCE :	06 APRIL 2025
FIELD(S) OF CALIBRATION:	ELECTRICAL PRESSURE VOLUME

This laboratory has demonstrated its technical competence to operate in accordance with MS ISO/IEC 17025:2017 (ISO/IEC 17025:2017).

This laboratory's fulfillment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001 (see Joint ISO-ILAC-IAF Communiqué dated April 2017).

*** The uncertainty covered by the CMC is expressed as the expanded uncertainty corresponding to a coverage probability of approximately 95 % and have a coverage factor of k=2 unless stated otherwise.**

CENTRAL LOCATION	Biomedical Calibration Lab (BMCL), Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam ME 004 Jabatan Kejuruteraan Elektrik Politeknik Primier Sultan Abdul Aziz Shah Seksyen U1, Persiaran Usahawan, 40150 Shah Alam, Selangor , 40150, Selangor
FIELD(S) OF CALIBRATION :	ELECTRICAL, PRESSURE, VOLUME

SCOPE OF CALIBRATION : ELECTRICAL

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
(ecg)/ Patient	0.50 mV to 5.50 mV	33 mVIV + 17 pV	Generation pulse
	0.75 mV to 80 mV	60 + 4.2	Measurement by
(manually Operated	a) Infusion Flow Rate:	None	
1. Multiparameter/	a) Pulse Amplitude	None	
	c) DC Voltage	None	
1. Non-invasive Blood	a) Pressure	None	

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
2. Defibrillator/ Pacer	a) Resistance	None	
3. Digital Pressure	a) Pressure	None	
3. Electrosurgical	a) Resistance	None	
4. Electrical Safety	a) Resistance	None	
Electrocardiograph	a) Pulse Amplitude	None	
	c) DC Voltage	None	
Parameter	None	Expressed as	
	None	an Uncertainty(+)*	
	None	an Uncertainty (+)*	
	None	uncertainty (+)*	
	None	uncertainty (+)*	
	None	None	
	None	None	
	None	None	
Pressure (nibp)	a) Pressure	None	
Simulator (continue)	0.75 mV to 80 mV	None	using Digital
	0.75 mV to 80 mV	None	Multimeter
	0.75 mV to 80 mV	None	(Keithley 2000).

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SCOPE OF CALIBRATION : PRESSURE

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
1. Syringe Pump	a) Infusion Flow Rate:	None	
Equipment)	0 kPa to 690 kPa	0.50 kPa	Generation by
	0 kPa to 690 kPa	None	using Pressure
	0 kPa to 690 kPa	None	Calibrator.
	b) Vacuum	None	
	-69 kPa to 0 kPa	0.14 kPa	Generation by
	-69 kPa to 0 kPa	None	using Pressure
	-69 kPa to 0 kPa	None	Calibrator.
Meter (biomedical	a) Pressure	None	
Simulator	0.50 mV to 5.50 mV	None	amplitude by
	0.50 mV to 5.50 mV	None	using Differential
	0.50 mV to 5.50 mV	None	Amplifier
	0.50 mV to 5.50 mV	None	(A-M Systems
	0.50 mV to 5.50 mV	None	3000) and
	0.50 mV to 5.50 mV	None	measurement by
	0.50 mV to 5.50 mV	None	using Digital
	0.50 mV to 5.50 mV	None	Oscilloscope
	0.50 mV to 5.50 mV	None	(Tektronix
	0.50 mV to 5.50 mV	None	3012C).
	b) Resistance	None	
	250 © to 1000	0.10 + 27 mQ	Measurement by
	1107 Q to 7355 O	0.10 mMA/Q + 0.23	using Digital
	13499 O to 31320	0.10 + 1.8.0	Multimeter
	94980 Q	120	(Keithley 2000).
	0 mmHg to 450 mmHg	0.20 mmHg	Generation by
	0 mmHg to 450 mmHg	None	using Pressure
	0 mmHg to 450 mmHg	None	Calibrator.
	400 °C to 630 °C	None	
	400 °C to 630 °C	None	

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SCOPE OF CALIBRATION : VOLUME

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (±)*	Remarks
2. Infusion Pump	a) Volume	None	
	a) Pressure	None	
Analyzer	a) Resistance	None	
	50 Q to 100 Q	0.10 + 4.3 mQ	Measurement by
	150 Q to 1200 O	0.10 mMA/O + 42 mQ	using Digital
	1300 Q to 1500 O	0.10 + 0.400	Multimeter (Fluke
	1300 Q to 1500 O	None	8846A).
	b) Energy	None	
	b) Energy	7.6 mJ/J + 0.25 J	Measurement by
	100 J to 360 J	9.3 mJ/J + 0.43 J	using Gold
	100 J to 360 J	None	Standard
	100 J to 360 J	None	Defibrillator
	100 J to 360 J	None	Transcutaneous
	100 J to 360 J	None	Pacer Analyzer
	100 J to 360 J	None	(Fluke Biomedical
	100 J to 360 J	None	Impulse 7000
	100 J to 360 J	None	DP).
	a) Resistance	None	
	10 to 1190 QO	0.10 mQ/Q + 6.7 mQ	Measurement by
	1200 Q to 5200 O	0.10 + 0.15.0	using Digital
	1200 Q to 5200 O	None	Multimeter
	1200 Q to 5200 O	None	(Keithley 2000).
	b) RMS Current	None	
	(1 Hz to 20 MHz)	None	
	250 mA to 500 mA	-0.6 mA/A + 2.6 mA	Generation current
	501 mA to 1000 mA	-1.3 MA/A + 4.4 mA	flow by using
	501 mA to 1000 mA	None	Current Coil
	501 mA to 1000 mA	None	(Pearson 411) and
	501 mA to 1000 mA	None	measurement by
	501 mA to 1000 mA	None	using RMS
	501 mA to 1000 mA	None	Voltmeter (Rohde
	501 mA to 1000 mA	None	& Schwartz URE
	501 mA to 1000 mA	None	3).
	a) Resistance	None	
	0.1 Oto 0.5 O	2.0 + 0.60 mQ	Decade Resistor
	0.1 Oto 0.5 O	0.9 + 0.60 mQ	(IET 1433-02)
	0.1 Oto 0.5 O	None	and Decade
	0.1 Oto 0.5 O	None	Resistor
	0.1 Oto 0.5 O	None	(IET HPRS-F-6-1)
	2 MQ to 10 MQ	0.9 pO/O + 5.8 kQ	Decade Resistor
	20 MQ to 100 MQ	3.0 + 58 kQ	(IET HRRS-5KV).
	b) AC Voltage	None	
	(at 50 Hz)	None	

Instrument Calibrated/Measurement Parameter	Range	Calibration and Measurement Capability Expressed as an Uncertainty (±)*	Remarks
	1V	0.62 mV	Generation by
	2Vto10V	60 + 5.7 mV	using Calibrator
	50 V to 300 V	0.10 mV/V + 59 mV	(Fluke 5520 A).
	c) AC Current	None	
	(at 50 Hz)	None	
	10 pA to 100 pA	14 mA/A	Generation by
	101 yA to 1000 pA	14mA/A+ 1.4 UA	using AC/DC
	1001 UA to 2000 pA	47 - 32 pA	Current Source
	2001 YA to 5500 pA	12 mA/A +33 PA	(Keithley 6221)
	d) DC Current	None	
	1 yA to 21	0.20 mA/A + 58 nA	Generation by
	22 UA to 210 pA	0.60 mA/A + 0.13 PA	using AC/DC
	211 UA to 2100 pA	0.70 mA/A + 1.1 PA	Current Source
	2101 YA to 7500 pA	0.60 mA/A + 12 pA	(Keithley 6221)
	a) Volume	None	
	25 ml to 45 ml	0.22 ml	Generation by
	25 ml to 45 ml	None	using Syringe
	25 ml to 45 ml	None	Pump
	25 ml to 45 ml	None	(Harvard PHD
	25 ml to 45 ml	None	2000) and
	25 ml to 45 ml	None	measurement by
	25 ml to 45 ml	None	using Parameter
	25 ml to 45 ml	None	Tester.
	b) Flow rate	None	
	75 mi/hr to 100 ml/hr	1.0	Generation by
	75 mi/hr to 100 ml/hr	None	using Syringe
	830 ml/hr	3.4	Pump
	830 ml/hr	None	(Harvard PHD
	830 ml/hr	None	2000) and
	830 ml/hr	None	measurement by
	830 ml/hr	None	using Parameter
	830 ml/hr	None	Tester.
	a) Pressure	None	
	0 kPa to 275 kPa	0.18 kPa	Generation by
	0 kPa to 275 kPa	None	using Pressure
	0 kPa to 275 kPa	None	Calibrator.
	10 MHz to 20 GHz	0.16 Hz	HP 83620A
	10 MHz to 26.5 GHz	0.18 Hz	HP 83630A
	250 kHz to 40 GHz	0.18 Hz	E8257D
	250 kHz to 40 GHz	None	(GPS-disciplined)
	Resolution Bandwidth	None	
	1 kHz to 3 MHz	1 MHz	
	Reference Level	None	
	Freq.: 250 kHz to 40 GHz	None	E8257D
	-90 dBm to 0 dBm	None	

Instrument Calibrated/Measurement Parameter	**Range**	**Calibration and Measurement Capability Expressed as an Uncertainty (±)***	**Remarks**
	- 2 ENR to +20	None	
	9 kHz to 26.5 GHz	0.19 Hz	
	Power Level	None	
	0 dBm to +20 dBm	None	
	9 kHz to 2 GHz	0.31 dB	
	>2 GHz to 8 GHz	0.57 dB	
	>8 GHz to 13.5 GHz	0.60 dB	
	>13.5 GHz to 26.5 GHz	0.67 dB	
	0 dBm to -30 dBm	None	
	9 kHz to 2 GHz	0.30 dB	
	>2 GHz to 8 GHz	0.57 dB	
	>8 GHz to 13.5 GHz	0.60 dB	
	>13.5 GHz to 26.5 GHz	0.64 dB	
	None	None	
	- 2 ENR to +20	None	
Type)	Up to 20 ml/hr	0.10	Measurement by
	Up to 20 ml/hr	None	using calibrated
	Above 20 mi/hr to 75 ml/hr	0.22 mi/hr	ASTM E287
	Above 20 mi/hr to 75 ml/hr	None	Class A
	Above 75 mi/hr to 100 ml/hr	0.29 mi/hr	Burettes,
	Above 75 mi/hr to 100 ml/hr	None	Stop Watch and
	Above 100 to 160	0.38	Parameter
	Above 100 to 160	None	Tester.
	Above 160 to 460 ml/hr	1.0	
	Above 460 to 830	1.7 mi/hr	
	b) Volume	None	
	0 ml to 45 ml	0.15 ml	Measurement by
	0 ml to 45 ml	None	using calibrated
	0 ml to 45 ml	None	ASTM E287
	0 ml to 45 ml	None	Class A burettes
	0 ml to 45 ml	None	and Parameter
	0 ml to 45 ml	None	Tester.
	0 ml to 45 ml	None	Flow rate range
	0 ml to 45 ml	None	up to 800 mi/hr.