PRODUCT MANUAL

Sensor

AtmosVue 40

Visibility, Background Luminance, and Present Weather System

Revision: 01/2026

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RELIABLE MONITORING SINCE 1974

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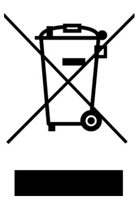
Please read first

About this manual

Please note that this manual was produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this. In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to Europe, Middle East, and Africa (EMEA) or Asia Pacific (APAC) users. Differences include the U.S. standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for EMEA or APAC use. Please note, however, *that when a power supply adapter is ordered from Campbell Scientific it will be suitable for use in your country*.

Reference to some radio transmitters, digital cell phones and aerials (antennas) may also not be applicable according to your locality. Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the EMEA or APAC market; in some cases alternatives are offered.

Recycling information for countries subject to WEEE regulations 2012/19/EU



At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility, per The Waste Electrical and Electronic Equipment (WEEE) Regulations 2012/19/EU. Campbell Scientific can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories. For further support, please contact Campbell Scientific, or your local agent.

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1. Introduction

The AtmosVue 40 combines the best of visibility, background luminance, and present weather monitoring in one package, leveraging the tried-and-true technology of Campbell Scientific products specific to the aviation industry. At the heart of this system is the CS125 Present Weather and Visibility Sensor, known for its exceptional performance and value. Its future-proof design allows for easy expansion, accommodating new sensors and systems without the need for a complete unit replacement, thereby reducing future costs.

Supporting the CS125 are the AtmosVue-BLM Background Luminance Sensor and AtmosVue-HV Digital Temperature and Relative Humidity Sensor components.

- The AtmosVue-BLM provides a high-quality background luminance measurement to allow better visibility measurements in low light conditions.
- The AtmosVue-HV enables precise atmospheric moisture inputs to the present weather algorithms, ensuring the highest accuracy of freezing and frozen hydrometeors, as well as dry lithometeors.

This specific sensor combination makes the AtmosVue 40 Aviation System a comprehensive yet cost-effective solution for your aviation weather monitoring needs, delivering accurate, real-time weather data you can trust to assist in timely airport operation decisions.

2. Cautionary statements

This manual provides important safety considerations for the installation, operation, and maintenance of the AtmosVue 40. These safety considerations are classified into three levels:

> WARNING:
> Warnings alert the installer or user to serious hazards. Ignoring these warnings could result in injury or death and/or irrevocable damage to the sensor unit.

> CAUTION:
> Cautions warn of potential hazards. Ignoring these cautions could result in the sensor being damaged and data being lost.

NOTE:
Notes highlight useful information in the installation, use and maintenance of this product. These should be followed carefully in order to gain the maximum benefit from the use of this product.

The system has been checked for safety before leaving the factory and contains no internally replaceable or modifiable parts.

WARNING:
Do not modify the AtmosVue40 because it can damage the unit and expose users to dangerous light levels and voltages.

WARNING:
Do not attempt to repair the unit without consulting Campbell Scientific.

CAUTION:
Ensure the correct voltage supply is provided to the sensor.

3. AtmosVue 40 components

The following components are included with the AtmosVue 40:

- AtmosVue 40 system (comprises of CS125, AtmosVue-BLM, AtmosVue-HV, and RAD06 radiation shield, plus all associated mounting hardware)
- AtmosVue 40 Power and Data Cable, 17 ft
- AtmosVue 40 Hood Heater Power Cable 17 ft
- AtmosVue40 Mast
- AtmosVue40 Plinth Adapter and mounting hardware
- AtmosVue 40 Toolkit

4. Overview

The AtmosVue 40 Aviation System is a robust, comprehensive solution for visibility and present weather monitoring, integrating several advanced components. It monitors aviation weather without any further infrastructure requirements, ensuring cost-effective, accurate, and timely weather data that meet the aviation industry's demanding requirements. The AtmosVue 40 Aviation System pairs seamlessly with ***Campbell Aero™*** Software to provide real-time, reliable, and precise weather information for air traffic controllers, meteorological observers, and maintenance personnel.

The AtmosVue 40 typically measures the following parameters:

- Visibility
- Present weather
- Background luminance
- Ambient air temperature
- Wet-bulb temperature
- Relative humidity

Optional measurements are possible.

Features

- Comprehensive and elegant aviation weather monitoring solution to save costs and infrastructure
- Integrated visibility, present weather, background luminance, ambient air temperature, wet-bulb temperature, and relative humidity in one package for superior performance and accuracy
- Advanced forward-scatter optical sensors for accuracy, reliability, and lower running costs
- Lengthy visibility range of 0 to 100 km (0 to 62 mi)
- Future-proof design for return on investment and expansion plans
- Outputs of up to three concurrent precipitation codes (METAR) and 57 SYNOP codes
- Additional service port for convenience and time-on-site reduction
- Direct input from the background luminance sensor to the present weather sensor without needing an additional data logger
- Optional heating for electronics housing located in heavy snowfall areas
- Reduced infrastructure costs and environmental footprint

4.1 Present weather sensor

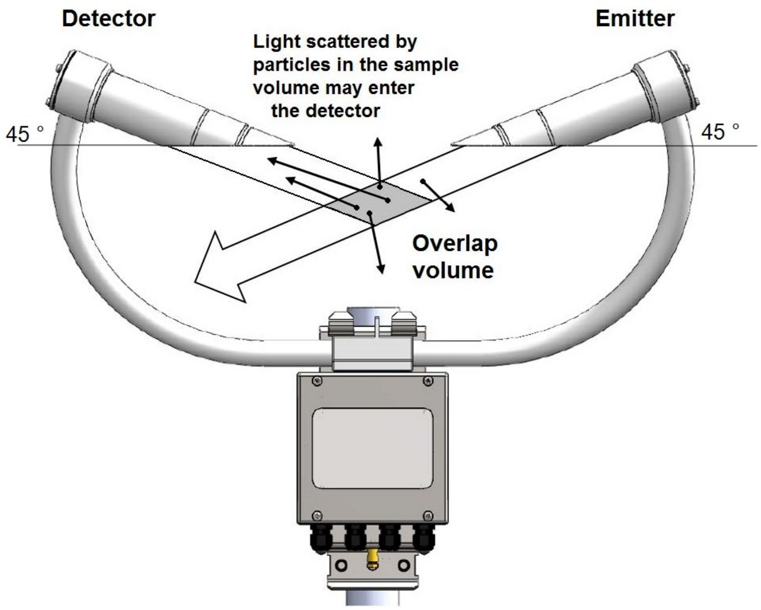


Figure 4-1. Particles in the sample volume scatter light in all directions, including into the detector

The present weather sensor consists of an emitter and detector aligned as in Figure 4-1 (p. 4). The emitter produces a beam of near infrared light pulsed at 1 kHz. A detector has a field of view that overlaps the beam. Light scattered by a particle (for example, a fog droplet or particle of precipitation) from the overlap or sample volume towards the detector is detected by a photodiode and recorded as a signal. The size of the signal is proportional to the extinction of the emitted beam caused by scattering. The scattering signal averaged over 1-second is used to calculate an extinction coefficient (EXCO), assuming the relationship between forward scatter and EXCO is linear. Sixty 1-second averages are then averaged to give a 1-minute average EXCO. This is then converted to a value of meteorological optical range (MOR) using Koschmieder law:

MOR = 3/EXCO, where MOR is in km and EXCO is in units of km^{-1}.

The calibration for visibility was derived by comparison with other high-grade, forward-scatter sensors and has been verified in a study by trained meteorological observers. This is called MOR calibration in this manual.

The present weather sensor is capable of identifying weather type in addition to measuring visibility. Weather type is identified through analysis of the amplitude and width of spikes in the avalanche photodiode (APD) signal, which corresponds to the particles of precipitation traversing the sample volume. The width of the spikes, which reflects the time taken for the particles to descend through the sample volume, serves as a proportional indicator of their fall speed (see Figure 4-2 [p. 5]).

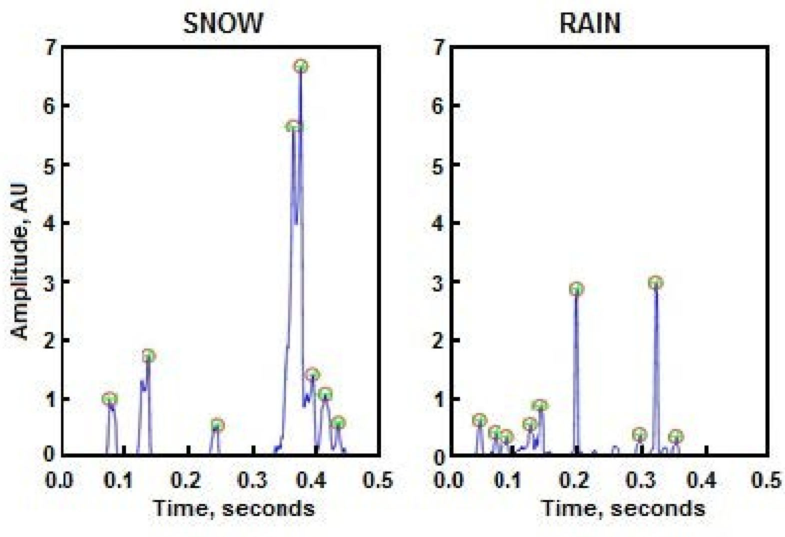


Figure 4-2. Signals from large, slow-falling snowflakes and smaller, faster raindrops

The AtmosVue 40 has a temperature sensor. Three parameters (fall speed, size, and temperature) are used to identify the particle type. If an additional external temperature and relative humidity probe is connected, then a wet-bulb temperature can be calculated. This provides additional information to more accurately distinguish between liquid and frozen particles, especially when the temperature in near 0 °C. Figure 4-3 (p. 5) shows how these temperatures are used to define possible precipitation types around 0 °C.

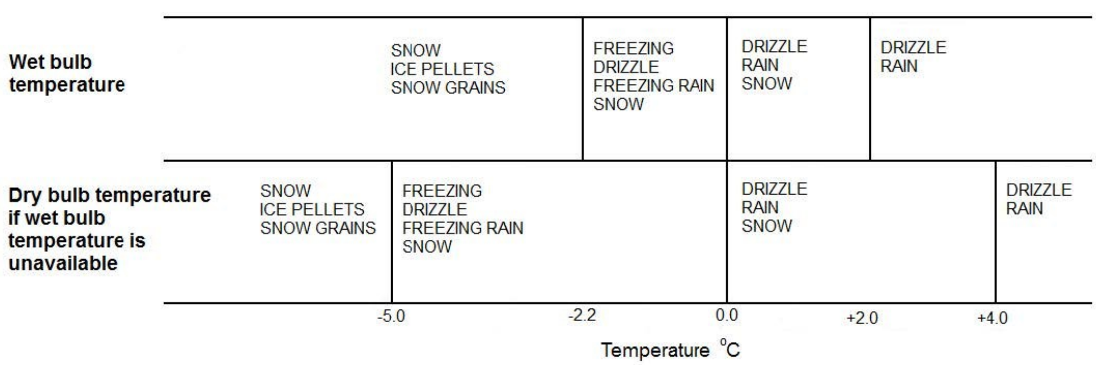


Figure 4-3. Possible precipitation types based on wet-bulb and dry-bulb temperatures

The processing algorithm then works with several maps, such as Figure 4-4 (p. 6), to identify each particle.

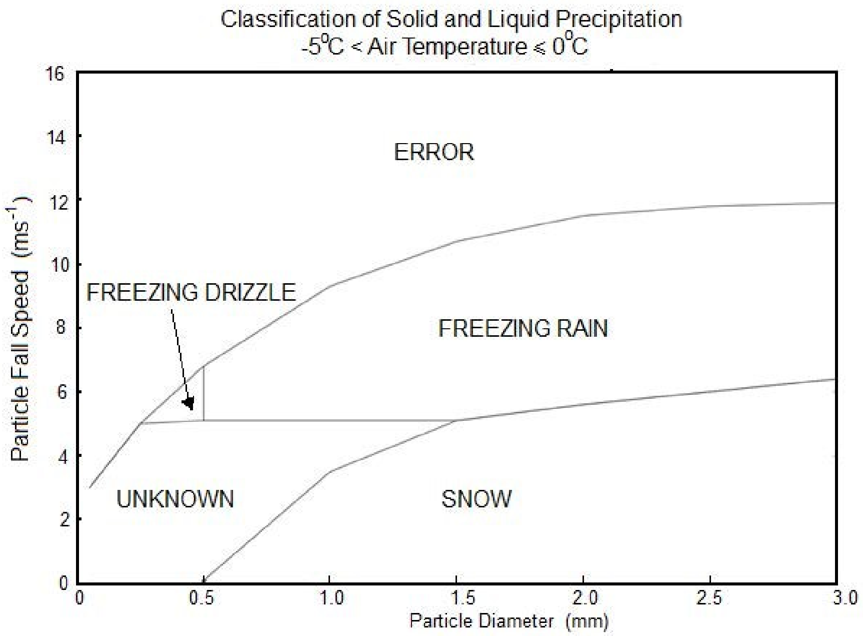


Figure 4-4. A typical size/speed map used by the AtmosVue 40 present weather algorithm

4.2 AtmosVue-BLM background luminance sensor

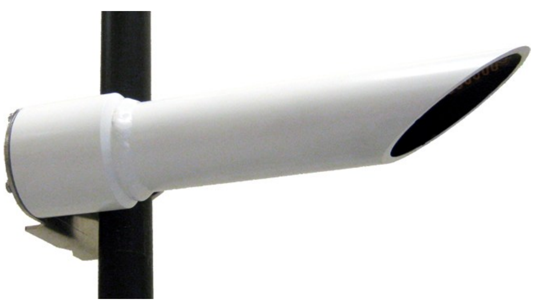


Figure 4-5. Background luminance sensor

The AtmosVue-BLM Background Luminance Sensor provides the luminance data required to assess the visibility range for lights, such as runway or warning lights. It accurately measures background luminance over a wide range from 0 cd/m^2 with a maximum of 45,000 cd/m^2. The sensor uses a photodiode with a spectral response close to the CIE human eye model and removes any unwanted wavelengths with a built-in band-pass filter.

The sensor features a fixed 6° field of view, as specified by the FAA. For easy installation, the background luminance sensor is mounted horizontally with the required 6° inclination built into the design. (Other angles are possible using the mounting bracket.)

A heated hood will prevent ice and snow build up, dew heaters will prevent condensation on the glass window, and a dirty window detection system will measure window contamination.

The sensor is undamaged when pointed directly at the sun, allowing complete flexibility in orientation. In addition, the sensor has a rugged IP66 rated environmental enclosure that protects it from the harshest conditions and allows the sensor to measure the atmosphere with high stability and repeatability.

4.3 AtmosVue-HV description

The AtmosVue-HV is a temperature and relative humidity sensor housed in a RAD06 6-plate radiation shield with a 1 m cable that connects to the AtmosVue 40. It completes the system by providing precise ambient air temperature, wet-bulb temperature, and relative humidity measurements. The AtmosVue-HV features a user-replaceable, individually calibrated chip element and a protective filter to minimize contaminants from dust, dirt, or pollutants while allowing sufficient air exchange. The wet-bulb temperature measurement is used as a superior detection threshold for freezing and frozen precipitation, while the relative humidity measurement is used per aviation guidelines for mist or haze thresholds that vary from region to region. Relative humidity measurements are also used to assist in dry lithometeor detection, such as smoke or dust storms, ensuring that better operational decisions can be made with confidence.

5. Specifications

5.1 Mechanical specifications

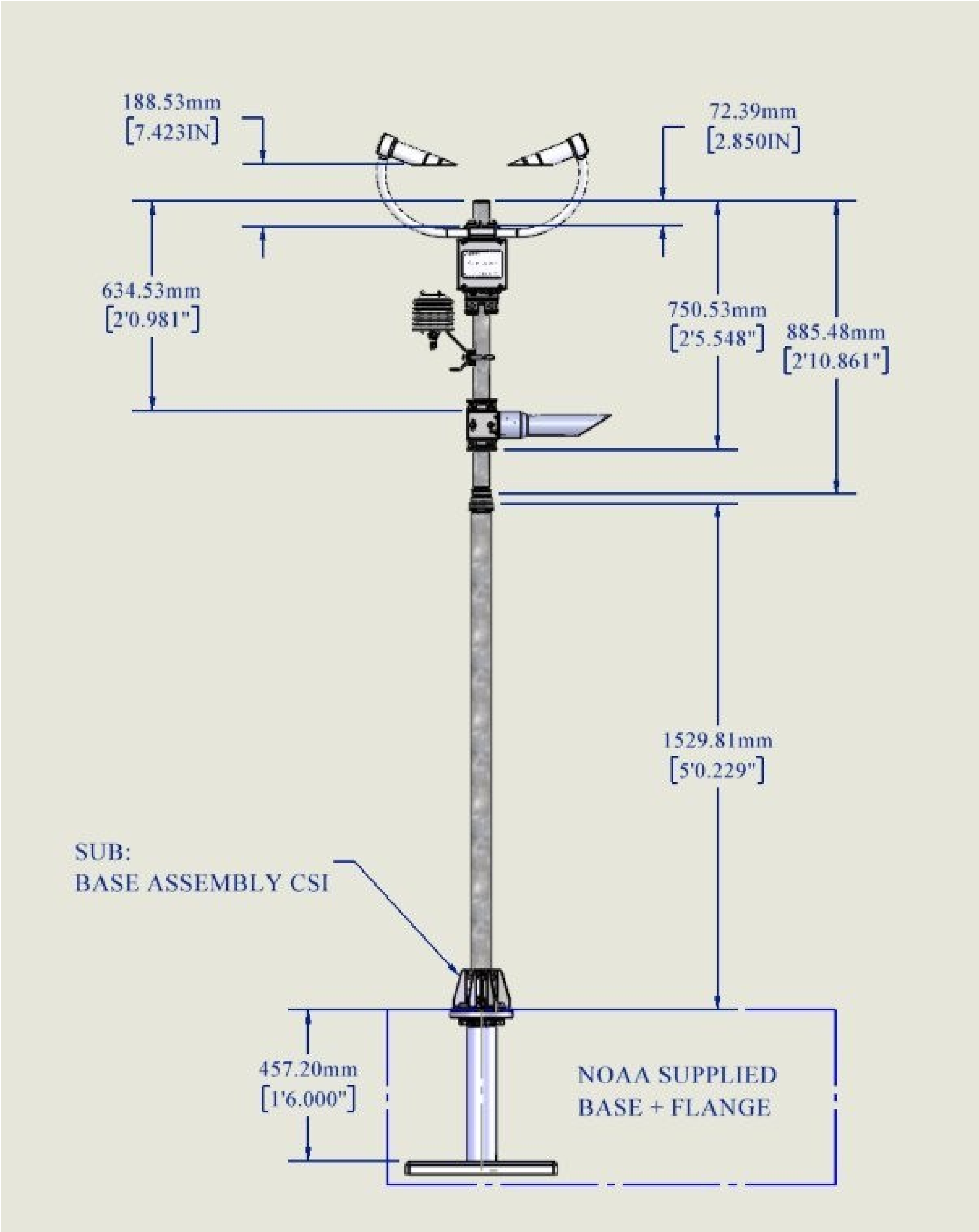


Figure 5-1. AtmosVue 40

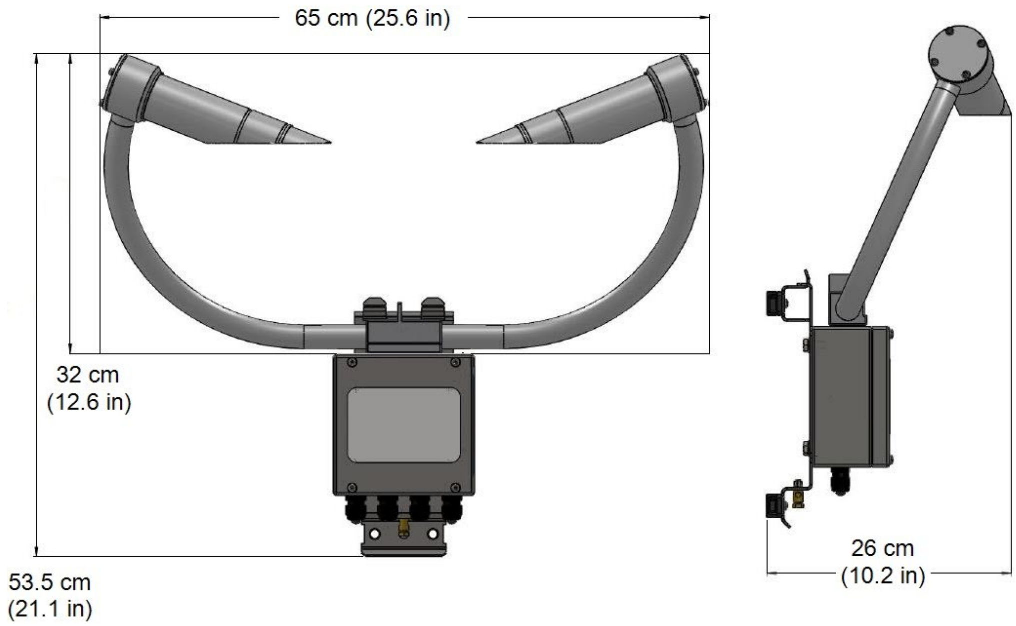


Figure 5-2. Present weather sensor dimensions

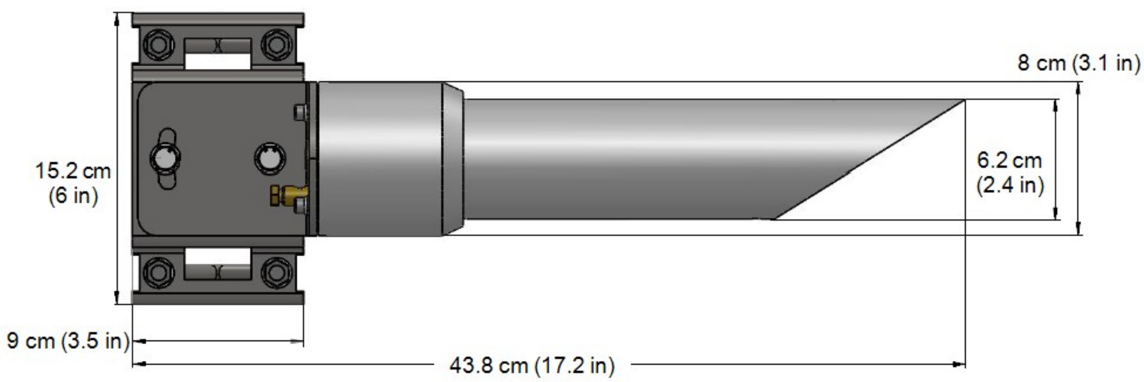


Figure 5-3. AtmosVue-BLM dimensions

Present weather sensor weight: 3 kg (6.6 lb)

AtmosVue-BLM weight: 2.4 kg (5.3 lb)

5.2 Environmental specifications

IP rating: IP66 / NEMA 4X

Sensor heater thresholds

Dew heater turn on: <35 °C

Dew heater turn off: >40 °C

Hood heater turn on:	<15 °C
Hood heater turn off:	>25 °C
Operating humidity range:	0 to 100%
Temperature range	
Operating:	–40 to 70 °C
Extended operating:	–50 to 70 °C
Storage:	–50 to 85 °C

NOTE:
Extended temperature ranges are only guaranteed if the sensor has been tested by Campbell Scientific and verified within this temperature range. Some degradation of absolute accuracy can be expected at the extremes of the extended ranges.

5.3 Communication specifications

NOTE:
The RS-232 communications interface will automatically turn itself off when not transmitting.

Supported formats:	RS-232 full duplex only (default) RS-485 half duplex Choice of 8 bit, no parity or 7 bit, even parity 1 stop bit Parity checking is not supported as most communication protocols used by the AtmosVue 40 have built in checksums, as well as checks that communications have been understood.
Serial setting:	8N1
Supported data rates:	1200 bps, 2400 bps, 9600 bps, 19200 bps, 38400 bps (default), 57600 bps, 115200 bps
Serial setting:	8N1
RS-232 communications	
RS-232 input threshold, low:	0.8 V (minimum), 1.5 V (nominal)
RS-232 input threshold, high:	2.0 V (nominal), 2.4 V (maximum)

RS-232 input absolute maximum: ±15 V

RS-232 input resistance: 12 kohm

RS-232 output voltage: 0.4 to 4.4 V

RS-485 communications

RS-485 input threshold voltage: ±0.2 V

RS-485 output (unloaded): 5 V

RS-485 output (load 5 ohm): 2 V

Maximum voltage at any terminal: ±7 V; the sensor ground and any RS-485 equipment ground cannot be further apart than this voltage. The sensor ground (pin 1) on connector B can be connected to the ground of the host equipment to reduce parasitic currents.

5.4 Measurement specifications

Visibility

Maximum reported visibility: 100 km (62.1 miles)

Minimum reported visibility: 5 m (16.4 ft)

Measurement resolution: 1 m (3.3 ft) over entire range

Accuracy calibration: ±2% against factory calibration disk

Accuracy: ±8% at < 600 m (< 1968.5 ft)
±10% at < 10,000 m (< 32,808.4 ft)
±15% at < 15,000 m (< 49,212.6 ft)
±20% at < 100,000 m (< 328,084 ft)

Precipitation and water equivalent

Reported accumulation range: 0 to 999.9 mm (0 to 39.4 in)

Accumulation accuracy: ±15% (against factory calibration standards in the laboratory for liquid precipitation)

Accumulation resolution: 0.1 mm

Reported intensity range: 0 to 999.9 mm/hr (0 to 39.4 in/hr); maximum intensity reported depends on precipitation mixture

Background luminance

Measurement range:	0 to 45,000 cd/m^2
Accuracy:	±0.2 cd/m^2 < 2 cd/m^2; ±10% > 2 cd/m^2
Resolution:	0.1 cd/m^2
Field of view:	6°
Spectral response:	CIE 1931

5.5 Electrical specifications

Electronics supply voltage:	7 to 30 VDC, 12 VDC nominal

CAUTION:
If a AtmosVue-HV probe is used, the supply voltage must not exceed 28 VDC.

Hood heater supply	
Supply voltage (DC or AC):	24 V nominal, 30 V maximum
Power:	2 x 30 W (total of 60 W)
Dew heater power:	2 x 0.6 W (total of 1.2 W)
Current drain at 12 VDC	
Continuous sampling with dew heaters ON and RS-232 communications active:	200 to 248 mA
Continuous sampling with dew heaters disabled:	110 to 151 mA
No sampling with dew heaters disabled:	21 to 30 mA
User alarm outputs	
High level:	3.8 V (85 °C), 4.13 V (25 °C)
Low level:	0.25 to 0.55 V
Accumulation resolution:	0.1 mm
Current:	32 mA

NOTE:

1. Ensure the hood heater override is set to off when the hood heaters are not used.
2. Campbell Scientific recommends the hood heaters are powered with 24 VAC/DC. While the heaters may run at voltages below 24 V, they will generate proportionally less heat, therefore reducing their ability to prevent ice build-up.

5.6 Present weather sensor optical

LED center wavelength: 850 nm

LED spectral bandwidth: ±35 nm

Light pulse rate: 1 kHz

6. Installation

6.1 Recommended tools

The following installation tools are recommended:

- 10 mm open spanner/wrench (for grounding boss; must be open ended)
- 13 mm spanner/wrench
- 19 mm open spanner/wrench (for cable glands; must be open ended)
- 2 mm flat screwdriver
- Number 2 cross-head screwdriver

6.2 Location and orientation

The sensor measures environmental variables and is designed to be located in harsh weather conditions. However, a few considerations should be taken into account if accurate and representative data from a site is to be obtained.

> **NOTE:**
> The descriptions in this section are not exhaustive. Refer to meteorological publications for further information on locating weather instruments.

The sensor should be sited in a position representative of local weather conditions, and not of a specific microclimate, unless the analysis of microclimate weather is being sought.

The sensor has good resistance to background light, but Campbell Scientific recommends avoiding locations where the transmitter points at a light scattering or reflecting surface. Ideally, the receiver should point north in the northern hemisphere or south in the southern hemisphere. The higher priority is making sure the receiver avoids pointing towards possible sources of reflected light in its field of view, such as nearby sensors or enclosures mounted below it on a mast. Where those objects cannot be moved, pointing the sensor away from north/south is acceptable. Failure to do this can result in a DC light saturation error when there is bright sunlight.

Figure 6-1. Top view of sensor oriented for the northern hemisphere

To give non-microclimatic measurements, the sensor should be sited away from possible physical obstructions that could affect the fall of precipitation. The sensor should also be positioned away from sources of heat, electrical interference, and direct light that could shine on the sensor lenses. Whenever possible, the sensor should be located away from windbreaks.

Several zones have been identified upwind and downwind of a windbreak in which the airflow is unrepresentative of the general speed and direction. Eddies are generated in the lee of the windbreak, and air is displaced upwind of it. The height and depth of these affected zones varies with the height, and to some extent, the density of the obstacle.

Generally, a structure disturbs the airflow in an upwind direction for a distance of about twice the height of the structure, and in a downwind direction for a distance of about six times the height. The airflow is also affected to a vertical distance of about twice the height of the structure. Therefore, the sensor should be located outside this zone of influence to obtain representative values for the region.

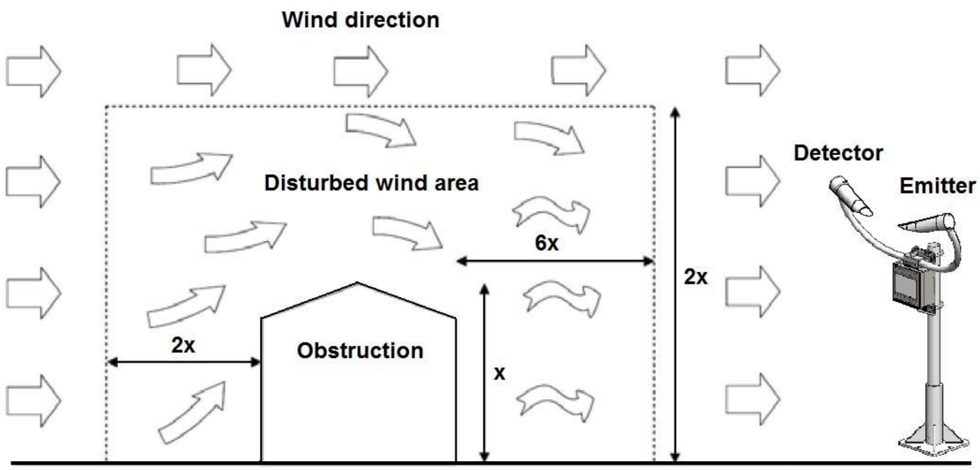


Figure 6-2. Airflow

To reduce the frequency of service requirements, place the sensor away from contamination sources; for roadside monitoring, larger mounting poles can be used. More frequent maintenance will be required when the instrument is in areas where contamination is unavoidable or where measurements may be safety critical.

The World Meteorological Organization (WMO) recommends a sample volume height of 1.5 m; however, for applications such as aviation or road visibility, other heights may be appropriate.

> NOTE:
> If operating indoors, sources of light and/or reflections will likely create false readings and erratic results.

> NOTE:
> While performing simple checks, blocking a lens or the sample volume will simulate an increase in visibility, not a decrease.

6.3 Equipment grounding

The sensor must be properly grounded. It is sufficient to ground the mounting bracket if the sensor is connected to a grounded metal mast and is in electrical contact with it. Otherwise, the mounting bracket should be earthed with the supplied ground lug (see Figure 6-3 [p. 17]).

A ground wire with a minimum cross section of 6 mm^2 and maximum length of 5 m should be used. The pole and foundations of a pole-mounted installation will provide some basic lightning protection and reduce radio frequency interference when correctly grounded.

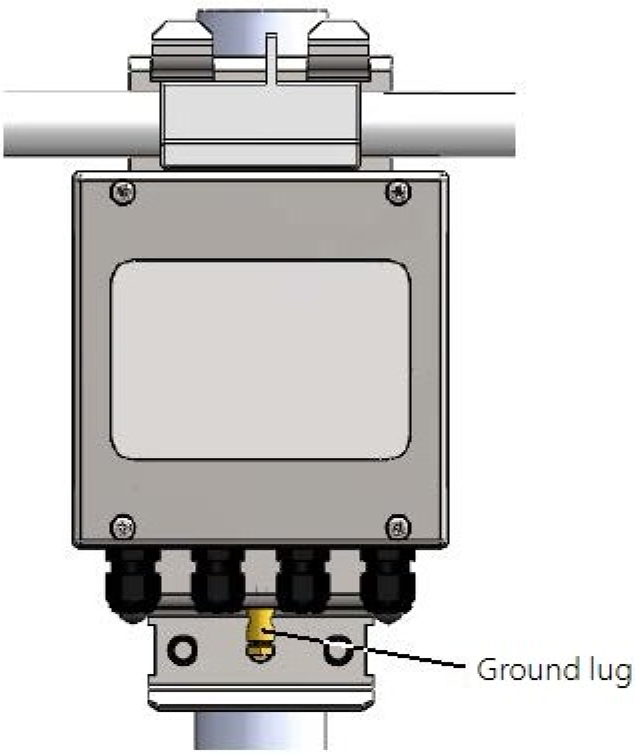


Figure 6-3. Ground lug

6.4 Connectors

The following is the connector panel for the AtmosVue 40.

Figure 6-4. Connector panel

The sensor is equipped with five IP66-rated connectors for power, communication, and auxiliary functions. Please note that the IP66 rating is only maintained when a connector is properly mated with either a cable or a protective cap.

- The first connector provides the main power and serial communications, supplying 9 to 30 VDC to the internal electronics. A 5-meter cable is supplied for this connection.
- The second connector supplies 24 V power to the hood heaters and is also fitted with a 5-meter cable.
- The third connector is used for the AtmosVue-HV temperature and humidity probe.
- The fourth connector delivers 24 V power to the AtmosVue-BLM Background Luminance Meter.
- The fifth connector provides serial communication and 12 V power to the AtmosVue-BLM.

CAUTION:
To prevent damage to the noise filters on the hood heater inputs, ensure correct wiring: if the heater uses AC voltage, connect the neutral wire (if present) to the black 0V cable and the live wire to the red cable. The black 0V connection must remain within 5 V of the main electronics ground or any other 0 V reference in the system to maintain proper grounding and avoid potential damage.

NOTE:
To use these connections, you may either use the supplied cables or fabricate your own using the guidelines provided in this manual. If you plan to build custom cables, we recommend contacting Campbell Scientific for assistance in selecting the appropriate cable type to ensure compatibility and optimal performance.

NOTE:
Campbell Scientific recommends using 24 AWG (0.205 mm^2) or larger cables for communications and 12V power lines, and 16 AWG (1.31 mm^2) or larger for 24V hood heater cables. These guidelines are designed to ensure reliable voltage levels at the equipment under all operating conditions for cable lengths up to 20 meters.

For installations exceeding 20 meters, it is essential to perform voltage drop calculations to ensure proper system performance and to avoid under-voltage issues.

Table 6-1: Connector 1 – Main communications and 12 V power (M12 Male A coded 8 way connector)			
Pin	Function	Color[1]	Notes
1	RX	White	
2	-	Brown	
3	0V comms	Green	100 Ohm resistor to 0V
4	-	Yellow	
5	12V	Gray	Main 12 V power input[2]
6	-	Pink	
7	TX	Blue	
8	0V	Red	Main 0V power[2]

[1]Using industrial standard cables

[2] Please be aware that this design uses a wire color scheme that differs from typical conventions: the **12V positive supply is Grey**, and the **0V (negative) supply is Red**. This choice is the result of standard cable availability constraints and has been fully considered in the system's design. Always refer to the pinout table above to ensure correct wiring. The sensor includes **reverse polarity protection**, so no damage will occur if the power connections are accidentally reversed.

Table 6-2: Connector 2—Main 24V hood heater power input (RD24 Male Connector [3 way + earth])			
Pin	Function	Color	Notes
1	-	-	Not connected
2	24V	Red	24V power input (16 AWG recommended)
3	0V	Black	Power return (16 AWG recommended)
4	Screen	-	Shield/earth connection

Table 6-3: Connector 3—SDI-12 temperature and humidity probe connector (M12 Female A coded 8 way connector)			
Pin	Function	Internal Color[1]	Notes
1		White	
2		Brown	
3		Green	
4		Yellow	
5	12V	Grey	This is a 12V power output
6	SDI-12 comms	Pink	
7		Blue	
8	0V	Red	This is the main 0V
[1]Using industrial standard cables			

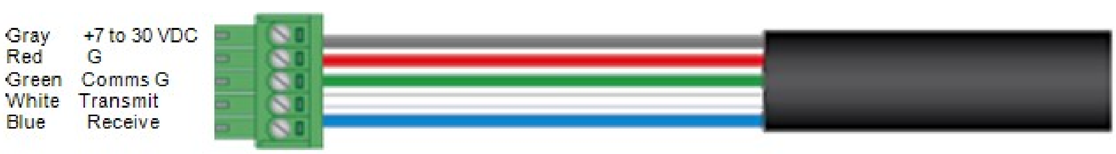
Table 6-4: Connector 4—AtmosVue Background Luminance Meter (BLM) 24V hood heater power output (RD24 Female Connector [3 way + earth])			
Pin	Function	Color	Notes
1	-	-	Not connected
2	24V	Red	24V output
3	0V	Black	
4	Screen	-	

Table 6-5: Connector 5—AtmosVue Background Luminance Meter (BLM) main communications and 12V output (M12 Female A coded 8 way connector)

Pin	Function	Internal Color[1]	Notes
1	RX	White	
2		Brown	
3	0V comms	Green	
4		Yellow	
5	12V	Grey	This is a 12V power to the BLM
6		Pink	
7	TX	Blue	
8	0V	Red	This is the main 0V

[1]Using industrial standard cables

6.5 Main cable



6.6 AtmosVue-HV T/RH sensor installation

The AtmosVue 40 has a temperature sensor mounted in the crossarm that is used in determining precipitation type.

An AtmosVue-HV T/RH sensor can be connected to a an AtmosVue 40 to allow the AtmosVue 40 to better identify different precipitation types, like distinguishing between mist and haze. The T/RH sensor improves the precipitation identification at temperatures near freezing and its use is highly recommended in regions where temperatures close to 0 °C are common. The T/RH sensor also allows relative humidity information to be included in data messages.

The T/RH sensor is mounted in a RAD6 6-plate radiation shield. The sensor cable has a connector that attaches to directly to the AtmosVue 40 connector panel (Connectors [p. 17]).

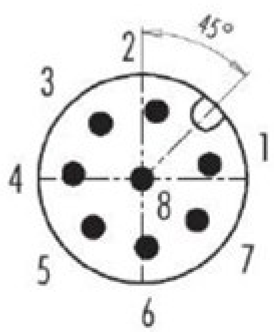
If a AtmosVue-HV is connected to the AtmosVue 40, the temperature used for assessment of precipitation type and included in data messages will come from the AtmosVue-HV instead of the temperature sensor.

WMO – No. 8, 2.1.4.1 recommends temperature measurement at a height of between 1.2 and 2.0 m above ground.

The AtmosVue-HV air temperature and relative humidity sensor connects to the **HV** connector. This connector has the following pin-out.

Table 6-6: HV cable pin-out

Pin	Wire color	Description
5	Gray	12 VDC
6	Pink	SDI-12
8	Red	G



6.7 Internal switches

The sensor is equipped with four switches located within the main enclosure. These switches perform certain functions when the sensor is turned on; their functions are described in Figure 6-5 (p. 23) and Table 6-7 (p. 23).

> **NOTE:**
> The switches are only read during the sequence to turn on the sensor. This means if the switches are pressed while the sensor is running, nothing will happen. The sensor will need to be power cycled, leaving the sensor off for at least 10 seconds for any of their functions to be performed.

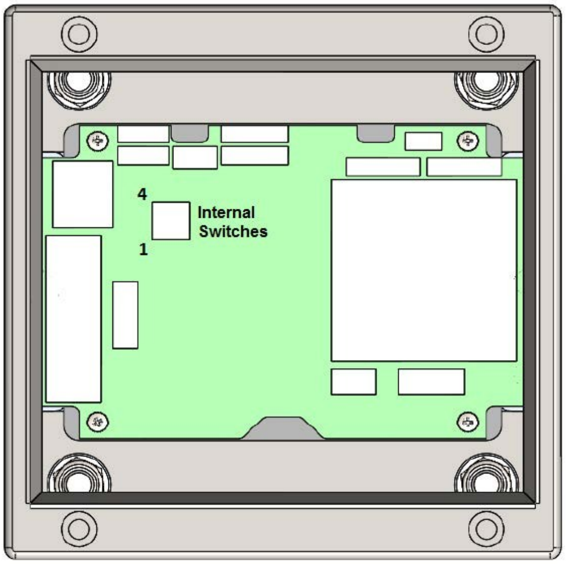


Figure 6-5. Internal switches

Table 6-7: Internal switch functions	
Switch number	**Function**
4	When using the AtmosVue 40, this switch must be set to **OFF**.
3	When **ON** and sensor is power cycled, this switch temporarily sets the sensor communications port to a default RS-232 communications, state at 38400 bps. This is useful during field tests or maintenance when the sensor has been remotely configured for RS-485 mode or a baud rate the computer does not support. This change is temporary and will not be stored to flash. However, if the menu system is accessed and a **Save and exit** command is performed, the new data rate setting will be committed to flash. Once the switch is **OFF** and the sensor is power cycled, the sensor will return to its previous communications settings.
2	*Reserved for future use, set to **OFF**.*
1	When **ON**, this switch will reset the sensor to its factory default values, affecting all communication settings. This will take immediate effect when the sensor is turned on. **NOTE:** To use this, the power supply must be stable. Do not leave this switch permanently **ON**.

NOTE:
If the lid is removed, do not overtighten the screws when it is replaced. A small gap should remain between the lid and box.

7. Operation

7.1 Messages

The default message format is message 14 (RVR Output). The following list shows the other options available.

```
- Basic = 0
- Partial = 1
- Full = 2
- Basic SYNOP = 3
- Partial SYNOP = 4
- Full SYNOP = 5
- Basic METAR = 6
- Partial METAR = 7
- Full METAR = 8
- Generic Basic SYNOP = 9
- Generic Partial SYNOP = 10
- Generic Full SYNOP = 11
- Custom output = 12
- Vaisala FD12 = 13
- RVR Output = 14

->
```

The message fields are space delimited with a unique start and end character allowing easy storage into any data logger. The messages have the following format.

Table 7-1: Message output structure

STX	Message fields	ETX	Carriage return	Line feed
0x02	Fields are described in Table 7-2 (p. 25)	0x03	0x0D	0x0A

NOTE:
STX and ETX are hexadecimal command characters.

7.1.1 Field descriptions for output messages

The following is an example of the AtmosVue 40 output. Refer to Table 7-2 (p. 25) for details about the fields.

Example message:

```
14 0 0 4 2192 M 1 1.66 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0.00 0.00 0 4 HZ 24.5 33 BLM 25.7 0 0 1 5DAD
```

Table 7-2: Campbell Scientific output message field descriptions

Field	Example value	Range	Description
Message ID	14	1 to 14	Choose 14 for the AtmosVue 40. The other options are used for stand-alone CS120A/CS125 present weather sensors.
Sensor ID	0	0 to 9	Unit number defined by the user to identify data; default is 0. Useful for RS-485 networks. Operates as an address in RS-485 mode.
System status	0	0 to 3	0. No fault 1. Possible degraded performance 2. Degraded performance 3. Maintenance required
Continuous interval	4	0 to 36000	The amount of time, in seconds, between outputs in continuous mode.
Visibility value	2192	5 to 100000 m	Current visibility distance being detected by the sensor.
Visibility units	M	M or F	M. meters F. feet
MOR format	1	0 or 1	0. MOR 1. TMOR
EXCO	1.66		Extinction coefficient (EXCO). Refer to Present weather sensor (p. 4) for more information.

Table 7-2: Campbell Scientific output message field descriptions			
Field	**Example value**	**Range**	**Description**
Averaging period[1]	1	1 or 10	1. One-minute average 10. Ten-minute average
System alarms (p. 27)	0 0 0 0 0 0 0 0 0 0 0 0	Outputs 12 error code values.	
Particle count	0.00	0 to 7200; or –99	Number of particles per minute; –99 indicates a sensor error or the sensor has been powered less than one minute.
Intensity	0.00	0 to 999.99 mm/hr; or –99	Rainfall intensity (mm/hr) provides one precision value of the last minute. A value of –99 indicates a sensor error or the sensor has been powered less than one minute.
SYNOP code	4	See Table C-1 (p. 50).	
METAR code	HZ	See Table C-2 (p. 53).	
Temperature	24.5	–40.0 to +80.0 °	External temperature in degrees Celsius.
Relative humidity	33	0 or 100%; or –99	Only outputs a valid external relative humidity (%RH) value if a AtmosVue-HV temperature and relative humidity sensor is connected. The sensor will output –99 if a AtmosVue-HV is not connected. The sensor will also output –99 if there is a fault.
BLM	BLM	BLM literal text.	
AtmosVue-BLM luminosity	25.7	1 to 50000	Current luminance being detected by the sensor. The maximum luminance level reported by the sensor can be defined by the user via the menu system.

Table 7-2: Campbell Scientific output message field descriptions			
Field	**Example value**	**Range**	**Description**
AtmosVue-BLM status	0	0 to 3	0. No fault 1. Possible degraded performance 2. Degraded performance 3. Maintenance required
AtmosVue-BLM day/night	0	0 or 1	1. Day 0. Night
AtmosVue-BLM units	1	1 or 2	1. cd/m^2 2. fL
Checksum	5DAD	Refer to Example of calculating a CCITT CRC using C program language (p. 49) for the checksum algorithm.	

[1]In accordance with WMO requirements, the sensor produces visibility measurements, that are either one-minute or ten-minute rolling averages, that are updated at the chosen output interval or when the sensor is polled. Those averages are not direct averages of MOR measurements but are averages of the extinction coefficient (EXCO), and that average is then used to calculate the MOR for that period. As the relationship between the extinction coefficient and MOR is not linear, it is possible to see quite rapid changes in MOR that might not be expected if the result was a rolling average of MOR. Take this into consideration, especially when testing the sensor with artificial obscurants or using the calibration disk.

7.1.2 System alarms

Full format options report system error alarms (Table 7-3 [p. 28]). Most errors are checked every 10 seconds, then the message output is updated. The following errors are checked at a different rate:

- Signature error—checked and reset at power up.
- Flash read and write errors—checked when flash memory is updated (for example, when changes are made through the memory structure). These errors are also reset on power up.
- Particle limit—checked every minute and reset when read.

Table 7-3: System alarms and descriptions		
Alarm	**Range**	**Description**
Emitter failure (emitter hoods main LED output power level)	0 to 2	0. Everything is within normal parameters 1. Light output level too low 2. Light output level too high
Emitter lens dirty[1]	0 to 3	0. OK; the reported attenuation is below 10% 1. Reported window signal value out of range (>30%); possible sensor fault or blocked hood 2. Slight dirt build up (10% signal attenuation or higher) 3. High level of dirt build up (>20%)
Emitter temperature	0 to 3	0. Temperature within operating conditions 1. Too low, less than –40 °C 2. Too high, over 80 °C 3. No sensor detected or below –54 °C
Detector lens dirty[1]	0 to 3	0. OK; the reported attenuation is below 10% 1. Reported window signal value out of range (>30%); possible sensor fault or blocked hood 2. Slight dirt build up (10% signal attenuation or higher) 3. High level of dirt build up (>20%)
Detector temperature	0 to 3	0. Temperature within operating conditions 1. Too low, less than –40 °C 2. Too high, over 80 °C 3. No sensor detected or below –54 °C
Detector DC saturation level (amount of background light seen by the detector hood)[1]	0 or 1	0. Within limits 1. Saturated; the sensor may not be able to perform visibility readings in some circumstances, possibly due to high level of reflections into the detector.

Table 7-3: System alarms and descriptions		
Alarm	**Range**	**Description**
Hood temperature	0 to 3	0. Temperature within operating conditions 1. Too low, less than –40 °C 2. Too high, over 80 °C 3. No sensor detected or below –54 °C
External temperature	0 to 3	0. Temperature within operating conditions 1. Too low, less than –40 °C 2. Too high, over 80 °C 3. No sensor detected or below –54 °C
Signature error	0 to 4	0. No fault 1. OS signature error at power up 2. User memory signature did not match when last reading 3. User memory fault at power up; secondary copy was reinstated to correct error. 4. User memory fault at power up; no secondary copy was found to reinstate. Factory defaults have been reinstated. System will need re-calibrating.
Flash read error	0 or 1	0. No errors 1. One or more errors reading user variables from flash occurred
Flash write error	0 or 1	0. No errors 1. One or more errors writing user variables to flash occurred
Particle limit	0 or 1	0. No errors 1. More particles detected than can be processed
[1]With operating system 14 onwards, to avoid short term appearance of alarms caused by transient events (such as insects or raindrops on the lens) the condition that triggers an increase in alarm level must persist for 15 minutes before the alarm is set.		

7.2 Interface methods

The sensor can be set up and controlled in one of three ways.

1. The first method is by using Campbell Scientific ***Device Configuration Utility*** software, which is available as a download on www.campbellsci.com. It is included in installations of ***LoggerNet***, ***RTDAQ***, and ***PC400***. This software allows an easy menu driven interface for configuring the sensor on any Microsoft™ based personal computer. All settings can be accessed using this program. The program includes online help instructions that describe its general use with the sensor and also how to load an operating system. The ***Device Configuration Utility*** can also be used as a terminal emulator to use the built-in menu system of the sensor and to access its calibration menu.
2. The second method is by using the command line interface where discrete commands are sent without response from the sensor. This would be the preferred method of setting up a sensor if it was connected to a data logger, for instance. The configuration setting commands can be sent using a data logger to the sensor, removing the need for a local computer to set up the unit.
3. The third method is to use Campbell Aero.

All three of these methods use the sensor serial connector B to communicate with the sensor. Connector B is the CS140 cable connected to the sensor's BLM COMMS/SERVICE port. To communicate with the sensor using the Service port, the CS140 (Connector B) cable must be disconnected from the BLM COMMS/SERVICE port. The AtmosVue40-to-RS-232 cable should then be connected between the BLM COMMS/SERVICE port and a laptop.

7.2.1 Configuring computer

This section describes setting up communications using a terminal emulator program. The terminal emulators built into many Campbell Scientific software products, such as ***LoggerNet***, can also be used.

The following settings should then be used by default:

Bits per second: 38400

Data bits: 8

Parity: none

Stop bits: 1 Flow control: none

NOTE:
After adjusting the baud rate of the unit, use the terminal emulator to adjust the bits per second value in the port settings. The AtmosVue 40 can not communicate with the computer if the unit and port setting baud rates differ.

The AtmosVue 40 should now be ready to accept commands.

7.2.2 Command line mode

The command line interface includes three major commands: `GET`, `SET`, and `POLL`.

1. `GET` is used to request all current user settable values from the AtmosVue 40.
2. `SET` specifies user settable values.
3. `POLL` requests the current visibility and/or alarm conditions from the sensor.

The AtmosVue 40 can be configured to expect any commands sent to it to include a valid checksum. For simple commands, such as `GET` and `POLL`, fixed value checksums can be used. For more complex `SET` commands, the checksum needs to be calculated. The use of the checksum is disabled by default. Campbell Scientific recommends enabling the checksum functionality, especially when long cable runs are used or in electronically noisy environments. Example of calculating a CCITT CRC using C program language (p. 49) provides example code for programmers implementing their own code. For Campbell Scientific data logger users, downloadable example programs are available at:

www.campbellsci.com/downloads/cs125-example-programs

7.2.2.1 GET command

The `GET` command retrieves settings data from the AtmosVue 40, including message format data and user alarm settings. This command does not retrieve visibility or environmental information from the AtmosVue 40. To retrieve visibility data, refer to the `POLL` command.

Example of a `GET` request:

```
GET : 0 : 0 : 2C67 :
```

Table 7-4: GET command transmitted data

Example	Description
0x02[1]	STX^B[2]
GET	GET command

Table 7-4: GET command transmitted data	
Example	**Description**
:	Delimiting character
0	Address based on sensor ID
:	Delimiting character
0	Reserved for future use; zero default
:	Delimiting character
2C67	Checksum
:	Delimiting character
0x03[1]	ETX^C[2]
0x0D[1]	Carriage return
[1] These values are shown in hexadecimal format, not ASCII.	

Example data returned by the **GET** command:

```
GET : 0 : 0 : 2C67 :
0 1 1 1000 1 0 15000 2 32000 M 60 1 2 0 1 1 0 0 0 1 7.0 80 0 CC8D
```

Table 7-5: GET command returned data	
Example	**Description**
0x02[1]	STX
0	Sensor ID
1	User alarm 1 set (1 = set)
1	User alarm 1 active (1 = active)
1000	User alarm 1 distance
1	User alarm 2 set (1 = set)
0	User alarm 2 active (0 = not active)
15000	User alarm 2 distance
2	Serial baud rate (2 = 38400 bps)
32000	Sensor serial number (read only)
M	Visibility units (M = meters)

Table 7-5: GET command returned data	
Example	Description
60	Continuous mode output interval (60 s)
1	Polling or continuous modes (1 =polling mode)
2	Message format, Basic/Partial/Full (2 = Full)
0	RS-232 or RS-485 serial communications enabled (0 = RS-232)
1	Averaging period (1 minute)
1	Sample timing (1 sample per second)
0	Dew heater override (0 =sensor automatically controls the dew heaters)
0	Hood heater override (0 =sensor automatically controls the hood heaters)
0	Dirty window compensation (0 = dirty window compensation turned off)
1	CRC checking on received commands (1 = CRC-16 checking enabled)
7.0	Sensor power down voltage
80	Relative humidity threshold
0	Data format and parity (0 = 8 bit, no parity)
CC8D	Checksum
0x04[1]	EOX
0x0D[1]	Carriage return
0x0A	Line feed
[1] These values are shown in hexadecimal format, not ASCII.	

7.2.2.2 SET command

The SET command is used to configure the AtmosVue 40 using the command line. The SET command is a single space delimited string that can be sent from any data logger or computer equipped with an RS-232 or RS-485 port. The SET command accesses identical settings within the AtmosVue 40 and ***Device Configuration Utility***. This command is used to change the default power up state of the sensor. The Set command is echoed back.

Example of a SET command:

```
SET:0:0 1 1 1000 1 0 15000 2 0 M 60 1 2 0 1 1 0 0 0 1 7 70 0 :8AB9:
```

Table 7-6: SET transmitted	
Example	**Description**
0x02[1]	STX^ B[2]
SET	Set command
:	Delimiting character
0	Current sensor ID
:	Delimiting character
0	Sensor ID (may be a new ID)
1	User alarm 1 set (1 = set)
1	User alarm 1 active (1 = active)
1000	User alarm 1 distance
1	User alarm 2 set (1 = set)
0	User alarm 2 active (0 = not active)
15000	User alarm 2 distance
2	Serial baud rate (2 = 38400 bps)
0	Sensor serial number (read only)
M	Visibility units (M=meters)
60	Continuous mode output interval (60 s)
1	Polling or continuous modes (1 = polling mode)
2	Message format, Basic/Partial/Full (2 = Full)
0	RS-232 or RS-485 serial communications enabled (0 = RS-232)
1	Averaging period (1 minute)
1	Sample timing (1 sample per second)
0	Dew heater override (0 =sensor automatically controls the dew heaters)
0	Hood heater override (0 =sensor automatically controls the hood heaters)
0	Dirty window compensation (0 = dirty window compensation turned off
1	CRC checking on received commands (1 = CRC-16 checking enabled)

Table 7-6: SET transmitted	
Example	**Description**
7	Sensor power down voltage
70	Relative humidity threshold[3]
0	Data format and parity (0 = 8 bit, no parity)
:	Delimiting character
8AB9	Checksum (use the valid CCITT checksum)
:	Delimiting character
0x03[1]	ETX ^ C[2]
0x0D[1]	Carriage return
0x0A	Line feed
[1]These values are shown in hexadecimal format, not ASCII.	
[2]As entered on a keypad.	

7.2.2.3 POLL command

The `POLL` command requests the current visibility and/or alarm conditions from the AtmosVue 40. The output format of this command depends on how the AtmosVue 40 is configured using the `SET` command or the menu interfaces.

Example of a `POLL` request:

```
POLL : 0 : 0 : 3 A3B:
```

Table 7-7: POLL transmitted data	
Example	**Description**
0x02[1]	STX ^B[2]
POLL	POLL command
:	Delimiting character
0	Address based on sensor ID
:	Delimiting character
0	Reserved for future use; zero default
:	Delimiting character

Table 7-7: POLL transmitted data	
Example	**Description**
3A3B	Checksum[2]
:	Delimiting character
0x03[1]	ETX ^C[2]
0x0D[1]	Carriage return
0x0A	Line feed

[1] These values are shown in hexadecimal format, not ASCII.

[2] As entered on a keypad.

[3]Not case sensitive.

If the setting to check the checksum on received command is enabled, checksum varies with the **Sensor ID** value. The following table gives the POLL command for different sensor IDs with the correct checksum.

Table 7-8: POLL commands for different sensor IDs

ID	POLL command with checksum
0	POLL:0:0:3A3B:
1	POLL:1:0:0D0B:
2	POLL:2:0:545B:
3	POLL:3:0:636B:
4	POLL:4:0:E6FB:
5	POLL:5:0:D1CB:
6	POLL:6:0:889B:
7	POLL:7:0:BFAB:
8	POLL:8:0:939A:
9	POLL:9:0:A4AA:

7.2.2.4 SETNC command

The format of the SETNC command is the same as the SET command, except it starts with SETNC. The only functional difference is the SETNC command does not commit the values set into flash memory. This means the next time the AtmosVue 40 is power cycled, it will revert back to its previous settings. This command should be used when a setting in the sensor is changed regularly, such as heater functions, because this command avoids the risk filling the flash storage memory.

> **NOTE:**
> This includes communication data rates, as well.

7.2.2.5 MSGSET command

The user customizable message format can be configured using the **MSGSET** command. When a valid **MSGSET** command is issued, the sensor sends a **MSGGET** response.

Example of a `MESGSET`command and the echoed reply:

```
MSGSET:0:121C:9794:
121C 7067
```

Table 7-9: MSGSET command transmitted data descriptions

Example	Descriptions
0x01(Hex)	SOH
:	Delimiting character
MSGSET	MSG SET
:	Delimiting character
0	Sensor ID
:	Delimiting character
121C	HEX value is the sum of all the required fields (see Table 7-10 [p. 38]).
:	Delimiting character
9794	Checksum
:	Delimiting character
0x04(Hex)	EOT

Table 7-10: Description of custom message bits	
Bit	**Description**
8000	*Reserved*
4000	*Reserved*
2000	Humidity (%)[1]
1000	Temperature (° C)
0800	NWS code
0400	METAR code
0200	SYNOP code
0100	Generic SYNOP
0080	Accumulation
0040	Intensity
0020	Particle count
0010	Sensor serial number
0008	Dirty windows values
0004	System alarms
0002	User alarms
0001	Averaging duration
[2]Only available if a temperature and relative humidity sensor is connected.	

The hex value is the hexadecimal sum of the hex values of the chosen fields. The **MSGSET** example used a **MSGSET** message to set a AtmosVue 40 to output temperature, SYNOP code, sensor serial number, dirty windows values, and system alarms. The calculated HEX value is 121C.

7.2.2.6 ACCRES command

If accumulation is included in a custom message, the **ACCRES** command resets the accumulation to zero.

Example of a **ACCRES** command and the echoed reply:

```
ACCRES:2:0:3A68:
```

Table 7-11: ACCRES command transmitted data	
Example	**Description**
0x02[1]	STX^ B[2]
ACCRES	ACCRES command
:	Delimiting character
2	Address based on sensor ID
:	Delimiting character
0	Reserved for future use, zero default
:	Delimiting character
3A68	Checksum
:	Delimiting character
0x03[1]	ETX ^ C[2]
0x0D[1]	Carriage return
0x0A	Line feed

[1]These values are shown in hexadecimal format, not ASCII.

[2]As entered on a keypad.

NOTE:
If the setting to check the checksum on received commands is enabled, the checksum will vary with the Sensor ID value.

7.3 Operating system (OS) update

Operating system (OS) updates for the sensor are performed using Campbell Scientific ***Device Configuration Utility*** software. This is available as a free download from the Campbell Scientific website. Please refer to the help in the ***Device Configuration Utility*** for full instructions on how to update the AtmosVue 40.

NOTE:
To use the ***Device Configuration Utility*** to carry out an OS change requires RS-232 communication. However, if a sensor is set to communicate by RS-485, it is not necessary to change this in the sensor. If a sensor is set to communicate by RS-485, it can be temporarily set to RS-232 with switch 3 (see Internal switches [p. 22]).

The following figures show the instructions for downloading an OS using the ***Device Configuration Utility***.

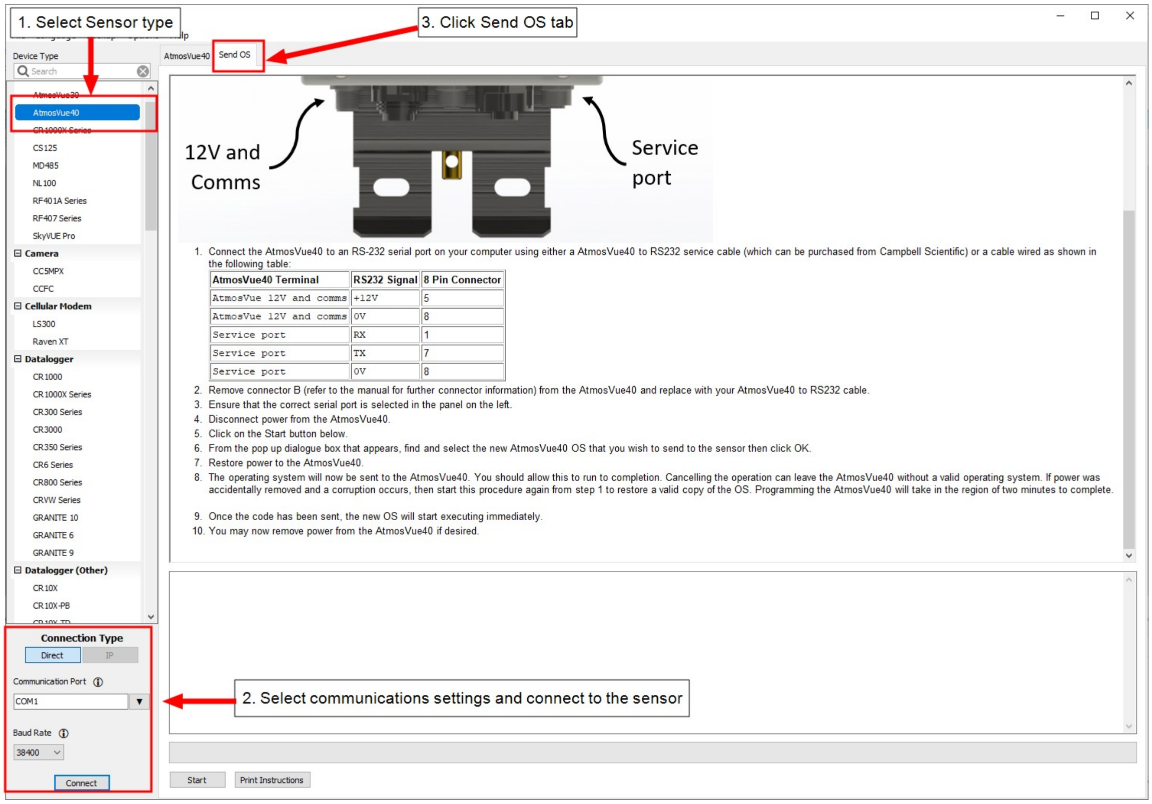


Figure 7-1. AtmosVue 40 ***Device Configuration Utility*** *OS download instructions*

8. Calibration and maintenance

8.1 Visibility calibration

The sensor can be checked and adjusted using the optional calibration kit. The calibration must be run using the menu system. Campbell Scientific ***Device Configuration Utility*** program includes a terminal emulation screen that allows access to the onboard menu. The calibration procedure requires a sensor calibrator disk and a computer with a standard serial port compatible with the sensor. If your sensor is not configured for RS-232 communications, switch internal switch 3 to ON, which sets the sensor communications port to RS-232 with a 38400 bps baud rate (see Internal switches [p. 22]). If the sensor is already set to the RS-232 mode, the internal switch does not need to be changed.

> **NOTE:**
> Ideally perform the test in the following conditions:
>
> - Ambient temperature: 0 to 50 °C
> - Local visibility: approximately 10,000 m or higher.
> - The system is self-regulating. However, it is recommended the sensor is calibrated at least every two years.

1. Clean lenses using pure alcohol or diluted detergent and a lint free cotton cloth. Refer to the Cleaning (p. 46) for more information. A simple visual check may be enough to confirm the lenses are clean.
2. Connect computer with ***Device Configuration Utility*** software to the RS-232 or Micro USB port on the data logger. Select the **Terminal** tab. Press Enter twice for the prompt (for example, **CR1000x>**). Type P and press Enter. Type the AtmosVue 40 serial port and press Enter.
3. Type **open 0** and press Enter to access the AtmosVue 40 **Setup Menu**.

4. Type 3 and press enter for the **Calibration Menu**.

```
CS125 CALIBRATION MENU 3
  ID 0
  S/N 1003
  (1) Perform calibration
  (2) Restore the factory calibration
  (3) Perform dirty windows zero offset calibration
  (4) Restore dirty windows factory calibration

  (9) Refresh
  (0) Return to main menu

  ->
```

5. Select option 1 to start the calibration process. When prompted, type Y to perform a calibration. Please note, after typing Y, the calibration process can not be exited until the test is complete. However, power cycling the unit at this point will have no adverse effect on the sensor.

```
Do you want to perform a calibration Y/N?
```

> **NOTE:**
> A confirmation is included at each calibration step to correct typing mistakes. Pressing Enter is not required after typing **y**.

6. When prompted, type the sensor calibrator serial number and extinction coefficient (EXCO) with a confirmation at each step.

> **NOTE:**
> Do not type the E at the beginning of the calibration disk serial number.

```
Do you want to perform a calibration (Y/N)? Y
Starting calibration.
Input the calibration disk serial number ->2000
Is 2000 correct? (Y/N)? Y
Input the calibration disk EXCO ->23.7
Is 23.7 correct? (Y/N)? Y

Place one calibration bung into each hood, then
press any key.
```

7. Place the foam bungs into the sensor hoods (see Figure 8-1 [p. 43]). The bungs are designed to block all light from the outside reaching inside the head. Place one bung into each hood. If either of the bungs are damaged or appear to have any gaps around the edge, contact Campbell Scientific (see Assistance for more information).

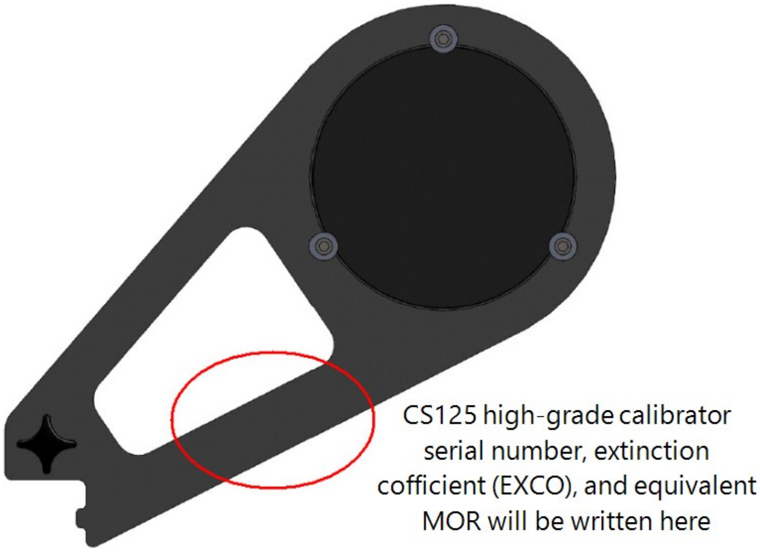


Figure 8-1. Calibration disk

```
Starting dark level calibration.
This test will take approximately two minutes.
```

This part of the test will take approximately two minutes. Every ten seconds a dot should appear indicating that the test is progressing as normal.

```
Dark level test complete. Please remove the bungs.
Now place the sensor calibrator into the sampling volume.
Press any key once this is done.
```

8. When instructed, remove the bungs.
9. Place the sensor calibrator into the volume by fastening it to the central mounting point (see Figure 8-2 [p. 44]).

> **NOTE:**
> At this stage, it is advisable to perform a simple visual check of the cleanliness of the calibration plate. If contaminated, clean it on both sides. Refer to Cleaning (p. 46) for more information.

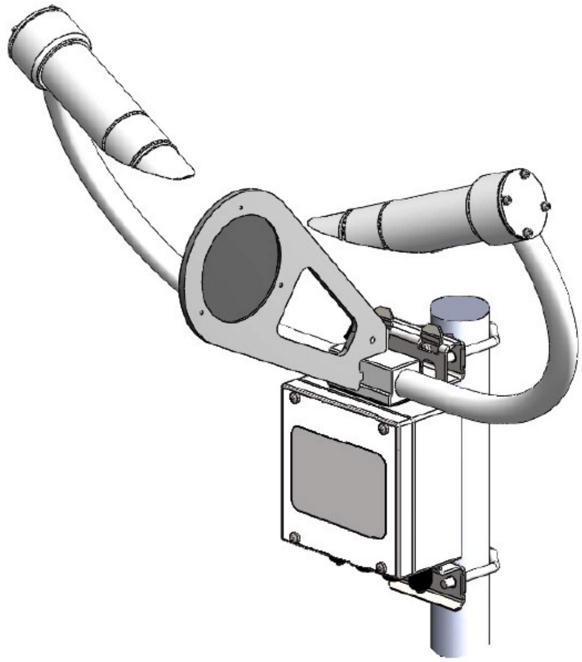


Figure 8-2. Mounting calibration disk

```
Starting light level calibration.
This test will take approximately two minutes.
```

This part of the test will take approximately two minutes. Every ten seconds, a dot should appear indicating the test is progressing as normal.

```
Calibration is now complete.
Saving user settings.
Press any key to exit.
```

Once the second stage of the test has been completed, the new calibration constants will be saved automatically. All calibration constants, including both the user and the factory setting, can be viewed from menu item 4 from the main menu once the test is completed.

10. Type 0 and press Enter to return to the **Main Menu**.
11. Type 90 and press Enter to save settings and exit the **Main Menu**.
12. Press Esc four times to exit the **Terminal mode**.
13. Disconnect ***Device Configuration Utility*** from the data logger.

8.2 AtmosVue 40 window zero calibration

Typing 3 in **Calibration - menu 3** allows the user to reset the zero contamination level for dirty windows detection. Typing 4 allows a return to the factory value if something goes wrong with the calibration process.

The dirty window zero calibration should be done every two years to correct for any slight drift in the dirty window detection or changes caused by scratches or degradation of the lenses (some of which may not be visible to the naked eye).

To carry out the dirty window zero offset calibration, make sure the windows are clean (see Cleaning [p. 46]). Temperature should ideally be in the range 15 to 30 °C and the sensor should be turned on for over 5 minutes. Before starting this process, make sure the lenses are dry and neither the calibration bungs nor calibration disk are in place.

```
CS125 CALIBRATION MENU 3
  ID 0
  S/N 1003
  (1) Perform calibration
  (2) Restore the factory calibration
  (3) Perform dirty windows zero offset calibration
  (4) Restore dirty windows factory calibration

  (9) Refresh
  (0) Return to main menu

  ->
```

Typing 3 returns text similar to the following:

```
Current values EO=3200 DO=4649 DD=995
Cal DW offset? Y/N?
```

Type Y and wait while the sensor is calibrating. When the calibration is done, the sensor will report numbers that are internal measurements used by the factory in case of a fault.

```
Calibrating dirty window system...Please wait

EO=3230 ES=371 DO=2251 DS=234 DD=1140
Press any key to exit (Not return)
```

Press any key and the dirty window zero offset calibration is complete. To verify calibration, return to the information screen and check the two dirty window alarm values; these values should be away from 0%.

8.3 Internal temperature check

The AtmosVue 40 has an internal temperature sensor in one of the crossarms. This is used as part of the present weather identification if a AtmosVue-HV temperature and RH sensor is not connected. This does not need recalibration, but it can be checked if a suitable nearby reference temperature measurement is available. The AtmosVue 40 external temperature provided in the output message (see Messages [p. 24]) should be within about 3 °C of the reference. Ideally, compare the temperatures in cloudy and windy conditions when the air temperature is as close to 0 °C as possible.

8.4 Cleaning

The AtmosVue 40 windows will require cleaning from time to time. The frequency of required cleaning depends on exposure of the instrument to contaminants, such as salt and dust. This will vary depending on the site location. The AtmosVue 40 is capable of self-diagnosing a dirty window and will indicate in its output when the window is contaminated.

> **NOTE:**
> A lower level of contamination than is detected by the dirty window alarms, can affect the visibility measurements. The sensor can be configured to correct for low-level contamination, although the correction accuracy depends on the type of impurity.

Campbell Scientific suggests cleaning at six-month intervals for locations not prone to contaminants and monthly intervals for those prone to contamination (coastal, roadside or airport use). In some cases, more frequent cleaning may be required where there are high levels of contaminants and high dependency on the instrument output.

> **CAUTION:**
> If the window requires cleaning, it is very important only a proper lens cloth or lens tissue is used. The use of inappropriate materials to clean the window can permanently damage or reduce the effectiveness of the window, leading to errors in measurement of precipitation and visibility.

Use an air duster to blow any loose dust and dirt from the window. Using a lint-free lens cloth or lens tissue with a small amount of isopropyl alcohol solvent, clean the surface by dragging the cloth, being careful not to apply excessive pressure.

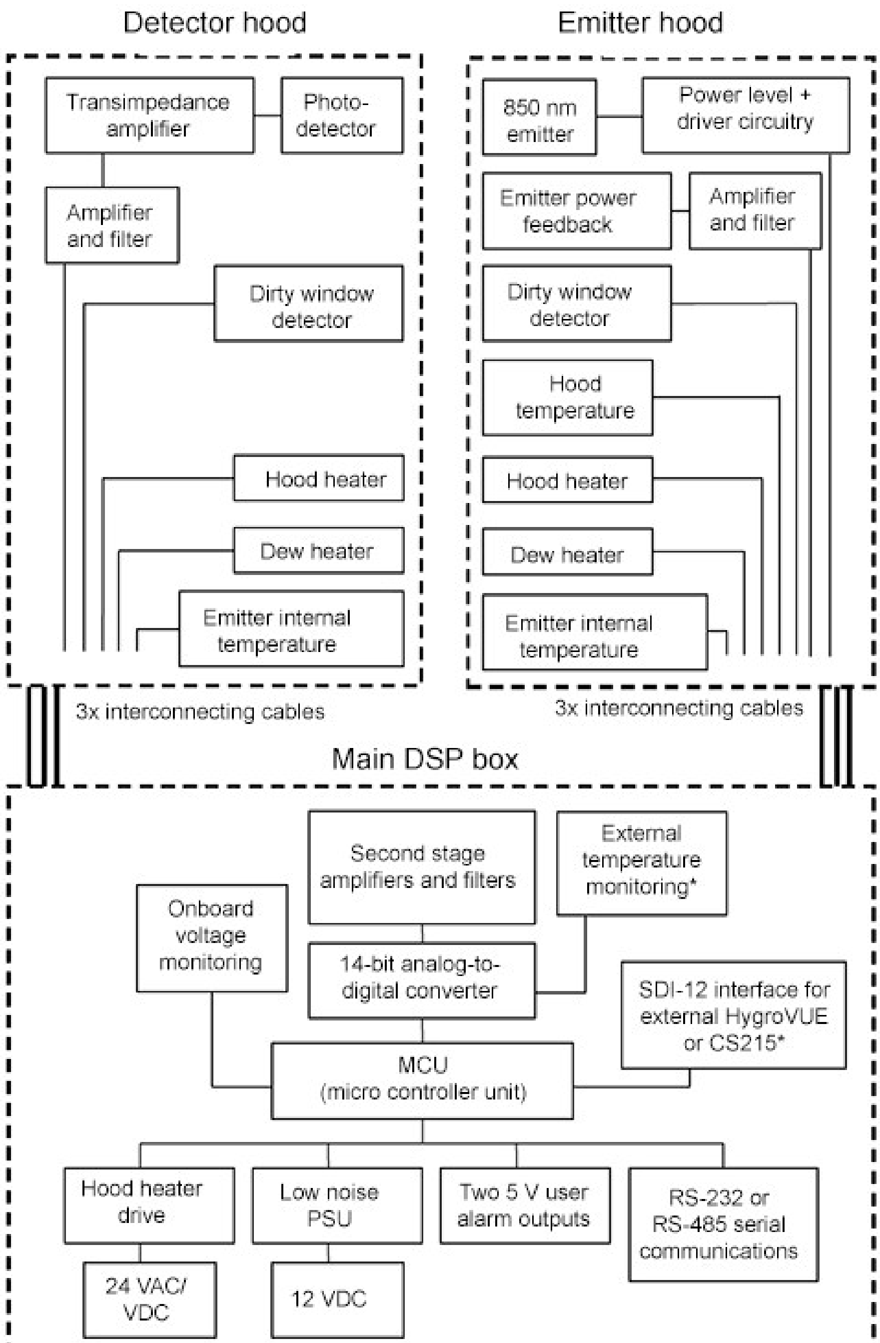
> **CAUTION:**
> Excessive pressure may lead to some types of contaminant scratching the window surface. Scratches can lead to reduced sensitivity.

Spiders webs and certain seeds may get lodged in the optical path, leading to low readings and false precipitation reports. Cleaning the visibility contamination with a duster will return the sensor to normal operation. If spiders are a persistent problem, carefully applying insecticide can deter them. Avoid getting insecticide on the windows.

8.5 Lubricating enclosure screws

The sensor enclosure screws should be lubricated with a suitable anti-seize grease to protect the threads from corrosion. This should be reapplied when resealing the enclosure at regular intervals, normally after replacing the desiccant. This is of particular importance if using the sensor in corrosive or salt laden atmospheres.

Appendix A. Block-diagram



*CS125 only

Appendix B. Example of calculating a CCITT CRC using C program language

The following code is provided as an example for programmers implementing their own code to communicate with the sensor. Refer to the downloadable example programs available at www.campbellsci.com/downloads/cs125-example-programs.

The checksum includes all characters after the STX and before the space preceding the checksum.

The SET and SETNC commands also exclude the two delimiting : characters, one on each side of the checksum itself.

```
//------------------------------------------------------------ -------------
// Creates a CCITT CRC16 checksum seeded with 0x0000 (XModem style) using a
// fast, non-table based algorithm.
// Pass in the data to convert into a CRC in the form of a NULL terminated
// character array (a string).
// Returns the CRC in the form of an unsigned 16 bit integer value
// Note: This algorithm has only been tested on a native 16-bit processor with
// a hardware barrel shifter // All integers are 16-bits long
//------------------------------------------------------------ -------------
unsigned int CRC_CCITT(char LineOfData[])
{
unsigned int crc;
// returned CRC value unsigned int i;
// counter crc = 0x0000;
// create a check sum for the incoming data for(i=0;i < strlen(LineOfData); i++)
{
unsigned crc_new = (unsigned char)(crc >> 8) | (crc << 8);
crc_new ^= LineOfData[i];
crc_new ^= (unsigned char)(crc_new & 0xff) >> 4;
crc_new ^= crc_new << 12;
crc_new ^= (crc_new & 0xff) << 5; crc = crc_new;
}
return(crc);
 }
```

Appendix C. Present weather codes produced by the AtmosVue 40

Table C-1 (p. 50) provides the 57 SYNOP and generic SYNOP codes that can be output by the sensor. Table C-2 (p. 53) provides METAR codes from WMO table 4678. Table C-3 (p. 53) provides the NWS codes that may be produced by the AtmosVue 40 in a custom message.

Table C-1: SYNOP and generic SYNOP code definitions

Weather type	4680 code
No significant weather observed	0
Haze, smoke, or dust in suspension in the air; visibility ≥ 1 km[1]	4
Haze, smoke, or dust in suspension in the air; visibility < 1 km[1]	5
Mist	10
Fog (in the preceding hour)	20
Precipitation (in the preceding hour)	21
Drizzle (not freezing) or snow grains (in the preceding hour)	22
Rain (not freezing), (in the preceding hour)	23
Snow (in the preceding hour)	24
Freezing rain or freezing drizzle (in the preceding hour)	25
FOG	30
Fog or ice fog in patches	31
Fog or ice fog in patches that has become thinner during the past hour	32
Fog or ice fog in patches with little change during the past hour	33
Fog or ice fog in patches has begun or become thicker during the past hour	34
Fog depositing rime	35

Table C-1: SYNOP and generic SYNOP code definitions	
Weather type	4680 code
PRECIPITATION	40
Precipitation: slight or moderate	41
Precipitation: heavy	42
Solid precipitation: slight or moderate[2]	43
Freezing precipitation: slight or moderate[2]	44
Freezing precipitation: heavy[2]	45
DRIZZLE[2]	50
Drizzle: not freezing, slight	51
Drizzle: not freezing, moderate	52
Drizzle: not freezing, heavy	53
Drizzle: freezing, slight	54
Drizzle: freezing, moderate	55
Drizzle: freezing, heavy	56
Drizzle and rain: slight	57
Drizzle and rain: moderate or heavy	58
RAIN[2]	60
Rain: slight	61
Rain: moderate	62
Rain: heavy	63
Rain, freezing: slight	64
Rain, freezing: moderate	65
Rain, freezing: heavy	66
Rain (or drizzle) and snow: slight	67
Rain (or drizzle) and snow: moderate or heavy	68
SNOW[2]	70
Snow: slight (snow includes graupel)	71
Snow: moderate (snow includes graupel)	72

Table C-1: SYNOP and generic SYNOP code definitions	
Weather type	4680 code
Snow: heavy (snow includes graupel)	73
Ice pellets: slight	74
Ice pellets: moderate	75
Ice pellets: heavy	76
Snow grains	77
SHOWER(S) OR INTERMITTENT PRECIPITATION	80
Rain shower(s) or intermittent rain: slight	81
Rain shower(s) or intermittent rain: moderate	82
Rain shower(s) or intermittent rain: heavy	83
Rain shower(s) or intermittent rain: violent	84
Snow shower(s) or intermittent snow: slight	85
Snow shower(s) or intermittent snow: moderate	86
Snow shower(s) or intermittent snow: heavy	87
Hail	89

[1]Only reported if a AtmosVue-HV sensor is connected to provide relative humidity; otherwise, it will default to mist (10) or fog (20, 30, 31, 32, 33, 34, or 35).

[2]Only reported in the generic SYNOP messages.

Table C-2: METAR code definitions[1]	
Weather type	**METAR code**
Unidentified precipitation	UP
Haze[2]	HZ
Mist[3]	BR
Fog[3]	FG
Drizzle[3, 4]	DZ
Rain[3, 4]	RA
Snow grains	SG
Snow[4]	SN
Ice pellets[4]	PL
Hail	SMGR
No significant weather	NSW

[1] Combinations of the codes can be reported. (for example, RASN for rain and snow).

[2] HZ is only be reported if a AtmosVue-HV sensor is connected to the AtmosVue 40 to provide relative humidity information.

[3] FZ (freezing) may be added as a descriptor in front of BR, FG, DZ, and RA (for example, FZBR for freezing mist).

[4] Intensity qualifiers (– for light and + for heavy) may be added in front of DZ, RA, SN, and PL (for example –RA for light rain or +SN for heavy snow).

Table C-3: NWS code definitions	
Weather type	**NWS code[1]**
Drizzle[2]	L
Rain[2]	R
Snow	S
Snow grains	SG

[1]Intensity qualifiers (– for light and + for heavy) may be added after the NWS code (for example –R for light rain or +S for heavy snow).

[2]FZ (freezing) may be added as a descriptor in front of L and R (for example, FZL for freezing drizzle).

Limited warranty

Covered equipment is warranted/guaranteed against defects in materials and workmanship under normal use and service for the period listed on your sales invoice or the product order information web page. The covered period begins on the date of shipment unless otherwise specified. For a repair to be covered under warranty, the following criteria must be met:

1. There must be a defect in materials or workmanship that affects form, fit, or function of the device.

2. The defect cannot be the result of misuse.

3. The defect must have occurred within a specified period of time; and

4. The determination must be made by a qualified technician at a Campbell Scientific Service Center/ repair facility.

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2. Batteries; and

3. Any equipment which has been subjected to misuse, neglect, acts of God or damage in transit.

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In the event of any conflict or inconsistency between the provisions of this Warranty and the provisions of Campbell Scientific's Terms, the provisions of Campbell Scientific's Terms shall prevail. Furthermore, Campbell Scientific's Terms are hereby incorporated by reference into this Warranty. To view Terms and conditions that apply to Campbell Scientific, Logan, UT, USA, see Terms and Conditions. To view terms and conditions that apply to Campbell Scientific offices outside of the United States, contact the regional office that serves your country.

Assistance

Products may not be returned without prior authorization. Please inform us before returning equipment and obtain a **return material authorization (RMA) number** whether the repair is under warranty/guarantee or not. See Limited warranty for information on covered equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page of the manual for a list of regional offices or visit www.campbellsci.com/contact to determine which Campbell Scientific office serves your country.

When returning equipment, a RMA number must be clearly marked on the outside of the package. Please state the faults as clearly as possible. Quotations for repairs can be given on request.

It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment. In support of this policy, when equipment is returned to Campbell Scientific, Logan, UT, USA, it is mandatory that a "Declaration of Hazardous Material and Decontamination" form be received before the return can be processed. If the form is not received within 5 working days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. For details on decontamination standards specific to your country, please reach out to your regional Campbell Scientific office.

> **NOTE:**
> All goods that cross trade boundaries may be subject to some form of fee (customs clearance, duties or import tax). Also, some regional offices require a purchase order upfront if a product is out of the warranty period. Please contact your regional Campbell Scientific office for details.

Safety

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC. FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.com You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a hardhat and eye protection, and take other appropriate safety precautions while working on or around tripods and towers.
- Do not climb tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- You can be killed or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in contact with overhead or underground utility lines.
- Maintain a distance of at least one-and-one-half times structure height, 6 meters (20 feet), or the distance required by applicable law, whichever is greater, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.

- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

Use and disposal of batteries

- Where batteries need to be transported to the installation site, ensure they are packed to prevent the battery terminals shorting which could cause a fire or explosion. Especially in the case of lithium batteries, ensure they are packed and transported in a way that complies with local shipping regulations and the safety requirements of the carriers involved.
- When installing the batteries follow the installation instructions very carefully. This is to avoid risk of damage to the equipment caused by installing the wrong type of battery or reverse connections.
- When disposing of used batteries, it is still important to avoid the risk of shorting. Do not dispose of the batteries in a fire as there is risk of explosion and leakage of harmful chemicals into the environment. Batteries should be disposed of at registered recycling facilities.

Avoiding unnecessary exposure to radio transmitter radiation

- Where the equipment includes a radio transmitter, precautions should be taken to avoid unnecessary exposure to radiation from the antenna. The degree of caution required varies with the power of the transmitter, but as a rule it is best to avoid getting closer to the antenna than 20 cm (8 inches) when the antenna is active. In particular keep your head away from the antenna. For higher power radios (in excess of 1 W ERP) turn the radio off when servicing the system, unless the antenna is installed away from the station, e.g. it is mounted above the system on an arm or pole.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

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