

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 to NIST and through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2005. Calibration conforms to ANSI/NCSI Z540.1-1994 and ANSI/NCSI Z540.3-2006.

ate:	26-O	et-18	Certificate #	#: 181026140	IE SO#:	162182	
emp:	22	Degrees (C Humidity:	18 %	Procedure:	TP-0113:08N	OV2011
endered	l To:	LOT - Qua	antum Design GM	ИВН			
strume	ntMode	el-S/N:	IL1700 #330				
alibrati	on/Rep	air Remarl	ks: None				
urta (IE:	ل د اد د ۱۸	N. N I					
arts (If	Needed	l): None					
arts (If	Needed	l): None					
As Found Tolerance In Out	I A	s Found Readings	As Found Permissible Error	Applied Current	Adjusted Readings	Permissible Adjustment Error	
As Found Tolerance	A F	s Found		Applied Current	Adjusted Readings 1.000E-3		Tolerance
As Found Tolerance In Out	A F	s Found Readings	Permissible Error			Adjustment Error	Tolerance In Out
As Found Tolerance In Out	A F	s Found Readings	Permissible Error +/- 0.5%	1.000E-3	1.000E-3	Adjustment Error +/- 0.2%	Tolerance In Out
As Found Tolerance In Oul	A F	s Found Readings 1.001E-3 1.002E-4	Permissible Error +/- 0.5% +/-0.5%	1.000E-3 1.000E-4	1.000E-3 1.000E-4	+/- 0.2% +/- 0.2%	Tolerance In Out
As Found Tolerance In Oul	A F	s Found Readings 1.001E-3 1.002E-4 1.000E-5	Permissible Error +/- 0.5% +/-0.5% +/-0.7%	1.000E-3 1.000E-4 1.000E-5	1.000E-3 1.000E-4 9.99E-6	+/- 0.2% +/- 0.2% +/- 0.2%	Tolerance In Out
As Found Tolerance In Oul	A F	s Found Readings 1.001E-3 1.002E-4 1.000E-5 1.008E-6	+/- 0.5% +/-0.5% +/-0.7% +/-1.0%	1.000E-3 1.000E-4 1.000E-5 1.000E-6	1.000E-3 1.000E-4 9.99E-6 1.000E-6	+/- 0.2% +/- 0.2% +/- 0.2% +/- 0.2%	Tolerance In Out
As Found Tolerance In Oul	A	s Found Readings 1.001E-3 1.002E-4 1.000E-5 1.008E-6	+/- 0.5% +/-0.5% +/-0.7% +/-1.0%	1.000E-3 1.000E-4 1.000E-5 1.000E-6 1.000E-7	1.000E-3 1.000E-4 9.99E-6 1.000E-6 9.99E-8	+/- 0.2% +/- 0.2% +/- 0.2% +/- 0.2% +/- 0.5%	Tolerance In Out

10nA=±0.079%, 1nA=±0.084%, 100pA=0.26%. Confidence Level of Uncertainty is 95% (K=2).

Measurement Uncertainty: 1mA=±0.065%, 100uA=±0.062%, 10uA=±0.062%, 1uA=±0.065%, 100nA=±0.073%,

The above Instrument was compared to the Keithley Current Calibrator/Source Model 263 S/N 0730631 on 3/12/2018 Calibration Due: 3/12/2019

calibrated

Calibrated By:

Electrical Calibration Tech. Chris Kucy

This certificate applies only to the item identified and shall not be reproduced other than in full, without the specific written approval by International Light Technologies, Inc.

Form F-094B Rev H

Page 1 of 1







ELECTRICAL INSTRUMENTATION CALIBRATION REPORT

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Date:	26-0	Oct-18	Certificate #	<i>‡</i> :	1810)261402	2E	SO#:	162182	
Temp:	22	Degrees C	Humidity:	17	%		Pro	ocedure:	TP-0113:08NO	OV2011
Rendere	d To:	LOT - Quar	ntum Design GM	1BH	I					
Instrume	ntMo	del-S/N:	IL1700 #2338							
Calibrati	on/Re	pair Remark	s: None							
Parts (If	Need	ed): None								
As Found Tolerance In Ou		As Found Readings	As Found Permissible Error	App	plied	Current	Adjusted	Readings	Permissible Adjustment Error	As Left Tolerance In Out

As Found Tolerance In Out	As Found Readings	As Found Permissible Error	Applied Current	Adjusted Readings	Permissible Adjustment Error	As Left Tolerance In Out
	1.000E-3	+/- 0.5%	1.000E-3	1.000E-3	+/- 0.2%	
	1.001E-4	+/-0.5%	1.000E-4	1.001E-4	+/- 0.2%	V
	1.000E-5	+/-0.7%	1.000E-5	1.000E-5	+/- 0.2%	
	1.002E-6	+/-1.0%	1.000E-6	1.000E-6	+/- 0.2%	V
✓	9.98E-8	+/-1.0%	1.000E-7	9.98E-8	+/- 0.5%	
	1.000E-8	+/-1.0%	1.000E-8	1.000E-8	+/- 0.5%	
V	1.000E-9	+/-1.0%	1.000E-9	1.000E-9	+/- 0.5%	V
	9.92E-11	+/-1.5%	1.000E-10	1.000E-10	+/- 1.0%	

Tolerance after repair and/or calibration:

✓ In

Out

Measurement Uncertainty: 1mA=±0.065%, 100uA=±0.062%, 10uA=±0.062%, 1uA=±0.065%, 100nA=±0.073%, 10nA=±0.079%, 1nA=±0.084%, 100pA=0.26%. Confidence Level of Uncertainty is 95% (K=2).

The above Instrument was compared to the Keithley Current Calibrator/Source Model 6430 S/N 4080572 on 12/6/2017 Calibration Due: 12/6/2018

calibrated

Calibrated By:

Electrical Calibration Tech. Chris Kucy

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Form F-094B Rev H

Page 1 of 1







OPTICAL CALIBRATION CERTIFICATE

Rendered-to: <u>LOT-QUANTUMDESIGN GMBH</u>	
Detector: SED240 #5676	Input Optic: W #7743
Filter: ACT5 #23008	Misc.: N/A #
Calibrated With: IL1700 #2338	+5V Bias <u>On</u>
(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACT	FOR AS CALIBRATED ON: 29-Oct-2018
4.11E-4 (A)(cm2)(eff W-1) assuming monoch	romatic irradiance at 270nm
5.38% *Change In Sensitivity From Previous Ca	libration Dated: 07-May-2014
Tolerance As Found: ☐ In ✓ Out	Tolerance As Left: ✓ In Out
Unit will read directly in effective watts per square centimeter w	then used with the sensitivity factor above.
	er elements and next element, counted from front surface of assembly, tion updates, lab experimental error or modifications to the hardware and Technology Detector Response D204 - December 2, 2015 - NIST Test No. 685/287304-15/1
INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TR	ANSFER STANDARDS:
U1023 U522 N/A LT Transfer Uncertainty to Customer = $\pm \frac{-4.5\%}{2}$ plus NIST U	Incertainty of: +/- 1% Confidence Level of Uncertainty is 95% (k=
LIGHT SOURCE: SpectroPro1500/1000W Xe	LAMP OUTPUT: 5.83E-7 W/cm2
INSTRUMENTATION: SED240 #3355	PROCEDURE: OP-0018
TEMPERATURE: 22.2 degrees C	HUMIDITY: 33%
CALIBRATED BY:	=
Calibration Technician: Cathy Olson	
THIS CERTIFICATE APPLIES ONLY TO THE ITEMS IDENTIFIED AND SH WRITTEN APPROVAL BY INTERNATIONAL LIGHT TECHNOLOGIES, IN	HALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE SPECIFIC C.
Calibration Date: 10/29/2018 Certificate No: 810299714	Sales Order #: 162182



OPTICAL CALIBRATION CERTIFICATE

Rendered-to: LOT-QUANTUMDESIGN GMBH		
Detector: SED240 #5676	Input Optic:	W #7743
Filter:UVB-1 #23781	Misc.:	N/A#
Calibrated With: IL1700 #2338		+5V Bias On
		r.
(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY FACT	TOR AS CALII	BRATED ON: 29-Oct-2018
(A)(cm2)(W-1) assuming monochrom (A)(cm2)(mW-1) assuming monochromat		
Unit will read directly in watts per square centimeter or milliWa above. PREVIOUSLY CALIBRATED WITH W #10237	itts per square o	centimeter when used with the sensitivity factor
REFERENCE PLANE Groove ONE formed by filter or diffused primary STANDARD: U.S. National Institute of Standards a		
I219 - December 3, 2015 - NIST Test No. 685/287304-15/2:		
INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TR	ANSFER STA	NDARDS:
U522 U1023 N/A		
ILT Transfer Uncertainty to Customer = $\frac{+/-5.5\%}{}$ plus NIST U	Incertainty of:	+/- 1.25 Confidence Level of Uncertainty is 95% (k=2)
LIGHT SOURCE: 19P Hg-Xe	LAMP OU	TPUT: _7,29E-3 W/cm2
INSTRUMENTATION: #1029/SCS280/W	PROCEDU	
TEMPERATURE: 22.2 degrees C	HUMIDIT	
CALIBRATED BY:		
Calibration Technician: Cathy Olson		
THIS CERTIFICATE APPLIES ONLY TO THE ITEMS IDENTIFIED AND SI WRITTEN APPROVAL BY INTERNATIONAL LIGHT TECHNOLOGIES, IN	HALL NOT BE RE	PRODUCED EXCEPT IN FULL, WITHOUT THE SPECIFIC
Calibration Date: 10/29/2018 Certificate No: 810299713		Order #: 162182



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 to NIST and through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2005. Calibration conforms to ANSI/NCSI Z540.1-1994 and ANSI/NCSI Z540.3-2006.

Detector: SED033 #7059	Input Optic: <u>W7 #00119</u>	
Filter: UVA #23821	Misc.: N/A #	
Calibrated With: IL1700 #2338	+5V Bias Off	
(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY	FACTOR AS CALIBRATED ON: 29-Oct-2018	
6.45E-3 (A)(cm2)(W-1) assuming mono		
Unit will read directly in watts per square centimeter or above. PREVIOUSLY CALIBRATED WITH W #1023		sitivity factor
REFERENCE PLANE Groove ONE formed by filter of	diffuser elements and next element, counted from front	surface of assembly,
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2	
PRIMARY STANDARD: U.S. National Institute of Star	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2	
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2	
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304 INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 Y TRANSFER STANDARDS: IL #01	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304 INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 Y TRANSFER STANDARDS: IL #01	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304 INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #139 SED400 #1490 ILT Transfer Uncertainty to Customer = +/- 4.5% plus	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 EY TRANSFER STANDARDS: IL #01 IST Uncertainty of: <u>+/- 1.16</u> Confidence Level of U	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/28730 ² INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490 (LT Transfer Uncertainty to Customer = +/- 4.5% plus LIGHT SOURCE: 19P Hg-Xe	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 Y TRANSFER STANDARDS: IL #01 IST Uncertainty of: +/- 1.16 Confidence Level of U LAMP OUTPUT: 3.02E-3 W/cm2	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304 INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490 ILT Transfer Uncertainty to Customer = +/- 4.5% plus LIGHT SOURCE: 19P Hg-Xe INSTRUMENTATION: SED033 #4544/UVA/W	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 Y TRANSFER STANDARDS: IL #01 IST Uncertainty of: _+/- 1.16 Confidence Level of U LAMP OUTPUT:3.02E-3 W/cm2 PROCEDURE: OP-0007	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/287304 INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490 (LT Transfer Uncertainty to Customer = +/- 4.5% plus LIGHT SOURCE: 19P Hg-Xe INSTRUMENTATION: SED033 #4544/UVA/W TEMPERATURE: 22.2 degrees C	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 EY TRANSFER STANDARDS: IL #01 IST Uncertainty of: _+/- 1.16 Confidence Level of U LAMP OUTPUT: 3.02E-3 W/cm2 PROCEDURE: OP-0007 HUMIDITY: 33%	287304-15/1
PRIMARY STANDARD: U.S. National Institute of Star I219 - December 3, 2015 - NIST Test No. 685/28730 ² INTERNATIONAL LIGHT TECHNOLOGIES PRIMA SED400 #139 SED400 #1490 ILT Transfer Uncertainty to Customer = +/- 4.5% plus LIGHT SOURCE: 19P Hg-Xe INSTRUMENTATION: SED033 #4544/UVA/W TEMPERATURE: 22.2 degrees C CALIBRATED BY:	lards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/2 EY TRANSFER STANDARDS: IL #01 IST Uncertainty of: +/- 1.16 Confidence Level of U LAMP OUTPUT: 3.02E-3 W/cm2 PROCEDURE: OP-0007 HUMIDITY: 33% On AND SHALL NOT BE REPRODUCED EXCEPT IN FULL, WITH	287304-15/1 ncertainty is 95% (k=2

10 Technology Drive, Peabody, MA 01960 USA 978-818-6180 / 978-818-6181 fax intl-lighttech.com

Form F-074 (Rev I)



OPTICAL CALIBRATION CERTIFICATE

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Detector: SED033 #4776	Input Optic: W #5599
Filter: F #16702	Misc.: N/A #
Calibrated With: IL1700 #2338	+5V Bias <u>Off</u>
(PIR) PEAK IRRADIANCE RESPONSE SENSITIVITY	FACTOR AS CALIBRATED ON: 29-Oct-2018
1.233E-2 (A)(cm2)(W-1) assuming monoch 1.233E-05 (A)(cm2)(mW-1) assuming monoch	
10.09% *Change In Sensitivity From Previous	us Calibration Dated: 07-May-2014
Tolerance As Found: ☐ In ✓ Out	Tolerance As Left: ✓ In ☐ Out
Unit will read directly in watts per square centimeter or mi above.	lliWatts per square centimeter when used with the sensitivity factor
REFERENCE PLANE Groove ONE formed by filter or c	liffuser elements and next element, counted from front surface of assembly.
	liffuser elements and next element, counted from front surface of assembly. tification updates, lab experimental error or modifications to the hardware
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standard	tification updates, lab experimental error or modifications to the hardware
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS:
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS:
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 T. Transfer Uncertainty to Customer =	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: IST Uncertainty of: +/- 0.31 Confidence Level of Uncertainty is 95% (k=
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 TT Transfer Uncertainty to Customer =+/- 3% plus NILIGHT SOURCE:1G 1000W QTH	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: STUNCETTAINTY OF: +/- 0.31 Confidence Level of Uncertainty is 95% (k= LAMP OUTPUT: 3.02E-5 W/cm2
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 T. Transfer Uncertainty to Customer =+/- 3% plus NI LIGHT SOURCE:1G_1000W_QTH INSTRUMENTATION:SED033 #6400	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: IST Uncertainty of: +/- 0.31 Confidence Level of Uncertainty is 95% (k= LAMP OUTPUT: 3.02E-5 W/cm2 PROCEDURE: OP-0029
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 IT Transfer Uncertainty to Customer =+/3%plus NI LIGHT SOURCE:IG 1000W QTH INSTRUMENTATION: SED033 #6400 IEMPERATURE:	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: IST Uncertainty of: +/- 0.31 Confidence Level of Uncertainty is 95% (k= LAMP OUTPUT: 3.02E-5 W/cm2 PROCEDURE: OP-0029 HUMIDITY: 33%
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 T Transfer Uncertainty to Customer =+/- 3% plus NI LIGHT SOURCE:1G 1000W QTH INSTRUMENTATION:SED033 #6400 TEMPERATURE: 22.2 degrees C	tification updates, lab experimental error or modifications to the hardware ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: IST Uncertainty of: +/- 0.31 Confidence Level of Uncertainty is 95% (k= LAMP OUTPUT: 3.02E-5 W/cm2 PROCEDURE: OP-0029 HUMIDITY: 33%
*difference includes intrinsic detector change, NIST recer adjustments. PRIMARY STANDARD: U.S. National Institute of Standa I219 - December 3, 2015 - NIST Test No. 685/287304-1 INTERNATIONAL LIGHT TECHNOLOGIES PRIMAR IL #01 IL #02 SED033 #3275 LT Transfer Uncertainty to Customer =+/3%plus NI LIGHT SOURCE:1G 1000W QTH INSTRUMENTATION: SED033 #6400 TEMPERATURE:2.2 degrees C CALIBRATED BY:	ards and Technology Detector Response 15/2: D204 - December 2, 2015 - NIST Test No. 685/287304-15/1 Y TRANSFER STANDARDS: IST Uncertainty of: +/- 0.31 Confidence Level of Uncertainty is 95% (k= LAMP OUTPUT: 3.02E-5 W/cm2 PROCEDURE: OP-0029 HUMIDITY: 33%

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Form F-074 (Rev I)



OPTICAL CALIBRATION CERTIFICATE

Rendered-to: LOT-QUANTUMDESIGN GMBH	
Detector: SED033 #4776	Input Optic: R #415
Filter: <u>F #16702</u>	Misc.: N/A #
Calibrated With: IL1700 #2338	+5V Bias <u>Off</u>
(PRR) PEAK RADIANCE RESPONSE SENSITIVITY FACTO	DR AS CALIBRATED ON: 29-Oct-2018
8.87E-4 (A)(cm2)(sr)(W-1) assuming monoch	romatic radiance at 600nm
-1.22% *Change In Sensitivity From Previous Ca	libration Dated: 07-May-2014
Tolerance As Found: ✓ In ☐ Out	Tolerance As Left: ✓ in ☐ Out
Unit will read directly in watts per square centimeter per steradie	an when used with the sensitivity factor above.
REFERENCE PLANE Average F.O.V. +/-0.75 Degrees	
*difference includes intrinsic detector change, NIST recertificat adjustments.	tion updates, lab experimental error or modifications to the hardware
PRIMARY STANDARD: U.S. National Institute of Standards a I219 - December 3, 2015 - NIST Test No. 685/287304-15/2:	
INTERNATIONAL LIGHT TECHNOLOGIES PRIMARY TR	ANSFER STANDARDS:
IL #01 IL #02 SED033 #3275	
ILT Transfer Uncertainty to Customer = <u>+/- 3%</u> plus NIST U	Incertainty of: <u>+/- 0.31</u> Confidence Level of Uncertainty is 95% (k=2)
LIGHT SOURCE: 1G 1000W QTH/Reflectance Tablet	LAMP OUTPUT: 9.26E-6 W/cm2/sr
INSTRUMENTATION: SED033 #6400	PROCEDURE: OP-0041
TEMPERATURE: 22.2 degrees C	HUMIDITY: 33%
CALIBRATED BY:	
Calibration Technician: Cathy Olson	
THIS CERTIFICATE APPLIES ONLY TO THE ITEMS IDENTIFIED AND SI WRITTEN APPROVAL BY INTERNATIONAL LIGHT TECHNOLOGIES, IN	HALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE SPECIFIC C.
Calibration Date: <u>10/29/2018</u> Certificate No: <u>810299710</u>	Sales Order #: 162182
	HJC-MRA PJLA Calibratic



OPTICAL CALIBRATION CERTIFICATE

Rendered-to: <u>LOT-QUANTUMDESIGN GMBH</u>	
Detector: SED038 #1386	Input Optic: W #3728
Filter: Y #5485	Misc.: N/A #
Calibrated With: IL1700 #330	+5V Bias <u>Off</u>
YIS)PHOTOPIC ILLUMINANCE RESPONSE SENSITIVIT	Y FACTOR AS CALIBRATED ON: 29-Oct-2018
3.68E-8 (A)(ft2)(lm-1) assuming 3215 K Color Temp	
<u>0.27%</u> *Change In Sensitivity From Previous Ca	alibration Dated: 07-May-2014
Tolerance As Found: ✓ In Out	Tolerance As Left: ✓ In Out
Jnit will read directly in lumens per square foot (footcandles) of	or lux when used with the sensitivity factor above.
*difference includes intrinsic detector change, NIST recertifica adjustments. PRIMARY STANDARD: U.S. National Institute of Standards	ser elements and next element, counted from front surface of assembly ation updates, lab experimental error or modifications to the hardware and Technology Detector Response t No.: 685/287261-15/1 - Calibration Due: November 5, 2025
	Uncertainty of: <u>+/- 0.5%</u> Confidence Level of Uncertainty is 95% (k
IGHT SOURCE: 1G 1000W QTH	LAMP OUTPUT: 226 lm/ft2
NSTRUMENTATION: #6400/Y EMPERATURE: 22.2 degrees C	PROCEDURE: OP-0070
EMPERATURE: 22.2 degrees C CALIBRATED BY:	HUMIDITY:33%
Calibration Technician: Cathy Olson	
·	SHALL NOT BE REPROPUSED EVERY IN FULL WITHOUT THE OPERIO
HIS CERTIFICATE APPLIES ONLY TO THE ITEMS IDENTIFIED AND S VRITTEN APPROVAL BY INTERNATIONAL LIGHT TECHNOLOGIES, IN	NC.



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 to NIST and through NIST to the International System of Units (SI). ILT is Accredited to ISO/IEC 17025:2005. Calibration conforms to ANSI/NCSI Z540.1-1994 and ANSI/NCSI Z540.3-2006.

Rendered-to: <u>LOT-QUANTUMDESIGN GMBH</u>	
Detector: SED038 #1386	Input Optic: R #172
Filter: Y #5485	Misc.: <u>N/A</u> #
Calibrated With: <u>IL1700 #330</u>	+5V Bias Off
	(141)
(YLS) PHOTOPIC LUMINANCE RESPONSE SENSITIVITY	FACTOR AS CALIBRATED ON: 29-Oct-2018
6.00E-10 (A)(fL-1) assuming 3215 K Color Ter	mperature
1.751E-10 (A)(m2)(cd-1) assuming 3215 K Color Te	emperature
0.50% *Change In Sensitivity From Previous Ca	libration Dated: 07-May-2014
Tolerance As Found: ✓ In Out	Tolerance As Left: ✓ In Out
Unit will read directly in foot-Lamberts when used with the sens	itivity factor above.
REFERENCE PLANE Average F.O.V. +/-0.75 Degrees	
*difference includes intrinsic detector change, NIST recertificat adjustments.	cion updates, lab experimental error or modifications to the hardware
PRIMARY STANDARD: U.S. National Institute of Standards a SED033#4528/Y#16218 - November 5, 2015 - NIST Test No	
LT Transfer Uncertainty to Customer = $\pm \frac{-4.3\%}{2}$ plus NIST U	ncertainty of: <u>+/- 0.5%</u> Confidence Level of Uncertainty is 95% (k=2)
LIGHT SOURCE: 1G 1000W QTH/Reflectance Tablet	LAMP OUTPUT: 218 fL
INSTRUMENTATION: #6400/Y	PROCEDURE: <u>OP-0071</u>
TEMPERATURE: 22.2 degrees C	HUMIDITY: 33%
CALIBRATED BY:	
Calibration Technician: Cathy Olson	
THIS CERTIFICATE APPLIES ONLY TO THE ITEMS IDENTIFIED AND SH WRITTEN APPROVAL BY INTERNATIONAL LIGHT TECHNOLOGIES, INC	HALL NOT BE REPRODUCED EXCEPT IN FULL, WITHOUT THE SPECIFIC C.
Calibration Date: <u>10/29/2018</u> Certificate No: <u>810299709</u>	Sales Order #: <u>162182</u>
	Hac-MRA Calibrate

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