International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

ELECTRICAL INSTRUMENTATION CALIBRATION REPORT

This document states that the instrument described below meets or exceeds all manufacturer specifications. The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006. subclause 5.3

Date: 21-Nov-22 Certificate #: 2211210416E SO#: 178365

Temp: 22 Degrees C Humidity: 16 % Procedure: TP-0135 REV D

Rendered To: Quantum Design GmBH

InstrumentModel-S/N: ILT2500 #00168

Calibration/Repair Remarks: New Instrument

Parts (If Needed):

As Found Tolerance In	As Found Tolerance Out	As Found Readings	As Found Permissible Error	Applied Current	Adjusted Readings	Permissible Adjustment Error	As Left Tolerance In	As Left Tolerance Out
☐	☐		+/-1.0%	1.000E-3	1.000E-03	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-4	1.000E-04	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-5	9.998E-06	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-6	9.996E-07	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-7	1.000E-07	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-8	9.999E-09	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-9	9.987E-10	+/- 0.5%	☑	☐
☐	☐		+/-1.0%	1.000E-10	1.000E-10	+/- 0.5%	☑	☐
☐	☐		+/-2.0%	1.000E-11	9.967E-12	+/- 1.0%	☑	☐
☐	☐		+/-10.0%	5.000E-12	4.839E-12	+/- 5.0%	☑	☐

Tolerance after repair and/or calibration: ☑ In ☐ Out

Measurement Uncertainty: 1mA=±0.04%, 100uA=±0.03%, 10uA=±0.1%, 1uA=±0.11%, 100nA=±0.11%, 10nA=±0.11%, 1nA=±0.17%, 100pA=±0.26%, 10pA=±1.27%, 1pA=±4.28%. Confidence Level of Uncertainty is 95% (K=2).

ILT's Simple Accept Decision Rule applies, unless stated above.

The above Instrument was compared to the Keithley Current Calibrator/Source Model 6430 S/N 4080572 calibrated on 1/13/2022 Calibration Due: 1/13/2023

Calibrated By: _____

Electrical Calibration Tech. Chris Kucy

Form F-094E Rev A

ilac-MRA PJLA Calibration Accreditation 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED240 #11525 Input Optic: W #17207

Filter: ACT5 #28399 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias On

(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

1.45E-4 (A)(cm2)(eff W-1) assuming monochromatic irradiance at 270nm

Unit will read directly in effective watts per square centimeter when used with the sensitivity factor above.

REFERENCE PLANE: Groove ONE formed by filter or diffuser elements and next element, counted from front surface of assembly.

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2 Calibration Due: December 3, 2025
D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Calibration Due: December 2, 2025

INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TRANSFER STANDARDS:

U1023 U522 N/A

ILT Transfer Uncertainty to Customer = +/- 4.5% plus NIST Uncertainty of: +/- 1.77% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: SpectroPro1500/1000W Xe LAMP OUTPUT: 1.067E-6 W/cm2

INSTRUMENTATION: SED240 #3355 PROCEDURE: OP-0018

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223307 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GmbH

Detector: SED240 #11526 Input Optic: W #17211

Filter: SCS280 #28904 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias On

(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

3.84E-4 (A)(cm2)(W-1) assuming monochromatic irradiance at 290nm

3.840E-07 (A)(cm2)(mW-1) assuming monochromatic irradiance at 290nm

Unit will read directly in watts per square centimeter or milliWatts per square centimeter when used with the sensitivity factor above.

REFERENCE PLANE: Groove ONE formed by filter or diffuser elements and next element, counted from front surface of assembly.

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2 Calibration Due: December 3, 2025
D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Calibration Due: December 2, 2025

INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TRANSFER STANDARDS:

U522 U1023 N/A

ILT Transfer Uncertainty to Customer = +/- 5.5% plus NIST Uncertainty of: +/- 1.25% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 19s Hg-Xe LAMP OUTPUT: 7.51E-4 W/cm2

INSTRUMENTATION: #1029/SCS280/W PROCEDURE: OP-0007

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223312 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED033 #11151 Input Optic: W #17213

Filter: UVA #29449 Misc.: N/A #

Calibrated With: ILT2500 #000168 +5V Bias Off

(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

7.88E-3 (A)(cm2)(W-1) assuming monochromatic irradiance at 360nm

7.880E-06 (A)(cm2)(mW-1) assuming monochromatic irradiance at 360nm

Unit will read directly in watts per square centimeter or milliWatts per square centimeter when used with the sensitivity factor above.

REFERENCE PLANE: Groove ONE formed by filter or diffuser elements and next element, counted from front surface of assembly.

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2 Calibration Due: December 3, 2025
D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Calibration Due: December 2, 2025

INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TRANSFER STANDARDS:

SED400 #139 SED400 #1490 IL #01

ILT Transfer Uncertainty to Customer = +/- 4.5% plus NIST Uncertainty of: +/- 1.16% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 19s Hg-Xe LAMP OUTPUT: 2.66E-3 W/cm2

INSTRUMENTATION: SED033 #4544/UVA/W PROCEDURE: OP-0007

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223308 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED033 #11152 Input Optic: W #17209

Filter: F #30034 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias Off

(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

1.24E-2 (A)(cm2)(W-1) assuming monochromatic irradiance at 600nm

1.240E-05 (A)(cm2)(mW-1) assuming monochromatic irradiance at 600nm

Unit will read directly in watts per square centimeter or milliWatts per square centimeter when used with the sensitivity factor above.

REFERENCE PLANE: Groove ONE formed by filter or diffuser elements and next element, counted from front surface of assembly.

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2 Calibration Due: December 3, 2025
D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Calibration Due: December 2, 2025

INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TRANSFER STANDARDS:

IL #01 IL #02 SED033 #3275

ILT Transfer Uncertainty to Customer = +/- 3% plus NIST Uncertainty of: +/- 0.31% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 1T 1000W QTH LAMP OUTPUT: 3.24E-5 W/cm2

INSTRUMENTATION: SED033 #6400 PROCEDURE: OP-0029

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223309 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED033 #11155 Input Optic: R #01429

Filter: F #30035 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias Off

(PRR) PEAK RADIANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

1.07E-3 (A)(cm2)(sr)(W-1) assuming monochromatic radiance at 600nm

Unit will read directly in watts per square centimeter per steradian when used with the sensitivity factor above.

REFERENCE PLANE: Average F.O.V. +/-0.75 Degrees

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2 Calibration Due: December 3, 2025
D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Calibration Due: December 2, 2025

INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TRANSFER STANDARDS:

IL #01 IL #02 SED033 #3275

ILT Transfer Uncertainty to Customer = +/- 3% plus NIST Uncertainty of: +/- 0.31% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 1T 1000W QTH/Reflectance Tablet LAMP OUTPUT: 1.00E-5 W/cm2/sr

INSTRUMENTATION: SED033 #6400 PROCEDURE: OP-0041

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223313 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED033 #11153 Input Optic: W #17210

Filter: Y4 #01044 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias Off

(YIS)PHOTOPIC ILLUMINANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

2.36E-8 (A)(ft2)(lm-1) assuming 3215 K Color Temperature

2.192E-09 (A)(lux-1) assuming 3215 K Color Temperature

Unit will read directly in lumens per square foot (footcandles) or lux when used with the sensitivity factor above.

REFERENCE PLANE: Groove ONE formed by filter or diffuser elements and next element, counted from front surface of assembly.

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
SED033 #4528 / Y #16218 - November 5, 2015 - NIST Test No.: 685/287261-15/1 - Calibration Due: November 5, 2025

ILT Transfer Uncertainty to Customer = +/- 4.3% plus NIST Uncertainty of: +/- 0.5% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 1T 1000W QTH LAMP OUTPUT: 251 lm/ft2

INSTRUMENTATION: #6400/Y PROCEDURE: OP-0070

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223310 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 66765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com

International Light TECHNOLOGIES
Part of Ocean Insight

CALIBRATION CERTIFICATE

OPTICAL CALIBRATION CERTIFICATE

International Light Technologies certifies that the calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2017. Calibration conforms to ANSI/NCSL Z540.1-1994 and ANSI/NCSL Z540.3-2006.subclause 5.3

Rendered-to: QUANTUM DESIGN GMBH

Detector: SED033 #11154 Input Optic: R #01428

Filter: Y4 #01046 Misc.: N/A #

Calibrated With: ILT2500 #00168 +5V Bias Off

(YLS) PHOTOPIC LUMINANCE RESPONSE SENSITIVITY FACTOR AS CALIBRATED ON: 22-Nov-2022

6.35E-10 (A)(fL-1) assuming 3215 K Color Temperature

1.853E-10 (A)(m2)(cd-1) assuming 3215 K Color Temperature

Unit will read directly in foot-Lamberts when used with the sensitivity factor above.

REFERENCE PLANE: Average F.O.V. +/-0.75 Degrees

PRIMARY STANDARD: U.S. National Institute of Standards and Technology Detector Response
SED033#4528/Y#16218 - November 5, 2015 - NIST Test No.: 685/287261-15/1 - Calibration Due: November 5, 2025

ILT Transfer Uncertainty to Customer = +/- 4.3% plus NIST Uncertainty of: +/- 0.5% Confidence Level of Uncertainty is 95% (k=2)

LIGHT SOURCE: 1T 1000W QTH/Reflectance Tablet LAMP OUTPUT: 243.5 fL

INSTRUMENTATION: #6400/Y PROCEDURE: OP-0071

TEMPERATURE: 22.8 degrees C HUMIDITY: 48%

CALIBRATED BY: J - Hoyt

Calibration Technician: Jon Hoyt

Calibration Date: 11/22/2022 Certificate No: 211223311 Sales Order #: 178365

ilac-MRA PJLA Calibration Accreditation# 86765

International Light Technologies | Part of Ocean Insight
10 Technology Drive, Peabody, MA 01960 USA
978-818-6180
www.intl-lighttech.com