



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

R&D CALIBRATIONS, INC. DBA: OPTO-CAL
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CALIBRATION

Valid To: August 31, 2024

Certificate Number: 6198.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 4}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	(±) CMC ^{2, 5}	Comments
DC Current – Generate	(0 to 2) pA (2 to 20) pA (20 to 200) pA (0.2 to 2) nA (2 to 20) nA (20 to 200) nA (0.2 to 2) μA (2 to 20) μA (20 to 200) μA (0.2 to 2) mA	0.49 % + 0.067 pA 0.44 % + 0.067 pA 0.29 % + 0.11 pA 0.085 % + 0.000 47 nA 0.075 % + 0.0035 nA 0.040 % + 0.019 nA 0.029 % + 0.000 17 μA 0.029 % + 0.0014 μA 0.029 % + 0.014 μA 0.033 % + 0.000 15 mA	Keithley 263

II. Optical Quantities

Parameter/Equipment	Range	(±) CMC ^{2,3}	Comments
Spectral Irradiance ($\mu\text{W}/\text{cm}^2 \cdot \text{nm}$) - Measure & Spectral Radiance – Measuring Instruments ($\mu\text{W}/\text{cm}^2 \cdot \text{nm} \cdot \text{sr}$)	(350 to 360) nm (360 to 370) nm (370 to 380) nm (380 to 390) nm (390 to 400) nm (400 to 450) nm (450 to 500) nm (500 to 555) nm (555 to 600) nm (600 to 655) nm (655 to 700) nm (700 to 800) nm (800 to 900) nm (900 to 1050) nm (1050 to 1100) nm	1.5 % 1.3 % 1.2 % 1.1 % 1.1 % 1.1 % 0.83 % 0.83 % 0.7 % 0.7 % 0.6 % 0.6 % 0.6 % 0.48 % 0.48 %	Osram Sylvania T6 1000W tungsten quartz- halogen lamp
Chromaticity (CIE 19) – Measure x y u' v' x y	(350 to 750) nm (380 to 1100) nm	0.000 64 0.000 61 0.0005' 0.000 72' 0.002 0.0019	Osram Sylvania T6 1000W tungsten quartz- halogen lamp Note: x, y, u' and v' are dimensionless quantities Gamma Scientific RS-12D
Illuminance lm/m^2 (Lux), Illuminance lm/ft^2 (Foot candles) Luminance cd/m^2 Luminance cd/ft^2 (Foot lamberts)	(350 to 750) nm (350 to 750) nm	1.1 % 1.1 %	Osram Sylvania T6 1000W tungsten quartz- halogen lamp
Luminance cd/m^2 (NITS) – Measure Luminance cd/ft^2 (Foot lamberts) -Measuring Equipment	(380 to 1100) nm (380 to 1100) nm	1.1 % 1.1 %	Gamma Scientific RS-12D
Correlated Color Temperature (CCT) – Measuring Equipment	(2600 to 3150) K	5.6 K	Osram Sylvania T6 1000W tungsten quartz- halogen Lamp

Parameter/Equipment	Range	(±) CMC ^{2,3}	Comments
Radiometric Detectors – Absolute Spectral Responsivity Amps per Watt (A/W)	200 nm	6.2 %	Hamamatsu S2281 & Gamma Scientific NM- 7H
	205 nm	6.2 %	
	210 nm	6.2 %	
	215 nm	6.2 %	
	220 nm	2.2 %	
	225 nm	2.1 %	
	230 nm	2.1 %	
	235 nm	2.2 %	
	240 nm	1.9 %	
	245 nm	1.9 %	
	250 nm	1.9 %	
	254.7 nm	2.0 %	
	260 nm	1.6 %	
	265 nm	1.6 %	
	270 nm	1.6 %	
	275 nm	1.7 %	
	280 nm	1.1 %	
	285 nm	1.1 %	
	290 nm	1.2 %	
	295 nm	1.1 %	
	300 nm	1.1 %	
	305 nm	1.1 %	
	310 nm	1.2 %	
	315 nm	1.1 %	
	320 nm	1.0 %	
	325 nm	1.1 %	
	330 nm	1.0 %	
	335 nm	1.1 %	
	340 nm	1.1 %	
	345 nm	1.1 %	
	350 nm	1.2 %	
	355 nm	1.3 %	
	360 nm	1.2 %	
	365 nm	1.2 %	
	370 nm	1.2 %	
	375 nm	0.9 %	
380 nm	0.8 %		
385 nm	0.8 %		
390 nm	0.8 %		
395 nm	0.8 %		
400 nm	0.7 %		
405 nm	0.7 %		
410 nm	0.7 %		
415 nm	0.7 %		
420 nm	0.7 %		
425 nm	0.7 %		
430 nm	0.7 %		
435 nm	0.7 %		
440 nm	0.7 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Radiometric Detectors – Absolute Spectral Responsivity Amps per Watt (A/W) (cont.)	445 nm	0.7 %	Hamamatsu S2281 & Gamma Scientific NM- 7H
	450 nm	0.7 %	
	455 nm	0.6 %	
	460 nm	0.7 %	
	465 nm	0.7 %	
	470 nm	0.7 %	
	475 nm	0.7 %	
	480 nm	0.7 %	
	485 nm	0.7 %	
	490 nm	0.7 %	
	495 nm	0.7 %	
	500 nm	0.6 %	
	505 nm	0.6 %	
	510 nm	0.6 %	
	515 nm	0.7 %	
	520 nm	0.7 %	
	525 nm	0.7 %	
	530 nm	0.7 %	
	535 nm	0.7 %	
	540 nm	0.7 %	
	545 nm	0.7 %	
	550 nm	0.6 %	
	555 nm	0.6 %	
	560 nm	0.6 %	
	565 nm	0.7 %	
	570 nm	0.7 %	
	575 nm	0.7 %	
	580 nm	0.7 %	
	585 nm	0.7 %	
	590 nm	0.7 %	
	595 nm	0.7 %	
	600 nm	0.7 %	
	605 nm	0.6 %	
610 nm	0.7 %		
615 nm	0.7 %		
620 nm	0.7 %		
625 nm	0.7 %		
630 nm	0.7 %		
635 nm	0.7 %		
640 nm	0.7 %		
645 nm	0.6 %		
650 nm	0.7 %		
655 nm	0.7 %		
660 nm	0.7 %		
665 nm	0.7 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Radiometric Detectors – Absolute Spectral Responsivity Amps per Watt (A/W) (cont.)	670 nm	0.6 %	Hamamatsu S2281 & Gamma Scientific NM- 7H
	675 nm	0.7 %	
	680 nm	0.7 %	
	685 nm	0.6 %	
	690 nm	0.6 %	
	695 nm	0.6 %	
	700 nm	0.6 %	
	705 nm	0.7 %	
	710 nm	0.7 %	
	715 nm	0.7 %	
	720 nm	0.7 %	
	725 nm	0.6 %	
	730 nm	0.6 %	
	735 nm	0.6 %	
	740 nm	0.6 %	
	745 nm	0.6 %	
	750 nm	0.6 %	
	755 nm	0.6 %	
	760 nm	0.6 %	
	765 nm	0.6 %	
	770 nm	0.6 %	
	775 nm	0.6 %	
	780 nm	0.6 %	
	785 nm	0.6 %	
	790 nm	0.6 %	
	795 nm	0.6 %	
	800 nm	0.6 %	
	805 nm	0.6 %	
	810 nm	0.6 %	
	815 nm	0.6 %	
	820 nm	0.6 %	
	825 nm	0.6 %	
	830 nm	0.6 %	
	835 nm	0.6 %	
	840 nm	0.6 %	
	845 nm	0.6 %	
850 nm	0.6 %		
855 nm	1.0 %		
860 nm	0.6 %		
865 nm	0.6 %		
870 nm	0.6 %		
875 nm	1.0 %		
880 nm	0.6 %		
885 nm	1.0 %		
890 nm	0.6 %		
895 nm	0.5 %		
900 nm	0.53 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Radiometric Detectors – Absolute Spectral Responsivity Amps per Watt (A/W) (cont.)	905 nm	0.53 %	Hamamatsu S2281 & Gamma Scientific NM- 7H
	910 nm	0.54 %	
	915 nm	0.53 %	
	920 nm	0.54 %	
	925 nm	0.54 %	
	930 nm	0.52 %	
	935 nm	0.51 %	
	940 nm	0.51 %	
	945 nm	0.51 %	
	950 nm	0.51 %	
	955 nm	0.49 %	
	960 nm	0.49 %	
	965 nm	0.5 %	
	970 nm	0.51 %	
	975 nm	0.55 %	
	980 nm	0.53 %	
	985 nm	0.51 %	
	990 nm	0.51 %	
	995 nm	0.51 %	
	1000 nm	0.50 %	
	1005 nm	0.50 %	
	1010 nm	0.50 %	
	1015 nm	0.50 %	
	1020 nm	0.50 %	
	1025 nm	0.5 %	
	1030 nm	0.5 %	
	1035 nm	0.5 %	
	1040 nm	0.5 %	
	1045 nm	0.5 %	
	1050 nm	0.5 %	
1055 nm	0.6 %		
1060 nm	0.6 %		
1065 nm	0.5 %		
1070 nm	0.7 %		
1075 nm	0.6 %		
1080 nm	0.7 %		
1085 nm	0.7 %		
1090 nm	0.7 %		
1095 nm	0.7 %		
1100 nm	0.8 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Photometers & Radiometers	254 nm	2.0 %	Hamamatsu S2281 & Palentronix AR982
	350 nm	1.3 %	
	355 nm	1.3 %	
	360 nm	1.2 %	
	365 nm	1.2 %	
	370 nm	1.2 %	
	375 nm	0.94 %	
	380 nm	0.88 %	
	385 nm	0.87 %	
	390 nm	0.89 %	
	395 nm	0.89 %	
	400 nm	0.76 %	
	405 nm	0.77 %	
	410 nm	0.78 %	
	415 nm	0.82 %	
	420 nm	0.85 %	
	425 nm	0.84 %	
	430 nm	0.87 %	
	435 nm	0.85 %	
	440 nm	0.81 %	
	445 nm	0.81 %	
	450 nm	0.78 %	
	455 nm	0.76 %	
	460 nm	0.79 %	
	465 nm	0.79 %	
	470 nm	0.80 %	
	475 nm	0.79 %	
	480 nm	0.81 %	
	485 nm	0.80 %	
	490 nm	0.78 %	
	495 nm	0.76 %	
	500 nm	0.74 %	
	505 nm	0.73 %	
	510 nm	0.72 %	
	515 nm	0.74 %	
	520 nm	0.73 %	
525 nm	0.75 %		
530 nm	0.74 %		
535 nm	0.75 %		
540 nm	0.75 %		
545 nm	0.75 %		
550 nm	0.72 %		
555 nm	0.74 %		
560 nm	0.73 %		
565 nm	0.74 %		
570 nm	0.75 %		
575 nm	0.73 %		
580 nm	0.73 %		
585 nm	0.72 %		

Parameter/Equipment	Range	(±) CMC ^{2,3}	Comments
Photometers & Radiometers (cont.)	590 nm	0.72 %	Hamamatsu S2281 & Palentronix AR982
	595 nm	0.72 %	
	600 nm	0.73 %	
	605 nm	0.70 %	
	610 nm	0.72 %	
	615 nm	0.74 %	
	620 nm	0.74 %	
	625 nm	0.73 %	
	630 nm	0.73 %	
	635 nm	0.74 %	
	640 nm	0.74 %	
	645 nm	0.73 %	
	650 nm	0.75 %	
	655 nm	0.78 %	
	660 nm	0.77 %	
	665 nm	0.77 %	
	670 nm	0.75 %	
	675 nm	0.76 %	
	680 nm	0.75 %	
	685 nm	0.74 %	
	690 nm	0.73 %	
	695 nm	0.72 %	
	700 nm	0.73 %	
	705 nm	0.74 %	
	710 nm	0.75 %	
	715 nm	0.74 %	
	720 nm	0.74 %	
	725 nm	0.71 %	
	730 nm	0.69 %	
	735 nm	0.68 %	
	740 nm	0.69 %	
	745 nm	0.70 %	
	750 nm	0.70 %	
	755 nm	0.69 %	
760 nm	0.67 %		
765 nm	0.68 %		
770 nm	0.69 %		
775 nm	0.69 %		
780 nm	0.69 %		
785 nm	0.70 %		
790 nm	0.71 %		
795 nm	0.71 %		
800 nm	0.69 %		
805 nm	0.70 %		
810 nm	0.70 %		
815 nm	0.68 %		
820 nm	0.67 %		
825 nm	0.68 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Photometers & Radiometers (cont.)	830 nm	0.69 %	Hamamatsu S2281 & Palentronix AR982
	835 nm	0.70 %	
	840 nm	0.69 %	
	845 nm	0.67 %	
	850 nm	0.67 %	
	855 nm	0.65 %	
	860 nm	0.65 %	
	865 nm	0.64 %	
	870 nm	0.63 %	
	875 nm	0.62 %	
	880 nm	0.63 %	
	885 nm	0.63 %	
	890 nm	0.63 %	
	895 nm	0.62 %	
	900 nm	0.61 %	
	905 nm	0.60 %	
	910 nm	0.61 %	
	915 nm	0.61 %	
	920 nm	0.62 %	
	925 nm	0.61 %	
	930 nm	0.60 %	
	935 nm	0.59 %	
	940 nm	0.58 %	
	945 nm	0.58 %	
	950 nm	0.58 %	
	955 nm	0.56 %	
	960 nm	0.56 %	
	965 nm	0.57 %	
	970 nm	0.57 %	
	975 nm	0.61 %	
	980 nm	0.62 %	
	985 nm	0.58 %	
	990 nm	0.74 %	
	995 nm	0.58 %	
1000 nm	0.64 %		
1005 nm	0.59 %		
1010 nm	0.59 %		
1015 nm	0.63 %		
1020 nm	0.66 %		
1025 nm	0.72 %		
1030 nm	0.60 %		
1035 nm	0.59 %		
1040 nm	0.60 %		
1045 nm	0.59 %		
1050 nm	0.62 %		
1055 nm	0.64 %		
1060 nm	0.83 %		
1065 nm	0.61 %		

Parameter/Equipment	Range	(±) CMC ^{2, 3}	Comments
Photometers & Radiometers (cont.)	1070 nm	0.71 %	Hamamatsu S2281 & Palentronix AR982
	1075 nm	0.72 %	
	1080 nm	0.78 %	
	1085 nm	0.86 %	
	1090 nm	0.78 %	
	1095 nm	0.79 %	
	1100 nm	0.89 %	

¹ This laboratory offers commercial calibration service.

² Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

⁴ This scope meets A2LA's *PI12 Flexible Scope Policy*.

⁵ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.



Accredited Laboratory

A2LA has accredited

R&D CALIBRATIONS, INC. DBA: OPTO-CAL

Lakeside, CA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 12th day of July 2022.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 866.01
Valid to August 31, 2024

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.