



CPS (NZ) Limited

Client Number 927

38J Angle Street, Onehunga, Auckland, 1061

Telephone 09 636-4999

www.cps.co.nz

Authorised Representative

Ms Kirsty Russell
Laboratory Manager

Programme

Metrology & Calibration Laboratory

Accreditation Number 271

Initial Accreditation Date 18 December 1985

Conformance Standard

ISO/IEC 17025:2017

General requirements for the competence of testing and calibration laboratories

Laboratory Services Summary

| | |
|------|--|
| 4.55 | Pipes, Hoses, Valves and Fittings |
| 5.03 | Engineers' Measuring Tools and Instruments |
| 5.22 | Precision Laboratory Balances |
| 5.23 | Industrial Balances |
| 5.41 | Barometers |
| 5.42 | Differential Pressure Measuring Devices (including Manometers) |
| 5.43 | Pressure Gauge Testers and Pressure Balances |
| 5.44 | Pressure and Vacuum Measurement |
| 5.61 | Temperature Measuring Equipment |
| 5.88 | Calibrators for Instrumentation |
| 5.89 | Indicating Instruments and Recording Instruments |
| 5.91 | Frequency Measurement and Time Measurement |

Key Technical Personnel

| | |
|---------------------------|--|
| Mr Paul Black | 5.22, 5.23, 5.42, 5.44 (ii)(iii), 5.61 |
| Mr Richard Ettema | 5.03, 5.88, 5.89, 5.91 |
| Mr Jerome Fryer | 5.03, 5.88, 5.89, 5.91 |
| Mr Mohammed Khan | 4.55, 5.22, 5.23, 5.44 (iii), 5.61 |
| Ms Kirsty Russell | 4.55, 5.22, 5.23, 5.41, 5.42, 5.43, 5.44, 5.61 |
| Mr Christopher Woudenberg | 4.55, 5.41, 5.42, 5.43, 5.44, 5.61 |

| | | | | |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 1 of 36 |
|--------------------------------------|--|----------|---------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

Calibration and Measurement Capability (CMC) uncertainties are expressed as an expanded uncertainty corresponding to a level of confidence of 95 % ^{Note1}.

Measurement results are traceable to the International System of Units (SI) via an unbroken chain of comparisons to the New Zealand National Standards or to the National Standards of other Signatories to the CIPM MRA.

Most calibrations of working pressure and temperature measuring equipment can be carried out on-site including a limited range of measurements that can be carried out using equipment and personnel in Fiji. Refer to the specific class of test information below for further information.

Branch laboratories are maintained at the following addresses:

107 De Havilland Drive, Bell Block, New Plymouth 4312. Phone (06) 755 4949
 31 Paerata Road, Pukekohe 2120. Phone (09) 636 4999
 11A Leslie Hills Road, Riccarton, Christchurch 8011. Phone (03) 963 9244

4.55 Pipes, Hoses, Valves and Fittings

(e) Other tests

The testing of Pressure Relief Valves and Pressure Switches up to 120000 kPa, in accordance with in-house methods. Measurements can be carried out on-site or in the laboratory.

5.03 Engineers' Measuring Tools and Instruments

(w) Other tools and instruments

Calibration of manual and powered torque tools to the performance requirements of ISO 6789:2003, ISO 5393:1994, or manufacturer's specification over the range:

| Range | CMC Uncertainty |
|----------------------|---|
| 0.1 N.m to 1 N.m | Between 0.51 % and 3.0 % of indication |
| 1 N.m to 10 N.m | Between 0.21 % and 0.72 % of indication |
| 10 N.m to 100 N.m | Between 0.21 % and 0.33 % of indication |
| 100 N.m to 1000 N.m | Between 0.25 % and 0.30 % of indication |
| 1000 N.m to 1500 N.m | 0.28 % of indication |

Torque calibrations may be conducted at the customer's premises

5.22 Precision Laboratory Balances

Calibration of balances in accordance with in-house methods based on MSL TG 25 and OIML R 111-1

| | |
|----------------|--|
| 1 mg to 100 mg | CMC Uncertainty 6.3 x 10 ⁻³ mg |
|----------------|--|

| | | | | |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 2 of 36 |
|--------------------------------------|--|----------|---------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|-------------------|---------------------------|
| 100 mg to 1000 mg | 1.6 x 10 ⁻² mg |
| 1 g to 100 g | 3.0 x 10 ⁻⁵ g |
| 100 g to 500 g | 7.8 x 10 ⁻⁷ g |

5.23 Industrial Balances

Ranges and CMC uncertainties as under class 5.22

5.41 Barometers

(a) Aneroid barometers (including digital barometers) by comparison with DHI 7601 pressure balance and piston/cylinder assemblies

CMC Uncertainty

| | |
|-------------------|-------------------------------|
| 80 kPa to 120 kPa | 0.23 Pa + 0.0014 % of reading |
|-------------------|-------------------------------|

5.42 Differential Pressure Measuring Devices

- (a) Diaphragm types
- (b) Liquid column types, inclined and vertical
- (c) Pressure transducers
- (d) Pressure recorders

By comparison with automatic calibrators (in laboratory or on-site)

| | |
|----------------------------------|---|
| Ruska 7250 LP -7 kPa to 7 kPa | CMC Uncertainty 0.01 % of reading or 0.042 Pa, whichever is greater |
|----------------------------------|---|

5.43 Pressure Gauge Testers and Pressure Balances

Pressure calibrators or indicators by comparison with DHI 7601 pressure balance and piston/cylinder assemblies

| | |
|---|--|
| Gauge mode – gas medium 4 kPa to 350 kPa 40 kPa to 7000 kPa | CMC Uncertainty 0.23 Pa + 0.0014 % of reading 2.0 Pa + 0.005 % of reading* |
|---|--|

*Reference uncertainty of 0.002 % of reading

| | |
|---|---|
| Gauge mode – liquid medium 100 kPa to 20,000 kPa | 0.018 kPa + 4.1x10 ⁻⁵ p, where p is indicated pressure in kPa* |
|---|---|

| | | | | |
|-----------------------------------|--|----------|---------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 3 of 36 |
|-----------------------------------|--|----------|---------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

20,000 kPa to 200,000 kPa

0.19 kPa + $4.9 \times 10^{-5} p$, where p is indicated pressure in kPa*

*Reference uncertainty of 0.004 % of reading

Absolute mode
 7 kPa to 350 kPa
 50 kPa to 7000 kPa

0.23 Pa + 0.0014 % of reading
 2.0 Pa + 0.005 % of reading*

*Reference uncertainty of 0.002 % of reading

5.44 Pressure and Vacuum Measurement

- (a) Pressure gauges
- (b) Vacuum gauges (Maximum vacuum achievable is subject to ambient barometric pressure conditions)
- (c) Pressure transducers
- (d) Pressure recorders

Accuracy classes: 0.1, 0.25, 0.6, 1.0, 1.6, 2.5, 4.0 in accordance with AS 1349:1986 and BS EN 837-1:1998; gauges of accuracy 4A, 3A, 2A, 1A and below as defined in ASME B40.100-2013

CMC Uncertainty

- i) By comparison with DHI 7601 and DHI 7302 pressure balances and piston/cylinder assemblies

Range and uncertainties as per 5.43 above, for gas medium, plus:

Gauge pressure – liquid medium
 100 kPa to 20,000 kPa

0.018 kPa + $4.1 \times 10^{-5} p$, where p is indicated pressure in kPa*

20,000 kPa to 200,000 kPa


0.19 kPa + $4.9 \times 10^{-5} p$, where p is indicated pressure in kPa*

*Reference uncertainty of 0.004 % of reading

- ii) By comparison with automatic calibrators (in laboratory or on-site)

Ruska 7250 LP
 -7 kPa to 7 kPa

0.01 % of reading or 0.042 Pa, whichever is greater

| | | | | |
|-----------------------------------|---|----------|----------------|--------------|
| Operations Manager Authorisation: |  | Issue 65 | Date: 25/03/22 | Page 4 of 36 |
|-----------------------------------|---|----------|----------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|--|--|
| DHI PPC3 and PPC4 Gauge pressure -15 kPa to 15 kPa | 0.03 % of reading or 0.005 % of span, whichever is greater |
| DHI PPC3 and PPC4 Gauge or absolute pressure -100 kPa to 7000 kPa | 0.008 % of reading* or 0.0024 % of span, whichever is greater *Reference uncertainty of 0.005 % of reading |
| Ruska controller and RPM4 automatic calibrator Gauge pressure 7000 kPa to 40000 kPa 40000 kPa to 70000 kPa | 0.013 % of reading or 0.0039 % of span, whichever is greater 0.013 % of reading or 0.0039 % of span, whichever is greater |
| iii) By comparison with digital reference gauges (in laboratory or on-site) CMC uncertainty is % reading or floor value, whichever value is greater | |
| -100 kPa to 0 kPa 0 kPa to 100 kPa 100 kPa to 200 kPa 200 kPa to 700 kPa 700 kPa to 2000 kPa 2000 kPa to 3000 kPa 3000 kPa to 7000 kPa 7000 kPa to 14000 kPa 14000 kPa to 70000 kPa 70000 kPa to 100000 kPa 100000 kPa to 200000 kPa | 0.25 kPa 0.06 % of reading or 0.02 kPa 0.06 % of reading or 0.04 kPa 0.06 % of reading or 0.14 kPa 0.06 % of reading or 0.4 kPa 0.06 % of reading or 0.6 kPa 0.06 % of reading or 1.4 kPa 0.06 % of reading or 2.8 kPa 0.06 % of reading or 14 kPa 0.06 % of reading or 20 kPa 0.1 % of range of device calibrated |

5.61 Temperature Measuring Equipment

(including temperature calibration of electronic thermometers)

- (a) Rare metal thermocouples
- (b) Base metal thermocouples
- (c) Platinum (and other metallic) resistance thermometers
- (e) Thermistors and other semi-conductor thermometers
- (f) Liquid-in-glass thermometers
- (g) Clinical thermometers
- (j) Radiation pyrometers, including infrared thermometers and infrared imaging cameras
- (k) Vapour pressure thermometers
- (l) Filled metal systems
- (m) Bimetallic systems
- (o) Indicators, recorders and controllers

| | | | | |
|--------------------------------------|--|----------|----------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date: 25/03/22 | Page 5 of 36 |
|--------------------------------------|--|----------|----------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

(p) Other direct reading temperature measuring systems including transducers and transmitters with electrical 4-20 mA, 1-10 Vdc and 1-5 Vdc outputs

Range applies to all of the above, except (j) (see further below)

| Range | CMC Uncertainty |
|-------------------|-----------------|
| Ice-point * | 0.01 °C |
| -100 °C to -60 °C | 0.080 °C |
| -60 °C to -20 °C | 0.028 °C |
| -20 °C to 200 °C | 0.015 °C |
| 200 °C to 660 °C | 0.17 °C |

*Includes ice-point measurements of liquid in glass thermometers

On-site temperature calibration is offered over the ranges below.

| | |
|------------------|----------|
| Ice-point* | 0.01 °C |
| -30 °C to -20 °C | 0.10 °C |
| -20 °C to 80 °C | 0.03 °C |
| 80 °C to 150 °C | 0.046 °C |
| 150 °C to 350 °C | 0.51 °C |

On-site temperature calibration is offered in Fiji over the ranges below.

| | |
|-----------------|----------|
| Ice-point | 0.02 °C |
| -25 °C to 25 °C | 0.031 °C |
| 25 °C to 80 °C | 0.019 °C |
| 80 °C to 150 °C | 0.020 °C |

Using a customer's device as a heat source. Note additional spatial uncertainties may apply

| | |
|------------------|---------|
| 150 °C to 400 °C | 0.19 °C |
|------------------|---------|

Radiation pyrometers, including infrared thermometers and infrared imaging cameras

| | |
|------------------|---------|
| -15 °C to 0 °C | 1.0 °C |
| 0 °C to 130 °C | 0.24 °C |
| 130 °C to 500 °C | 0.75 °C |

Thermocouple simulation internal reference junction (all units in °C) can be carried out onsite

| J Type | |
|--------------|------|
| -210 to -100 | 0.27 |
| -100 to -30 | 0.16 |
| -30 to 150 | 0.14 |

| | | | | |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 6 of 36 |
|--------------------------------------|--|----------|---------------|--------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|--------------|------|
| 150 to 760 | 0.17 |
| 760 to 1200 | 0.23 |
| K Type | |
| -200 to -100 | 0.33 |
| -100 to -25 | 0.18 |
| -25 to 120 | 0.16 |
| 120 to 1000 | 0.26 |
| 1000 to 1372 | 0.4 |
| T Type | |
| -250 to -150 | 0.63 |
| -150 to 0 | 0.24 |
| 0 to 120 | 0.16 |
| 120 to 400 | 0.14 |

Thermocouple simulation reference junction at 0 °C.

Using the tables outlined in appendix D of "Traceable Temperatures" second edition.

Resistance Based thermometry

Using the tables outlined in appendix C of "Traceable Temperatures" second edition.

5.88 Calibrators for Instrumentation

In accordance with in-house methods based on manufacturer's recommendations

| (a) | DC voltage | CMC Uncertainty |
|--------------|------------|------------------|
| 200 mV range | | |
| | 0 mV | 0.2 µV |
| | 29.9 mV | 12 µV/V + 0.2 µV |
| | 100 mV | 9.4 µV/V |
| | 190 mV | 9.6 µV/V |
| 2 V range | | |
| | 0.2 V | 4.6 µV/V |
| | 0.329 V | 3.5 µV/V |
| | 1 V | 3.1 µV/V |
| | 1.9 V | 2.9 µV/V |
| 20 V range | | |
| | 2 V | 3.7 µV/V |
| | 3.29 V | 3.7 µV/V |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 7 of 36



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|---|--|
| 5 V | 3.9 $\mu\text{V/V}$ |
| 10 V | 3.9 $\mu\text{V/V}$ |
| 15 V | 3.9 $\mu\text{V/V}$ |
| 19 V | 3.9 $\mu\text{V/V}$ |
| 200 V range | |
| 20 V | 2.9 $\mu\text{V/V}$ |
| 32.9 V | 2.8 $\mu\text{V/V}$ |
| 50 V | 2.7 $\mu\text{V/V}$ |
| 100 V | 2.6 $\mu\text{V/V}$ |
| 190 V | 2.6 $\mu\text{V/V}$ |
| 1000 V range | |
| 200 V | 2.8 $\mu\text{V/V}$ |
| 329 V | 2.8 $\mu\text{V/V}$ |
| 334 V | 2.8 $\mu\text{V/V}$ |
| 900 V | 2.5 $\mu\text{V/V}$ |
| 1020 V | 2.5 $\mu\text{V/V}$ |
| Hewlett Packard 3458A Multimeter Reference Instrument | |
| 0 mV to 120 mV | 4 $\mu\text{V/V}$ + 300 nV |
| 0 V to 1.2 V | 6 $\mu\text{V/V}$ + 300 nV |
| 0 V to 12 V | 6 $\mu\text{V/V}$ + 1 μV |
| 0 V to 120 V | 8 $\mu\text{V/V}$ + 60 μV |
| 0 V to 1050 V | 10 $\mu\text{V/V}$ + 100 μV |
| Fluke 8846A Multimeter Reference Instrument | |
| 0 mV to 100 mV | 26 $\mu\text{V/V}$ + 3.5 μV |
| 0 V to 1 V | 12 $\mu\text{V/V}$ + 7 μV |
| 0 V to 10 V | 18 $\mu\text{V/V}$ + 50 μV |
| 0 V to 100 V | 26 $\mu\text{V/V}$ + 600 μV |
| 0 V to 1000 V | 7 $\mu\text{V/V}$ + 10 mV |

(b) AC voltage

All values in $\mu\text{V/V}$

| | | 10 Hz | 20 Hz | 45 Hz | 200 Hz | 1 kHz | 3 kHz | 8 kHz | 10 kHz | 18 kHz | 20 kHz | 25 kHz | 50 kHz | 100 kHz | 450 kHz | 500 kHz | 1 MHz | |
|-----|----|-------|-------|-------|--------|-------|-------|-------|--------|--------|--------|--------|--------|---------|---------|---------|-------|--|
| 2 | mV | | 2300 | | 1100 | 4400 | | | | 4500 | 10000 | | | | | | | |
| 3 | mV | | 2300 | 270 | 460 | | | | 4400 | 4500 | 10000 | | | | | | | |
| 10 | mV | | | | 310 | 460 | | | | 1100 | | 2700 | | | | | | |
| 20 | mV | | 330 | | 200 | 460 | | | | 950 | 720 | 1700 | | | | | | |
| 30 | mV | 160 | | 190 | 180 | 200 | | 200 | 160 | 160 | 1500 | | | | | | | |
| 300 | mV | 180 | | 41 | 39 | 43 | | 42 | 62 | 140 | 1700 | | | | | | | |
| 3 | V | 180 | | 36 | 33 | 55 | | 56 | 170 | 260 | 1900 | | | | | | 7000 | |

Operations Manager
Authorisation:

Issue 65

Date: 25/03/22

Page 8 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | | | | | | | | | | |
|------|---|-----|-----|----|----|-----|-----|-----|--|--|--|
| 30 | V | 190 | 44 | 36 | 47 | 170 | 220 | 300 | | | |
| 200 | V | | 53 | 40 | 52 | 170 | 160 | 330 | | | |
| 300 | V | | | | | | | | | | |
| 1000 | V | | 130 | 40 | 48 | 83 | | | | | |
| 1020 | V | | | 40 | 83 | | | | | | |

Hewlett Packard 3458A Multimeter Reference Instrument (RMS sinusoidal voltage given)

| | | |
|-----------------|-------------------|------------------|
| 1.2 mV to 12 mV | 1 Hz to 40 Hz | 0.03 % + 3 µV |
| | 40 Hz to 1 kHz | 0.02 % + 3 µV |
| | 1 kHz to 20 kHz | 0.03 % + 1.1 µV |
| | 20 kHz to 300 kHz | 0.01 % + 1.1 µV* |
| 6 mV to 120 mV | 1 Hz to 40 Hz | 70 µV/V + 4 µV |
| | 40 Hz to 1 kHz | 20 µV/V + 4 µV |
| | 1 kHz to 20 kHz | 70 µV/V + 2 µV |
| | 20 kHz to 2 MHz | 0.016 % + 2 µV* |
| 0.06 V to 1.2 V | 1 Hz to 40 Hz | 70 µV/V + 40 µV |
| | 40 Hz to 1 kHz | 40 µV/V |
| | 1 kHz to 20 kHz | 20 µV/V |
| | 20 kHz to 2 MHz | 20 µV* |
| 0.6 V to 12 V | 1 Hz to 40 Hz | 70 µV/V + 400 µV |
| | 40 Hz to 1 kHz | 70 µV/V + 400 µV |
| | 1 kHz to 20 kHz | 200 µV |
| | 20 kHz to 2 MHz | 200 µV* |
| 6 V to 120 V | 1 Hz to 40 Hz | 0.02 % + 4 mV |
| | 40 Hz to 1 kHz | 4 mV |
| | 1 kHz to 20 kHz | 2 mV |
| | 20 kHz to 1 MHz | 2 mV* |
| 35 V to 700 V | 1 Hz to 40 Hz | 0.04 % + 28 mV |
| | 40 Hz to 1 kHz | 0.04 % + 28 mV |
| | 1 kHz to 20 kHz | 0.06 % + 14 mV |
| | 20 kHz to 100 kHz | 14 mV* |

This is an abbreviated table.

* best available over several discrete ranges combined (values given are typically from the lower end of the frequency range).

Fluke 8846A Multimeter Reference Instrument (RMS sinusoidal voltage given)

| | | |
|-----------------|---------------|----------------|
| >5 mV to 100 mV | 3 Hz to 5 Hz | 1 % + 40 µV |
| | 5 Hz to 10 Hz | 0.35 % + 40 µV |

| | | | | |
|--------------------------------------|--|----------|---------------|--------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 9 of 36 |
|--------------------------------------|--|----------|---------------|--------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|-----------------|--------------------|-----------------|
| | 10 Hz to 20 Hz | 40 µV |
| | 20 Hz to 40 Hz | 40 µV |
| | 40 Hz to 100 Hz | 40 µV |
| | 100 Hz to 200 Hz | 40 µV |
| | 200 Hz to 1 kHz | 40 µV |
| | 1 kHz to 20 kHz | 40 µV |
| | 20 kHz to 50 kHz | 0.1 % + 50 µV |
| | 50 kHz to 100 kHz | 80 µV |
| | 100 kHz to 300 kHz | 2 % + 500 µV |
| >0.05 V to 1 V | 3 Hz to 5 Hz | 1 % + 300 µV |
| | 5 Hz to 10 Hz | 0.35 % + 300 µV |
| | 10 Hz to 20 Hz | 0.04 % + 300 µV |
| | 20 Hz to 40 Hz | 0.02 % + 300 µV |
| | 40 Hz to 100 Hz | 0.01 % + 300 µV |
| | 100 Hz to 200 Hz | 0.01 % + 300 µV |
| | 200 Hz to 1 kHz | 0.01 % + 300 µV |
| | 1 kHz to 20 kHz | 300 µV |
| | 20 kHz to 50 kHz | 500 µV |
| | 50 kHz to 100 kHz | 800 µV |
| | 100 kHz to 300 kHz | 1 % + 5 mV |
| >0.5 V to 10 V | 3 Hz to 5 Hz | 1 % + 3 mV |
| | 5 Hz to 10 Hz | 0.35 % + 3 mV |
| | 10 Hz to 20 Hz | 0.09 % + 3 mV |
| | 20 Hz to 40 Hz | 0.04 % + 3 mV |
| | 40 Hz to 100 Hz | 0.04 % + 3 mV |
| | 100 Hz to 200 Hz | 0.04 % + 3 mV |
| | 200 Hz to 1 kHz | 0.04 % + 3 mV |
| | 1 kHz to 20 kHz | 0.04 % + 3 mV |
| | 20 kHz to 50 kHz | 0.06 % + 5 mV |
| | 50 kHz to 100 kHz | 0.2 % + 8 mV |
| | 100 kHz to 300 kHz | 1 % + 50 mV |
| >5 V to 100 V | 3 Hz to 5 Hz | 1 % + 30 mV |
| | 5 Hz to 10 Hz | 0.35 % + 30 mV |
| | 10 Hz to 20 Hz | 0.31 % + 30 mV |
| | 20 Hz to 40 Hz | 0.08 % + 30 mV |
| | 40 Hz to 100 Hz | 0.06 % + 30 mV |
| | 100 Hz to 200 Hz | 0.06 % + 30 mV |
| | 200 Hz to 1 kHz | 0.05 % + 30 mV |
| | 1 kHz to 20 kHz | 0.03 % + 30 mV |
| | 20 kHz to 50 kHz | 0.05 % + 50 mV |
| | 50 kHz to 100 kHz | 0.1 % + 80 mV |
| | 100 kHz to 300 kHz | 500 mV |
| >50 V to 1000 V | 3 Hz to 5 Hz | 1 % + 220 mV |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 10 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|--------------------|-----------------|
| 5 Hz to 10 Hz | 0.35 % + 220 mV |
| 10 Hz to 20 Hz | 0.31 % + 220 mV |
| 20 Hz to 40 Hz | 0.08 % + 220 mV |
| 40 Hz to 100 Hz | 0.07 % + 220 mV |
| 100 Hz to 200 Hz | 0.06 % + 220 mV |
| 200 Hz to 1 kHz | 0.06 % + 220 mV |
| 1 kHz to 20 kHz | 0.06 % + 220 mV |
| 20 kHz to 50 kHz | 370 mV |
| 50 kHz to 100 kHz | 600 mV |
| 100 kHz to 300 kHz | 3.70 V |

(c) DC current

| | |
|--------------|-------------------|
| 330 µA range | |
| 0 µA | 0.15 nA |
| 190 µA | 11 µA/A + 0.15 nA |
| 329 µA | 21 µA/A |

| | |
|--------------|----------|
| 3.3 mA range | |
| 1.9 mA | 9.9 µA/A |
| 3.29 mA | 22 µA/A |

| | |
|-------------|---------|
| 33 mA range | |
| 19 mA | 23 µA/A |
| 32.9 mA | 28 µA/A |

| | |
|--------------|---------|
| 330 mA range | |
| 190 mA | 16 µA/A |
| 329 mA | 50 µA/A |

| | |
|-----------|----------|
| 3 A range | |
| 1.09 A | 23 µA/A |
| 2.99 A | 170 µA/A |

| | |
|------------|---------|
| 20 A range | |
| 10.9 A | 98 µA/A |
| 19.9 A | 78 µA/A |

Hewlett Packard 3458A Multimeter Reference Instrument

| | |
|----------------|------------------|
| 0 nA to 120 nA | 50 µA/A + 5.2 nA |
| 0 µA to 1.2 µA | 41 µA/A + 5.2 nA |
| 0 µA to 12 µA | 41 µA/A + 5.2 nA |
| 0 µA to 120 µA | 41 µA/A + 5.4 nA |
| 0 mA to 1.2 mA | 37 µA/A + 7 nA |
| 0 mA to 12 mA | 32 µA/A + 50 nA |

Operations Manager
Authorisation:

Issue 65

Date:25/03/22

Page 11 of 36



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|--|-------------------|------------------|
| | 20 Hz to 45 Hz | 0.10 % + 200 nA |
| | 45 Hz to 100 Hz | 200 nA |
| | 100 Hz to 1 kHz | 200 nA |
| | 1 kHz to 5 kHz | 200 nA |
| | 5 kHz to 20 kHz | 200 nA |
| | 20 kHz to 50 kHz | 0.4 % + 400 nA |
| | 50 kHz to 100 kHz | 0.55 % + 1.5 µA |
| 0.6 mA to 12 mA | 10 Hz to 20 Hz | 0.4 % + 2 µA |
| | 20 Hz to 45 Hz | 0.10 % + 2 µA |
| | 45 Hz to 100 Hz | 2 µA |
| | 100 Hz to 1 kHz | 2 µA |
| | 1 kHz to 5 kHz | 2 µA |
| | 5 kHz to 20 kHz | 2 µA |
| | 20 kHz to 50 kHz | 0.4 % + 4 µA |
| | 50 kHz to 100 kHz | 0.55 % + 15 µA |
| 6 mA to 120 mA | 10 Hz to 20 Hz | 0.4 % + 20 µA |
| | 20 Hz to 45 Hz | 0.10 % + 20 µA |
| | 45 Hz to 100 Hz | 20 µA |
| | 100 Hz to 1 kHz | 20 µA |
| | 1 kHz to 5 kHz | 20 µA |
| | 5 kHz to 20 kHz | 20 µA |
| | 20 kHz to 50 kHz | 0.4 % + 40 µA |
| | 50 kHz to 100 kHz | 0.55 % + 150 µA |
| 52.5 mA to 1.05 A | 10 Hz to 20 Hz | 0.4 % + 200 µA |
| | 20 Hz to 45 Hz | 0.16 % + 200 µA |
| | 45 Hz to 100 Hz | 0.08 % + 200 µA |
| | 100 Hz to 1 kHz | 0.1 % + 200 µA |
| | 1 kHz to 5 kHz | 0.1 % + 200 µA |
| | 5 kHz to 20 kHz | 0.1 % + 200 µA |
| | 20 kHz to 50 kHz | 1 % + 400 µA |
| Fluke 8846A Multimeter Reference Instrument (RMS sinusoidal current given) | | |
| >5 µA to 100 µA | 3 Hz to 5 Hz | 1.1 % + 0.06 µA |
| | 5 Hz to 10 Hz | 0.35 % + 0.06 µA |
| | 10 Hz to 20 Hz | 0.32 % + 0.06 µA |
| | 20 Hz to 40 Hz | 0.14 % + 0.06 µA |
| | 40 Hz to 100 Hz | 0.13 % + 0.06 µA |
| | 100 Hz to 200 Hz | 0.12 % + 0.06 µA |
| | 200 Hz to 1 kHz | 0.11 % + 0.06 µA |
| | 1 kHz to 5 kHz | 0.06 % + 0.06 µA |
| | 5 kHz to 10 kHz | 0.7 µA |
| >0.05 mA to 1 mA | 3Hz to 5 Hz | 1 % + 0.4 µA |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 13 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|------------------|------------------|----------------------|
| | 5 Hz to 10 Hz | 0.3 % + 0.4 μ A |
| | 10 Hz to 20 Hz | 0.3 % + 0.4 μ A |
| | 20 Hz to 40 Hz | 0.11 % + 0.4 μ A |
| | 40 Hz to 100 Hz | 0.1 % + 0.4 μ A |
| | 100 Hz to 200 Hz | 0.09 % + 0.4 μ A |
| | 200 Hz to 1 kHz | 0.09 % + 0.4 μ A |
| | 1 kHz to 5 kHz | 0.1 % + 0.4 μ A |
| | 5 kHz to 10 kHz | 2.5 μ A |
| >0.5 mA to 10 mA | 3 Hz to 5 Hz | 1.1 % + 6 μ A |
| | 5 Hz to 10 Hz | 0.35 % + 6 μ A |
| | 10 Hz to 20 Hz | 0.15 % + 6 μ A |
| | 20 Hz to 40 Hz | 0.07 % + 6 μ A |
| | 40 Hz to 100 Hz | 0.06 % + 6 μ A |
| | 100 Hz to 200 Hz | 0.06 % + 6 μ A |
| | 200 Hz to 1 kHz | 0.05 % + 6 μ A |
| | 1 kHz to 5 kHz | 6 μ A |
| | 5 kHz to 10 kHz | 70 μ A |
| >5 mA to 100 mA | 3 Hz to 5 Hz | 1 % + 40 μ A |
| | 5 Hz to 10 Hz | 0.3 % + 40 μ A |
| | 10 Hz to 20 Hz | 0.2 % + 40 μ A |
| | 20 Hz to 40 Hz | 0.07 % + 40 μ A |
| | 40 Hz to 100 Hz | 0.07 % + 40 μ A |
| | 100 Hz to 200 Hz | 0.07 % + 40 μ A |
| | 200 Hz to 1 kHz | 0.07 % + 40 μ A |
| | 1 kHz to 5 kHz | 0.1 % + 40 μ A |
| | 5 kHz to 10 kHz | 250 μ A |
| >20 mA to 329 mA | 3 Hz to 5 Hz | 1 % + 320 μ A |
| | 5 Hz to 10 Hz | 0.3 % + 320 μ A |
| | 10 Hz to 20 Hz | 0.2 % + 320 μ A |
| | 20 Hz to 40 Hz | 0.07 % + 320 μ A |
| | 40 Hz to 100 Hz | 0.07 % + 320 μ A |
| | 100 Hz to 200 Hz | 0.06 % + 320 μ A |
| | 200 Hz to 1 kHz | 0.05 % + 320 μ A |
| | 1 kHz to 5 kHz | 320 μ A |
| | 5 kHz to 10 kHz | 2.30 mA |
| >0.05 A to 1 A | 3 Hz to 5 Hz | 1 % + 400 μ A |
| | 5 Hz to 10 Hz | 0.3 % + 400 μ A |
| | 10 Hz to 20 Hz | 0.35 % + 400 μ A |
| | 20 Hz to 40 Hz | 0.12 % + 400 μ A |
| | 40 Hz to 100 Hz | 400 μ A |
| | 100 Hz to 200 Hz | 400 μ A |
| | 200 Hz to 1 kHz | 400 μ A |
| | 1 kHz to 5 kHz | 400 μ A |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 14 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|------------------|------------------|-----------------|
| | 5 kHz to 10 kHz | 7 mA |
| >0.15 A to 3 A | 3 Hz to 5 Hz | 1.1 % + 1.8 mA |
| | 5 Hz to 10 Hz | 0.35 % + 1.8 mA |
| | 10 Hz to 20 Hz | 0.4 % + 1.8 mA |
| | 20 Hz to 40 Hz | 0.17 % + 1.8 mA |
| | 40 Hz to 100 Hz | 1.8 mA |
| | 100 Hz to 200 Hz | 1.8 mA |
| | 200 Hz to 1 kHz | 1.8 mA |
| | 1 kHz to 5 kHz | 1.8 mA |
| | 5 kHz to 10 kHz | 3.7 % + 21 mA |
| >0.5 A to 10 A | 3 Hz to 5 Hz | 1.1 % + 6 mA |
| | 5 Hz to 10 Hz | 0.35 % + 6 mA |
| | 10 Hz to 20 Hz | 0.4 % + 6 mA |
| | 20 Hz to 40 Hz | 0.17 % + 6 mA |
| | 40 Hz to 100 Hz | 6 mA |
| | 100 Hz to 200 Hz | 0.01 % + 6 mA |
| | 200 Hz to 1 kHz | 0.02 % + 6 mA |
| | 1 kHz to 5 kHz | 0.08 % + 6 mA |
| | 5 kHz to 10 kHz | 0.35 % + 70 mA |
| (e) Resistance | | |
| Calibrator range | | |
| 0 Ω | | 18 μΩ |
| 1.9 Ω | | 21 μΩ/Ω + 18 μΩ |
| 10.9 Ω | | 15 μΩ/Ω |
| 11.9 Ω | | 10 μΩ/Ω |
| 19 Ω | | 10 μΩ/Ω |
| 30 Ω | | 6.4 μΩ/Ω |
| 33 Ω | | 6.2 μΩ/Ω |
| 109 Ω | | 7.8 μΩ/Ω |
| 119 Ω | | 8.6 μΩ/Ω |
| 190 Ω | | 8.4 μΩ/Ω |
| 300 Ω | | 6.1 μΩ/Ω |
| 330 Ω | | 6.3 μΩ/Ω |
| 1.09 kΩ | | 6.9 μΩ/Ω |
| 1.19 kΩ | | 7.4 μΩ/Ω |
| 1.9 kΩ | | 6.7 μΩ/Ω |
| 3 kΩ | | 6.2 μΩ/Ω |
| 3.3 kΩ | | 5.7 μΩ/Ω |
| 10.9 kΩ | | 7.8 μΩ/Ω |
| 11.9 kΩ | | 5.6 μΩ/Ω |
| 19 kΩ | | 5.6 μΩ/Ω |
| 30 kΩ | | 6.8 μΩ/Ω |
| 33 kΩ | | 5.7 μΩ/Ω |

Operations Manager
Authorisation:

Issue 65

Date: 25/03/22

Page 15 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|---------|----------|
| 109 kΩ | 8.7 μΩ/Ω |
| 119 kΩ | 8.7 μΩ/Ω |
| 190 kΩ | 8.7 μΩ/Ω |
| 300 kΩ | 14 μΩ/Ω |
| 330 kΩ | 14 μΩ/Ω |
| 1.09 MΩ | 16 μΩ/Ω |
| 1.19 mΩ | 17 μΩ/Ω |
| 1.9 MΩ | 16 μΩ/Ω |
| 3 MΩ | 14 μΩ/Ω |
| 3.3 MΩ | 14 μΩ/Ω |
| 10.9 MΩ | 24 μΩ/Ω |
| 11.9 MΩ | 84 μΩ/Ω |
| 19 MΩ | 24 μΩ/Ω |
| 30 MΩ | 150 μΩ/Ω |
| 33 MΩ | 160 μΩ/Ω |
| 109 MΩ | 140 μΩ/Ω |
| 119 MΩ | 260 μΩ/Ω |
| 400 MΩ | 840 μΩ/Ω |
| 640 MΩ | 930 μΩ/Ω |
| 1090 MΩ | 940 μΩ/Ω |

Hewlett Packard 3458A Multimeter Reference Instrument

| | |
|---------------|-------------------|
| 0 Ω to 12 Ω | 24 μΩ/Ω + 50 μΩ |
| 0 Ω to 120 Ω | 12 μΩ/Ω + 500 μΩ |
| 0 Ω to 1.2 kΩ | 10 μΩ/Ω + 500 μΩ |
| 0 Ω to 12 kΩ | 10 μΩ/Ω + 5 mΩ |
| 0 Ω to 120 kΩ | 11 μΩ/Ω + 50 mΩ |
| 0 Ω to 1.2 MΩ | 15 μΩ/Ω + 2 Ω |
| 0 Ω to 12 MΩ | 50 μΩ/Ω + 100 Ω |
| 0 Ω to 120 MΩ | 500 μΩ/Ω + 1 kΩ |
| 0 Ω to 1.2 GΩ | 5000 μΩ/Ω + 10 kΩ |

Fluke 8846A Multimeter Reference Instrument

| | |
|---------------|-----------------|
| 0 Ω to 10 Ω | 0.05 % + 3 mΩ |
| 0 Ω to 100 Ω | 0.02 % + 4 mΩ |
| 0 Ω to 1 kΩ | 0.02 % + 10 mΩ |
| 0 Ω to 10 kΩ | 0.02 % + 100 mΩ |
| 0 Ω to 100 kΩ | 0.01 % + 1 Ω |
| 0 Ω to 1 MΩ | 0.01 % + 10 Ω |
| 0 Ω to 10 MΩ | 0.04 % + 100 Ω |
| 0 Ω to 100 MΩ | 0.4 % + 10 kΩ |
| 0 Ω to 1 GΩ | 2 % + 100 kΩ |

Miscellaneous

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 16 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

220 V range
22 V
219.9 V

6.3 μ V/V
4.8 μ V/V

1000 V range
220 V
1000 V

7.9 μ V/V
6.5 μ V/V

(b) AC voltmeters

All values in μ V/V

| | | 10 Hz | 20 Hz | 40 Hz | 50 Hz | 1 kHz | 20 kHz | 30 kHz | 50 kHz | 100 kHz | 300 kHz | 500 kHz | 1 MHz |
|------|----|-------|-------|-------|-------|-------|--------|--------|--------|---------|---------|---------|-------|
| 2 | mV | 2100 | 2100 | 1900 | | | 2000 | | 2700 | 5500 | 10000 | 12000 | |
| 2.2 | mV | 1900 | 1900 | 1800 | | | 1900 | | 2500 | 2500 | 9900 | 11000 | |
| 22 | mV | 400 | | 260 | 240 | | | 360 | 660 | 1400 | 2200 | 4200 | |
| 220 | mV | 290 | 280 | 110 | 81 | | | 140 | 380 | 920 | 2100 | 7500 | |
| 2.2 | V | 260 | 240 | 91 | 58 | | | 87 | 130 | 920 | 2400 | 8800 | |
| 22 | V | 250 | 240 | 91 | 66 | | | 190 | 320 | 800 | 1800 | 1500 | |
| 220 | V | 240 | 240 | 91 | 52 | | | 83 | 150 | | | | |
| 250 | V | | 330 | | | 460 | | | 470 | 1800 | | | |
| 750 | V | | | 467 | | | 470 | | | 1800 | | | |
| 1050 | V | | | 68 | | | 130 | 460 | | | | | |

In the Christchurch laboratory

All values in μ V/V

| | | 0.01 Hz | 10 Hz | 20 Hz | 45 Hz | 1 kHz | 5 kHz | 10 kHz | 20 kHz | 30 kHz | 50 kHz | 100 kHz | 500 kHz |
|------|----|---------|-------|-------|-------|-------|-------|--------|--------|--------|--------|---------|---------|
| 1 | mV | 45000 | 380 | 380 | 180 | 180 | 180 | 180 | 280 | 330 | 960 | 1900 | 1900 |
| 33 | mV | 5000 | 320 | 320 | 71 | 120 | 51 | 64 | 120 | 120 | 300 | 580 | 580 |
| 330 | mV | 5000 | 320 | 320 | 33 | 120 | 42 | 48 | 120 | 150 | 440 | 780 | 780 |
| 3.3 | V | 5000 | 320 | 320 | 30 | 120 | 100 | 98 | 120 | 98 | 150 | | |
| 33 | V | | | | 320 | 120 | 64 | 120 | 220 | 110 | 550 | | |
| 330 | V | | | | 320 | 120 | 64 | 180 | | | | | |
| 1020 | V | | | | 320 | 120 | 64 | 180 | | | | | |

(c) DC ammeters

220 μ A range
0 μ A
220 μ A

5.3 nA
38 μ A/A + 5.3 nA

Operations Manager
Authorisation:

Issue 65

Date: 25/03/22

Page 18 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|--|----------|
| 2.2 mA range | |
| 0.22 mA | 59 µA/A |
| 2.19 mA | 34 µA/A |
| 22 mA range | |
| 2.2 mA | 48 µA/A |
| 21.9 mA | 32 µA/A |
| 220 mA range | |
| 22 mA | 66 µA/A |
| 219 mA | 48 µA/A |
| 2.2 A range | |
| 0.22 A | 120 µA/A |
| 2.2 A | 110 µA/A |
| 11 A range | |
| 2.2 A | 440 µA/A |
| 11 A | 300 µA/A |
| 20 A range | |
| 11 A | 810 µA/A |
| 19.9 A | 790 µA/A |
| Clamp meters using current coil (nominal ranges) | |
| 4 mA | 0.47 % |
| 12 mA | 0.31 % |
| 20 mA | 0.21 % |
| 100 mA | 0.19 % |
| 3 A | 2.20 % |
| 10 A | 0.69 % |
| 100 A | 0.67 % |
| 550 A | 0.58 % |
| 600 A | 0.58 % |
| 900 A | 0.55 % |
| In the Christchurch laboratory | |
| Fluke 5522A Calibrator Reference Instrument | |
| 0 µA to 330 µA | 81 µA/A |
| 0 mA to 3.3 mA | 26 µA/A |
| 0 mA to 33 mA | 36 µA/A |
| 0 mA to 330 mA | 41 µA/A |
| 0 mA to 1.1 A | 98 µA/A |
| 1.1 A to 3 A | 110 µA/A |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 19 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | |
|----------------|-----------|
| 0 A to 11 A | 120 µA/A |
| 11 A to 20.5 A | 1000 µA/A |

Fluke 52120A Transconductance Amplifier Reference Instrument (using Fluke 5522A Calibrator)

CMC uncertainty for DC Current is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5522A voltage or current output values and the Fluke 52120A Range. Example uncertainties are given below (truncated to two significant figures). Output values are at 10% and 100% of each range.

Fluke 52120A, Fluke 5522A Reference Instruments current

| Range | Output | |
|---------------|--------|------------|
| 0.2 A to 2 A | 0.2 A | 0.49 mA/A |
| | 2 A | 0.13 mA/A |
| 2 A to 20 A | 2 A | 0.45 mA/A |
| | 20 A | 0.091 mA/A |
| 10 A to 100 A | 10 A | 0.44 mA/A |
| | 100 A | 0.082 mA/A |

Fluke 52120A Transconductance Amplifier and Fluke 52120A/COIL 3KA (using Fluke 5522A Calibrator) Reference Instruments

CMC uncertainty for equivalent DC Current using the Fluke 52120A and 52120A/COIL 3KA is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5522A voltage or current output values, the Fluke 52120A Range and the Fluke 52120A/COIL 3KA Range. Example uncertainties are given below (rounded to two significant figures).

Fluke 52120A, Fluke 5522A Reference Instruments current

| | | |
|-----------------|--------|-----------|
| 5 A to 50 A | 5 A | 9.8 mA/A |
| | 50 A | 7.3 mA/A |
| 50 A to 500 A | 50 A | 9.8 mA/A |
| | 500 A | 7.3 mA/A |
| 250 A to 2500 A | 250 A | 3.2 mA/A |
| | 2500 A | 0.65 mA/A |

Fluke 52120A Transconductance Amplifier and Fluke 52120A/COIL 6KA (using Fluke 5522A Calibrator) Reference Instruments

CMC uncertainty for equivalent DC Current using the Fluke 52120A and 52120A/COIL 6KA is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5522A voltage or current output values, the Fluke 52120A Range and the Fluke 52120A/COIL 6KA Range. Example uncertainties are given below (rounded to two significant figures).

Fluke 52120A, Fluke 5522A Reference Instruments current

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 20 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|-----------------|--------|----------|
| 10 A to 100 A | 10 A | 8.4 mA/A |
| | 100 A | 7.1 mA/A |
| 100 A to 1000 A | 100 A | 8.4 mA/A |
| | 1000 A | 7.1 mA/A |
| 500 A to 5000 A | 500 A | 5.5 mA/A |
| | 5000 A | 4.3 mA/A |

(d) AC ammeters

All values in $\mu\text{A/A}$

| | | 10 Hz | 20 Hz | 40 Hz | 45 Hz | 100 Hz | 1 kHz | 5 kHz | 10 kHz | 30 kHz |
|-----|---------------|-------|-------|-------|-------|--------|-------|-------|--------|--------|
| 9 | μA | 1900 | 1900 | 1100 | | | 930 | 1500 | 7700 | |
| 220 | μA | 570 | 580 | 540 | | | 130 | 320 | 1200 | |
| 330 | μA | | | | | | | | | 13000 |
| 2.2 | mA | 280 | 240 | 160 | | | 100 | 220 | 1200 | |
| 3.3 | mA | 430 | 240 | 160 | | | 100 | 200 | 1100 | 7700 |
| 22 | mA | | | | | | | | | 3100 |
| 33 | mA | | | | | 160 | | | 100 | 190 |
| 220 | mA | 280 | 240 | 160 | | | 100 | 190 | 1000 | 3500 |
| 330 | mA | | 380 | 360 | 360 | | 460 | 1000 | 8100 | |
| 2.2 | A | | | | | | | 360 | 820 | 3200 |
| 11 | A | | | | | | 360 | 820 | 3200 | |
| 20 | A | | | | 1100 | 1100 | 1300 | 23000 | | |

Clamp meters using current coil (nominal ranges)

Frequency 50 Hz

| | |
|--------|--------|
| 3 mA | 0.22 % |
| 30 mA | 0.63 % |
| 300 mA | 0.36 % |
| 3 A | 0.28 % |
| 10 A | 0.61 % |
| 100 A | 0.80 % |
| 550 A | 0.20 % |
| 600 A | 0.71 % |
| 900 A | 0.66 % |

Frequency 400 Hz

| | |
|-------|-------|
| 20 A | 1.8 % |
| 50 A | 1.3 % |
| 100 A | 1.2 % |
| 120 A | 1.1 % |
| 250 A | 1.2 % |
| 400 A | 1.1 % |

Operations Manager
Authorisation:

Issue 65

Date: 25/03/22

Page 21 of 36



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

In the Christchurch laboratory

Fluke 5522A Calibrator Reference Instrument

All values in $\mu\text{A/A}$

| | | 10 Hz | 20 Hz | 40 Hz | 45 Hz | 100 Hz | 1 kHz | 5 kHz | 10 kHz | 30 kHz |
|------|---------------|-------|-------|-------|-------|--------|-------|-------|--------|--------|
| 29 | μA | 600 | 470 | 300 | 440 | 1300 | 1200 | 1600 | 3200 | 3200 |
| 330 | μA | 550 | 350 | 250 | 240 | 150 | 260 | 1100 | 2200 | 2200 |
| 3.3 | mA | 460 | 260 | 160 | 160 | 160 | 260 | 1100 | 2100 | 2100 |
| 33 | mA | 560 | 290 | 160 | 160 | 160 | 250 | 300 | 1600 | 1600 |
| 330 | mA | 690 | 620 | 190 | 190 | 190 | 910 | 4500 | | |
| 1.1 | A | 630 | 700 | 330 | 330 | 330 | 730 | 12000 | | |
| 3 | A | | | 280 | 350 | 380 | 13000 | | | |
| 11 | A | | | 1200 | 1300 | 540 | 8800 | | | |
| 20.5 | A | | | 1200 | 1300 | 540 | 8800 | | | |

Fluke 52120A Transconductance Amplifier (using Fluke 5500A Calibrator) Reference Instruments

CMC uncertainty for AC Current is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5500A voltage or current output values and the Fluke 52120A range. Example uncertainties are given below (rounded to two significant figures). Available frequency range 10 Hz to 10 kHz. Output values are at 10% and 100% of each range

Uncertainty values in mA/A

| Range | Output | 50 Hz | 400 Hz | 10 kHz |
|---------------|--------|-------|--------|--------|
| 0.2 A to 2 A | 0.2 A | 5.4 | 5.4 | 310 |
| | 2 A | 0.56 | 0.56 | 31 |
| 2 A to 20 A | 2 A | 4.7 | 4.7 | 47 |
| | 20 A | 0.49 | 0.49 | 4.7 |
| 12 A to 120 A | 12 A | 1.6 | 7.8 | 88 |
| | 120 A | 0.23 | 0.80 | 35 |

Fluke 52120A Transconductance Amplifier and Fluke 52120A/COIL 3KA (using 5522A Calibrator) Reference Instruments

CMC uncertainty for equivalent AC Current using the Fluke 52120A and 52120A/COIL 3KA is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5522A voltage or current output values, the Fluke 52120A Range and the Fluke 52120A/COIL 3KA Range. Example uncertainties are given below (rounded to two significant figures). Available frequency range is 50 Hz to 400 Hz.

Uncertainty values in mA/A

| | | | | |
|-----------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 22 of 36 |
|-----------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| Range | Output | 50 Hz | 400 Hz |
|-----------------|--------|-------|--------|
| 5 A to 50 A | 5A | 11 | 11 |
| | 50 A | 7.3 | 7.3 |
| 50 A to 500 A | 50 A | 11 | 11 |
| | 500 A | 7.3 | 7.3 |
| 300 A to 3000 A | 300 A | 3.4 | 8.4 |
| | 3000 A | 0.56 | 1.0 |

Fluke 52120A Transconductance Amplifier and Fluke 52120A/COIL 6KA (using 5522A Calibrator) Reference Instruments

CMC uncertainty for equivalent AC Current using the Fluke 52120A and 52120A/COIL 6KA is calculated as the root sum of squares of the uncertainties for the appropriate Fluke 5500A voltage or current output values, the Fluke 52120A Range and the Fluke 52120A/COIL 6KA Range. Example uncertainties are given below (rounded to two significant figures). Available frequency range is 50 Hz to 400 Hz.

Uncertainty values in mA/A

| Range | Output | 50 Hz | 400 Hz |
|-----------------|--------|-------|--------|
| 10 A to 100 A | 10 A | 10 | 10 |
| | 100 A | 7.2 | 7.2 |
| 100 A to 1000 A | 100 A | 9.6 | 9.6 |
| | 1000 A | 7.2 | 7.2 |
| 600 A to 6000 A | 600 A | 5.8 | 9.3 |
| | 6000 A | 4.3 | 3.9 |

(e) **Wattmeters**

CMC uncertainty for power (W and VA) is calculated as the root sum of squares of the uncertainties for the appropriate voltage and current values (and power factor, if applicable).

Voltage limitations: 1 mVac to 1020 Vac, or 0 V to 1020 Vdc. Current limitations: 29 µAac to 20.5 Aac, or 0 A to 20.5 Adc. Auxiliary voltage limitations: 10 mVac to 5 Vac, or 0 V to 7 Vdc.

The range of direct output is from 29 nWac through to 20.91 kWac (at unity power factor), or 0 Wdc through to 20.91 kWdc (or equivalent in VA).

Power can be simulated over greater ranges for equipment incorporating current clamps or current transformers. (Maximum output available for the voltage input is 1020 V, and maximum output available for the “current” input is 20.5 A or 5 V).

(f) **Varmeters**

| | | | | |
|-----------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 23 of 36 |
|-----------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

CMC uncertainty for reactive power (VAr) is calculated as the root sum of squares of the uncertainties for the appropriate voltage, current, and power factor values.

Voltage and current limitations apply as for Wattmeters above.

(g) Phase angle indicators

Refer to 5.88 miscellaneous – Phase angle

In the Christchurch laboratory

| | | |
|---------------|------------------|-------|
| 0° to 179.98° | 10 Hz to 65 Hz | 0.10° |
| | 65 Hz to 500 Hz | 0.25° |
| | 500 Hz to 1 kHz | 0.50° |
| | 1 kHz to 5 kHz | 2.5° |
| | 5 kHz to 10 kHz | 5.0° |
| | 10 kHz to 30 kHz | 10° |

(h) Power factor meters

CMC uncertainty for power factor may be calculated from the least uncertainty given above for Phase angle indicators. (For example: Least uncertainty for power factor of 0.500 at 50 Hz is ACos (0.500) ± 0.10°, which is 0.500 (+ 0.001511,-0.001512) or 0.500 ± 0.002).

Voltage and current limitations apply as for Wattmeters above.

(i) Ohmmeters

| | |
|--------|-----------------|
| 0 Ω | 38 μΩ |
| 1 Ω | 46 μΩ/Ω + 38 μΩ |
| 1.9 Ω | 84 μΩ/Ω |
| 10 Ω | 21 μΩ/Ω |
| 19 Ω | 21 μΩ/Ω |
| 100 Ω | 9.2 μΩ/Ω |
| 190 Ω | 9.5 μΩ/Ω |
| 1 kΩ | 6.2 μΩ/Ω |
| 1.9 kΩ | 6.5 μΩ/Ω |
| 10 kΩ | 6.2 μΩ/Ω |
| 19 kΩ | 6.1 μΩ/Ω |
| 100 kΩ | 7.7 μΩ/Ω |
| 190 kΩ | 9.2 μΩ/Ω |
| 1 MΩ | 12 μΩ/Ω |
| 1.9 MΩ | 16 μΩ/Ω |
| 10 MΩ | 36 μΩ/Ω |
| 19 MΩ | 42 μΩ/Ω |
| 100 MΩ | 93 μΩ/Ω |
| 1 GΩ | 220 μΩ/Ω |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 24 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

In the Christchurch laboratory using a Fluke 5522A Calibrator Reference Instrument

| | |
|-------------------|-----------|
| 0 Ω to 11 Ω | 91 μΩ/Ω |
| 11 Ω to 33 Ω | 45 μΩ/Ω |
| 33 Ω to 110 Ω | 20 μΩ/Ω |
| 110 Ω to 330 Ω | 12 μΩ/Ω |
| 330 Ω to 1.1 kΩ | 16 μΩ/Ω |
| 1.1 kΩ to 3.3 kΩ | 11 μΩ/Ω |
| 3.3 kΩ to 11 kΩ | 9.2 μΩ/Ω |
| 11 kΩ to 33 kΩ | 22 μΩ/Ω |
| 33 kΩ to 110 kΩ | 19 μΩ/Ω |
| 110 kΩ to 330 kΩ | 26 μΩ/Ω |
| 330 kΩ to 1.1 MΩ | 22 μΩ/Ω |
| 1.1 MΩ to 3.3 MΩ | 49 μΩ/Ω |
| 3.3 MΩ to 11 MΩ | 85 μΩ/Ω |
| 11 MΩ to 33 MΩ | 76 μΩ/Ω |
| 33 MΩ to 110 MΩ | 130 μΩ/Ω |
| 110 MΩ to 330 MΩ | 300 μΩ/Ω |
| 330 MΩ to 1100 MΩ | 1500 μΩ/Ω |

(j) LCR meters

| Capacitance | Frequency | CMC |
|-------------|-----------|-----------|
| 0.22 nF | 5 kHz | 1800 μF/F |
| 0.39 nF | 1 kHz | 2900 μF/F |
| 0.48 nF | 1 kHz | 1300 μF/F |
| 0.6 nF | 1 kHz | 830 μF/F |
| 1 nF | 1 kHz | 540 μF/F |
| 2 nF | 1 kHz | 460 μF/F |
| 7 nF | 1 kHz | 390 μF/F |
| 10.9 nF | 1 kHz | 190 μF/F |
| 20 nF | 1 kHz | 190 μF/F |
| 70 nF | 1 kHz | 240 μF/F |
| 109 nF | 1 kHz | 270 μF/F |
| 200 nF | 1 kHz | 480 μF/F |
| 300 nF | 1 kHz | 690 μF/F |
| 0.7 μF | 100 Hz | 780 μF/F |
| 1.09 μF | 100 Hz | 780 μF/F |
| 2 μF | 100 Hz | 790 μF/F |
| 3 μF | 100 Hz | 780 μF/F |
| 7 μF | 100 Hz | 790 μF/F |
| 10 μF | 100 Hz | 830 μF/F |
| 20 μF | 100 Hz | 910 μF/F |
| 30 μF | 100 Hz | 1000 μF/F |
| 70 μF | 50 Hz | 630 μF/F |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 25 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|---------|-------|----------|
| 109 µF | 50 Hz | 780 µF/F |
| 200 µF | dc | 290 µF/F |
| 300 µF | dc | 250 µF/F |
| 0.33 mF | dc | 240 µF/F |
| 0.7 mF | dc | 280 µF/F |
| 1.09 mF | dc | 240 µF/F |
| 1.1 mF | dc | 230 µF/F |
| 2 mF | dc | 250 µF/F |
| 3 mF | dc | 230 µF/F |
| 3.3 mF | dc | 250 µF/F |
| 10.9 mF | dc | 240 µF/F |
| 20 mF | dc | 230 µF/F |
| 30 mF | dc | 230 µF/F |
| 33 mF | dc | 230 µF/F |
| 110 mF | dc | 240 µF/F |

In the Christchurch laboratory using a Fluke 5522A Calibrator Reference Instrument

| | |
|-------------------|------------|
| 0.22 nF to 0.4 nF | 25000 µF/F |
| 0.4 nF to 1.1 nF | 9100 µF/F |
| 1.1 nF to 3.3 nF | 3000 µF/F |
| 3.3 nF to 11 nF | 1900 µF/F |
| 11 nF to 33 nF | 3000 µF/F |
| 33 nF to 110 nF | 910 µF/F |
| 110 nF to 330 nF | 910 µF/F |
| 0.33 µF to 1.1 µF | 1900 µF/F |
| 1.1 µF to 3.3 µF | 1900 µF/F |
| 3.3 µF to 11 µF | 1300 µF/F |
| 11 µF to 33 µF | 1600 µF/F |
| 33 µF to 110 µF | 970 µF/F |
| 110 µF to 330 µF | 1700 µF/F |
| 0.33 mF to 1.1 mF | 2100 µF/F |
| 1.1 mF to 3.3 mF | 1500 µF/F |
| 3.3 mF to 11 mF | 1500 µF/F |
| 11 mF to 33 mF | 1500 µF/F |
| 33 mF to 110 mF | 1300 µF/F |

(n) Digital storage recorders

This section gives CMC uncertainties for oscilloscope calibrations using the Wavetek 9500 Calibrator Reference Instrument

| | | |
|----------------------|--------------------------|-----------------|
| DC Voltage into 1 MΩ | -222.4 V to -99.999 V | 0.014 % + 25 µV |
| | -99.999 V to -9.9999V | 0.012 % + 25 µV |
| | -9.9999 V to -999.99 mV | 0.019 % + 25 µV |
| | -999.99 mV to -99.999 mV | 50 µV/V + 25 µV |
| | -99.999 mV to -9.9999 mV | 25 µV |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 26 of 36



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|---|-------------------------------------|---------------------------|
| | -9.9999 mV to -999.99 μ V | 25 μ V |
| | -999.99 μ V to -888 μ V | 0.025 % + 25 μ V |
| | 0 V | 15 μ V |
| | 888 μ V to 1 mV | 0.025 % + 25 μ V |
| | 1 mV to 10 mV | 25 μ V |
| | 10 mV to 100 mV | 25 μ V |
| | 100 mV to 1V | 30 μ V/V + 25 μ V |
| | 1 V to 10 V | 0.016 % + 25 μ V |
| | 10 V to 100 V | 0.015 % + 25 μ V |
| | 100 V to 222.4 V | 0.012 % + 25 μ V |
| DC Voltage into 50 Ω | -5.56 V to -888 μ V | 0.025 % + 25 μ V |
| | 0 V | 15 μ V |
| | 888 μ V to 5.56 V | 0.025 % + 25 μ V |
| Square Voltage into 1 M Ω (negative, positive, or symmetric) | 35.52 μ Vpp to 999.99 μ Vpp | 1 % + 10 μ V |
| | 1 mVpp to 21 mVpp | 0.1 % + 15 μ V |
| | 21.001 mVpp to 556 mVpp | 0.1 % + 1 μ V |
| | 556.01 mVpp to 210 Vpp | 0.05 % + 1 μ V |
| | 0 V | 15 μ V |
| Output Frequency | 10 Hz to 100 kHz | 0.25 μ Hz/Hz |
| Square Voltage into 50 Ω (negative, positive or symmetric) | 35.52 μ Vpp to 999.99 μ Vpp | 1.0 % + 10 μ V |
| | 1 mVpp to 21 mVpp | 0.1 % + 15 μ V |
| | 21.001 mVpp to 556 mVpp | 0.1 % + 1 μ V |
| | 556.01 mVpp to 5.56 Vpp | 0.05 % + 1 μ V |
| | 0 V | 15 μ V |
| Output Frequency | 10 Hz to 100 kHz | 0.25 μ Hz/Hz |
| Levelled Sine | | |
| Reference level | | |
| 50 kHz to 10 MHz | 4.4 mVpp to 5.56 Vpp | 1.5 % |
| Flatness relative to reference level | | |
| 100 MHz to 100 MHz | 4.44 mVpp to 1 Vpp | 0.7 % |
| | 1 Vpp to 3.337 Vpp | 0.7 % |
| | 3.337 Vpp to 5.56 Vpp | 1.5 % |
| 100 MHz to 550 MHz | 4.44 mVpp to 1 Vpp | 2 % |
| | 1 Vpp to 3.337 Vpp | 2 % |
| | 3.337 Vpp to 5.56 Vpp | 3 % |
| 550 MHz to 1.1 GHz | 4.44 mVpp to 1 Vpp | 2 % |
| | 1 Vpp to 3.3369 Vpp | 2% |
| Low Edge | | |

| | | | | |
|-----------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 27 of 36 |
|-----------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|------------------------------------|---|----------------------------------|
| into 50 Ω and 1 MΩ | | |
| Output Voltage | 4.4 mVpp to 3.1 Vpp | 3 % |
| Rise/Fall Time (10 % to 90 %) | 4.44 mVpp to 3.1 Vpp | 500 ps nominal |
| Output Period | 500 ns to 100 ms | 0.25 μs/s |
| High Edge into 50 Ω | | |
| Output Voltage | 888 mVpp to 5.56 Vpp | 3 % |
| Rise/Fall Time (10 % to 90 %) | 888 mVpp to 5.56 Vpp | 100 ns nominal |
| Output Period | 10 μs to 100 ms | 0.25 μs/s |
| High Edge into 1 MΩ | | |
| Output Voltage | 888 mVpp to 100 Vpp 100.01 Vpp to 210 Vpp | 3 % 3 % |
| Rise/Fall Time (10 % to 90 %) | 888 mVpp to 100 Vpp 100.01 Vpp to 210 Vpp | 150 ns nominal 200 ns nominal |
| Output Period | 10 μs to 100 ms | 0.25 μs/s |
| Fast Edge into 50 Ω | | |
| Output Voltage | 4.44 Vpp to 3.1 Vpp | 3 % |
| Rise/Fall Time (10 % to 90 %) | 4.44 Vpp to 3.1 Vpp | 150 ps nominal |
| Output Period | 500 ns to 100 ms | 0.25 μs/s |
| Time Markers into 50 Ω and 1 MΩ | | |
| Square (nom. peak to peak) | 9.0091 ns to 55 s 100 mV, 250 mV, 500 mV 1 V (Rise/Fall Time 1 ns typical) | 0.25 μs/s 0.05 μs/s |
| Sine (nom. peak to peak) | 450.5 ps to 909.1 ps 100 mV, 250 mV, 500 mV | 0.25 μs/s |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 28 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|--|---|--|
| | 909.1 ps to 9.0091 μ s 100 mV, 250 mV, 500 mV, 1 V (Rise/Fall Time 1 ns typical) | 0.25 μ s/s |
| Pulse (nom. peak to peak) | 900.91 ns to 55 s 100 mV, 250 mV, 500 mV, 1 V (Rise/Fall Time 1 ns typical) | 0.25 μ s/s |
| Triangle (nom. peak to peak) | 900.91 ns to 55 s 100 mV, 250 mV, 500 mV, 1 V (Rise/Fall Time 2.5 % period) | 0.25 μ s/s |
| DC Current | 88.8 μ A to 111.2 mA -111.2 mA to -88.8 μ A | 0.25 % + 0.5 μ A 0.25 % + 0.5 μ A |
| Square Current | 88.8 μ A _{pp} to 111.2 mA _{pp} | 0.25 % + 0.5 μ A |
| Resistance | 10 Ω to 40 Ω 40 Ω to 90 Ω 90 Ω to 150 Ω 50 k Ω to 800 k Ω 800 k Ω to 1.2 M Ω 1.2 M Ω to 12 M Ω | 0.5 % 0.1 % 0.5 % 0.5 % 0.1 % 0.5 % |
| Capacitance | 1 pF to 35 pF 35 pF to 95 pF | 2 % + 0.25 pF 2 % + 0.25 pF |
| Composite Video Output | | |
| Amplitude 1.0 V peak to peak Pattern: (Full Raster) White, Grey or Black Sync Polarity: Positive or Negative Standards: 625-line 50 Hz, 525-line 60 Hz Trigger Output: Composite Sync or Odd Field start | | |
| LF Linear Ramp | | |
| Waveforms: 1 V peak to peak triangle, symmetrical about ground Ramp Time: 1 ms, 10 ms, 100 ms or 1 s 0.25 % μs/s (Ramp Time wave form is rising/falling/flat over period 3 x s For example: 1 ms rising, 1 ms falling, 1 ms flat, over 3 ms period) | | |
| Overload Pulse | | |
| Amplitude: 5 V to 20 V into 50 Ω Polarity: Positive or Negative from ground Duration: 0.2 s to 100 s (subject to pulse energy limits) | | |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 29 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

Energy: 1.6 J to 50 J
 Power into 50 Ω: 0.5 W to 8 W
 Trigger: Manual triggering only, maximum repetition rate 0.3 Hz

Zero Skew

Unadjusted Skew < 50 ps ch to ch
 Skew Temp Coefficient: <0.2 ps/°C
 Output Amplitude: 1 Vpp
 Frequency Range: 10 Hz to 100 MHz

Input Leakage Function

Open Circuit Output Leakage < 50 pA
 Short Circuit Output Offset < 15 μV

(q) Other specified devices

Voltage simulation of temperature (Fluke 5522A Calibrator Reference Instrument)

Simulated thermocouple output and thermocouple measurement.

Thermocouple Type

| | | |
|---|--------------------|----------|
| B | 600 °C to 800 °C | 0.44 °C |
| | 800 °C to 1000 °C | 0.34 °C |
| | 1000 °C to 1550 °C | 0.30 °C |
| | 1550 °C to 1820 °C | 0.33 °C |
| C | 0 °C to 150 °C | 0.30 °C |
| | 150 °C to 650 °C | 0.26 °C |
| | 650 °C to 1000 °C | 0.31 °C |
| | 1000 °C to 1800 °C | 0.50 °C |
| | 1800 °C to 2316 °C | 0.84 °C |
| E | -250 °C to -100 °C | 0.50 °C |
| | -100 °C to -25 °C | 0.16 °C |
| | -25 °C to -350 °C | 0.14 °C |
| | 350 °C to 650 °C | 0.16 °C |
| | 650 °C to 1000 °C | 0.21 °C |
| J | -210 °C to -100 °C | 0.27 °C |
| | -100 °C to -30 °C | 0.16 °C |
| | -30 °C to 150 °C | 0.070 °C |
| | 150 °C to 760 °C | 0.17 °C |
| | 760 °C to 1200 °C | 0.23 °C |

Operations Manager
 Authorisation:

Issue 65

Date:25/03/22

Page 30 of 36



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|---|--------------------|---------|
| K | -200 °C to -100 °C | 0.33 °C |
| | -100 °C to -25 °C | 0.18 °C |
| | -25 °C to 120 °C | 0.16 °C |
| | 120 °C to 1000 °C | 0.26 °C |
| | 1000 °C to 1372 °C | 0.40 °C |
| L | -200 °C to -100 °C | 0.37 °C |
| | -100 °C to 800 °C | 0.26 °C |
| | 800 °C to 900 °C | 0.17 °C |
| N | -200 °C to -100 °C | 0.40 °C |
| | -100 °C to -25 °C | 0.22 °C |
| | -25 °C to 120 °C | 0.19 °C |
| | 120 °C to 410 °C | 0.18 °C |
| | 410 °C to 1300 °C | 0.27 °C |
| R | 0 °C to 250 °C | 0.57 °C |
| | 250 °C to 400 °C | 0.35 °C |
| | 400 °C to 1000 °C | 0.33 °C |
| | 1000 °C to 1767 °C | 0.40 °C |
| S | 0 °C to 250 °C | 0.47 °C |
| | 250 °C to 1000 °C | 0.36 °C |
| | 1000 °C to 1400 °C | 0.37 °C |
| | 1400 °C to 1767 °C | 0.46 °C |
| T | -250 °C to -150 °C | 0.63 °C |
| | -150 °C to 0 °C | 0.24 °C |
| | 0 °C to 120 °C | 0.16 °C |
| | 120 °C to 400 °C | 0.14 °C |
| U | -200 °C to 0 °C | 0.56 °C |
| | 0 °C to 600 °C | 0.27 °C |
| <p>Temperature standard is selectable between ITS-90 or IPTS-68.</p> <p>Simulated RTD output</p> <p>RTD Type</p> <p>Pt 385, 100 Ω</p> | | |
| | -200 °C to -80 °C | 0.05 °C |
| | -80 °C to 0 °C | 0.05 °C |
| | 0 °C to 100 °C | 0.07 °C |
| | 100 °C to 300 °C | 0.09 °C |
| | 300 °C to 400 °C | 0.10 °C |
| | 400 °C to 630 °C | 0.12 °C |
| | 630 °C to 800 °C | 0.23 °C |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 31 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|-----------------------------|--------------------|---------|
| Pt 3926, 100 Ω | -200 °C to -80 °C | 0.05 °C |
| | -80 °C to 0 °C | 0.05 °C |
| | 0 °C to 100 °C | 0.07 °C |
| | 100 °C to 300 °C | 0.09 °C |
| | 300 °C to 400 °C | 0.10 °C |
| | 400 °C to 630 °C | 0.12 °C |
| Pt 3916, 100 Ω | -200 °C to -190 °C | 0.25 °C |
| | -190 °C to -80 °C | 0.04 °C |
| | 80 °C to 0 °C | 0.05 °C |
| | 0 °C to 100 °C | 0.06 °C |
| | 100 °C to 260 °C | 0.07 °C |
| | 260 °C to 300 °C | 0.08 °C |
| | 300 °C to 400 °C | 0.09 °C |
| | 400 °C to 600 °C | 0.10 °C |
| PtNi 385, 120 Ω (NI 120) | -80 °C to 0 °C | 0.08 °C |
| | 0 °C to 100 °C | 0.08 °C |
| | 100 °C to 260 °C | 0.14 °C |

Temperature standard is selectable between ITS-90 or IPTS-68

AC Harmonics (Fluke 5522A Calibrator Reference Instrument)

| Fundamental frequency | Voltage | Current | Auxiliary Voltage |
|-----------------------|------------------|------------------|-------------------|
| 10 Hz to 45 Hz | 33 mV to 33 V | 3.3 mA to 3 A | 10 mV to 5 V |
| 45 Hz to 65 Hz | 33 mV to 1020 V | 3.3 mA to 20.5 A | 10 mV to 5 V |
| 65 Hz to 500 Hz | 33 mV to 1020 V | 33 mA to 20.5 A | 100 mV to 5 V |
| 500 Hz to 5 kHz | 330 mV to 1020 V | 33 mA to 20.5 A | 100 mV to 5 V |
| 5 kHz to 10 kHz | 3.3 V to 1020 V | 33 mA to 330 mA | 100 mV to 5 V |
| 10 kHz to 30 kHz | 3.3 V to 1020 V | 33 mA to 330 mA | 100 mV to 3.3 V |

Maximum frequency of harmonic output: 30 kHz (10 kHz for 3.3 V to 5 V Auxiliary Voltage).
 Harmonics available: 2 through 50, limited by maximum frequency of harmonic output.
 (For example: a fundamental frequency of 5 kHz limits the maximum harmonic to 6, i.e. 30 kHz.
 Harmonics through to 50 are available for a fundamental frequency from 10 to 600 Hz {200 Hz for 3.3 to 5 V Auxiliary Voltage}).

CMC uncertainty for amplitude (voltage or current) is as per the uncertainties given in sections (a) DC voltmeters, (b) AC Voltmeters, (c) DC ammeters, and (d) AC ammeters, except that the floor component is doubled. (Note that uncertainties for Auxiliary Voltage are not given).

CMC uncertainty for phase is the greater of that given in (g) Phase angle indicators or 1°.

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 32 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

For example: the CMC uncertainty for phase for a 400 Hz fundamental frequency and 10 kHz harmonic frequency is 10° (from Phase angle least uncertainty for 10 kHz). Another example: the CMC uncertainty for phase for a 50 Hz fundamental frequency and 400 Hz harmonic frequency is 1° (Phase angle CMC uncertainty for 400 Hz is 0.25°, therefore 1° is used).

Electrical test equipment

The CMC uncertainties in this section are applicable to the use of the Transmille 2100 Reference Instrument for the calibration of the following equipment: Insulation testers, PAT testers, RCD testers, Line/Loop testers, Earth testers and equipment employing one or more such functions.

Continuity – Resistance

| | |
|-------------------|-----------------|
| 20 mΩ | 0.01 Ω |
| 0.10 Ω to 20.00 Ω | 0.01 Ω* |
| 100 Ω | 0.01 % + 0.01 Ω |
| 1 kΩ | 0.01 % + 0.01 Ω |

This is an abbreviated table.* minimum uncertainty over this range

Continuity – Current

Measured using multimeters – refer to 5.88(c) and (d).

Insulation Resistance – Resistance

| | |
|-----------------|-------|
| 0.01 MΩ to 5 MΩ | 0.1 % |
| 5 MΩ to 1 GΩ | 1 % |
| 1 GΩ to 10 GΩ | 1 % |

Insulation Resistance – Voltage

| | |
|-------------------------|-------------|
| 50 V nominal | 0.8 V |
| 100 V to 1000 V nominal | 1 % + 0.8 V |

Insulation Resistance – Current


| | |
|------------------|--------------|
| 0 mA to 9.999 mA | 1.3 % + 6 μA |
|------------------|--------------|

AC Voltage Output

| | |
|--------------|-------------|
| 0 V to 400 V | 1 % + 0.1 V |
|--------------|-------------|

RCD Time

| | |
|---------------|--------|
| 0.02 s to 5 s | 0.7 ms |
|---------------|--------|

| | | | |
|--|----------|---------------|---------------|
| Operations Manager Authorisation:  | Issue 65 | Date:25/03/22 | Page 33 of 36 |
|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

RCD Current

Typically measured using multimeters – refer to 5.88(c) and (d).
 Uncertainties below are for indications from the Transmille 2100 Reference Instrument.

| | | |
|----------------|---------------|----------------|
| 3 mA to 200 mA | <190 ms | 5 % + 0.2 mA |
| | 190 ms to 5 s | 0.06 mA |
| 200 mA to 1 A | <190 ms | 5 % + 2 mA |
| | 190 ms to 5 s | 0.4 % + 0.6 mA |

Loop Resistance

| | | |
|-----------------|---------------|-------|
| Ranges 1 to 7 | 0.00 Ω to 5 Ω | 18 mΩ |
| Ranges 8 to 9 | 5 Ω to 10 Ω | 22 mΩ |
| Ranges 10 to 11 | 100 Ω to 1 kΩ | 22 mΩ |

Resistance values are nominal. The Auto Loop least uncertainty is 18 mΩ. This has been added to the Loop Resistance uncertainties above.

PAT Earth Bond Resistance

| | | |
|-----------------|----------------------|---------------|
| Range 1 | 0.045 Ω | 13.8 % + 4 mΩ |
| Range 2 | 0.1058 Ω | 8.8 % + 4 mΩ |
| Range 3 | 0.157 Ω | 4.3 % + 4 mΩ |
| Range 4 | 0.2753 Ω | 4.4 % + 4 mΩ |
| Range 5 | 0.3858 Ω | 2.6 % + 4 mΩ |
| Range 6 | 0.5548 Ω | 3.0 % + 4 mΩ |
| Range 7 | 1.0638 Ω | 3.6 % + 4 mΩ |
| Range 8 | 5.113 Ω | 0.4 % + 4 mΩ |
| Range 9 | 10.054 Ω | 0.3 % + 4 mΩ |
| Ranges 10 to 11 | 98.74 Ω to 1001.77 Ω | 0.1 % + 4 mΩ |

Resistance values are nominal.

PAT Earth Bond Current

| | | |
|---------------|------------------|-------|
| | Impedance | |
| 0 to 100 mA | 20 mΩ | 6 mA |
| | 0.1 Ω | 6 mA |
| 100 mA to 8 A | 20 mΩ | 60 mA |
| | 0.1 Ω | 60 mA |

PAT Insulation Resistance

| | |
|----------------|-------|
| 0.1 MΩ to 5 MΩ | 0.1 % |
| 5 MΩ to 1 GΩ | 1 % |
| 1 GΩ to 10 GΩ | 1 % |

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 34 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

PAT Leakage Current

| | |
|--------|--------------|
| 2 mA | 1.5 % + 2 µA |
| 4.7 mA | 1.5 % + 2 µA |
| 7.7 mA | 1.5 % + 2 µA |

Leakage current values are nominal.

PAT Leakage Voltage

| | |
|----------------|---------------|
| 100 V to 300 V | 1.5 % + 0.9 V |
|----------------|---------------|

PAT Load Testing

| | |
|---------------------|--------|
| 0 Ω (Short Circuit) | 0.02 Ω |
| 440 Ω (0.13 kVA) | 5 % |

Note that 0.13 kVA load assumes 240 V supply, and as is given in manufacturer's specifications. Actual loading using 230 V supply is 0.12 kVA.

Line Voltage Measurement

| | |
|----------------|---------------|
| 200 V to 260 V | 0.8 % + 0.6 V |
|----------------|---------------|

5.91 Frequency Measurement and Time Measurement

- (a) Frequency meters
- (c) Counters

| Nominal range | CMC Uncertainty |
|---------------|-----------------|
| 10 Hz | 1.3 µHz/Hz |
| 100 Hz | 1.3 µHz/Hz |
| 120 Hz | 1.3 µHz/Hz |
| 1000 Hz | 1.3 µHz/Hz |
| 10 kHz | 1.3 µHz/Hz |
| 50 kHz | 1.3 µHz/Hz |
| 100 kHz | 1.3 µHz/Hz |
| 1000 kHz | 1.3 µHz/Hz |
| 2000 kHz | 1.4 µHz/Hz |
| 10000 kHz | 1.3 µHz/Hz |

In the Christchurch laboratory

Frequency meters:

Frequency Range

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 35 of 36 |
|--------------------------------------|--|----------|---------------|---------------|



CPS (NZ) Limited
 Metrology & Calibration Laboratory
SCOPE OF ACCREDITATION

Accreditation Number 271

| | | |
|-----------------------|---------------------|------------------|
| Levelled sine voltage | 0.1 Hz to 12 kHz | 3 μ Hz/Hz |
| | 12 kHz to 1100 MHz | 0.25 μ Hz/Hz |
| Square voltage | 10 Hz to 100 kHz | 0.25 μ Hz/Hz |
| Period Range | | |
| Time markers | 450.5 ps to 55 s | 0.25 μ s/s |
| Counters: | | |
| Frequency Range | | |
| Time markers | 0.02 Hz to 2200 MHz | 0.25 μ Hz/Hz |

Note 1:

Unless stated otherwise the CMC is based on the performance of the best available device and measurement uncertainties achieved for specific calibrations may be greater than the CMC Uncertainty. A laboratory may not report measurement uncertainties lower than its CMC. However, if the device under calibration has a greater accuracy than the device used to calculate the CMC the laboratory may be able to use the calibration data to lower its CMC Uncertainty. Please contact the laboratory to discuss your specific requirements.

| | | | | |
|--------------------------------------|--|----------|---------------|---------------|
| Operations Manager Authorisation: | | Issue 65 | Date:25/03/22 | Page 36 of 36 |
|--------------------------------------|--|----------|---------------|---------------|