



Certificate of Calibration

Model: CR1000X

Serial Number: 65059

Temperature Option: Standard Temperature Tested

Test Panel Location: 19

CSI Calibration Number: 817609

Calibration Procedures: TST31865A R1 TST31865C R2 PRC33A R24

Instrument Calibration Condition

Received Disposition: N/A

Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval, a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated in accordance with the interval stated below to ensure sustained accuracy and reliable performance.

Calibration Date: 07-Nov-24

Recommended Interval: 3 Years of Service

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	JF50102	29-Nov-24	JF50102
CSI 10 KHz	08/20/28	28-Mar-25	08/20/28

Calibration Procedures

Voltage Excitation

Analog Input Ranges

Pulse Counters

System Power

Period Averaging

Control Ports

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Instrument Data Report

Analog Input Accuracy

S/N: 65059

Datalogger Option: Standard Temperature Tested

Range (mV)	Input (mV)	*Tolerance (mV)	Differential		Temp. (°C)
			As Received (mV)	As Returned (mV)	
±5000	5000	±2.0	N/A	5000.63	22.6
±5000	-5000	±2.0	N/A	-5000.63	22.6
±1000	1000	±0.4	N/A	1000.133	22.6
±200	200	±0.08	N/A	200.026	22.6
±200	-200	±0.08	N/A	-200.023	22.6
±5000	5000	±3.0	N/A	4999.93	-40
±5000	5000	±3.0	N/A	4999.88	70
±5000	5000	±4.0	N/A	N/A	-55
±5000	5000	±4.0	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Typical (mA)	As Received (mA)	As Returned (mA)	Temp. (°C)
<1.0	N/A	0.70	22.6

Real-Time Clock

Tolerance (min/year)	As Returned	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.6	14.


Calibration Technician

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Certificate of Calibration

Model: CR1000X

Serial Number: 65060

Temperature Option: Standard Temperature Tested

Test Panel Location: 20

CSI Calibration Number: 817610

Calibration Procedures: TST31865A R1 TST31865C R2 PRC33A R24

Instrument Calibration Condition

Received Disposition: N/A

Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval, a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated in accordance with the interval stated below to ensure sustained accuracy and reliable performance.

Calibration Date: 07-Nov-24

Recommended Interval: 3 Years of Service

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	JF50102	29-Nov-24	JF50102
CSI 10 KHz	08/20/28	28-Mar-25	08/20/28

Calibration Procedures

Voltage Excitation

Analog Input Ranges

Pulse Counters

System Power

Period Averaging

Control Ports

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Instrument Data Report

Analog Input Accuracy

S/N: 65060

Datalogger Option: Standard Temperature Tested

Range (mV)	Input (mV)	*Tolerance (mV)	Differential		Temp. (°C)
			As Received (mV)	As Returned (mV)	
±5000	5000	±2.0	N/A	5000.45	22.6
±5000	-5000	±2.0	N/A	-5000.45	22.6
±1000	1000	±0.4	N/A	1000.094	22.6
±200	200	±0.08	N/A	200.020	22.6
±200	-200	±0.08	N/A	-200.015	22.6
±5000	5000	±3.0	N/A	4999.80	-40
±5000	5000	±3.0	N/A	4999.69	70
±5000	5000	±4.0	N/A	N/A	-55
±5000	5000	±4.0	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Typical (mA)	As Recieved (mA)	As Returned (mA)	Temp. (°C)
<1.0	N/A	0.90	22.6

Real-Time Clock

Tolerance (min/year)	As Returned	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.6	14.


Calibration Technician

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Certificate of Calibration

Model: CR1000X

Serial Number: 65062

Temperature Option: Standard Temperature Tested

Test Panel Location: 22

CSI Calibration Number: 817612

Calibration Procedures: TST31865A R1 TST31865C R2 PRC33A R24

Instrument Calibration Condition

Received Disposition: N/A

Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval, a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated in accordance with the interval stated below to ensure sustained accuracy and reliable performance.

Calibration Date: 07-Nov-24

Recommended Interval: 3 Years of Service

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	JF50102	29-Nov-24	JF50102
CSI 10 KHz	08/20/28	28-Mar-25	08/20/28

Calibration Procedures

Voltage Excitation

Analog Input Ranges

Pulse Counters

System Power

Period Averaging

Control Ports

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Instrument Data Report

Analog Input Accuracy

S/N: 65062

Datalogger Option: Standard Temperature Tested

Range (mV)	Input (mV)	*Tolerance (mV)	Differential		Temp. (°C)
			As Received (mV)	As Returned (mV)	
±5000	5000	±2.0	N/A	5000.41	22.6
±5000	-5000	±2.0	N/A	-5000.40	22.6
±1000	1000	±0.4	N/A	1000.085	22.6
±200	200	±0.08	N/A	200.017	22.6
±200	-200	±0.08	N/A	-200.014	22.6
±5000	5000	±3.0	N/A	4999.89	-40
±5000	5000	±3.0	N/A	4999.83	70
±5000	5000	±4.0	N/A	N/A	-55
±5000	5000	±4.0	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Typical (mA)	As Recieved (mA)	As Returned (mA)	Temp. (°C)
<1.0	N/A	0.70	22.6

Real-Time Clock

Tolerance (min/year)	As Returned	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.6	14.


Calibration Technician

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Certificate of Calibration

Model: CR1000X

Serial Number: 65063

Temperature Option: Standard Temperature Tested

Test Panel Location: 23

CSI Calibration Number: 817613

Calibration Procedures: TST31865A R1 TST31865C R2 PRC33A R24

Instrument Calibration Condition

Received Disposition: N/A

Returned Disposition: In Tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval, a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated in accordance with the interval stated below to ensure sustained accuracy and reliable performance.

Calibration Date: 07-Nov-24

Recommended Interval: 3 Years of Service

Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	JF50102	29-Nov-24	JF50102
CSI 10 KHz	08/20/28	28-Mar-25	08/20/28

Calibration Procedures

Voltage Excitation

Analog Input Ranges

Pulse Counters

System Power

Period Averaging

Control Ports

CSI certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The collective measurement uncertainty of the calibration process exceeds a 4:1 accuracy ratio. Policies and procedures at this facility comply with ISO-9001.

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Instrument Data Report

Analog Input Accuracy

S/N: 65063

Datalogger Option: Standard Temperature Tested

Range (mV)	Input (mV)	*Tolerance (mV)	Differential		Temp. (°C)
			As Received (mV)	As Returned (mV)	
±5000	5000	±2.0	N/A	5000.14	22.6
±5000	-5000	±2.0	N/A	-5000.13	22.6
±1000	1000	±0.4	N/A	1000.026	22.6
±200	200	±0.08	N/A	200.006	22.6
±200	-200	±0.08	N/A	-200.003	22.6
±5000	5000	±3.0	N/A	5000.00	-40
±5000	5000	±3.0	N/A	4999.98	70
±5000	5000	±4.0	N/A	N/A	-55
±5000	5000	±4.0	N/A	N/A	85

*Tolerance values are specified accuracy not including offset. Offset voltages are not included because an offset removal procedure is used to account for calibrator offset. Refer to CSI Process Control Document PRC7A.

Quiescent System Power

Typical (mA)	As Received (mA)	As Returned (mA)	Temp. (°C)
<1.0	N/A	0.80	22.6

Real-Time Clock

Tolerance (min/year)	As Returned	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.6	14.



Calibration Technician

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Model 525 Series Certification/Calibration Information

(form PR-TRL-AL-02.docx)

The sensors go through the certified calibration process to document for record with $\pm 1\%$ accuracy.

The recorded error readings for this sensor was: .48 .75

Calibration Date: 4-30-25 S/N: 103103-0625

BY: VR

NOTICE!!!

During Shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.

Model 525 Series Certification/Calibration Information

(form PR-TRL-AL-02.docx)

The sensors go through the certified calibration process to document for record with $\pm 1\%$ accuracy.

The recorded error readings for this sensor was: .86 - .00

Calibration Date: 7-23-25 S/N: 103645-0825

BY: AF

NOTICE!!!

During Shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.



721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6173
Calibration Date : Jun-2025
Recommended Recalibration Date : Jun-2027
Calibration Factor : $24.37 \text{ W m}^{-2} \text{ per mV}$
Calibration Uncertainty : $\pm 5 \%$
Measurement Repeatability : $< 1 \%$
Non-stability (Long-term Drift) : $< 2 \%$ per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 12-Jun-2025

Please keep this document for your records



721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6174
Calibration Date : Jun-2025
Recommended Recalibration Date : Jun-2027
Calibration Factor : 24.63 W m^{-2} per mV
Calibration Uncertainty : $\pm 5 \%$
Measurement Repeatability : $< 1 \%$
Non-stability (Long-term Drift) : $< 2 \%$ per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 12-Jun-2025

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721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6178
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 24.32 W m⁻² per mV
Calibration Uncertainty : $\pm 5 \%$
Measurement Repeatability : $< 1 \%$
Non-stability (Long-term Drift) : $< 2 \%$ per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Birgham

Date : 14-Aug-2025

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INSTRUMENTS

721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6196
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 24.62 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 14-Aug-2025

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HygroVue™ 5

Digital Temperature and
Relative Humidity Sensor



Appendix E. Sensor element calibration

The sensor elements are individually calibrated during manufacturing. The manufacturer provides a statement (see [Figure E-1](#) [p. 36]) as both a description and proof of the HygroVue 5 sensor element's calibration traceability.

Calibration Certification – Digital Humidity- and Temperature Sensors

SENSIRION
THE SENSOR COMPANY

Calibration Certification

Name and address of the manufacturer: Sensirion AG
Laubisruestrasse 50
CH-8712 Switzerland

Description: Digital Humidity- and Temperature Sensors

- SHT1x
- SHT3x
- SHTC1
- STS21
- SHT2x
- SHT7x
- SHTW2
- STS3x

The above mentioned products are calibrated to meet the specifications according to the corresponding Sensirion data sheet. Each device is individually tested after its calibration.

Sensirion uses transfer standards for the calibration. These transfer standards are themselves subject to a scheduled calibration procedure. The calibration of the reference itself used for the calibration of the transfer standards is performed by an ISO/IEC 17025 accredited laboratory.

The accreditation body is full member of the International Laboratory Accreditation Cooperation (www.ilac.org). Calibration certificates issued by facilities accredited by a signatory to the ILAC Mutual Recognition Arrangement (MRA) are accepted by all signatories to the ILAC MRA.

This provides traceability of measurement to recognized national standards and to units of measurement realized at the "National Physical Laboratory" (NPL) or other recognized national standards laboratories like "Physikalisch-Technische Bundesanstalt" (PTB) or "National Institute of Standards and Technology" (NIST).

Staefa, February 2018


Stephan Weber,
Director,
Head of Quality Management, Sensirion AG


Volker Bom
Manager,
Head of Quality Engineering, SensirionAG

Figure E-1. Calibration certificate



Certificate of Calibration

Model:	CR1000Xe
Serial Number:	78648
Manufacturer:	Campbell Scientific Inc.
Description:	Measurement and Control Datalogger
Calibration Procedure:	TST31865A R1 TST31865C R2
Calibration Number:	851007
Calibration Date:	2025-08-25
Recommended Calibration Interval:	3 years from calibration date
As Left:	In Tolerance

Analog Input Accuracy

Range	Input	Tolerance	Temp (°C)	As Left
± 5000 (mV)	5000	±2.0	22	5000.749
± 5000 (mV)	-5000	±2.0	22	-5000.747
± 1000 (mV)	1000	±0.4	22	1000.153
± 200 (mV)	200	±0.08	22	200.03008
± 200 (mV)	-200	±0.08	22	-200.02959
± 5000 (mV)	5000	±3.0	-40	4999.6733
± 5000 (mV)	5000	±3.0	70	5000.092

Quiescent System Power

Typical (mW)	As Left	Temp (°C)
<25	24.1	22
<25		-55
<29		85

Real-Time Clock

Tolerance (min/year)	As Left	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Calibration Standards

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	EO50737R	2026-08-05	EO50737R
CSI 10KHz	05/27 09	2026-06-05	05/27 09

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22	38.65

Performing Technician

J Woffinden

The Quality Management System of Campbell Scientific, Inc. (CSI) is Registered to be in conformance to ISO 9001:2015 for the design, manufacture and service of environmentally rugged measurement and control instrumentation.

CSI certifies that at the time of calibration, the above listed instrument met or exceeded published specifications and was calibrated using internationally recognized standards whose accuracies are traceable to SI Units through the National Institute of Standards and Technology or equivalent NMI. No warranty is given or implied that this instrument will maintain specified tolerances throughout the recommended calibration interval. This certificate only applies to the instrument listed.

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Certificate of Calibration

Model: CR1000Xe
Serial Number: 78649
Manufacturer: Campbell Scientific Inc.
Description: Measurement and Control Datalogger
Calibration Procedure: TST31865A R1 TST31865C R2
Calibration Number: 851011
Calibration Date: 2025-08-25
Recommended Calibration Interval: 3 years from calibration date
As Left: In Tolerance

Analog Input Accuracy

Range	Input	Tolerance	Temp (°C)	As Left
± 5000 (mV)	5000	±2.0	22	5000.1533
± 5000 (mV)	-5000	±2.0	22	-5000.155
± 1000 (mV)	1000	±0.4	22	1000.03534
± 200 (mV)	200	±0.08	22	200.00664
± 200 (mV)	-200	±0.08	22	-200.00626
± 5000 (mV)	5000	±3.0	-40	4999.6167
± 5000 (mV)	5000	±3.0	70	4999.9526

Quiescent System Power

Typical (mW)	As Left	Temp (°C)
<25	24.7	22
<25		-55
<29		85

Real-Time Clock

Tolerance (min/year)	As Left	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Calibration Standards

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	EO50737R	2026-08-05	EO50737R
CSI 10KHz	05/27 09	2026-06-05	05/27 09

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22	38.65

Performing Technician

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Certificate of Calibration

Model: CR1000Xe
Serial Number: 78653
Manufacturer: Campbell Scientific Inc.
Description: Measurement and Control Datalogger
Calibration Procedure: TST31865A R1 TST31865C R2
Calibration Number: 851052
Calibration Date: 2025-08-25
Recommended Calibration Interval: 3 years from calibration date
As Left: In Tolerance

Analog Input Accuracy

Range	Input	Tolerance	Temp (°C)	As Left
± 5000 (mV)	5000	±2.0	22.13	5000.5454
± 5000 (mV)	-5000	±2.0	22.13	-5000.5435
± 1000 (mV)	1000	±0.4	22.13	1000.1138
± 200 (mV)	200	±0.08	22.13	200.02376
± 200 (mV)	-200	±0.08	22.13	-200.02197
± 5000 (mV)	5000	±3.0	-40	4999.9536
± 5000 (mV)	5000	±3.0	70	4999.9336

Quiescent System Power

Typical (mW)	As Left	Temp (°C)
<25	22.4	22.13
<25		-55
<29		85

Real-Time Clock

Tolerance (min/year)	As Left	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Calibration Standards

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	EO50737R	2026-08-05	EO50737R
CSI 10KHz	05/27 09	2026-06-05	05/27 09

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.13	48.92

Performing Technician

J Woffinden

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Certificate of Calibration

Model: CR1000Xe
Serial Number: 78654
Manufacturer: Campbell Scientific Inc.
Description: Measurement and Control Datalogger
Calibration Procedure: TST31865A R1 TST31865C R2
Calibration Number: 851053
Calibration Date: 2025-08-25
Recommended Calibration Interval: 3 years from calibration date
As Left: In Tolerance

Analog Input Accuracy

Range	Input	Tolerance	Temp (°C)	As Left
± 5000 (mV)	5000	±2.0	22.13	5000.3896
± 5000 (mV)	-5000	±2.0	22.13	-5000.388
± 1000 (mV)	1000	±0.4	22.13	1000.0819
± 200 (mV)	200	±0.08	22.13	200.01627
± 200 (mV)	-200	±0.08	22.13	-200.01604
± 5000 (mV)	5000	±3.0	-40	4999.896
± 5000 (mV)	5000	±3.0	70	4999.855

Quiescent System Power

Typical (mW)	As Left	Temp (°C)
<25	22.3	22.13
<25		-55
<29		85

Real-Time Clock

Tolerance (min/year)	As Left	Temp. (°C)
± 3 minutes	Pass	-40 to +70

Calibration Standards

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	EO50737R	2026-08-05	EO50737R
CSI 10KHz	05/27 09	2026-06-05	05/27 09

Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.13	48.92

Performing Technician

J Woffinden

The Quality Management System of Campbell Scientific, Inc. (CSI) is Registered to be in conformance to ISO 9001:2015 for the design, manufacture and service of environmentally rugged measurement and control instrumentation.

CSI certifies that at the time of calibration, the above listed instrument met or exceeded published specifications and was calibrated using internationally recognized standards whose accuracies are traceable to SI Units through the National Institute of Standards and Technology or equivalent NMI. No warranty is given or implied that this instrument will maintain specified tolerances throughout the recommended calibration interval. This certificate only applies to the instrument listed.

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Model 525 Series Certification/Calibration Information

(form PR-TRL-AL-02.docx)

The sensors go through the certified calibration process to document for record with $\pm 1\%$ accuracy.

The recorded error readings for this sensor was: - .23 .06

Calibration Date: 5-2-25 S/N: 103078-0625

BY: VR

NOTICE!!!

During Shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.

Model 525 Series Certification/Calibration Information

(form PR-TRL-AL-02.docx)

The sensors go through the certified calibration process to document for record with $\pm 1\%$ accuracy.

The recorded error readings for this sensor was: - .26 - .29

Calibration Date: 7-23-25 S/N: 103635-0825

BY: A.F

NOTICE!!!

During Shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.

Model 525 Series Certification/Calibration Information

(form PR-TRL-AL-02.docx)

The sensors go through the certified calibration process to document for record with $\pm 1\%$ accuracy.

The recorded error readings for this sensor was: .52 - .24

Calibration Date: 7-23-25 S/N: 103638-0825

BY: A.F

NOTICE!!!

During Shipment the tipping assembly has been secured to avoid possible damage to the pivot assembly. Lift off collection and remove rubber band from inside to release tipping mechanism before installation.



Certificate of Calibration

Instrument: BVC10 Serial No: 4949 AS LEFT
Serial No: 4949
Manufacturer: Campbell Scientific Australia
Calibration ID: 684a22e51ed5d86f5b60d54c

Instrument Calibration Condition

As Found disposition: N/A
As Left disposition: In tolerance

Recommended Calibration Schedule

If the customer has not requested a calibration interval, a non-mandatory recommended interval is provided. Based on past experience and assumed normal usage, it is recommended that this instrument be calibrated in accordance with the interval stated below to ensure sustained accuracy and reliable performance.

Calibration date: 15-Jun-2025 at 13:01:57

Recommended Interval: 12 months

Calibration Standard Used

This instrument has been calibrated against a Fluke7250i Pressure Controller/Calibrator standard. The 7250i is traceable to the National Institute of Standards and Technology (NIST, USA).

Make/Model	Serial Number	Cal. Date	Certificate Number
Fluke 7250i	69455	01 AUG 2024	APL241788

CSA certifies the above instrument meets or exceeds published specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique.

Instrument Data Report

At the time of shipment, the instrument described above was within its operating specifications as per the below calibration results:

As Left Status:

Environment Temperature: 20 degC

Applied (hPa)	Measured (hPa)	Abs Error (hPa)	Cal Error (hPa)	Specification (hPa)	Result
499.91	499.91	0.00±0.03	0.15	0.3±0.1	Pass
599.7	599.69	0.00±0.03	0.15	0.3±0.1	Pass
699.67	699.66	0.01±0.03	0.15	0.3±0.1	Pass
799.58	799.56	0.01±0.03	0.15	0.3±0.1	Pass
899.46	899.44	0.02±0.03	0.15	0.3±0.1	Pass
999.37	999.35	0.02±0.03	0.15	0.3±0.1	Pass
1099.31	1099.29	0.01±0.03	0.15	0.3±0.1	Pass

Environment Temperature: -40 degC

Applied (hPa)	Measured (hPa)	Abs Error (hPa)	Cal Error (hPa)	Specification (hPa)	Result
499.84	499.82	0.02±0.01	0.15	0.5±0.1	Pass
599.76	599.74	0.02±0.01	0.15	0.5±0.1	Pass
699.58	699.57	0.02±0.01	0.15	0.5±0.1	Pass
799.53	799.51	0.02±0.01	0.15	0.5±0.1	Pass
899.37	899.35	0.02±0.01	0.15	0.5±0.1	Pass
999.25	999.23	0.02±0.01	0.15	0.5±0.1	Pass
1099.15	1099.14	0.02±0.01	0.15	0.5±0.1	Pass

Environment Temperature: 60 degC

Applied (hPa)	Measured (hPa)	Abs Error (hPa)	Cal Error (hPa)	Specification (hPa)	Result
500.5	500.5	0.00±0.04	0.15	0.5±0.1	Pass
600.03	600.02	0.01±0.04	0.15	0.5±0.1	Pass
699.85	699.83	0.02±0.04	0.15	0.5±0.1	Pass
799.79	799.76	0.03±0.04	0.15	0.5±0.1	Pass
899.76	899.73	0.03±0.04	0.15	0.5±0.1	Pass
999.7	999.67	0.03±0.04	0.15	0.5±0.1	Pass
1099.66	1099.65	0.01±0.04	0.15	0.5±0.1	Pass



INSTRUMENTS

721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6199
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 25.58 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 14-Aug-2025

Please keep this document for your records



721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6205
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 24.37 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 18-Aug-2025

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721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6206
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 24.53 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 18-Aug-2025

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721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6208
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 25.00 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 18-Aug-2025

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721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6209
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 24.97 W m⁻² per mV
Calibration Uncertainty : ± 5 %
Measurement Repeatability : < 1 %
Non-stability (Long-term Drift) : < 2 % per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 18-Aug-2025

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721 West 1800 North
Logan, UT 84321

Certificate of Calibration Thermopile Pyranometer Model CS320 Series

Serial Number : CS320_6222
Calibration Date : Aug-2025
Recommended Recalibration Date : Aug-2027
Calibration Factor : 25.34 W m⁻² per mV
Calibration Uncertainty : $\pm 5 \%$
Measurement Repeatability : $< 1 \%$
Non-stability (Long-term Drift) : $< 2 \%$ per year

Calibration Procedure

Calibration is based on a side-by-side comparison under high intensity discharge metal halide lamps using the mean of (4) Apogee transfer standard pyranometers. Apogee transfer standards are calibrated to the mean of at least (2) ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of the four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments per year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Traceability

Reference Instrument	Serial Number	ISO 9060 Classification
EKO Instruments MS80	S16088044	Spectrally Flat Class A
Kipp & Zonen CM11	060089	Spectrally Flat Class A
Kipp & Zonen CMP11	101625	Spectrally Flat Class A
Hukseflux SR20	2497	Spectrally Flat Class A
Apogee CS320	TS1	Fast Response Class C
Apogee CS320	TS2	Fast Response Class C
Apogee CS320	TS3	Fast Response Class C
Apogee CS320	TS4	Fast Response Class C

Technical Manager :

Jacob Bingham

Date : 18-Aug-2025

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