Schedule of Accreditation

issued by

United Kingdom Accreditation Service

2 Pine Trees, Chertsey Lane, Staines-upon-Thames, TW18 3HR, UK

0043

Accredited to ISO/IEC 17025:2017

Roxspur Measurement and Control Ltd

Issue No: 064 **Issue date:** 02 February 2021

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Calibration performed by the Organisations at the locations specified below

Locations covered by the organisation and their relevant activities

Laboratory locations:

Location details		Activity	Location code
Address 2 Downgate Drive Sheffield South Yorkshire S4 8BT	**Local contact** Mr Mark Donnelly Tel: +44 (0)114 244 2521 Fax: +44 (0)114 243 4838 Email:Mark.Donnelly@ttelectronics.com Website: www.roxspur.com	Electrical Flow Pressure Temperature	P1

Site activities performed away from the locations listed above:

Location details		Activity	Location code
The customers' site or premises must be suitable for the nature of the particular calibrations undertaken and will be the subject of contract review arrangements between the laboratory and the customer.	**Local contact** Mr Mark Donnelly Tel: +44 (0)114-244 2521 Fax: +44 (0)114-243 4838 Email: mark.donnelly@ttelectronics.com Website: www.roxspur.com	Electrical Pressure Temperature	S

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Roxspur Measurement and Control Calibration Laboratory

Issue No: 064 **Issue date:** 02 February 2021

Calibration performed by the Organisation at the locations specified

DETAIL OF ACCREDITATION

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL				
DC Voltage			Measured using digital multimeter. The capability includes generation and measurement of this quantity.	
	0 V to 200 mV	15 ppm + 0.70 μV		P1
	200 mV to 2 V	10 ppm + 0.60 μV		
	2 V to 20 V	10 ppm		
	20 V to 200 V	15 ppm		
	200 V to 1000 V	15 ppm		
	0 V to 30 V	5.0 mV		S
DC Current				
	0 μA to 200 μA	50 ppm + 2.0 nA	Measured using digital multimeter. The capability includes generation and measurement of this quantity	P1
	200 μA to 2 mA	75 ppm + 15 nA		
	2 mA to 20 mA	75 ppm		
	20 mA to 200 mA	100 ppm		
	200 mA to 2 A	200 ppm		
	0 mA to 100 mA	0.010 mA		S
Generation	320 mA to 3.2 A	550 ppm + 150 μA		P1
	3.2 A to 10 A	500 ppm + 1.1 mA		
	10 A to 20 A	0.11 % + 5.2 mA		
	20 A to 1000 A	0.37 %	For the calibration of clampmeters only, using multi-turn coil method.	
DC Resistance				
Measurement	0 Ω to 20 Ω	100 ppm + 2.0 mΩ	Measured using digital multimeter. The capability includes generation and measurement of this quantity	P1
	20 Ω to 2 kΩ	20 ppm + 2.0 mΩ		
	2 kΩ to 20 kΩ	20 ppm		
	20 kΩ to 200 kΩ	30 ppm		
	200 kΩ to 2 MΩ	50 ppm		
	2 MΩ to 20 MΩ	200 ppm		
	20 MΩ to 200 MΩ	700 ppm		
	200 MΩ to 2 GΩ	0.10 %		
AC Voltage			Measured using digital multimeter. The capability includes generation and measurement of this quantity	
	10 mV to 200 mV			P1
	20 Hz to 10 kHz	280 ppm + 8.0 μV		
	10 kHz to 100 kHz	550 ppm + 10 μV		
	200 mV to 200 V			
	20 Hz to 30 kHz	400 ppm		
	30 kHz to 100 kHz	480 ppm		
	200 V to 1100 V			
	45 Hz to 10 kHz	450 ppm		
	10 kHz to 30 kHz	510 ppm		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
ELECTRICAL (cont'd)				
AC Current			Measured using digital multimeter. The capability includes generation and measurement of this quantity	
	20 Hz to 1 kHz			
	10 μA to 200 μA	250 ppm + 41 nA		P1
	200 μA to 200 mA	350 ppm		
	200 mA to 2 A	600 ppm		
	1 kHz to 5 kHz			P1
	10 μA to 200 μA	800 ppm + 30 nA		
	200 μA to 200 mA	700 ppm		
	200 mA to 2 A	0.13 %		
Generation	*10 Hz to 3 kHz*			
	2 A to 20 A	0.25 % + 7.0 mA		
	40 Hz to 100 Hz			
	20 A to 1000 A	0.50 %	For the calibration of clampmeters only, using multi-turn coil method.	
Frequency				
	0.1 Hz to 120 MHz	0.7 ppm	Using counter timer.	P1
Time interval	30 s to 8 hrs	0.15 s	Using counter timer.	P1
	30 s to 8 hrs	0.25 s		S
Electrical calibration of temperature indicators, controllers and recorders for the following sensors:				
Noble metal thermocouples			Using millivolt injection or measurement	
Types R and S	0 °C to 200 °C	0.50 °C	with cold junction compensation	P1
	200 °C to 1700 °C	0.40 °C		
Type B	600 °C to 1700 °C	0.40 °C	with cold junction compensation	P1
Type R and S	0 °C to 200 °C	0.60 °C	with cold junction compensation	S
	200 °C to 1700 °C	0.60 °C		
Type B	600 °C to 1700 °C	1.0 °C	with cold junction compensation	S
Base metal thermocouples	-200 °C to 0.0 °C	0.26 °C	with cold junction compensation	P1
	0 °C to 1372 °C	0.20 °C		
	-200 °C to 0.0 °C	0.80 °C	with cold junction compensation	S
	0 °C to 1372 °C	0.60 °C		

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
Electrical calibration of temperature indicators, controllers and recorders for the following sensors: (cont'd)				
Pt 100	-200 °C to +850 °C	0.050 °C	Using DC Resistance measurement or injection.	P1
	-200 °C to +850 °C	0.50 °C		S
FLOW				
Flow rate of calibration gas: Compressed Air Oxygen Argon Carbon Dioxide Nitrous Oxide Helium Nitrogen	0.005 l/min to 0.25 l/min 0.25 l/min to 2.5 l/min 2.5 l/min to 50 l/min	0.53 % 0.34 % 0.43 %	Calibration of flowmeters measuring volumetric or mass flowrates under ambient conditions.	P1
PRESSURE Gas pressure (absolute)			Methods consistent with EURAMET CG17.	
Calibration of pressure indicating instruments and gauges	3.5 kPa to 120 kPa 120 kPa to 200 kPa 200 kPa to 2.6 MPa	0.059 % + 6.0 Pa 0.090 % + 8.2 Pa 0.060 % + 5.8 Pa	Calibration of pressure devices with an electrical output may be undertaken	P1
	3 kPa to 96 kPa 96 kPa to 105 kPa 105 kPa to 2.1 MPa	3.0 kPa 400 Pa 3.0 kPa		S
Gas pressure (gauge)				
Calibration of pressure indicating instruments and gauges	-90 kPa to -2.5 kPa -2.5 kPa to 2.5 kPa 2.5 kPa to 100 kPa 100 kPa to 2.5 MPa	0.059 % + 6.0 Pa 0.09 % + 0.058 Pa 0.063 % + 5.8 Pa 0.011 %		P1
	-90 kPa to +2.0 MPa	2.5 kPa		S
Hydraulic pressure (absolute)				
Calibration of pressure indicating instruments and gauges	700 kPa to 6.1 MPa 6.1 MPa to 120.1 MPa	0.013 % + 8.3 Pa 0.014 % + 8.3 Pa		P1
	10 kPa to 60 MPa	220 kPa		S
Hydraulic pressure (gauge)				
Calibration of pressure indicating instruments and gauges	600 kPa to 6 MPa 6 MPa to 120 MPa	0.013 % 0.014 %		P1
	0 to 70 MPa	220 kPa		S

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
TEMPERATURE				
Resistance thermometers	-196 °C 0 °C to -80 °C Ice Point (0 °C) Triple Point of water (0.01 °C) Gallium Melt Point (29.7646 °C) 0 °C to 300 °C	0.040 °C 0.050 °C 0.031 °C 0.012 °C 0.010 °C 0.050 °C	Calibration performed within Liquid Baths	P1
Platinum thermocouples	0 °C to 1100 °C 1100 °C to 1600 °C 1064.18 °C 1553.5 °C	0.50 °C 1.8 °C 0.50 °C 1.8 °C	Calibration performed within Tube Furnace or Metrology Well Au and Pd wire bridge measurements	P1
	0 °C to 1100 °C 1100 °C to 1600 °C	2.0 °C 4.0 °C		S
	Fixed point calibrations			
	Gallium Melt Point (29.7646 °C) Tin (231.9 °C) Zinc (419.5 °C)	0.35 °C 0.50 °C 0.50 °C	Calibration performed within Metal Fixed Points	P1
Other thermocouples	-196 °C 0 °C to -80 °C Gallium Melt Point (29.7646 °C) 0 °C to 300 °C 300 °C to 650 °C 650 °C to 1100 °C 1100 °C to 1300 °C	0.26 °C 0.15 °C 0.10 °C 0.15 °C 0.25 °C 1.0 °C 2.5 °C	Calibration performed within Liquid Bath, Metrology Well or Furnace	P1
	-80 °C to +200 °C 200 °C to 1000 °C 1000 °C to 1300 °C	1.0 °C 3.0 °C 5.0 °C		S
Compensating and extension cables for Noble metal thermocouples Base metal thermocouples	 0 °C to 40 °C 0 °C to 40 °C	 0.26 °C 0.15 °C	Calibration performed within Liquid Baths	P1
Liquid-in-glass thermometers	-80 °C to -40 °C -40 °C to 0 °C Ice point (0 °C) 0 °C to 100 °C 100 °C to 300 °C	0.11 °C 0.050 °C 0.050 °C 0.050 °C 0.050 °C		P1

Measured Quantity Instrument or Gauge	Range	Calibration and Measurement Capability (CMC) Expressed as an Expanded Uncertainty (k = 2)	Remarks	Location Code
TEMPERATURE (cont'd)				
Electronic thermometers with sensors	Range as per sensors	As for sensors		P1
Electronic thermometers with sensors Analogue Digital	0 °C to 200 °C 200 °C to 600 °C 600 °C to 1100 °C 1100 °C to 1300 °C	0.50 °C 1.3 °C 2.0 °C 3.4 °C		S
Metal block calibrators	-100 °C to +300 °C 300 °C to 1100 °C	0.050 °C 1.0 °C		P1
Temperature surveys				
Autoclaves, incubators, fridges/refrigerators and freezers	-80 °C to +200 °C	1.0 °C	Single and multipoint time dependent temperature profiling, also referred to as spatial temperature surveying or mapping	S
Ovens, furnaces, fridges/refrigerators and environmental chambers	0 °C to 600 °C 600 °C to 1100 °C 1100 °C to 1600 °C	1.1 °C 1.9 °C 3.5 °C		
END				

Appendix - Calibration and Measurement Capabilities

Introduction

The definitive statement of the accreditation status of a calibration laboratory is the Accreditation Certificate and the associated Schedule of Accreditation. This Schedule of Accreditation is a critical document, as it defines the measurement capabilities, ranges and boundaries of the calibration activities for which the organisation holds accreditation.

Calibration and Measurement Capabilities (CMCs)

The capabilities provided by accredited calibration laboratories are described by the Calibration and Measurement Capability (CMC), which expresses the lowest uncertainty of measurement that can be achieved during a calibration. If a particular device under calibration itself contributes significantly to the uncertainty (for example, if it has limited resolution or exhibits significant non-repeatability) then the uncertainty quoted on a calibration certificate will be increased to account for such factors. The CIPM-ILAC definition of the CMC is as follows:

A CMC is a calibration and measurement capability available to customers under normal conditions:
(a) as published in the BIPM key comparison database (KCDB) of the CIPM MRA; or
(b) as described in the laboratory's scope of accreditation granted by a signatory to the ILAC Arrangement.

The CMC is normally used to describe the uncertainty that appears in an accredited calibration laboratory's schedule of accreditation and is the uncertainty for which the laboratory has been accredited using the procedure that was the subject of assessment. The CMC is calculated according to the procedures given in M3003 and is normally stated as an expanded uncertainty at a coverage probability of 95 %, which usually requires the use of a coverage factor of $k = 2$. An accredited laboratory is not permitted to quote an uncertainty that is smaller than the published CMC in certificates issued under its accreditation.

The CMC may be described using various methods in the Schedule of Accreditation:

As a single value that is valid throughout the range.
As an explicit function of the measurand or of a parameter (see below).
As a range of values. The range is stated such that the customer can make a reasonable estimate of the likely uncertainty at any point within the range.
As a matrix or table where the CMCs depend on the values of the measurand and a further quantity.
In graphical form, providing there is sufficient resolution on each axis to obtain at least two significant figures for the CMC.

Expression of CMCs - symbols and units

In general, only units of the SI and those units recognised for use with the SI are used to express the values of quantities and of the associated CMCs. Nevertheless, other commonly used units may be used where considered appropriate for the intended audience. For example, the term "ppm" (part per million) is frequently used by manufacturers of test and measurement equipment to specify the performance of their products. Terms like this may be used in Schedules of Accreditation where they are in common use and understood by the users of such equipment, providing their use does not introduce any ambiguity in the capability that is being described.

When the CMC is expressed as an explicit function of the measurand or of a parameter, this often comprises a relative term (e.g., percentage) and an absolute term, i.e. one expressed in the same units as those of the measurand. This form of expression is used to describe the capability that can be achieved over a range of values. Some examples are shown below. It should be noted that these expressions are *not* mathematical formulae but are instead written in a commonly used shorthand for expressing uncertainties - therefore, for purposes of clarity, an indication of how they are to be interpreted is also provided below.

DC voltage, 100 mV to 1 V: 0.0025 % + 5.0 µV

Over the range 100 mV to 1 V, the CMC is 0.0025 %·V + 5.0 µV, where V is the measured voltage.

Hydraulic pressure, 0.5 MPa to 140 MPa: 0.0036 % + 0.12 ppm/MPa + 4.0 Pa

Over the range 0.5 MPa to 140 MPa, the CMC is $0.0036\ \%\cdot p + (0.12\cdot 10^{-6}\cdot p\cdot 10^{-6}) + 4.0$ Pa, where p is the measured pressure in Pa.

It should be noted that the percentage symbol (%) simply represents the number 0.01. In cases where the CMC is stated only as a percentage, this is to be interpreted as meaning percentage of the measured value or indication.

Thus, for example, a CMC of 1.5 % means $1.5 \cdot 0.01 \cdot i$, where i is the instrument indication.