

## 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: 0.86082

Calibration Date: 5-18-18 S/N: 76443-618

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: -0.41-0.60

Calibration Date: 10-22-18

S/N: 78456-1118

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: -37.41

Calibration Date: 10-22-18 SN: 78458-1118

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: -02.14

Calibration Date: 9-28-18 S/N: 78437-1118

BY: CS

### 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.





## CALIBRATION CERTIFICATE

R.M. Young Company certifies that the following sensor

Serial Number WS17148

was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

To maintain published specifications, regular maintenance intervals are required.

Date: 6/20/19

By:

  
Insp. By

R.M. YOUNG COMPANY 2801 Aero Park Drive, Traverse City, Michigan 49686 U.S.A.  
Tel: (231) 946-3980 Fax: (231) 946-4772 Email: [met.sales@youngusa.com](mailto:met.sales@youngusa.com)





## CALIBRATION CERTIFICATE

R.M. Young Company certifies that the following sensor


Serial Number WS 17142

was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

To maintain published specifications, regular maintenance intervals are required.

Date: 6/20/19

By:

  
Insp. By

R.M. YOUNG COMPANY 2801 Aero Park Drive, Traverse City, Michigan 49686 U.S.A.  
Tel: (231) 946-3980 Fax: (231) 946-4772 Email: [met.sales@youngusa.com](mailto:met.sales@youngusa.com)





## CALIBRATION CERTIFICATE

R.M. Young Company certifies that the following sensor


Serial Number WS 17149

was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

To maintain published specifications, regular maintenance intervals are required.

Date: 6/20/19

By:

  
Insp. By

R.M. YOUNG COMPANY 2801 Aero Park Drive, Traverse City, Michigan 49686 U.S.A.  
Tel: (231) 946-3980 Fax: (231) 946-4772 Email: [met.sales@youngusa.com](mailto:met.sales@youngusa.com)





## CALIBRATION CERTIFICATE

R.M. Young Company certifies that the following sensor

Serial Number WS 17143

was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

To maintain published specifications, regular maintenance intervals are required.

Date: 6/20/19

By:

  
Insp. By

**R.M. YOUNG COMPANY** 2801 Aero Park Drive, Traverse City, Michigan 49686 U.S.A.

Tel: (231) 946-3980 Fax: (231) 946-4772 Email: [met.sales@youngusa.com](mailto:met.sales@youngusa.com)





## Certificate of Calibration

Model: CR1000X

Serial Number: 11620

Temperature Option: Standard Temperature Tested

Test Panel Location: 19

CSI Calibration Number: 613631

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 insure sustained accuracy and reliable performance.

Calibration Date: 02-Aug-19

Recommended Interval: 3 Years of Service

### Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	AM50563	08-Mar-20	AM50563
CSI 10KHz Precision Osc	05/27 06	04-Apr-20	05/27 06

### 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: 11620

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	5000.37	22.2
±5000	-5000	±2.0	N/A	-5000.37	22.2
±1000	1000	±0.4	N/A	1000.072	22.2
±200	200	±0.08	N/A	200.015	22.2
±200	-200	±0.08	N/A	-200.013	22.2
±5000	5000	±3.0	N/A	5000.02	-40
±5000	5000	±3.0	N/A	5000.03	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	0.93	22.2

## Real-Time Clock

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

## Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.2	48.

  
Calibration Technician

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## Certificate of Calibration

Model: CR1000X

Serial Number: 11625

Temperature Option: Standard Temperature Tested

Test Panel Location: 24

CSI Calibration Number: 613636

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 insure sustained accuracy and reliable performance.

Calibration Date: 02-Aug-19

Recommended Interval: 3 Years of Service

### Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	AM50563	08-Mar-20	AM50563
CSI 10KHz Precision Osc	05/27 06	04-Apr-20	05/27 06

### 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: 11625

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	5000.18	22.2
±5000	-5000	±2.0	N/A	-5000.17	22.2
±1000	1000	±0.4	N/A	1000.034	22.2
±200	200	±0.08	N/A	200.007	22.2
±200	-200	±0.08	N/A	-200.004	22.2
±5000	5000	±3.0	N/A	4999.96	-40
±5000	5000	±3.0	N/A	4999.96	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	0.73	22.2

## Real-Time Clock

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

## Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.2	48.

  
Calibration Technician

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## Certificate of Calibration

Model: CR1000X

Serial Number: 7588

Temperature Option: Standard Temperature Tested

Test Panel Location: 9

CSI Calibration Number: 593145

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 insure sustained accuracy and reliable performance.

Calibration Date: 13-Dec-18

Recommended Interval: 3 Years of Service

### Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	AM50563	09-Mar-19	AM50563
CSI 10KHz Precision Osc	05/27 06	05-Apr-19	05/27 06

### 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: 7588

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	5000.01	22.8
±5000	-5000	±2.0	N/A	-5000.02	22.8
±1000	1000	±0.4	N/A	1000.006	22.8
±200	200	±0.08	N/A	200.002	22.8
±200	-200	±0.08	N/A	-199.998	22.8
±5000	5000	±3.0	N/A	5000.06	-40
±5000	5000	±3.0	N/A	5000.08	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	0.90	22.8

## Real-Time Clock

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

## Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.8	18.

  
Calibration Technician

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## Certificate of Calibration

Model: CR1000X

Serial Number: 10888

Temperature Option: Standard Temperature Tested

Test Panel Location: 19

CSI Calibration Number: 610094

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 insure sustained accuracy and reliable performance.

Calibration Date: 25-Jun-19

Recommended Interval: 3 Years of Service

### Report of Calibration Standards Used

Make/Model	Serial Number	Cal. Due Date	Trace Number
KROHN-HITE 523	AM50563	08-Mar-20	AM50563
CSI 10KHz Precision Osc	05/27 06	04-Apr-20	05/27 06

### 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: 10888

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	4999.64	22.9
±5000	-5000	±2.0	N/A	-4999.64	22.9
±1000	1000	±0.4	N/A	999.927	22.9
±200	200	±0.08	N/A	199.986	22.9
±200	-200	±0.08	N/A	-199.983	22.9
±5000	5000	±3.0	N/A	4999.86	-40
±5000	5000	±3.0	N/A	5000.14	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	0.99	22.9

## Real-Time Clock

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

## Laboratory Environment

Temperature (°C)	Relative Humidity (%)
22.9	27.

  
Calibration Technician

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## CALIBRATION CERTIFICATE

Unique Lab Report No.: ULR - CC211719000000401N				
<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)	Date of Receipt of DUC : 03/02/2020 Date of Calibration : 04/02/2020 Due Date of Calibration : 03/02/2021 Issue Date of Certificate : 05/02/2020 Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0401(T)				
<b>Identification &amp; Description of DUC :</b>	<b>HYGROVUES TEMP. &amp; RH PROBE</b>			
	Range/Size: Temp. - 40 to 70°C, Humidity- 0% to 100%	Make: Campbell Scientific	ID. No.: 009570-003/01	Condition at Receipt: OK
	Least Count : 0.01°C&0.03%	Model no /Sr. no.: E1077	Location: ---	
<b>Calibration performed : At Lab</b>	<b>Ref. Standard / Procedure: TS/WI/219</b>			
<b>Environmental Conditions :</b>	Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)			

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Thermo Hygrometer	HTC	19000055829	MCLPL	22/11/2020

Discipline: Thermal Calibration [Group – Temperature]

## CALIBRATION RESULTS

Sr. No.	Standard Value (°C)	*DUC Reading (°C)
1	25.0	25.11
2	33.5	34.03
3	44.0	44.11

## Calibration Results (Relative Humidity)

Sr. No.	Standard Value (%)	*DUC Reading (%)
1	35	35.24
2	51	51.17
3	75	75.18

Remarks: (Measurement Uncertainty: ±1.2°C&amp; 2.2 %RH)

Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

1. Standard equipments used for calibration are traceable to National/International Standards.
2. The reported Expanded Uncertainty in measurement is with the coverage factor ( $k=2$ ) and a coverage probability of approximately 95%.
3. The certificate refers only to the particular item submitted for calibration.
4. Results reported are valid at the time of and under stated conditions of measurement.
5. Next calibration due date is given as requested by the customer.
6. This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
7. Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 03, Rev. Date: 17.02.2019



Authorized By  
Rajeev Sharma

## Techcom Systems

Regd. Office : 49, Bank Colony, Alwar (Raj.)- 301001

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E-mail : calibration\_techcom@yahoo.com, rajnish20@gmail.com

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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)  
Delhi Off.: D-7 D-93A, East Gate Estate, Delhi- 110045



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No.: ULR - CC211719000000402N			
Date of Receipt of DUC :		03/02/2020			
Date of Calibration :		04/02/2020			
Due Date of Calibration :		03/02/2021			
Issue Date of Certificate :		05/02/2020			
Page No. :		01 of 01			
Calibration Certificate No.: TS/2K19-0402(T)					
Identification & Description of DUC :	HYGROVUE5 TEMP. & RH PROBE				
	Range/Size: Temp. - -40 to 70°C, Humidity- 0% to 100%	Make: Campbell Scientific	ID. No.: 009570-003/02		
	Least Count : 0.01°C&0.03%	Model no /Sr. no.: E1088	Location: ---		
Calibration performed : At Lab		Ref. Standard / Procedure: TS/WI/219			
Environmental Conditions :		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)			
Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Thermo Hygrometer	HTC	19000055829	MCLPL	22/11/2020

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Standard Value (°C)	*DUC Reading (°C)
1	25.0	25.13
2	33.5	34.05
3	44.0	44.14

Sr. No.	Standard Value (%)	*DUC Reading (%)
1	35	35.20
2	51	51.15
3	75	75.14

Remarks: (Measurement Uncertainty: ±1.2°C &amp; 2.2 %RH)

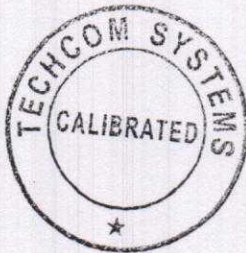
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

1. Standard equipments used for calibration are traceable to National/International Standards.
2. The reported Expanded Uncertainty in measurement is with the coverage factor ( $k=2$ ) and a coverage probability of approximately 95%.
3. The certificate refers only to the particular item submitted for calibration.
4. Results reported are valid at the time of and under stated conditions of measurement.
5. Next calibration due date is given as requested by the customer.
6. This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
7. Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 03, Rev. Date: 17.02.2019



Authorized By  
Rajeev Sharma

Techcom Systems

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Distt. Alwar (Raj.) 301019 Mob.: 8003004111, 0144-2331871  
Jaipur Off.: 401-H, Gurupragna Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No.: ULR - CC211719000000403N			
Date of Receipt of DUC :		03/02/2020			
Date of Calibration :		04/02/2020			
Due Date of Calibration :		03/02/2021			
Issue Date of Certificate :		05/02/2020			
Page No. :		01 of 01			
Calibration Certificate No.: TS/2K19-0403(T)					
<b>HYGROVUE5 TEMP. &amp; RH PROBE</b>					
<b>Identification &amp; Description of DUC :</b>	Range/Size: Temp. - -40 to 70°C, Humidity- 0% to 100%	Make: Campbell Scientific	ID. No.: 009570-003/03		
	Least Count : 0.01°C&0.03%	Model no /Sr. no.: E1083	Location: ---		
Condition at Receipt: OK					
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> TS/WI/219			
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)			
<b>Standard Equipment/s used for Calibration</b>					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Thermo Hygrometer	HTC	19000055829	MCLPL	22/11/2020

Discipline: Thermal Calibration [Group – Temperature]

## CALIBRATION RESULTS

Sr. No.	Standard Value (°C)	*DUC Reading (°C)
1	25.0	25.10
2	33.5	34.02
3	44.0	44.10

## Calibration Results (Relative Humidity)

Sr. No.	Standard Value (%)	*DUC Reading (%)
1	35	35.21
2	51	51.12
3	75	75.13

Remarks: (Measurement Uncertainty: ±1.2°C &amp; 2.2 %RH)

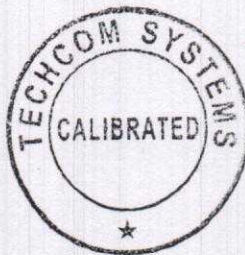
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

1. Standard equipments used for calibration are traceable to National/International Standards.
2. The reported Expanded Uncertainty in measurement is with the coverage factor ( $k=2$ ) and a coverage probability of approximately 95%.
3. The certificate refers only to the particular item submitted for calibration.
4. Results reported are valid at the time of and under stated conditions of measurement.
5. Next calibration due date is given as requested by the customer.
6. This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
7. Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 03, Rev. Date: 17.02.2019

Authorized By  
Rajeev Sharma

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Distt. Alwar (Raj.) 301019 Mob.: 8003004111, 0144-2331871  
Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

Unique Lab Report No.: ULR - CC211719000000404N					
CUSTOMER NAME & ADDRESS: MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)	Date of Receipt of DUC :	03/02/2020			
	Date of Calibration :	04/02/2020			
	Due Date of Calibration :	03/02/2021			
	Issue Date of Certificate :	05/02/2020			
	Page No. :	01 of 01			
Calibration Certificate No.: TS/2K19-0404(T)					
Identification & Description of DUC :	HYGROVUE5 TEMP. & RH PROBE				
	Range/Size: Temp. - -40 to 70°C, Humidity- 0% to 100%	Make: Campbell Scientific			
	Least Count : 0.01°C&0.03%	Model no /Sr. no.: E1078			
	ID. No.: 009570-003/04	Condition at Receipt: OK			
	Location: ---				
Calibration performed : At Lab	Ref. Standard / Procedure: TS/WI/219				
Environmental Conditions :	Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)				
Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Thermo Hygrometer	HTC	19000055829	MCLPL	22/11/2020

Discipline: Thermal Calibration [Group – Temperature]

## CALIBRATION RESULTS

Sr. No.	Standard Value (°C)	*DUC Reading (°C)
1	25.0	25.12
2	33.5	34.04
3	44.0	44.12

## Calibration Results (Relative Humidity)

Sr. No.	Standard Value (%)	*DUC Reading (%)
1	35	35.23
2	51	51.14
3	75	75.16

Remarks: (Measurement Uncertainty: ±1.2°C &amp; 2.2 %RH)

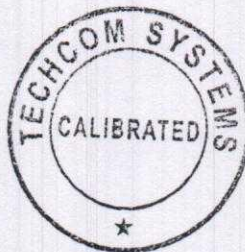
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

1. Standard equipments used for calibration are traceable to National/International Standards.
2. The reported Expanded Uncertainty in measurement is with the coverage factor ( $k=2$ ) and a coverage probability of approximately 95%.
3. The certificate refers only to the particular item submitted for calibration.
4. Results reported are valid at the time of and under stated conditions of measurement.
5. Next calibration due date is given as requested by the customer.
6. This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
7. Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 03, Rev. Date: 17.02.2019

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Rajeev Sharma

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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000414F	
Date of Receipt of DUC :		03/02/2020	
Date of Calibration :		04/02/2020	
Due Date of Calibration :		03/02/2021	
Issue Date of Certificate :		05/02/2020	
Page No. :		01 of 01	
Calibration Certificate No.: TS/2K19-0414(T)			
<b>TEMPERATURE SENSOR</b>			
<b>Identification &amp; Description of DUC :</b>	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/01
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
	Condition at Receipt: OK		
Calibration performed : At Lab		Ref. Standard / Procedure: ITS-90 & TS/WI/203	
Environmental Conditions :		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.69	0.31	0.99
2	60	59.43	0.57	
3	80	79.46	0.54	
4	90	89.44	0.56	
5	100	99.40	0.60	

Remarks:

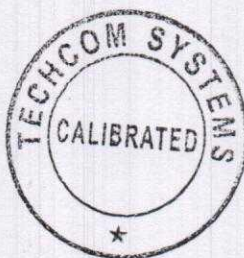
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
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B  
Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



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Rajeev Sharma

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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000415F	
Date of Receipt of DUC :		03/02/2020	
Date of Calibration :		04/02/2020	
Due Date of Calibration :		03/02/2021	
Issue Date of Certificate :		05/02/2020	
Page No. :		01 of 01	
Calibration Certificate No.: TS/2K19-0415(T)			
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>		
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/02
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
Condition at Receipt: OK			
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ± 2) °C      Relative Humidity: (50 ± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.69	0.31	0.99
2	60	59.43	0.57	
3	80	79.47	0.53	
4	90	89.44	0.56	
5	100	99.37	0.63	

Remarks:

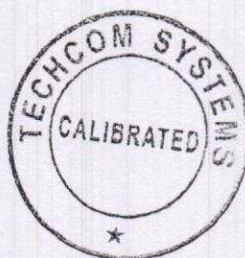
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
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Calibrated By  
Rajnish Mishra

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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

CUSTOMER NAME & ADDRESS: MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000416F		
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020		
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020		
Page No. : 01 of 01				
Calibration Certificate No.: TS/2K19-0416(T)				
Identification & Description of DUC :	TEMPERATURE SENSOR			Condition at Receipt: OK
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/03	
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
Calibration performed : At Lab		Ref. Standard / Procedure: ITS-90 & TS/WI/203		
Environmental Conditions :		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.45	0.55	
3	80	79.50	0.50	
4	90	89.47	0.53	
5	100	99.37	0.63	

Remarks:

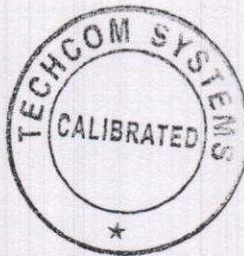
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

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Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000417F	
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020	
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020	
Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0417(T)			
<b>TEMPERATURE SENSOR</b>			
<b>Identification &amp; Description of DUC :</b>	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/04
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
	Condition at Receipt: OK		
Calibration performed : At Lab		Ref. Standard / Procedure: ITS-90 & TS/WI/203	
Environmental Conditions :		Temperature: (25 ± 2) °C Relative Humidity: (50 ± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.46	0.54	
3	80	79.50	0.50	
4	90	89.45	0.55	
5	100	99.40	0.60	

Remarks:

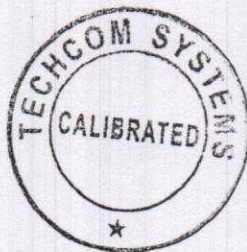
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

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Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



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Jaipur Off.: 401-H, Gurupragna Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000418F		
Date of Receipt of DUC :		03/02/2020		
Date of Calibration :		04/02/2020		
Due Date of Calibration :		03/02/2021		
Issue Date of Certificate :		05/02/2020		
Page No. :		01 of 01		
Calibration Certificate No.: TS/2K19-0418(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			Condition at Receipt: OK
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/05	
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
Calibration performed : At Lab		Ref. Standard / Procedure: ITS-90 & TS/WI/203		
Environmental Conditions :		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.67	0.33	0.99
2	60	59.46	0.54	
3	80	79.47	0.53	
4	90	89.46	0.54	
5	100	99.38	0.62	

Remarks:

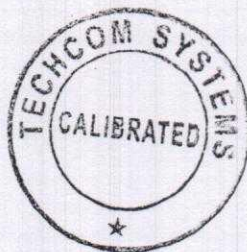
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

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Calibrated By  
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Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000419F		
Date of Receipt of DUC :		03/02/2020		
Date of Calibration :		04/02/2020		
Due Date of Calibration :		03/02/2021		
Issue Date of Certificate :		05/02/2020		
Page No. :		01 of 01		
Calibration Certificate No.: TS/2K19-0419(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			Condition at Receipt: OK
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/06	
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203		
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

## Standard Equipment/s used for Calibration

Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.48	0.52	
3	80	79.47	0.53	
4	90	89.44	0.56	
5	100	99.40	0.60	

Remarks:

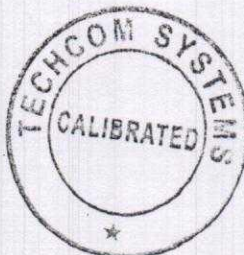
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
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Calibrated By  
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Format No.:TS/CC/01, Rev. No.:04, Rev. Date:15.03.2019

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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000420F	
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020	
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020	
Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0420(T)			
<b>TEMPERATURE SENSOR</b>			
<b>Identification &amp; Description of DUC :</b>	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/07
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
	Condition at Receipt: OK		
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.50	0.50	
3	80	79.47	0.53	
4	90	89.43	0.57	
5	100	99.40	0.60	

Remarks:

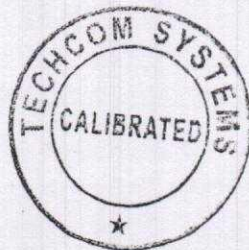
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

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Calibrated By  
Rajnish Mishra

Format No.:TS/CC/01, Rev. No.:04, Rev. Date:15.03.2019



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Rajeev Sharma

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Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000421F	
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020	
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020	
Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0421(T)			
<b>TEMPERATURE SENSOR</b>			
Identification & Description of DUC :	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: 110PV-L/08
	Least Count : N/a	Modal No./Sr. No : 110PV-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
Condition at Receipt: OK			
Calibration performed : At Lab		Ref. Standard / Procedure: ITS-90 & TS/WI/203	
Environmental Conditions :		Temperature: (25 ±2) °C Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]


Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.70	0.30	0.99
2	60	59.47	0.53	
3	80	79.46	0.54	
4	90	89.44	0.56	
5	100	99.40	0.60	

Remarks:

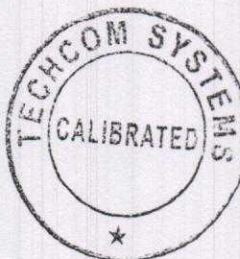
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.


Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor (k=2) and a coverage probability of approximately 95%.
- The certificate refers only to the particular item submitted for calibration.
- Results reported are valid at the time of and under stated conditions of measurement.
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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000406F	
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020	
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020	
Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0406(T)			
<b>TEMPERATURE SENSOR</b>			
<b>Identification &amp; Description of DUC :</b>	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/01
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
	Condition at Receipt: OK		
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC °C	Values of STD °C	ERROR °C	Uncertainty of Measurement (k=2) (±) °C
1	50	49.64	0.36	0.99
2	60	59.49	0.51	
3	80	79.48	0.52	
4	90	89.42	0.58	
5	100	99.37	0.63	

Remarks:

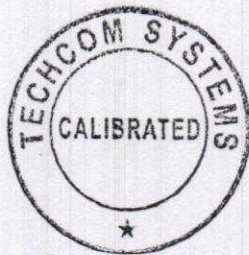
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor ( $k=2$ ) and a coverage probability of approximately 95%.
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B  
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Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



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## CALIBRATION CERTIFICATE

Unique Lab Report No. (ULR) - CC211719000000407F				
<b>CUSTOMER NAME &amp; ADDRESS:</b> <b>MEATECH SOLUTIONS LLP</b> 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)	Date of Receipt of DUC :	03/02/2020		
	Date of Calibration :	04/02/2020		
	Due Date of Calibration :	03/02/2021		
	Issue Date of Certificate :	05/02/2020		
	Page No. :	01 of 01		
Calibration Certificate No.: TS/2K19-0407(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/02	Condition at Receipt: OK
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure: ITS-90 &amp; TS/WI/203</b>		
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.50	0.50	
3	80	79.48	0.52	
4	90	89.42	0.58	
5	100	99.37	0.63	

Remarks:

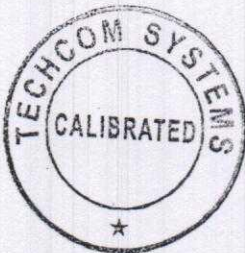
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor (k=2) and a coverage probability of approximately 95%.
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<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000408F		
Date of Receipt of DUC :		03/02/2020		
Date of Calibration :		04/02/2020		
Due Date of Calibration :		03/02/2021		
Issue Date of Certificate :		05/02/2020		
Page No. :		01 of 01		
Calibration Certificate No.: TS/2K19-0408(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			Condition at Receipt: OK
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/03	
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203		
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC °C	Values of STD °C	ERROR °C	Uncertainty of Measurement (k=2) (±) °C
1	50	49.67	0.33	0.99
2	60	59.50	0.50	
3	80	79.48	0.52	
4	90	89.48	0.52	
5	100	99.38	0.62	

Remarks:

Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor (k=2) and a coverage probability of approximately 95%.
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Rajnish Mishra

Format No.:TS/CC/01, Rev. No.:04, Rev. Date:15.03.2019



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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000409F	
Date of Receipt of DUC : 03/02/2020		Date of Calibration : 04/02/2020	
Due Date of Calibration : 03/02/2021		Issue Date of Certificate : 05/02/2020	
Page No. : 01 of 01			
Calibration Certificate No.: TS/2K19-0409(T)			
<b>TEMPERATURE SENSOR</b>			
<b>Identification &amp; Description of DUC :</b>	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/04
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
	Condition at Receipt: OK		
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

CALIBRATION RESULTS  
Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.70	0.30	0.99
2	60	59.48	0.52	
3	80	79.46	0.54	
4	90	89.48	0.52	
5	100	99.38	0.62	

Remarks:

Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000410F	
Date of Receipt of DUC :		03/02/2020	
Date of Calibration :		04/02/2020	
Due Date of Calibration :		03/02/2021	
Issue Date of Certificate :		05/02/2020	
Page No. :		01 of 01	
Calibration Certificate No.: TS/2K19-0410(T)			
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>		
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/05
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
Condition at Receipt: OK			
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.48	0.52	
3	80	79.44	0.56	
4	90	89.46	0.54	
5	100	99.40	0.60	

Remarks:

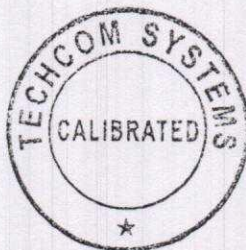
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

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## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> <b>MEATECH SOLUTIONS LLP</b> 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000411F	
Date of Receipt of DUC :		03/02/2020	
Date of Calibration :		04/02/2020	
Due Date of Calibration :		03/02/2021	
Issue Date of Certificate :		05/02/2020	
Page No. :		01 of 01	
Calibration Certificate No.: TS/2K19-0411(T)			
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>		
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID, No.: CS240U-L-300/06
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm
		Condition at Receipt: OK	
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203	
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)	

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]


Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.48	0.52	
3	80	79.42	0.58	
4	90	89.46	0.54	
5	100	99.38	0.62	

Remarks:

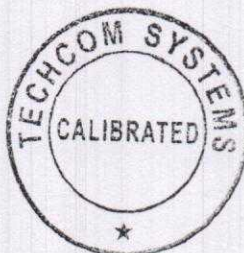
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

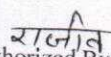
Notes:

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## CALIBRATION CERTIFICATE

Unique Lab Report No. (ULR) - CC211719000000412F				
<b>CUSTOMER NAME &amp; ADDRESS:</b> <b>MEATECH SOLUTIONS LLP</b> 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)	Date of Receipt of DUC :	03/02/2020		
	Date of Calibration :	04/02/2020		
	Due Date of Calibration :	03/02/2021		
	Issue Date of Certificate :	05/02/2020		
	Page No. :	01 of 01		
Calibration Certificate No.: TS/2K19-0412(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/07	Condition at Receipt: OK
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
Calibration performed : At Lab	Ref. Standard / Procedure: ITS-90 & TS/WI/203			
Environmental Conditions :	Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)			

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&I/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC	Values of STD	ERROR	Uncertainty of Measurement (k=2) (±)
	°C	°C	°C	°C
1	50	49.68	0.32	0.99
2	60	59.48	0.52	
3	80	79.45	0.55	
4	90	89.46	0.54	
5	100	99.40	0.60	

Remarks:

Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor (k=2) and a coverage probability of approximately 95%.
- The certificate refers only to the particular item submitted for calibration.
- Results reported are valid at the time of and under stated conditions of measurement.
- Next calibration due date is given as requested by the customer.
- This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
- Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.: TS/CC/01, Rev. No.: 04, Rev. Date: 15.03.2019



Authorized By  
Rajeev Sharma

Techcom Systems

Regd. Office : 49, Bank Colony, Alwar (Raj.)- 301001

Mob. : 8003004111, 0144-2331871

E-mail : ealibration\_techcom@yahoo.com, rajshar30@gmail.com

Lab. : Sector-4, Plot No. 334, Rajasthan Housing Board, Bhiwadi  
Distt. Alwar (Raj.) 301019 Mob.: 8003004111, 0144-2331871  
Jaipur Off.: 401-H, Gurupragna Society, Tonk Road, Jaipur (Rajasthan)  
Delhi Off.: R7-D 83A, East Delhi, Delhi-110055



## CALIBRATION CERTIFICATE

<b>CUSTOMER NAME &amp; ADDRESS:</b> MEATECH SOLUTIONS LLP 2 <sup>nd</sup> Floor, A-06, Info City, Sec.-34, Gurugram-122002 (Hr.)		Unique Lab Report No. (ULR) - CC211719000000413F		
Date of Receipt of DUC :		03/02/2020		
Date of Calibration :		04/02/2020		
Due Date of Calibration :		03/02/2021		
Issue Date of Certificate :		05/02/2020		
Page No. :		01 of 01		
Calibration Certificate No.: TS/2K19-0413(T)				
<b>Identification &amp; Description of DUC :</b>	<b>TEMPERATURE SENSOR</b>			Condition at Receipt: OK
	Range/Size: -40 to 105 °C	Make: Campbell Scientific	ID. No.: CS240U-L-300/08	
	Least Count : N/a	Modal No./Sr. No : CS240U-L	Location: ---	
	Length of Sensor: 6.35 cm	Dia. of Sensor: 2.54cm	Immersion Depth of Sensor: 30 mm	
<b>Calibration performed : At Lab</b>		<b>Ref. Standard / Procedure:</b> ITS-90 & TS/WI/203		
<b>Environmental Conditions :</b>		Temperature: (25 ±2) °C      Relative Humidity: (50± 10%)		

Standard Equipment/s used for Calibration					
Sr. No.	Name	Make	Certificate No.	Traceability	Calibration Valid Upto
01	Dig. Indicator with RTD Sensor	YCT	30006381	CC-2733	12/03/2020
02	Digital Multimeter	Fluke	C&IJ/CAL/19-12/069	C&I	18/12/2020

## CALIBRATION RESULTS

Discipline: Thermal Calibration [Group – Temperature]

Sr. No.	Values of DUC °C	Values of STD °C	ERROR °C	Uncertainty of Measurement (k=2) (±) °C
1	50	49.67	0.33	0.99
2	60	59.43	0.57	
3	80	79.45	0.55	
4	90	89.44	0.56	
5	100	99.39	0.61	

Remarks:

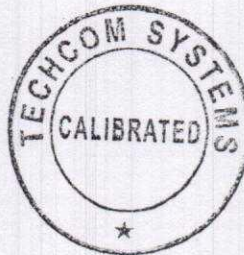
Abbreviations: DUC-Device Under Calibration, STD-Standard Equipment.

Notes:

- Standard equipments used for calibration are traceable to National/International Standards.
- The reported Expanded Uncertainty in measurement is with the coverage factor (k=2) and a coverage probability of approximately 95%.
- The certificate refers only to the particular item submitted for calibration.
- Results reported are valid at the time of and under stated conditions of measurement.
- Next calibration due date is given as requested by the customer.
- This certificate shall not be reproduced except in full without permission of CEO of Laboratory.
- Calibration Certificate without signature is not valid.

Calibrated By  
Rajnish Mishra

Format No.:TS/CC/01, Rev. No.:04, Rev. Date:15.03.2019

Authorized By  
Rajeev Sharma

## Techcom Systems

Regd. Office : 49, Bank Colony, Alwar (Raj.)- 301001

Mob. : 8003004111, 0144-2331871

E-mail : calibration\_techcom@yahoo.com, rajshar30@gmail.com

Lab. : Sector-4, Plot No. 334, Rajasthan Housing Board, Bhiwadi  
Distt. Alwar (Raj.) 301019 Mob.: 8003004111, 0144-2331871  
Jaipur Off.: 401-H, Gurupragya Society, Tonk Road, Jaipur (Rajasthan)  
Delhi Off.: RZ-D 83A, East, Dabri Extn. Delhi - 110045





# Calibration Certificate

Technician: SO <sup>SO</sup>  
Part No: 2781600MA1B2YT1  
Model: 278

Serial No: 7569826      Range: 610 to 1100 HPA/MB  
Work Order: 24469782      Nom. Output: 0.05 to 2.5 VDC  
Date: 01/28/2020      Supply: 24vdc

## CALIBRATION DATA

APPLIED PRESSURE (hPa)	TRANSDUCER OUTPUT (VDC)	PRESSURE CONVERSION (hPa)	ERROR (hPa)	EQUIPMENT UNCERTAINTY (hPa)
610.02	0.0498	609.96	-0.06	+/- 0.10
732.54	0.6634	732.68	0.14	+/- 0.10
855.02	1.2758	855.16	0.14	+/- 0.10
977.50	1.8881	977.62	0.12	+/- 0.10
1100.02	2.5014	1100.28	0.26	+/- 0.10

### AMBIENT CONDITIONS:

Humidity: 17.0 %RH  
Pressure: 995.3 hPa

Temperature: 24.0 degree C

### SPECIFICATIONS:

Accuracy Specification: +/- 0.5 hPa @ +20 degree C (+68 degree F).

### NOTES:

1. This calibration was performed in compliance with ANSI/NCSL Z540-1-1994.
2. All errors are expressed in hPa.
3. Consult specification sheet for additional information.
4. This calibration is certified per N.I.S.T. traceable primary standards.  
Reference standard: I/N\_00048-SN142-DHI\_PPC3-100KA700KS/A100KS.  
Reference standard cal. date: 8/13/19.
5. This certificate may not be reproduced, except in full, without written approval from Setra Systems.
6. This calibration was performed using procedure P2781X.

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## Calibration Certificate

Technician: SO *So*  
Part No: 2781600MA1B2YT1  
Model: 278

Serial No: 7569830      Range: 610 to 1100 hPa/MB  
Work Order: 24469782      Nom. Output: 0.05 to 2.5 VDC  
Date: 01/24/2020      Supply: 24vdc

### CALIBRATION DATA

APPLIED PRESSURE (hPa)	TRANSDUCER OUTPUT (VDC)	PRESSURE CONVERSION (hPa)	ERROR (hPa)	EQUIPMENT UNCERTAINTY (hPa)
610.03	0.0497	609.93	-0.10	+/- 0.10
732.53	0.6633	732.65	0.12	+/- 0.10
855.03	1.2761	855.23	0.20	+/- 0.10
977.52	1.8883	977.67	0.15	+/- 0.10
1100.02	2.5009	1100.18	0.16	+/- 0.10

### AMBIENT CONDITIONS:

Humidity: 25.0 %RH  
Pressure: 1018.4 hPa

Temperature: 11.5 degree C

### SPECIFICATIONS:

Accuracy Specification: +/- 0.5 hPa @ +20 degree C (+68 degree F).

### NOTES:

1. This calibration was performed in compliance with ANSI/NCSL Z540-1-1994.
2. All errors are expressed in hPa.
3. Consult specification sheet for additional information.
4. This calibration is certified per N.I.S.T. traceable primary standards.  
Reference standard: I/N\_00048-SN142-DHI\_PPC3-100KA700KS/A100KS.  
Reference standard cal. date: 8/13/19.
5. This certificate may not be reproduced, except in full, without written approval from Setra Systems.
6. This calibration was performed using procedure P2781X.

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# Calibration Certificate

Technician: SO *So*  
Part No: 2781600MA1B2YT1  
Model: 278

Serial No: 7569828      Range: 610 to 1100 HPA/MB  
Work Order: 24469782      Nom. Output: 0.05 to 2.5 VDC  
Date: 01/24/2020      Supply: 24vdc

## CALIBRATION DATA

APPLIED PRESSURE (hPa)	TRANSDUCER OUTPUT (VDC)	PRESSURE CONVERSION (hPa)	ERROR (hPa)	EQUIPMENT UNCERTAINTY (hPa)
610.02	0.0492	609.84	-0.18	+/- 0.10
732.53	0.6633	732.66	0.13	+/- 0.10
855.01	1.2756	855.12	0.11	+/- 0.10
977.52	1.8869	977.38	-0.14	+/- 0.10
1100.02	2.5004	1100.07	0.05	+/- 0.10

### AMBIENT CONDITIONS:

Humidity: 11.0 %RH  
Pressure: 1018.0 hPa

Temperature: 24.5 degree C

### SPECIFICATIONS:

Accuracy Specification: +/- 0.5 hPa @ +20 degree C (+68 degree F).

### NOTES:


1. This calibration was performed in compliance with ANSI/NCSL Z540-1-1994.
2. All errors are expressed in hPa.
3. Consult specification sheet for additional information.
4. This calibration is certified per N.I.S.T. traceable primary standards.  
Reference standard: I/N\_00048-SN142-DHI\_PPC3-100KA700KS/A100KS.  
Reference standard cal. date: 8/13/19.
5. This certificate may not be reproduced, except in full, without written approval from Setra Systems.
6. This calibration was performed using procedure P2781X.

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# Calibration Certificate

Technician: SO   
Part No: 2781600MA1B2YT1  
Model: 278

Serial No: 7569827      Range: 610 to 1100 HPA/MB  
Work Order: 24469782      Nom. Output: 0.05 to 2.5 VDC  
Date: 01/24/2020      Supply: 24vdc

## CALIBRATION DATA

APPLIED PRESSURE (hPa)	TRANSDUCER OUTPUT (VDC)	PRESSURE CONVERSION (hPa)	ERROR (hPa)	EQUIPMENT UNCERTAINTY (hPa)
610.04	0.0499	609.98	-0.06	+/- 0.10
732.52	0.6631	732.61	0.09	+/- 0.10
855.03	1.2754	855.09	0.06	+/- 0.10
977.52	1.8873	977.47	-0.05	+/- 0.10
1100.03	2.5002	1100.04	0.01	+/- 0.10

### AMBIENT CONDITIONS:

Humidity: 11.0 %RH  
Pressure: 1018.0 hPa

Temperature: 24.5 degree C

### SPECIFICATIONS:

Accuracy Specification: +/- 0.5 hPa @ +20 degree C (+68 degree F).

### NOTES:

1. This calibration was performed in compliance with ANSI/NCSL Z540-1-1994.
2. All errors are expressed in hPa.
3. Consult specification sheet for additional information.
4. This calibration is certified per N.I.S.T. traceable primary standards.  
Reference standard: I/N\_00048-SN142-DHI\_PPC3-100KA700KS/A100KS.  
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6. This calibration was performed using procedure P2781X.

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<b>CERTIFICATE NUMBER</b>	019482197289
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	197289
<b>SENSITIVITY</b>	10.72 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	26 August 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2^\circ\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^\circ$ , longitude:  $-2.3547^\circ$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3^\circ\text{C}$ .

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrheliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from  $23.5$  to  $49.8$  with a mean of  $32.9$  degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7^\circ\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^\circ$ , longitude:  $-9.8458^\circ$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

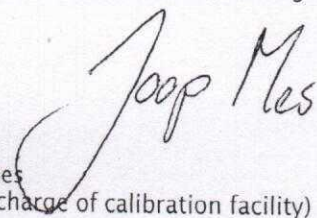
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

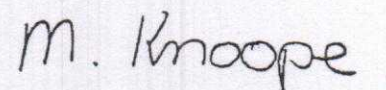
## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 26 August 2019

  
J. Mes  
(in charge of calibration facility)

  
M. Knoope  
(in charge of test)

Kipp & Zonen B.V.  
Trade name: OTT HydroMet  
Company registered in Delft

Trade register no.: 27239004  
VAT no.: NL0055.74.857.B.01  
Member of HMEI

EUR payments  
Deutsche Bank AG  
IBAN: NL70 DEUT 0265 2482 48  
BIC: DEUTNL2A

USD payments only  
Deutsche Bank AG  
IBAN: DE60100701000162416200  
BIC: DEUTDEBB101



<b>CERTIFICATE NUMBER</b>	019482197288
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	197288
<b>SENSITIVITY</b>	10.29 $\mu\text{V/W/m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	26 August 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W/m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2^\circ\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^\circ$ , longitude:  $-2.3547^\circ$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of  $1031 \text{ W/m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of  $132 \text{ W/m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3^\circ\text{C}$ .

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrheliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11 \mu\text{V/W/m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of  $874 \text{ W/m}^2$ . The solar zenith angle varied from  $23.5$  to  $49.8$  with a mean of  $32.9$  degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7^\circ\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11 \mu\text{V/W/m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^\circ$ , longitude:  $-9.8458^\circ$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrheliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

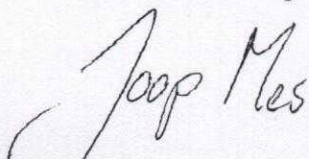
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

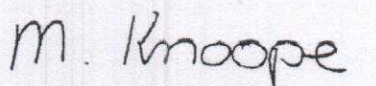
## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* From October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 26 August 2019

  
J. Mes  
(in charge of calibration facility)

  
M. Knoope  
(in charge of test)

Kipp & Zonen B.V.  
Trade name: OTT HydroMet  
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Trade register no.: 27239004  
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Member of HMEI

EUR payments  
Deutsche Bank AG  
IBAN: NL70 DEUT 0265 2482 48  
BIC: DEUT3333

USD payments only  
Deutsche Bank AG  
IBAN: DE60100701000162416200  
BIC: DEUTDE33



<b>CERTIFICATE NUMBER</b>	020137198163
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	198163
<b>SENSITIVITY</b>	11.13 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	18 December 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2$  °C.

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude: 37.094°, longitude: -2.3547°, altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from +22.8 to +29.7 with a mean of +27.3 °C.

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrhemometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrhemometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from 23.5 to 49.8 with a mean of 32.9 degrees. The ambient temperature ranged from +12.6 to +26.2 with a mean of +23.7 °C. The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrhemometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

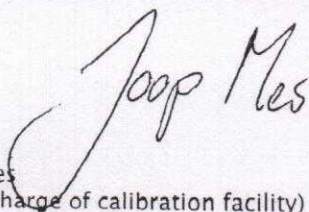
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

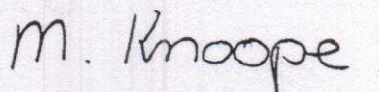
## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 18 December 2019

  
J. Mes  
(in charge of calibration facility)

  
M. Knoope  
(in charge of test)

Kipp & Zonen B.V.  
Trade name: OTT HydroMet  
Company registered in Delft

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VAT no.: NL0055.74.857.B.01  
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IBAN: DE60100701000162416200  
BIC: DEUTDEBB101



<b>CERTIFICATE NUMBER</b>	020137198160
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	198160
<b>SENSITIVITY</b>	11.17 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	18 December 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2$   $^{\circ}\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^{\circ}$ , longitude:  $-2.3547^{\circ}$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3$   $^{\circ}\text{C}$ .

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from  $23.5$  to  $49.8$  with a mean of  $32.9$  degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7$   $^{\circ}\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^{\circ}$ , longitude:  $-9.8458^{\circ}$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

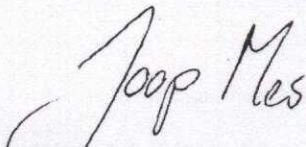
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

## Notice

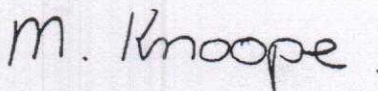
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\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 18 December 2019



J. Mes  
(in charge of calibration facility)



M. Knoope  
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BIC: DEUTDE33



<b>CERTIFICATE NUMBER</b>	020071198159
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	198159
<b>SENSITIVITY</b>	9.38 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	17 December 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2$  °C.

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude: 37.094°, longitude: -2.3547°, altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from +22.8 to +29.7 with a mean of +27.3 °C.

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from 23.5 to 49.8 with a mean of 32.9 degrees. The ambient temperature ranged from +12.6 to +26.2 with a mean of +23.7 °C. The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

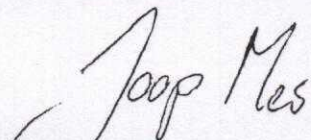
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).
2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ . The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

## Notice

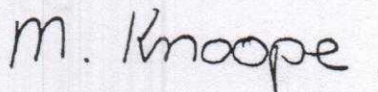
The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 17 December 2019



J. Mes  
(in charge of calibration facility)



M. Knoope  
(in charge of test)

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USD payments only  
Deutsche Bank AG  
IBAN: DE60100701000162416200  
BIC: DEUTDEBB101



<b>CERTIFICATE NUMBER</b>	020137198162
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	198162
<b>SENSITIVITY</b>	10.54 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	18 December 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2^\circ\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^\circ$ , longitude:  $-2.3547^\circ$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3^\circ\text{C}$ .

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrhanometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrhanometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from  $23.5$  to  $49.8$  with a mean of  $32.9$  degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7^\circ\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^\circ$ , longitude:  $-9.8458^\circ$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrhanometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

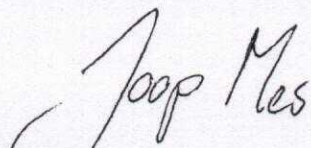
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

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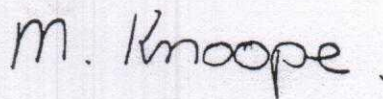
Delft, The Netherlands, 18 December 2019



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(in charge of calibration facility)

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<b>CERTIFICATE NUMBER</b>	020137198165
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	198165
<b>SENSITIVITY</b>	10.91 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	18 December 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2$   $^{\circ}\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^{\circ}$ , longitude:  $-2.3547^{\circ}$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018. The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3$   $^{\circ}\text{C}$ . The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyr heliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyr heliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from  $23.5$  to  $49.8$  with a mean of  $32.9$  degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7$   $^{\circ}\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11$   $\mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^{\circ}$ , longitude:  $-9.8458^{\circ}$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyr heliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

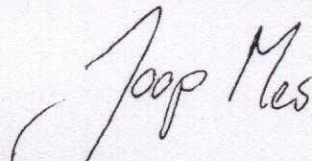
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

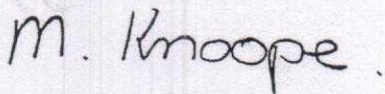
Delft, The Netherlands, 18 December 2019



J. Mes  
(in charge of calibration facility)

Kipp & Zonen B.V.  
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M. Knoope  
(in charge of test)

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<b>CERTIFICATE NUMBER</b>	018865196506
<b>PYRANOMETER MODEL</b>	SMP10-V
<b>SERIAL NUMBER</b>	196506
<b>SENSITIVITY</b>	10.65 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen CMP 21 sn 070114 active from 01 August 2018
<b>CALIBRATION DATE</b>	15 May 2019
<b>CLASSIFICATION</b>	ISO 9060, Class A (Sec. Standard)*

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. Temperature of calibration:  $22 \pm 2^\circ\text{C}$ .

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5. The measurements were performed in Tabernas, Spain (latitude:  $37.094^\circ$ , longitude:  $-2.3547^\circ$ , altitude: 503m above sea level). Dates of measurements: 8, 10-12 June 2018.

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 769 to 1182 with a mean of 1031  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 99 to 191 with a mean of 132  $\text{W}/\text{m}^2$ . The ambient temperature ranged from  $+22.8$  to  $+29.7$  with a mean of  $+27.3^\circ\text{C}$ .

The direct radiation on the reference pyranometer as obtained with the alternating-sun-shade method was compared to the DNI measured by the absolute cavity pyrhemliometer PMO6 SN 103. The PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrhemliometer Comparison (IPC). The PMO6 participates every IPC since 2005 and it participates in the yearly NPC hosted by NREL in Golden, Colorado to verify its stability. WRR factor of PMO6: 0.99789 (from the last IPC, IPC-2015).

This calibration proved that the reference pyranometer has been stable and that the original sensitivity  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$  is valid and will be applied (see PMOD calibration details). Observed sensitivity differences between the consecutive years are well within the calibration uncertainty.

PMOD calibration details: The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The pyranometer was installed horizontally. During the comparisons, the global radiation ranged from 638 to 1195 with a mean of 874  $\text{W}/\text{m}^2$ . The solar zenith angle varied from 23.5 to 49.8 with a mean of 32.9 degrees. The ambient temperature ranged from  $+12.6$  to  $+26.2$  with a mean of  $+23.7^\circ\text{C}$ . The sensitivity calculation is based on 435 individual measurements. The readings of the WSG are referred to the World Radiometric Reference (WRR). The estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $8.37 \pm 0.11 \mu\text{V}/\text{W}/\text{m}^2$ . The measurements were performed in Davos (latitude:  $46.8143^\circ$ , longitude:  $-9.8458^\circ$ , altitude: 1558m above sea level). Dates of measurements: 24, 30 June 1, 2 July 2015.

Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrhemliometer PMO2 (member of the WSG, WRR-Factor: 0.998623, based on the last IPC-2010) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM22 SN 020059 (ventilated with heated air).

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference CMP 21 is  $\pm 0.11/8.37 = \pm 1.31\%$ . (See traceability text).

2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

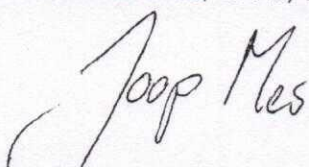
The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(1.31^2 + 0.5^2)} = \pm 1.41\%$ .

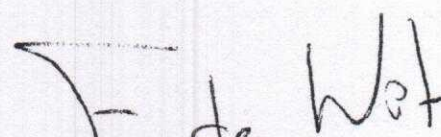
## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

\* from October 2018 the classification conforms to ISO 9060:2018. Instruments issued before that date conform to ISO 9060:1990.

Delft, The Netherlands, 15 May 2019

  
J. Mes  
(in charge of calibration facility)

  
F. de Wit  
(in charge of test)

Kipp & Zonen B.V.  
Trade name: OTT HydroMet  
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## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER	020124190152
PYRHELIOMETER MODEL	PH1-V
SERIAL NUMBER	190152
SENSITIVITY	22.67 $\mu\text{V}/(\text{W}/\text{m}^2)$
TEMPERATURE	22 $\pm$ 2 °C
REFERENCE PYRHELIOMETER	Kipp & Zonen PH 1 sn 160002 active from 01 August 2018
CALIBRATION DATE	16 December 2019
INSTRUMENT CLASS	ISO 9060:2018, , spectrally flat

### Calibration procedure

Exact interchange of test pyrliometer and reference pyrliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Minimum irradiance 650 W/m². Room temperature 22  $\pm$  2 °C.

### Hierarchy of traceability

This reference pyrliometer was compared against the absolute cavity pyrliometer PMO6 SN 103 using the sun as source according to ISO 9059 "Calibration of field pyrliometers by comparison to a reference pyrliometer". The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrliometer Comparison (IPC). During the yearly NPC hosted by NREL in Golden, Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm$  0.3%. The measurements were performed in Davos and Golden, Colorado (Davos: latitude: 46.8143°, longitude: -9.8458°, altitude: 1558 m above sea level; Golden: latitude: 39.742°, longitude: 105.18°, altitude: 1829 m above sea level). WRR- factor of PMO6: 0.997916.

The comparison was performed in Tabernas, Spain (latitude: 37.094°, longitude: -2.3547°, altitude: 503m above sea level). During the comparisons the reference pyrliometer received direct solar radiation with intensities ranging from 770 to 937 W/m², with a mean of 889 W/m². The ambient air temperature ranged from +22.7 to +29.8 °C with a mean of +27.3 °C. The sensitivity calculation is based on 98 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are valid for similar environmental conditions and amount: 20.72  $\pm$  0.04  $\mu\text{V}/(\text{W}/\text{m}^2)$ . Date of measurements: 8, 10-12 June 2018

### Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PH 1 is 0.04/20.72 =  $\pm$  0.22%. (See traceability text).

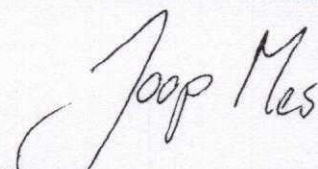
2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be  $\pm$  1%.

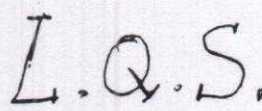
The estimated combined expanded uncertainty (k=2) is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.22^2 + 1^2)} = \pm 1.02\%$ .

### Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 16 December 2019

  
J. Mes  
(in charge of calibration facility)

  
L. Schuurmans  
(in charge of test)

Kipp & Zonen B.V.  
Trade name: OTT HydroMet  
Company registered in Delft

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BIC: DEUTDE33



<b>CERTIFICATE NUMBER</b>	020124190152
<b>PYRANOMETER MODEL</b>	PR1-V
<b>SERIAL NUMBER</b>	190152
<b>SENSITIVITY</b>	28.70 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>TEMPERATURE</b>	$22 \pm 2$ °C
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen PR 1 sn160001 active from 01 August 2018
<b>CALIBRATION DATE</b>	09 December 2019

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500 W/m<sup>2</sup>. During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5 on a suntracking platform. The measurements were performed in Tabernas, Spain (latitude: 37.094°, longitude: -2.3547°, altitude: 503m above sea level).

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 913 to 1181 with a mean of 1034 W/m<sup>2</sup> and tilted diffuse radiation intensities from 104 to 200 with a mean of 138 W/m<sup>2</sup>. The ambient temperature ranged from +22.8 to +29.7 with a mean of +27.3 °C. The sensitivity calculation and the single measurements deviation ( $\sigma$ ) are based on 208 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $27.54 \pm 0.14$   $\mu\text{V}/\text{W}/\text{m}^2$   
 Dates of measurements: 8 - 12 June 2018

The direct solar radiation as measured by the absolute cavity pyrhemometer using the sun as source was compared to the calculated direct irradiance of the reference pyranometer. The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrhemometer Comparison (IPC). During the yearly IPC hosted by NREL in Boulder Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The measurements were performed in Davos and Golden Colorado (Davos: latitude: 46.8143°, longitude: -9.8458°, altitude: 1558 m above sea level; Golden: latitude: 39.742°, longitude: 105.18°, altitude: 1829 m above sea level). WRR factor of PMO6: 0.99789 (from the last International Pyrhemometer Comparison, IPC-2015)

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

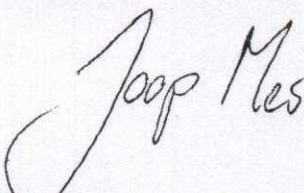
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PR 1 is  $\pm 0.14/27.54 = \pm 0.36\%$ . (See traceability text).

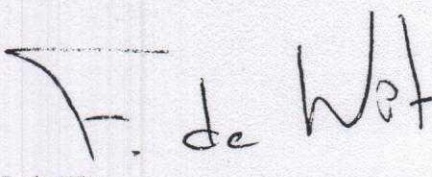
2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .  
 The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.36^2 + 0.5^2)} = \pm 0.63\%$ .

## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 09 December 2019

  
 J. Mes  
 (in charge of calibration facility)

  
 F. de Wit  
 (in charge of test)

Kipp & Zonen B.V.  
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 Company registered in Delft

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 BIC: DEUTDEBB101



## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER	020124190153
PYRHELIOMETER MODEL	PH1-V
SERIAL NUMBER	190153
SENSITIVITY	22.48 $\mu\text{V}/(\text{W}/\text{m}^2)$
TEMPERATURE	22 $\pm$ 2 $^{\circ}\text{C}$
REFERENCE PYRHELIOMETER	Kipp & Zonen PH 1 sn 160002 active from 01 August 2018
CALIBRATION DATE	17 December 2019
INSTRUMENT CLASS	ISO 9060:2018, , spectrally flat

### Calibration procedure

Exact interchange of test pyrheliometer and reference pyrheliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0'. Minimum irradiance 650  $\text{W}/\text{m}^2$ . Room temperature 22  $\pm$  2  $^{\circ}\text{C}$ .

### Hierarchy of traceability

This reference pyrheliometer was compared against the absolute cavity pyrheliometer PMO6 SN 103 using the sun as source according to ISO 9059 "Calibration of field pyrheliometers by comparison to a reference pyrheliometer". The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). During the yearly NPC hosted by NREL in Golden, Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The measurements were performed in Davos and Golden, Colorado (Davos: latitude: 46.8143', longitude: -9.8458', altitude: 1558 m above sea level; Golden: latitude: 39.742', longitude: 105.18', altitude: 1829 m above sea level). WRR- factor of PMO6: 0.997916.

The comparison was performed in Tabernas, Spain (latitude: 37.094', longitude: -2.3547', altitude: 503m above sea level). During the comparisons the reference pyrheliometer received direct solar radiation with intensities ranging from 770 to 937  $\text{W}/\text{m}^2$ , with a mean of 889  $\text{W}/\text{m}^2$ . The ambient air temperature ranged from +22.7 to +29.8  $^{\circ}\text{C}$  with a mean of +27.3  $^{\circ}\text{C}$ . The sensitivity calculation is based on 98 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are valid for similar environmental conditions and amount: 20.72  $\pm$  0.04  $\mu\text{V}/(\text{W}/\text{m}^2)$ . Date of measurements: 8, 10-12 June 2018

### Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PH 1 is 0.04/20.72 =  $\pm 0.22\%$ . (See traceability text).

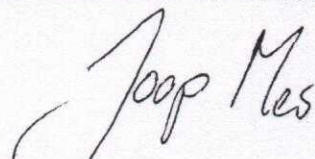
2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be  $\pm 1\%$ .


The estimated combined expanded uncertainty ( $k=2$ ) is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.22^2 + 1^2)} = \pm 1.02\%$ .

### Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 17 December 2019

  
J. Mes  
(in charge of calibration facility)

  
L. Schuurmans  
(in charge of test)

Kipp & Zonen B.V.  
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<b>CERTIFICATE NUMBER</b>	020124190153
<b>PYRANOMETER MODEL</b>	PR1-V
<b>SERIAL NUMBER</b>	190153
<b>SENSITIVITY</b>	28.11 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>TEMPERATURE</b>	22 $\pm$ 2 $^{\circ}\text{C}$
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen PR 1 sn160001 active from 01 August 2018
<b>CALIBRATION DATE</b>	09 December 2019

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5 on a suntracking platform. The measurements were performed in Tabernas, Spain (latitude: 37.094', longitude: -2.3547', altitude: 503m above sea level).

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 913 to 1181 with a mean of 1034  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 104 to 200 with a mean of 138  $\text{W}/\text{m}^2$ . The ambient temperature ranged from +22.8 to +29.7 with a mean of +27.3  $^{\circ}\text{C}$ . The sensitivity calculation and the single measurements deviation ( $\sigma$ ) are based on 208 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 27.54  $\pm$  0.14  $\mu\text{V}/\text{W}/\text{m}^2$   
Dates of measurements: 8 - 12 June 2018

The direct solar radiation as measured by the absolute cavity pyrhemometer using the sun as source was compared to the calculated direct irradiance of the reference pyranometer. The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrhemometer Comparison (IPC). During the yearly IPC hosted by NREL in Boulder Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The measurements were performed in Davos and Golden Colorado (Davos: latitude: 46.8143', longitude: -9.8458', altitude: 1558 m above sea level; Golden: latitude: 39.742', longitude: 105.18', altitude: 1829 m above sea level). WRR factor of PMO6: 0.99789 (from the last international Pyrhemometer Comparison, IPC-2015)

## Justification of total instrument calibration uncertainty

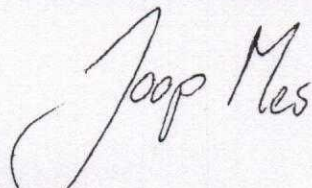
The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

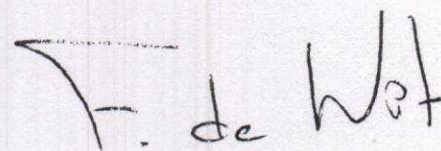
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PR 1 is  $\pm 0.14/27.54 = \pm 0.36\%$ . (See traceability text).
  2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .
- The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.36^2 + 0.5^2)} = \pm 0.63\%$ .

## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 09 December 2019

  
J. Mes  
(in charge of calibration facility)

  
F. de Wit  
(in charge of test)

Kipp & Zonen B.V.  
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BIC: DEUTDEBB101



## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER	020124190151
PYRHELIOMETER MODEL	PH1-V
SERIAL NUMBER	190151
SENSITIVITY	22.25 $\mu\text{V}/(\text{W}/\text{m}^2)$
TEMPERATURE	22 $\pm$ 2 $^{\circ}\text{C}$
REFERENCE PYRHELIOMETER	Kipp & Zonen PH 1 sn 160002 active from 01 August 2018
CALIBRATION DATE	16 December 2019
INSTRUMENT CLASS	ISO 9060:2018, , spectrally flat

### Calibration procedure

Exact interchange of test pyrheliometer and reference pyrheliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Minimum irradiance 650  $\text{W}/\text{m}^2$ . Room temperature 22  $\pm$  2  $^{\circ}\text{C}$ .

### Hierarchy of traceability

This reference pyrheliometer was compared against the absolute cavity pyrheliometer PMO6 SN 103 using the sun as source according to ISO 9059 "Calibration of field pyrheliometers by comparison to a reference pyrheliometer". The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). During the yearly NPC hosted by NREL in Golden, Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The measurements were performed in Davos and Golden, Colorado (Davos: latitude: 46.8143°, longitude: -9.8458°, altitude: 1558 m above sea level; Golden: latitude: 39.742°, longitude: 105.18°, altitude: 1829 m above sea level). WRR factor of PMO6: 0.997916.

The comparison was performed in Tabernas, Spain (latitude: 37.094°, longitude: -2.3547°, altitude: 503m above sea level). During the comparisons the reference pyrheliometer received direct solar radiation with intensities ranging from 770 to 937  $\text{W}/\text{m}^2$ , with a mean of 889  $\text{W}/\text{m}^2$ . The ambient air temperature ranged from +22.7 to +29.8  $^{\circ}\text{C}$  with a mean of +27.3  $^{\circ}\text{C}$ . The sensitivity calculation is based on 98 individual measurements. The sensitivity and its expanded uncertainty (95% level of confidence) are valid for similar environmental conditions and amount: 20.72  $\pm$  0.04  $\mu\text{V}/(\text{W}/\text{m}^2)$ . Date of measurements: 8, 10-12 June 2018

### Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PH 1 is 0.04/20.72 =  $\pm 0.22\%$ . (See traceability text).

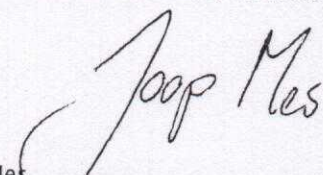
2. Based on experience the expanded uncertainty of the transfer procedure (calibration by non-simultaneous comparison) is estimated to be  $\pm 1\%$ .

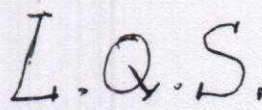
The estimated combined expanded uncertainty ( $k=2$ ) is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.22^2 + 1^2)} = \pm 1.02\%$ .

### Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 16 December 2019

  
J. Mes  
(in charge of calibration facility)

  
L. Schuurmans  
(in charge of test)

Kipp & Zonen B.V.  
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Company registered in Delft

Trade register no.: 27239004  
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<b>CERTIFICATE NUMBER</b>	020124190151
<b>PYRANOMETER MODEL</b>	PR1-V
<b>SERIAL NUMBER</b>	190151
<b>SENSITIVITY</b>	27.52 $\mu\text{V}/\text{W}/\text{m}^2$ at normal incidence on horizontal pyranometer
<b>TEMPERATURE</b>	22 $\pm$ 2 $^{\circ}\text{C}$
<b>REFERENCE PYRANOMETER</b>	Kipp & Zonen PR 1 sn160001 active from 01 August 2018
<b>CALIBRATION DATE</b>	09 December 2019

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

## Hierarchy of traceability

The reference pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "alternating sun-and-shade method" ISO 9846 paragraph 5 on a suntracking platform. The measurements were performed in Tabernas, Spain (latitude: 37.094', longitude: -2.3547', altitude: 503m above sea level).

The receiver surface was pointed directly at the sun using a solar tracker. During the comparisons, the instrument received tilted global radiation intensities from 913 to 1181 with a mean of 1034  $\text{W}/\text{m}^2$  and tilted diffuse radiation intensities from 104 to 200 with a mean of 138  $\text{W}/\text{m}^2$ . The ambient temperature ranged from +22.8 to +29.7 with a mean of +27.3  $^{\circ}\text{C}$ . The sensitivity calculation and the single measurements deviation ( $\sigma$ ) are based on 208 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are: 27.54  $\pm$  0.14  $\mu\text{V}/\text{W}/\text{m}^2$   
Dates of measurements: 8 - 12 June 2018

The direct solar radiation as measured by the absolute cavity pyrliometer using the sun as source was compared to the calculated direct irradiance of the reference pyranometer. The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). During the yearly IPC hosted by NREL in Boulder Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm 0.3\%$ . The measurements were performed in Davos and Golden Colorado (Davos: latitude: 46.8143', longitude: -9.8458', altitude: 1558 m above sea level; Golden: latitude: 39.742', longitude: 105.18', altitude: 1829 m above sea level). WRR factor of PMO6: 0.99789 (from the last international Pyrheliometer Comparison, IPC-2015)

## Justification of total instrument calibration uncertainty

The combined uncertainty of the result of the calibration is the positive "root sum square" of two uncertainties.

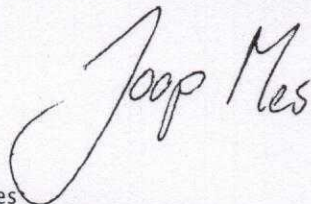
1. The expanded uncertainty due to random effects and instrumental errors during the calibration of the reference PR 1 is  $\pm 0.14/27.54 = \pm 0.36\%$ . (See traceability text).
2. Based on experience, the expanded uncertainty of the transfer procedure (calibration by comparison) is estimated to be  $\pm 0.5\%$ .

The estimated combined expanded uncertainty is the positive "root sum square" of these two uncertainties:  $\sqrt{(0.36^2 + 0.5^2)} = \pm 0.63\%$ .

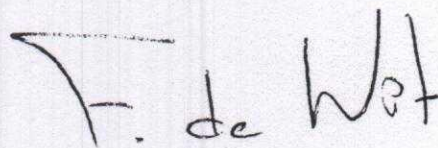
## Notice

The calibration certificate supplied with the instrument is valid at the date of first use. Even though the calibration certificate is dated relative to manufacture, or recalibration, the instrument does not undergo any sensitivity changes when kept in the original packing. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity may deviate with time. See the 'non-stability' value (% change in sensitivity per year) given in the radiometer specifications.

Delft, The Netherlands, 09 December 2019



J. Mes  
(in charge of calibration facility)



F. de Wit  
(in charge of test)

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## CALIBRATION CERTIFICATE

CERTIFICATE NUMBER	020124190150
PYRHELIOMETER MODEL	PH1-V
SERIAL NUMBER	190150
SENSITIVITY	22.95 $\mu\text{V}/(\text{W}/\text{m}^2)$
TEMPERATURE	22 $\pm$ 2 °C
REFERENCE PYRHELIOMETER	Kipp & Zonen PH 1 sn 160002 active from 01 August 2018
CALIBRATION DATE	16 December 2019
INSTRUMENT CLASS	ISO 9060:2018, , spectrally flat

### Calibration procedure

Exact interchange of test pyrheliometer and reference pyrheliometer in a horizontal parallel beam of light from a Xenonlamp. Full collimation angle of beam is 1.0°. Minimum irradiance 650 W/m². Room temperature 22  $\pm$  2 °C.

### Hierarchy of traceability

This reference pyrheliometer was compared against the absolute cavity pyrheliometer PMO6 SN 103 using the sun as source according to ISO 9059 "Calibration of field pyrheliometers by comparison to a reference pyrheliometer". The reference PMO6 is calibrated against the World Standard Group (WSG), maintained at the WRC Davos every International Pyrheliometer Comparison (IPC). During the yearly NPC hosted by NREL in Golden, Colorado the reference PMO6 is verified. The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The originally estimated uncertainty of the WRR relative to SI is  $\pm$ 0.3%. The measurements were performed in Davos and Golden, Colorado (Davos: latitude: 46.8143°, longitude: -9.8458°, altitude: 1558 m above sea level; Golden: latitude: 39.742°, longitude: 105.18°, altitude: 1829 m above sea level). WRR- factor of PMO6: 0.997916.

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### Justification of total instrument calibration uncertainty

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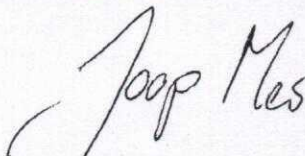
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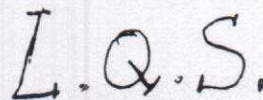
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Delft, The Netherlands, 16 December 2019



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(in charge of calibration facility)



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**CERTIFICATE NUMBER** 020124190150  
**PYRANOMETER MODEL** PR1-V  
**SERIAL NUMBER** 190150  
**SENSITIVITY** 29.04  $\mu\text{V}/\text{W}/\text{m}^2$  at normal incidence on horizontal pyranometer  
**TEMPERATURE**  $22 \pm 2^\circ\text{C}$   
**REFERENCE PYRANOMETER** Kipp & Zonen PR 1 sn160001 active from 01 August 2018  
**CALIBRATION DATE** 09 December 2019

## Calibration procedure

The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 1 m above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam.

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## Justification of total instrument calibration uncertainty

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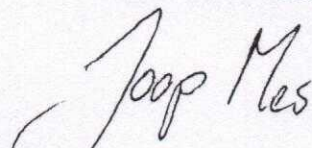
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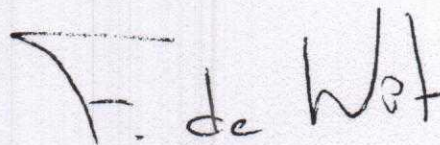
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Delft, The Netherlands, 09 December 2019



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