Weather MicroServer™

User Manual

Columbia
Weather Systems

Weather MicroServer™

User Manual

Version 4.08

All specifications subject to change without notice.

Printed in U. S. A.

Welcome!

Welcome to the Columbia Weather Systems family of users and congratulations on your purchase of the Weather MicroServer.

Please read this manual completely prior to installation.

Important Notice: Shipping Damage

BEFORE YOU READ ANY FURTHER, please inspect all system components for obvious shipping damage. The Weather MicroServer is a small board computer and can be damaged by rough handling. Your unit was packaged to minimize the possibility of damage in transit. Therefore, we recommend that you save the shipping container for any future shipment of your unit.

In the event your order arrives in damaged condition, it is important that the following steps be taken immediately. The title transfers automatically to you, the customer, once the material is entrusted to the transport company.

NOTE: DO NOT RETURN THE INSTRUMENT TO COLUMBIA WEATHER SYSTEMS until the following steps are completed. Failure to follow this request will jeopardize your claim.

1. Open the container and inspect the contents. Do not throw away the container or any damaged parts. Try to keep items in the same condition as originally received.
2. Notify the transport company immediately in writing, preferably by facsimile, about the shipping damage.
3. Wait for the transport company's representative to inspect the shipment personally.
4. After inspection, request permission from Columbia Weather Systems for return of the damaged instrument by calling the Service Department, (503) 629-0887.
5. Return approved items to us at the following address:

   Columbia Weather Systems, Inc.

   5285 NE Elam Young Parkway, Suite C100

   Hillsboro, OR 97124
6. After return authorization is issued and we receive the instrument, an estimate of the cost of repair will be sent to you for submittal to the transport company as a claim.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. The Weather MicroServer is adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

1. Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself with a wrist strap and a resistive connection cord to the equipment chassis before touching the boards. When neither of the above is possible, at least touch a conductive part of the equipment chassis with your other hand before touching the boards.
2. Always hold the boards by the edges and avoid touching the component contacts.

Table of Contents

SECTION 1: INTRODUCTION

The Weather MicroServer

The Weather MicroServer is a self-contained and proprietary system. It employs a web browser user interface which allows the operator to monitor weather data in real-time, log data as it is received, and configure station functionality.

No additional software is required to operate the MicroServer.

The MicroServer is compatible with any weather station from Columbia Weather Systems.

The device easily connects to an existing network with an included Ethernet cable. Four serial ports offer interface to peripheral devices or sensors. The main serial port (COM1) interfaces with all our available weather stations.

The Weather MicroServer can provide real-time weather data to WeatherMaster Software and the Weather Display Console over a network connection. This allows users to simultaneously monitor the weather using any computer or device connected to the network.

Once configured the Weather MicroServer can automatically provide FTP output, and XML web service. FTP output includes XML, CSV, and CSV append formats.

SNMP, Modbus/TCP, Modbus/RTU, BACnet and DNP3 communication protocols are standard for Industrial Management applications.

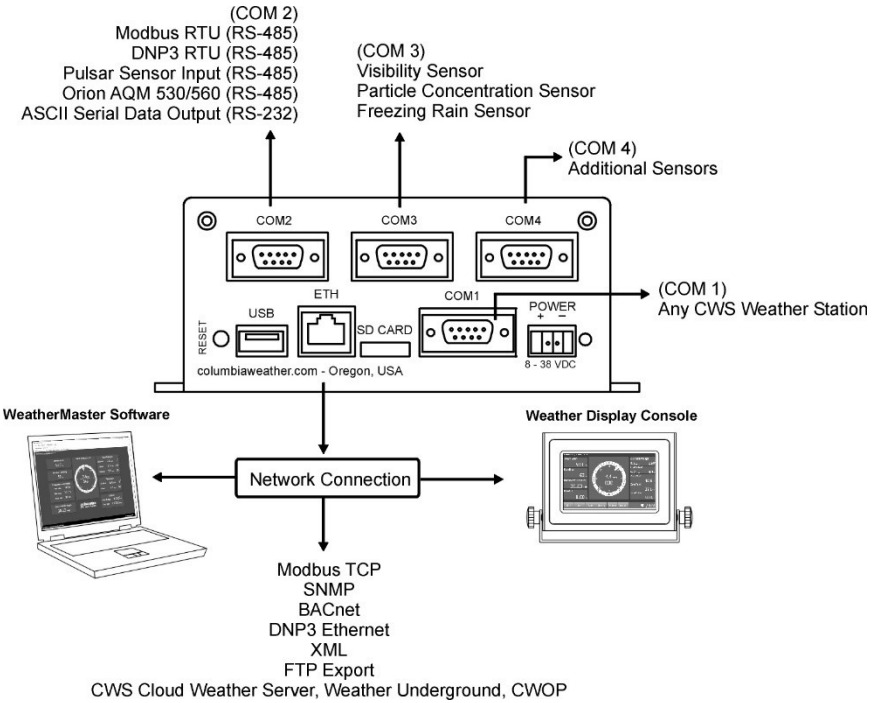
The Weather MicroServer includes automatic data output to Weather Underground, the CWS cloud-based Weather Server and the Citizen Weather Observer Program (CWOP).

The MicroServer stores all parameters on a 1-minute or 1-second interval in daily data log files. The interval is user selectable.

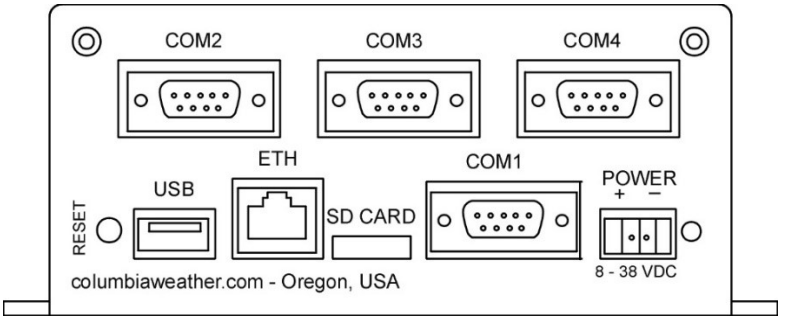
The Weather MicroServer interfaces with any Capricorn, Magellan, Magellan MX, Vela, Orion, or Pulsar weather stations to provide a range of weather parameters and monitoring options.

The MicroServer also interfaces with the Orion AQM to provide air quality measurements including gas and particulate matter.

MicroServer System Diagram

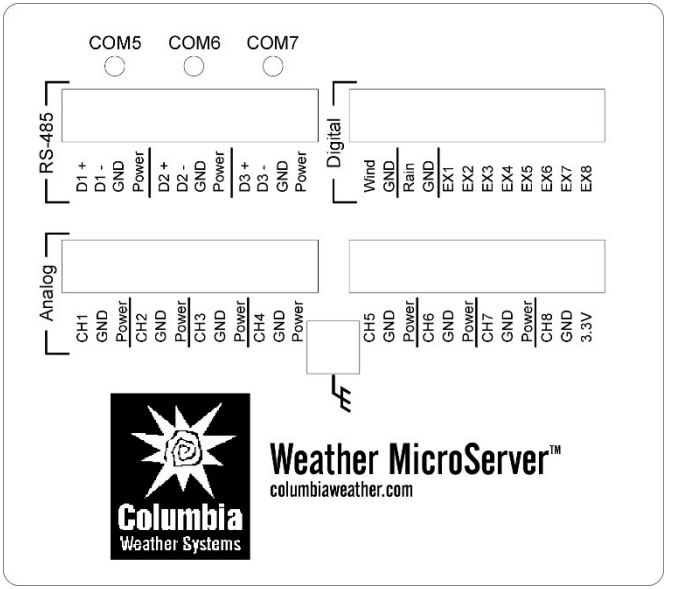


Front Panel:



The MicroServer has four RS232 Serial ports, an Ethernet port, USB port, SD Card slot, reset button, and power connector.

Top Panel:



The Top Panel includes three RS485 Serial ports for sensor input and Modbus RTU interface, eight (8) Analog Channels available for additional sensors, a rain input channel for a tipping bucket rain gauge, and a wind speed input channel for a mechanical wind sensor.

EX channels are for future expansion.

Measurements and Calculations

Wind Speed and Direction Parameters

(The MicroServer can accept two wind sensors)

- Wind Speed
- Adjusted Wind Direction
- 3 Second Rolling Average Wind Speed
- 3 Second Rolling Average Wind Direction
- 2 Minute Rolling Average Wind Speed
- 2 Minute Rolling Average Wind Direction
- 10 Minute Rolling Average Wind Speed
- 10 Minute Rolling Average Wind Direction
- 10 Minute Gust Wind Direction
- 10 Minute Gust Wind Speed
- 10 Minute Gust Time
- 60 Minute Gust Wind Direction
- 60 Minute Gust Wind Speed
- 60 Minute Gust Time
- 60 Minute Rolling Average Wind Speed
- 60 Minute Rolling Average Wind Direction
- 2 Minute Gust Wind Direction
- 2 Minute Gust Wind Speed
- 2 Minute Gust Time
- 1 Minute Sustained Wind Speed
- 30 Second Rolling Vector Mean Wind Direction
- 30 Second Rolling Vector Mean Wind Speed
- 30 Second Rolling Standard Deviation Wind Direction

Precipitation Parameters

- Rain Today
- Rain this week
- Rain this month
- Rain this year
- Rain Rate
- Rain Last Hour
- Hail Today (Orion Sensor Only)
- Hail Rate (Orion Sensor Only)
- Precipitation Type (Pulsar Sensor Only)

Pulsar 100 Only

- Total Particles
- Total Drops
- Drizzle Particles
- Snow Particles
- Hail Particles
- Drops (0-0.5 mm)
- Drops (0.5-1.0 mm)
- Drops (1.0-1.5 mm)
- Drops (1.5-2.0 mm)
- Drops (2.0-2.5 mm)
- Drops (2.5-3.0 mm)
- Drops (3.0-3.5 mm)
- Drops (3.5-4.0 mm)
- Drops (4.0-4.5 mm)
- Drops (4.5-5.0 mm)
- Drops (5.0-5.5 mm)
- Drops (> 5.5 mm)

Relative Humidity Parameter

- Relative Humidity

Solar Radiation Parameter

- Solar Radiation
- UV Index (Pulsar 10 Sensor Only)

Temperature Parameters

- Temperature 1
- Temperature 2*
- Temperature 3*
- Temperature 4*
- Average Temperature Today
- Degree Days

Barometric Pressure Parameters

- Raw Barometric Pressure
- Adjusted Barometric Pressure
- Pressure Tendency

Calculated Parameters

- Wind Chill
- Heat Index
- Dew Point
- Density Altitude

- Wet Bulb Temperature
- Wet Bulb Globe Temperature

Atmospheric Parameters

- Saturated Vapor Pressure
- Vapor Pressure
- Dry Air Pressure
- Dry Air Density
- Wet Air Density
- Absolute Humidity
- Air Density Ratio
- Adjusted Altitude
- SAE Correction Factor
- Specific Enthalpy (Pulsar Only)

Air Quality Parameters

- Nitrogen Dioxide
- Carbon Monoxide
- Nitric Oxide
- Ozone
- PM 10 micron count
- PM 2.5 micron count
- PM 1 micron count
- Air Quality Index
- AQI Criteria
- Gas Measurement Validity
- Device Health Index
- Device Status
- Elapsed Seconds
- Main Pollutant

Visibility

- Visibility
- Extinction Coefficient

Lightning

- 1 Minute Lightning Count (Pulsar 800 Sensor Only)
- 30 Minute Lightning Count (Pulsar 800 Sensor Only)

* Available with Capricorn/Pegasus and Capricorn FLX Weather Stations and MicroServer Analog Channels

Technical Specifications

- 900 MHz ARM Processor
- 4 Serial Communication Ports (RS-232)
- RS-485 capable on COM2, COM5, COM6, COM7
- 1 Ethernet Port
- 1 USB Port
- 16GB Micro SD Card
- Enclosure Dimensions: 6.40” W x 2.60” H x 5.40” D
- Weight: 415 grams, 0.9lbs
- Operating temperature: -40° to +85°C
- Power 8 to 38 VDC (67mA at 12VDC)

The Weather MicroServer is supplied with a wall-mount switching power supply.

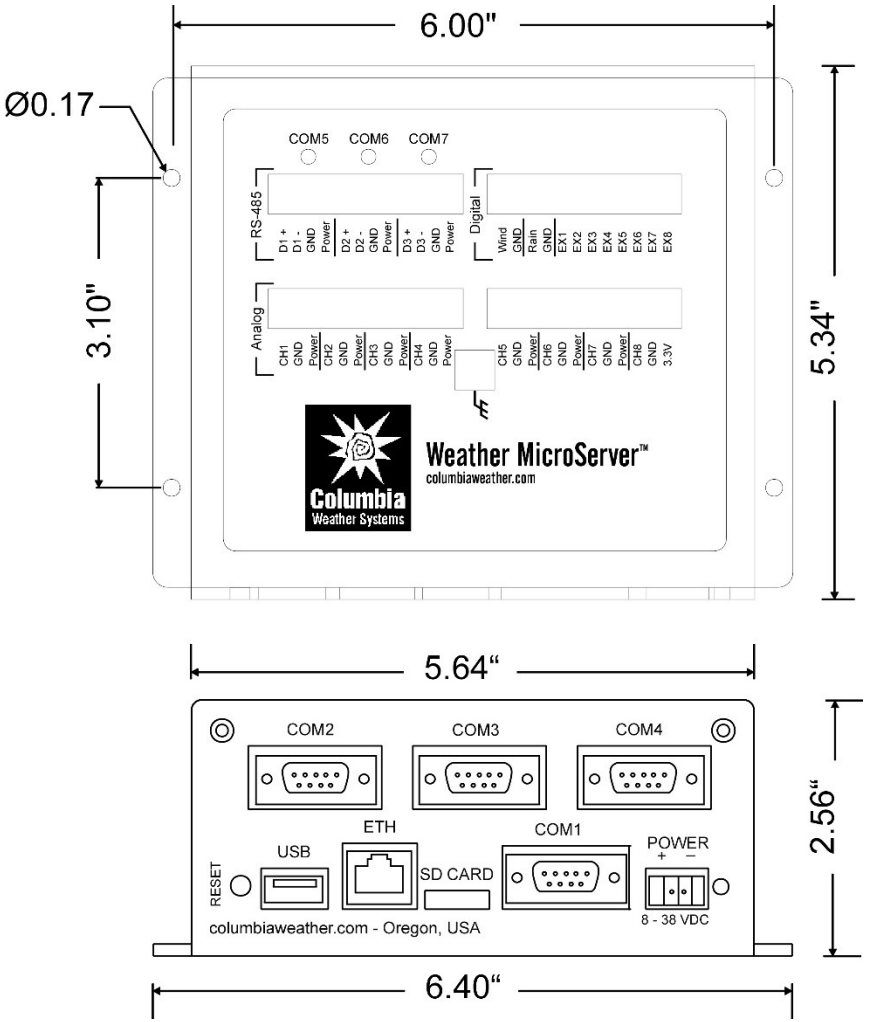
Input Voltage: 90 ~ 246VAC

Output Voltage: 12VDC

Output Max Current: 2 Amps

Max Power: 24 Watts

Dimensions


6.00"
Ø0.17
3.10"
5.34"
COM5
COM6
COM7
RS-485
D1 +
D1 -
GND
Power
D2 +
D2 -
GND
Power
D3 +
D3 -
GND
Power
Digital
Wind
GND
Rain
GND
EX1
EX2
EX3
EX4
EX5
EX6
EX7
EX8
Analog
CH1
GND
Power
CH2
GND
Power
CH3
GND
Power
CH4
GND
Power
CH5
GND
Power
CH6
GND
Power
CH7
GND
Power
CH8
GND
3.3V
Columbia
Weather Systems
Weather MicroServer™
columbiaweather.com
5.64“
2.56“
6.40“
COM2
COM3
COM4
ETH
COM1
POWER
+ −
USB
RESET
SD CARD
8 - 38 VDC
columbiaweather.com - Oregon, USA

SECTION 2: SYSTEM CONFIGURATION

The Weather MicroServer is compatible with any weather station from Columbia Weather Systems. It is designed to receive weather data input from any Orion, Magellan, Magellan MX, Capricorn, Pegasus, Pulsar, or Vela weather stations.

Orion Weather Station Interface

The Orion Weather Station connects to COM1 of the MicroServer using an RS-232 cable or a wireless link.

For a direct cabled connection, COM1 of the MicroServer connects to the Interface Module using an RS-232 cable provided with the station.

For a wireless connection, COM1 of the MicroServer connects to the wireless transceiver using an RS-232 cable provided with the transceiver.

RS485 Communication

The Orion Weather Station can also be configured for RS485 communication. With this configuration the Interface Module connects to COM2 on the MicroServer.

Magellan, Magellan MX & Vela Weather Station Interface

The Magellan, Magellan MX and Vela Weather Stations connect to COM1 of the MicroServer using an RS-232 cable or a wireless link.

For a direct cabled connection, COM1 of the MicroServer connects to the Interface Module using an RS-232 cable provided with the station.

For a wireless connection, COM1 of the MicroServer connects to the client wireless transceiver using an RS-232 cable provided with the transceiver.

Magnetic Declination Setting for Magellan MX Sensor

The Magellan MX sensor firmware allows the setting of a declination angle to correct the wind direction output to True North. Once the declination angle is set in the sensor, it is stored permanently in non-volatile memory. The declination angle must be reset only if the system is used in a different geographical location separated by many miles from the original location.

Please note that the magnetic declination is set at the factory per system, based on the shipping destination.

To reset the magnetic declination for the Magellan MX Sensor, first determine the magnetic declination for the station location by visiting:

https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination

Then in Sensor Inputs under Installed Devices click the pencil icon and select the Device Properties tab. Enter in the magnetic declination and click Save to Sensor.

RS-485 Communication

The Magellan MX can also be configured for RS-485 communication. With this configuration the Interface Module connects to COM2 on the MicroServer.

Please note the Magnetic Declination cannot be reset when the Magellan MX is configured for RS-485 communication. Contact support for more information.

Capricorn and Pegasus Weather Stations Interface

The Capricorn 2000EX, Capricorn FLX, Pegasus and Pegasus FLX Weather Station connects to COM1 of the MicroServer using an RS-232 cable or a wireless link.

For a direct cabled connection, COM1 of the MicroServer connects to the “Modem Serial” port on the Capricorn Control Module using an RS-232 cable provided with the station.

For a wireless connection, COM1 of the MicroServer connects to the client wireless transceiver using an RS-232 cable provided with the transceiver.

RS-485 Communication

The Capricorn FLX can also be configured for RS-485 communication. With this configuration the Capricorn FLX connects to COM2 on the MicroServer.

Secondary Orion Sensor Interface (536, 535, 534, 533, 532 Models)

More than one Orion Sensor can be connected to the MicroServer using an RS-232 cable or a wireless link.

The secondary Orion Sensor connects to COM2, COM3, or COM4 on the MicroServer.

Pulsar Weather Station Interface

The Pulsar Weather Station communicates over RS-485 with the MicroServer.

Input to COM 2:

The Pulsar Sensor connects to COM2 on the MicroServer through the Interface Module using an RJ-11 cable provided with the station. In Sensor Inputs the Serial Port selection should be COM6-485.

The Pulsar Sensor can also connect directly to the Top Panel on the MicroServer. In most cases it will connect to COM6.

Magnetic Declination Setting for Pulsar Sensor

The Pulsar Sensor firmware allows the setting of a declination angle to correct the wind direction output to True North. Once the declination angle is set in the sensor, it is stored permanently in non-volatile memory. The declination angle must be reset only if the system is used in a different geographical location separated by many miles from the original location.

Please note that the magnetic declination is set at the factory per system, based on the shipping destination.

To reset the magnetic declination for the Pulsar Sensor, first determine the magnetic declination for the station location by visiting:

https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination

Then in Sensor Inputs under Installed Devices click the pencil icon and select the Device Properties tab. Enter in the magnetic declination and click Save to Sensor.

Lightning Event Count for Pulsar Sensor

The Pulsar 800 Model includes a Lightning Detection Sensor (3-6 mile range) that provides a 1-minute Lightning Event Count and a 30-minute Lightning Event Count on the Latest Measurements page.

Precipitation Type for Pulsar Sensor

The Pulsar 600, 700, 800 and 100 Models include a Precipitation Sensor that can differentiate between different types of precipitation. A code is displayed on the Latest Measurements page to indicate the type of precipitation.

Please reference the chart below to decipher the code.

Precipitation Type	**Code**
No precipitation	0
Unspecified precipitation	40
Liquid precipitation; rain	60
Solid precipitation; snow	70
Freezing Rain	67 (Pulsar 100 only)
Sleet	69 (Pulsar 100 only)
Hail	90 (Pulsar 100 only)

Additional Sensors (Serial Connection)

In addition to our standard weather stations other sensors can be connected to the MicroServer.

PTB330 Pressure Sensor

The PTB330 Pressure Sensor typically connects to COM2 through the Interface Module. This connection is RS-232.

In the user interface, Sensor Inputs page, select PTB330 Pressure Sensor.

To enter in the Altitude, Reference Elevation and QFE Temperature, click the pencil icon and select the Device Properties tab.

Visibility Sensor Interface

Two types of visibility sensors can be connected to the MicroServer to provide visibility data. Our standard visibility sensor (SVS1) and a low power visibility sensor (CS120A). This connection is RS-232 through the Interface Module.

The MicroServer will display three parameters for the standard visibility sensor: visibility, extinction coefficient, and lux (if a photo sensor is included).

In the user interface, Sensor Inputs page, select Visibility data SVS1 or CS120A.

Particle Concentration Interface

A particulate/dust monitor (ES-642 Dust Monitor) can be connected to the MicroServer to provide particle concentration data. The MicroServer will display the particle concentration data in mg per cubic meter on the Latest Measurements page.

In the user interface, Sensor Inputs page, select Particle Concentration Sensor.

Air Quality Monitor Orion AQM 530/560

The Orion AQM can be connected to the MicroServer. It typically connects to COM2 through the Interface Module. It can also connect directly to one of the serial ports on the Top Panel.

IR Surface Temperature:

The DST111 Infrared Surface Temperature Sensor typically connects to COM2 through the Interface Module. This connection is RS-485.

In the user interface, Sensor Inputs page, select IR Surface Temp Sensor.

Electronic Compass

An electronic compass (TNT Compass) can be connected to the MicroServer. It will provide a compass heading on the Latest Measurements page.

In the user interface, Sensor Inputs page, select TNT Compass.

Freezing Rain Sensor

A Freezing Rain Sensor can be connected to the MicroServer. Typically, it connects to COM3 through a converter. It will provide an “Ice” or “No Ice” status on the Latest Measurements page.

In the user interface, Sensor Inputs page, select Freezing Rain Sensor.

Tipping Bucket Rain Gauge

A tipping bucket rain gauge with a 0.01inch/tip measurement can be connected to the MicroServer Rain Channel.

In the user interface, Sensor Inputs page, select Tipping Bucket Rain (standard).

A tipping bucket rain gauge with a 0.2mm/tip measurement can also be connected to the MicroServer Rain Channel.

In the user interface, Sensor Inputs page, select Tipping Bucket Rain (0.2mm/tip).

Mechanical Wind Sensor

A Mechanical Wind Sensor (034B & 034E) can be connected to the MicroServer Wind Channel. It can measure wind speed and direction.

To configure Wind Direction, click the + button, select Onboard Analog Sensors and click Add Device. Click the pencil icon next to Onboard Analog Sensors. Select Wind Direction under Analog Channel 8, click OK and then Save Changes.

Onboard Analog Sensors

The MicroServer also includes eight (8) analog input channels that can be configured to accept our standard sensors as follows:

Standard Solar Radiation Sensor - used to measure solar irradiance (P/N 82601).

- Solar Radiation-SS - Choose for sensors purchased on or after November 2018.
- Solar Radiation-legacy - Choose for sensors purchased prior to November 2018.

Please note if you have purchased a new replacement Standard Solar Radiation Sensor, change the Analog Channel drop-down to Solar Radiation-SS.

Temperature (AD36) - standard sensor used to measure air, soil/water, or PV panel temperature.

Temperature (2210) - an alternative temperature sensor (used in custom applications).

IR Surface Temperature - (used in custom applications)

Wind Direction - Mechanical Wind Sensor used to measure wind direction.

Analog channels 1 through 7 have a 0 to 2.5 VDC input and are configured as follows:

Channel: 0 to 2.5VDC signal input

GND: Ground

Power: +5VDC supply voltage (standard)

Channel 8 is configured for wind direction and is configured as follows:

Channel: 0 to 2.5VDC signal input

GND: Ground

Power: +3.3VDC supply voltage

To enable a sensor click the **+** button on the Sensor Inputs page, select Onboard Analog Sensors and click Add Device. Click the pencil icon next to Onboard Analog Sensors. Select the appropriate sensor and click OK. Click Save Changes.

To connect the sensors to the input channels, see the Installation section.

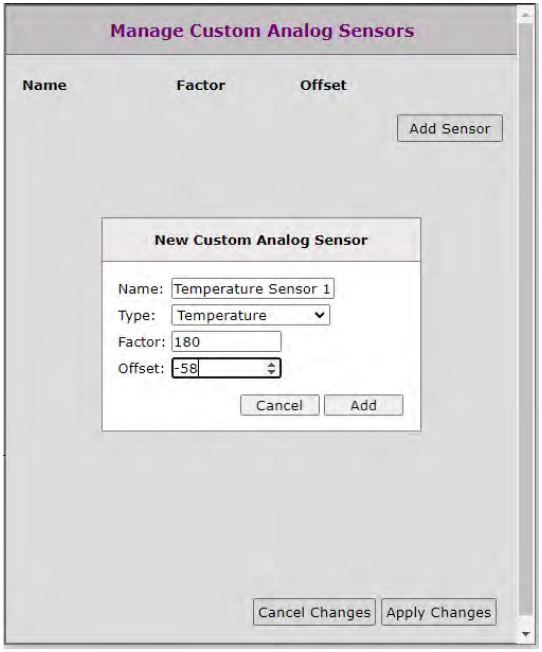
Custom Analog Sensors

In addition to the standard sensors, the MicroServer can also accept additional sensors that require custom configuration. The following sensor types are available for configuration: temperature, solar radiation, UV radiation, Photosynthetically Active Radiation (PAR), relative humidity, barometric pressure, wind speed & direction, carbon dioxide level, and snow depth/water level.

If one of these sensors was ordered with the MicroServer, the MicroServer will be configured at the factory to work with the sensor.

To define a custom analog sensor please follow the procedure below:

Click the + button, select Onboard Analog Sensors and click Add Device. Click the pencil icon next to Onboard Analog Sensors. Click Manage Analog Sensors. The window below will be displayed:



Click Add Sensor. Enter a name for the sensor.

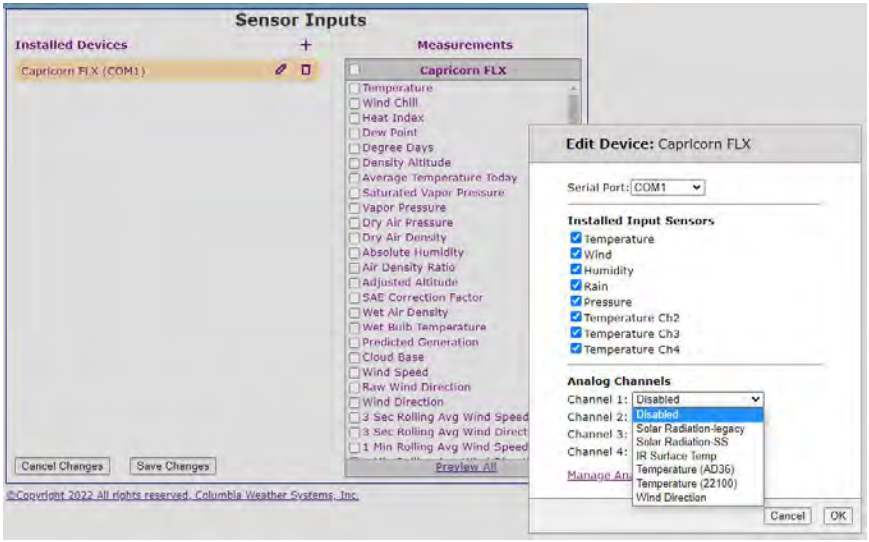
Select the type of sensor. Enter the Factor and Offset.

Click Add when finished. Click Apply Changes.

The new sensor will now be available for selection from the Analog Channel sensor drop-down menu.

Click Apply Changes when finished.

Capricorn FLX Analog Sensor Configuration



The Capricorn FLX Weather Station utilizes four (4) analog input channels for additional sensors.

Solar Radiation channels 1 & 2 are reserved for the standard solar radiation sensor.

Standard Solar Radiation Sensor - used to measure solar irradiance (P/N 82601).

- Solar Radiation-SS - Choose for sensors purchased on or after November 2018.
- Solar Radiation-legacy - Choose for sensors purchased prior to November 2018.

Please note if you have purchased a new replacement Standard Solar Radiation Sensor, change the Analog Channel drop-down to Solar Radiation-SS.

The additional 2 analog channels on the Capricorn FLX Control Module can accept the following sensors:

Solar Radiation - used to measure solar irradiance.

Temperature (AD36) - standard sensor used to measure air, soil/water, or PV panel temperature.

Temperature (2210) - an alternative temperature sensor (used in custom applications).

IR Surface Temperature - (used in custom applications)

Wind Direction - Mechanical Wind Sensor used to measure wind direction.

All analog channels on the Capricorn FLX Control Module are 0 to 2.5 VDC input and are configured as follows:

Pin 1: +3.3 VDC supply voltage

Pin 2: Ground

Pin 3: 0 to 2.5VDC signal input

To enable a sensor on an analog channel, click the drop-down menu next to the analog channel to which the sensor is connected to.

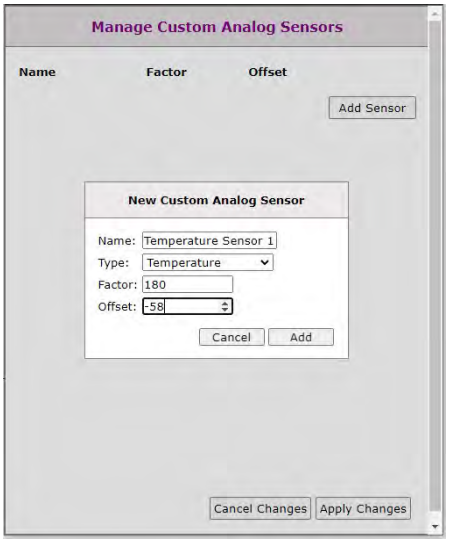
To connect the sensors to the input channels, see the Capricorn FLX User Manual or System Diagram.

Custom Analog Sensors

In addition to the standard sensors, the Capricorn FLX can also accept additional sensors that require custom configuration. The following sensor types are available for configuration: temperature, solar radiation, UV radiation, Photosynthetically Active Radiation (PAR), relative humidity, barometric pressure, carbon dioxide level and snow depth/water level.

If one of these sensors was ordered with the Capricorn FLX, the Capricorn FLX will be configured at the factory to work with the sensor.

Click the + button, select Onboard Analog Sensors and click Add Device. Click the pencil icon next to Onboard Analog Sensors. Click Manage Analog Sensors. The window below will be displayed:



Click Add Sensor. Enter a name for the sensor.

Select the type of sensor. Enter the Factor and Offset.

Click Add when finished. Click Apply Changes.

The new sensor will now be available for selection from the Analog Channel sensor drop-down menu.

Click Apply Changes when finished.

SECTION 3: INSTALLATION

The MicroServer should be installed in a clean, dry location.

Before installing the MicroServer, the network settings may need to be changed for the MicroServer to be compatible with your network. See Network Setup in the Operation Section for additional information.

Connect an Ethernet cable from the Ethernet port of the MicroServer to a network device such as router, hub or switch.

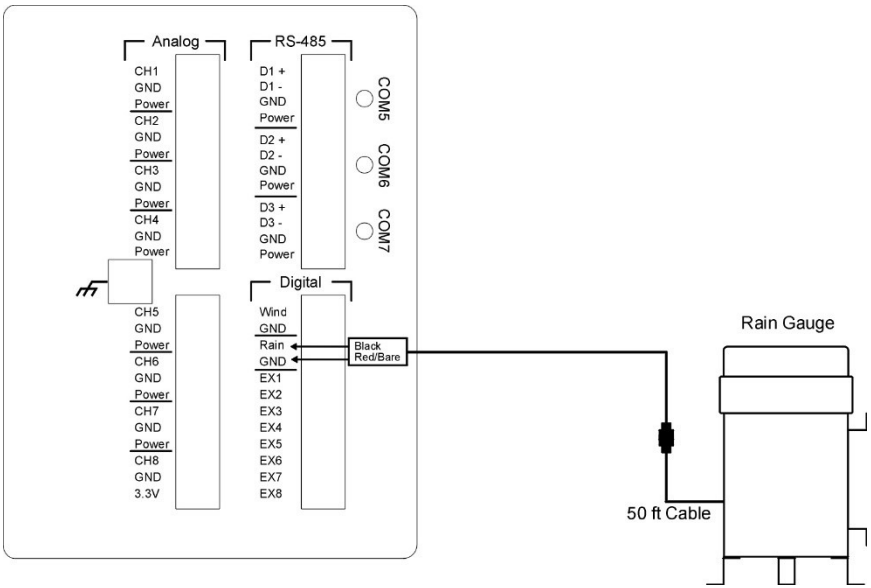
A 12VDC Power Supply is included to power the MicroServer.

To connect your weather station to the MicroServer, see the laminated system diagram provided with the station.

Sensor Connections

Tipping Bucket Rain Gauge Interface

A tipping bucket rain gauge can be connected to the Rain Channel on the Top Panel of the MicroServer as shown below:

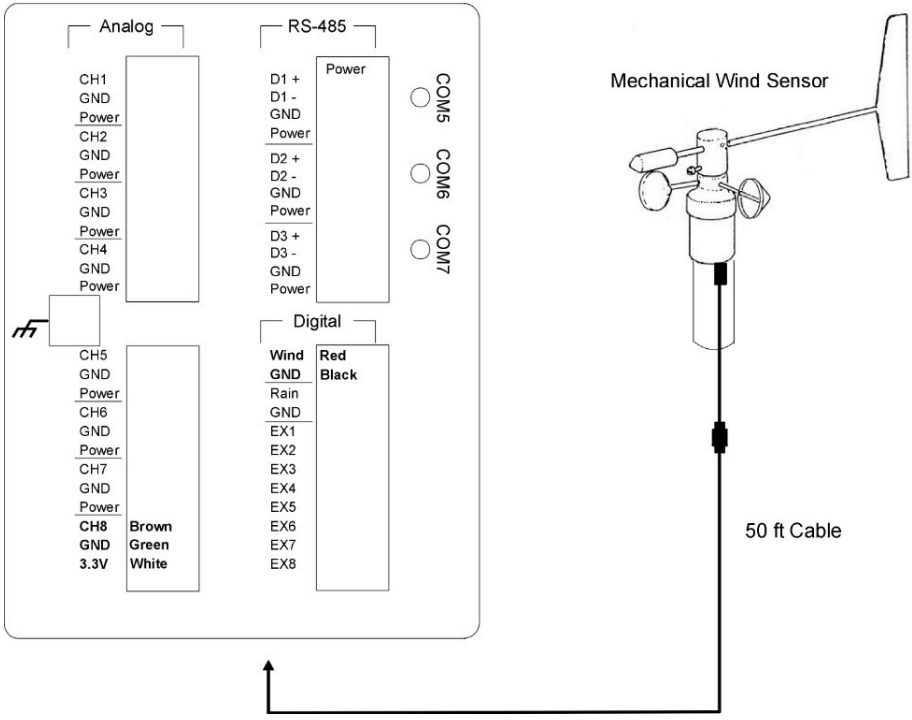


Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the green terminal block screws on the MicroServer as follows:

Description	Function	Color
Rain	Signal	Black
GND	Ground	Red/Bare

Mechanical Wind Sensor Interface

A mechanical Wind Sensor can be connected to the Wind Channel on the Top Panel of the MicroServer as shown below:



Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the green terminal block screws on the MicroServer as follows:

Wind Direction

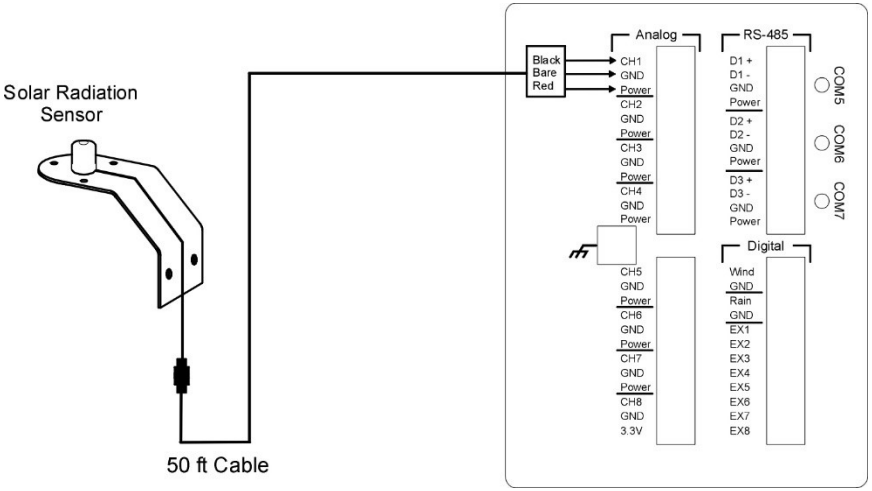
Pin	Function	Color
CH8	Wind Direction Signal	Brown
GND	Ground	Green
3.3V	Reference Voltage	White

Wind Speed

Pin	Function	Color
Wind	Wind Speed Signal	Black
GND	Ground	Red

Solar Radiation Sensor (Pyranometer) Interface

A solar radiation sensor can be connected to one of the Analog Channels (CH1 – CH7) on the Top Panel of the MicroServer as shown below:



Installing the standard solar radiation sensor

The standard solar radiation sensor can be installed on the mast using the hardware included to provide solar radiation measurement or to the solar panel frame to provide plane of array solar measurement.

Connect the solar sensor to the specified analog channel on the MicroServer according to the connection diagram provided with the system.

Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the green terminal block screws on the MicroServer as follows:

Pin	Function	Color
CH#	Signal	Black
GND	Ground	Bare
Power	+5V (standard)	Red

Installing the panel temperature sensor

The panel temperature sensor can be attached to the back of the solar panel using a 5-minute epoxy (not supplied).

Use tie wraps to secure the cable to the panel frame.

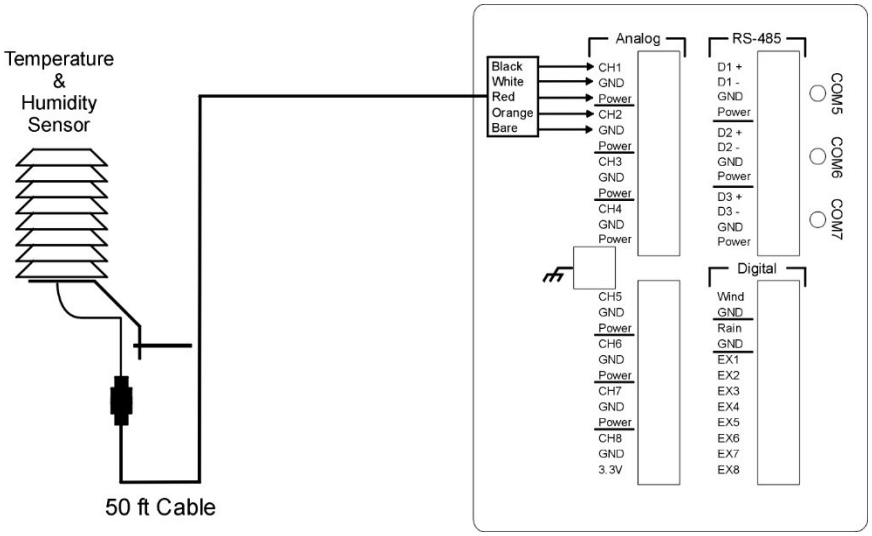
Connect the panel temperature sensor to the specified analog channel on the MicroServer according to the connection diagram provided with the system.

Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the green terminal block screws on the MicroServer as follows:

Pin	Function	Color
CH#	Signal	Black
GND	Ground	Bare
Power	+5V (standard)	Red

Temperature/Relative Humidity Sensor Interface

A Temperature/Relative Humidity Sensor can be connected to one of the Analog Channels (CH1 – CH7) on the Top Panel of the MicroServer as shown below:



Installing the Temperature/Relative Humidity sensor

The standard Temp/RH sensor can be installed on the mast using the hardware included to provide Temperature and Relative Humidity measurements.

Connect the Temp/RH to the specified analog channel on the MicroServer according to the connection diagram provided with the system.

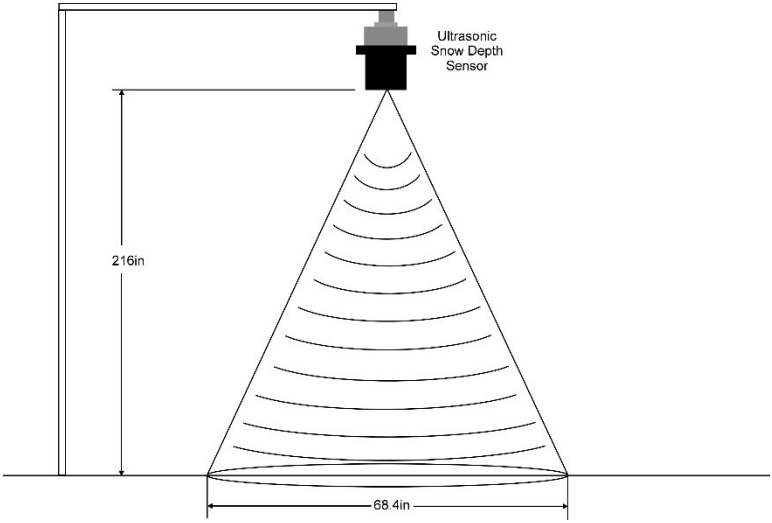
Using a #1 Straight Slot screwdriver, attach the wires from the end of the sensor cable to the green terminal block screws on the MicroServer as follows:

Pin	Function	Color
CH#	RH Signal	Black
GND	Ground	White
Power	+5V (standard)	Red
CH#	Temp Signal	Orange
GND	Ground/Shield	Bare

Installing the Snow Depth/Water Level Sensor

The Snow Depth/Water Level Sensor is programmed to be mounted at a height of 216in (18ft) from the ground.

At 18ft (216in) the sensor requires a clear area of 68.4 inches in diameter.



To avoid inaccurate readings, the sensor should be mounted away from any obstructions in the measurement area.

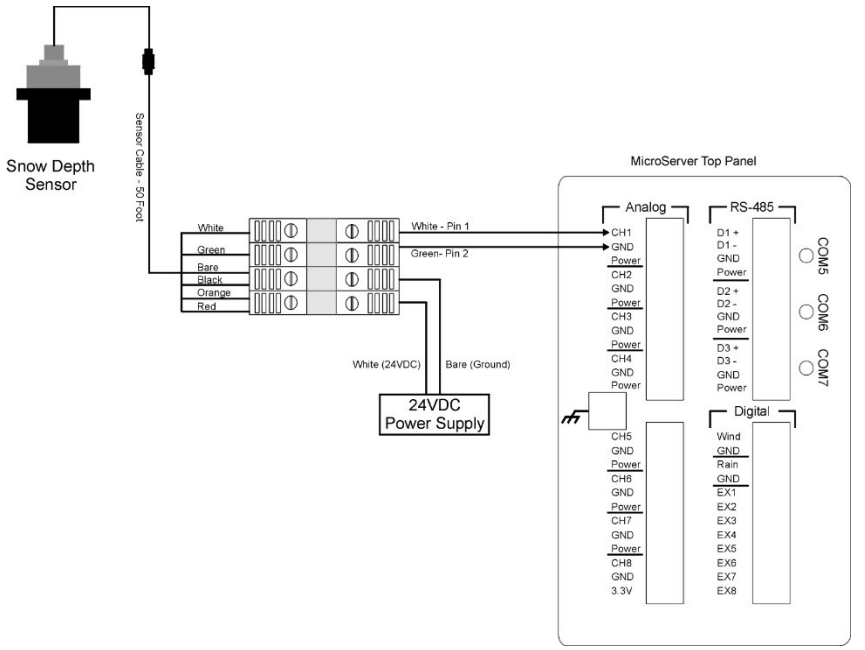
If the sensor cannot be installed at 216in (18ft) an Offset will need to be entered into the Snow/Water Depth offset on the Parameter Settings page.

Connection to the MicroServer

A 12VDC Power Supply is included to power the MicroServer.

A separate 24VDC Power Supply is included to power the Snow Depth/Water Level Sensor.

The Snow Depth/Water Level Sensor connects to one of the analog Channels on the MicroServer.


Snow Depth Sensor
Sensor Cable - 50 Foot
White
Green
Bare
Black
Orange
Red
White - Pin 1
Green- Pin 2
White (24VDC)
Bare (Ground)
24VDC Power Supply
MicroServer Top Panel
Analog
CH1
GND
Power
CH2
GND
Power
CH3
GND
Power
CH4
GND
Power
CH5
GND
Power
CH6
GND
Power
CH7
GND
Power
CH8
GND
3.3V
RS-485
D1 +
D1 -
GND
Power
D2 +
D2 -
GND
Power
D3 +
D3 -
GND
Power
COM5
COM6
COM7
Digital
Wind
GND
Rain
GND
EX1
EX2
EX3
EX4
EX5
EX6
EX7
EX8

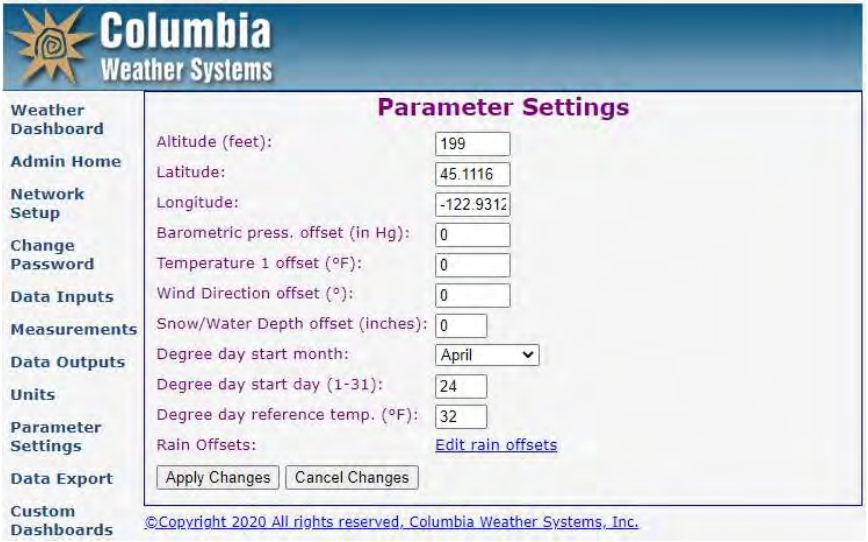
Configuration:

If the Snow Depth/Water Level Sensor is sold with the MicroServer it is provided preconfigured at the factory to work with the Snow Depth/Water Level Sensor.

The following information is provided here for reference and calibration purposes.

On the Parameter Settings Page, the height of the Snow Depth/Water Level Sensor is entered as an offset.

The default Snow/Water Depth offset is 216.

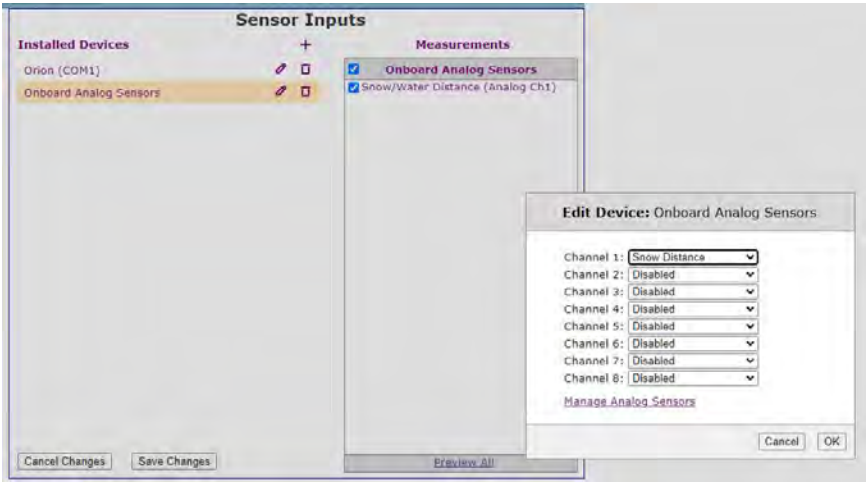


The sensor is programmed to be mounted at 216” (18ft) from the ground.

If the sensor height is different, enter the new height in inches into the Snow/Water Depth offset on the Parameter Settings page as shown above.

On the Sensor Inputs page, a Custom Analog Sensor has been created with the following custom sensor settings:

Name: Snow/Water Distance
Sensor Type: Snow/Water Distance
Factor: - 86.4
Offset: 216



The Offset will vary from sensor to sensor due to calibration.

Refer to the Snow Depth/Water Level Sensor installation guide for calibration.

Grounding the MicroServer Chassis

The MicroServer chassis includes a lug on the Top Panel for grounding the unit to Earth Ground.

Weatherproof Enclosure

For outdoor installations, the MicroServer can be housed in a 12”x10”x6” weatherproof enclosure.

The system enclosure includes a power supply, mounting panels, terminal blocks for sensor connections as well as hardware to mount the enclosure onto a mast.

The enclosure houses the MicroServer and Interface Module. The enclosure also includes a connection diagram. Interface Module not required with Capricorn FLX System.

A lug on the outside of the enclosure is provided for grounding the unit to Earth Ground. A 14 to 16 AWG copper wire is recommended for proper grounding.

SECTION 4: OPERATION

Weather MicroServer User Interface

The Weather MicroServer utilizes a web browser user interface. The MicroServer is configured at the factory with IP address 192.168.0.50.

The IP address along with other network settings can be changed to match the local network configuration. Please see Network Setup for more information.

Once the MicroServer is connected to the network, open an Internet browser such as Chrome and type in the following IP address: 192.168.0.50

If this IP address is already being used by another device, see Network Setup in the Operation Section.

Note: please enter your own IP address if it has been changed from the 192.168.0.50 default.

When the User Interface is accessed, the Main Dashboard page will be displayed.

Main Dashboard

The Main Dashboard page displays the station name and the main parameters in the selected units.

Auxiliary, Trend, and Latest Measurements can also be accessed from this page.

The “Measured At” displays the date & time of the last measurement and how many seconds since that measurement. If the weather station has lost power, is no longer functioning or has a connection problem, “Measured At” will show the date & time of the last measurement received, with the seconds since data was last received.

The yellow band along the wind dial is a graphical representation of the 30 Second Vector Mean and Standard Deviation Wind Direction.

The Device Admin area is only accessible with login credentials.

Auxiliary

The Auxiliary page displays additional parameters in the selected units.

Trend

The Trend page displays a 24-hour graph of the selected measurement.

The graph will display up to 24-hour data from 12:00 AM to the current time.

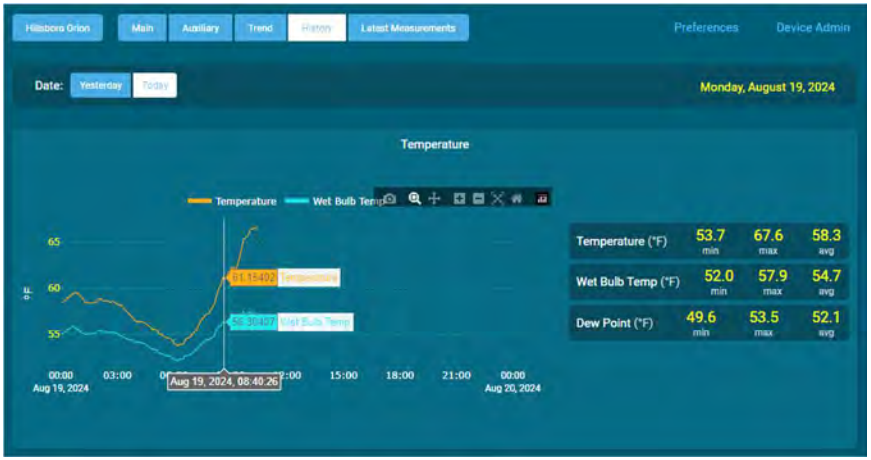
The graph is self-scaling based on the data values and the size of the graph window.

To select a measurement, use the drop-down arrow in the Measurement field and select the desired measurement.

The graph can display up to two measurements at once.

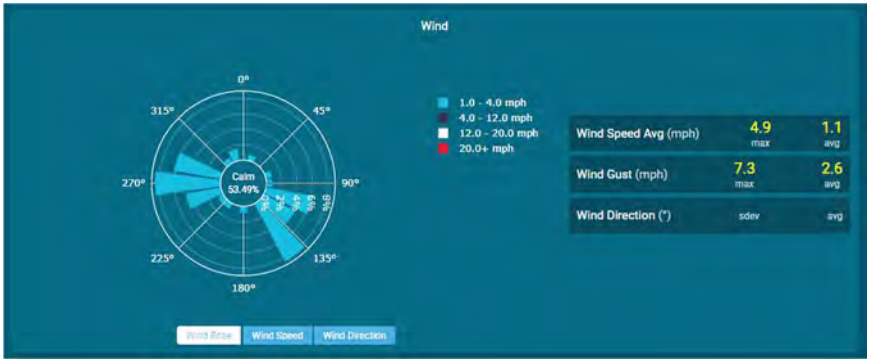
History

Temperature Tile:



Displays trend data for the Temperature, Wet Bulb Temperature and Dew Point for the last 48 hours.

Wind Tile:
Three options are available: Wind Rose, Wind Speed Trend, and Wind Direction Trend.

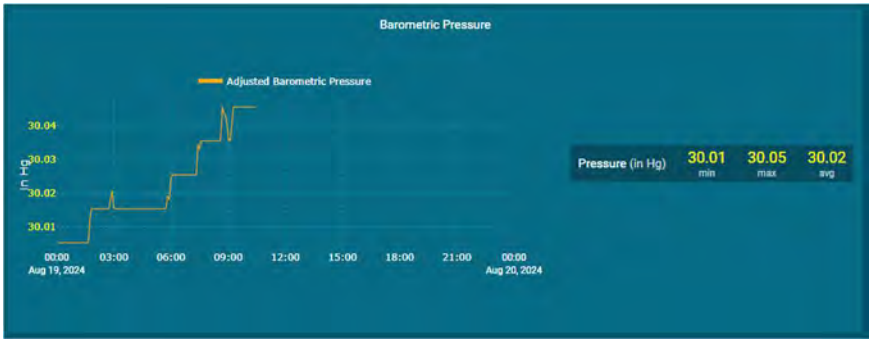


The Wind Rose displays the wind direction percentage and corresponding color coded wind speed value (2-minute average) for the day.
The readout on the right displays the 2-minute average wind speed, 10-minute wind gust and standard deviation of the wind direction based on the 2-minute average wind direction reading.

Wind Speed Trend – Displays Trend for 10-minute wind gust and 2-minute average wind speed for the last 48 hours.

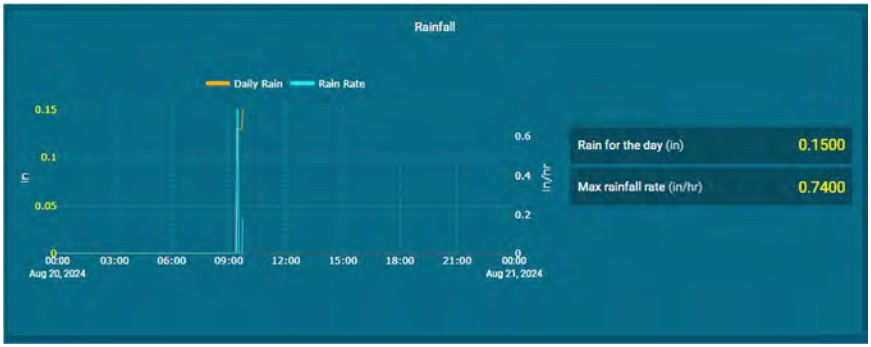
Wind Direction Trend – Displays a scatterplot of the wind direction 2-minute average.

Barometric Pressure tile:



Displays trend data for Barometric Pressure for the last 48 hours.

Rainfall tile:



Displays trend data for Rain for the day and Rain Rate for the last 48 hours.

Latest Measurements

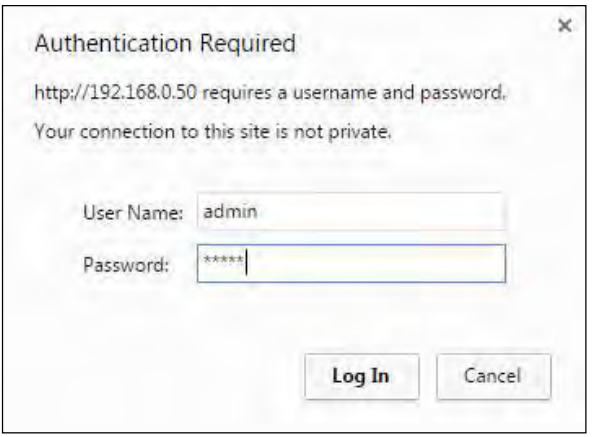
The Latest Measurements page displays the current parameter values in the selected units.

Only the selected parameters in the Selected Measurements page will be displayed.

The Latest Measurements page updates every two seconds.

Device Admin

To access the administrative area of the User Interface, click on the Device Admin menu item. The user will be prompted to enter a user name and password.



The default username is **admin** and the default password is also **admin**.

The username cannot be changed but the password can.

There is no limit to the length of characters the password can be.

The allowable special characters are as follows:

.,|!@#$%&*()+-^~`]+

If the password has been changed and lost, please follow the steps for Manual Recovery Mode Entry in the Recovery Mode section.

For further support send an email to: support@columbiaweather.com

Admin Home

The Admin Home page is an informational page that includes the station name, firmware version, current time, serial number, and status.

The displayed time is the time generated by the real-time clock in the MicroServer. Be sure to refresh the browser for the current time.

The MicroServer status is Running or Stopped. The Data Manager software starts automatically on power up.

The Copyright information below the home page status links to the Columbia Weather Systems website.

Shutdown

Click the Shutdown button to stop the Data Manager and ensure a proper shutdown of the MicroServer.

Station Name

Change the station name to reflect the station location, company name or function.

The station name will be displayed on the browser top bar.

This name will identify this station in the Home page, Weather Dashboard page, Latest Measurements page and in the XML data file.

Firmware Update

Firmware updates can be emailed directly to the user upon request.

The update firmware file has the “msu” extension and does not need to be unzipped or altered in any way. Copy the file to a computer on the network.

Weather Device Recovery Mode

To upgrade the MicroServer firmware click on Update Firmware, then click Enter Recovery Mode to boot the MicroServer into the upgrade environment. Once in Recovery Mode click Update Firmware, click Choose File and select the firmware file.

Click Update Firmware to install the new firmware file and begin the upgrade process. The update will take up to 5 minutes.

It is very important that the power is not disconnected from the Weather MicroServer during this process. Do not attempt firmware update during periods of power uncertainty.

Date and Time

Date and Time page allows the user to change the MicroServer date and time.

The data should be in yyyy-mm-dd format.

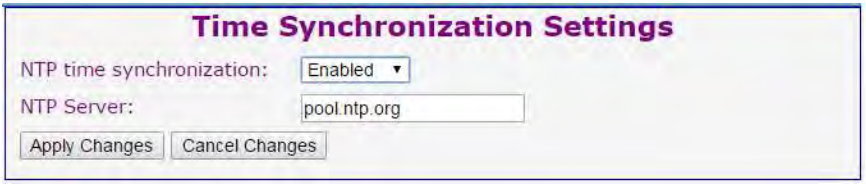
The time should be in hh:mm:ss format. Please be sure to enter the seconds when setting the time.

Select the time zone from the drop-down menu. The United States regional time zones are listed near the bottom of the list.

The MicroServer date and time is stamped on all records.

Reboot the MicroServer after the date and time have been set.

NTP Time Synchronization



To synchronize the time with an NTP time server click “NTP time synchronization settings”. Choose “Enable” from the NTP time synchronization drop-down menu.

Click Date and Time, select the correct time zone for the station location from the drop-down menu.

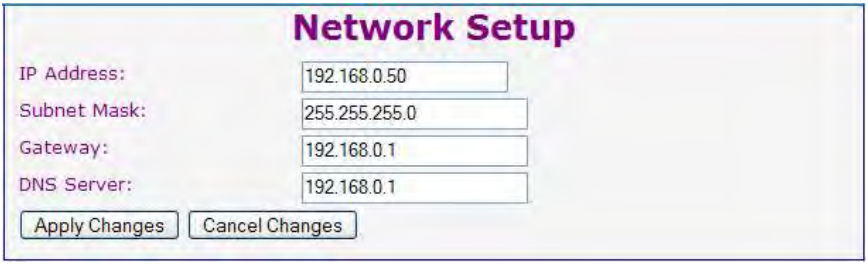
Enter the correct time in manually, click Apply Changes.

Reboot the MicroServer for changes to take effect.

The NTP time synchronization setting is enabled by default.

The default NTP time server is pool.ntp.org.

Network Setup



Network Setup page allows the user to change the IP address, subnet mask, gateway, and DNS Server settings.

The MicroServer factory settings are as follows:
IP address 192.168.0.50
Subnet Mask: 255.255.255.0
Gateway: 192.168.0.1
DNS Server: 192.168.0.1

If the IP Address, Subnet Mask, Gateway or DNS Server settings are different than the above, the MicroServer settings must be changed to match the network in order for the MicroServer to be visible on the network.

To change the MicroServer network settings:

1. Connect the MicroServer to a stand-alone computer (for example a laptop) via a standard or crossover Ethernet cable.
2. Change the computer IP Address to 192.168.0.49. The Subnet Mask should be 255.255.255.0. Contact your Network Administrator for assistance.
3. Browse the MicroServer at 192.168.0.50
4. In the MicroServer User Interface, click on Network Setup and change the settings to match your network.
5. Click on Save Changes.
6. Disconnect the MicroServer from the stand-alone computer and connect it to the network using a standard Ethernet cable.
7. Browse the MicroServer at the new IP address from the network to verify that the changes are successful.
8. Change the computer (laptop) network settings back to default settings.

Change Password

Change Password page allows the user to change the Admin password.

There is no limit to the length of characters the password can be.

The allowable special characters are as follows:

.,|!@#$%&*()+-^~`]+

If the password has been changed and lost, please follow the steps for Manual Recovery Mode Entry in the Recovery Mode section.

For further support send an email to: support@columbiaweather.com

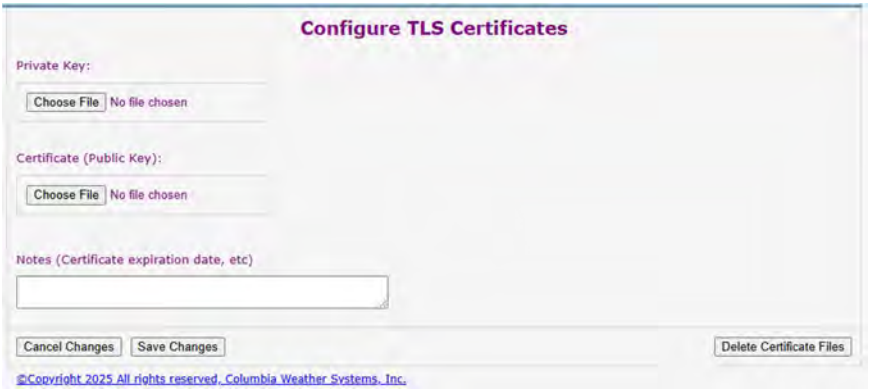
Web Server

To configure the MicroServer to communicate over HTTPS:

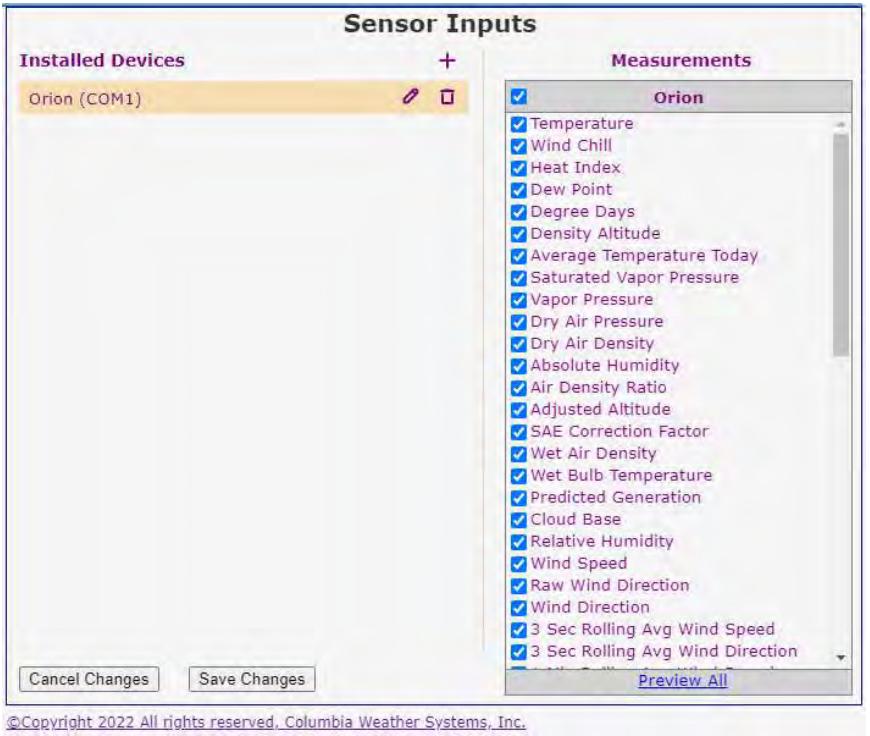
1. Download the device settings file from the Backup and Restore page.
2. Click Web Server>Configure Certificates
3. Upload the appropriate Private Key and Public Key Certificates.
4. Click Save Changes.
5. Click Web Server.
6. Select HTTPS Enabled and/or HTTPS Redirect as needed.
7. Click Save Changes. Reboot the MicroServer from the Diagnostics page.

The unit will now be available over HTTPS.

Example URL: https://192.168.0.50



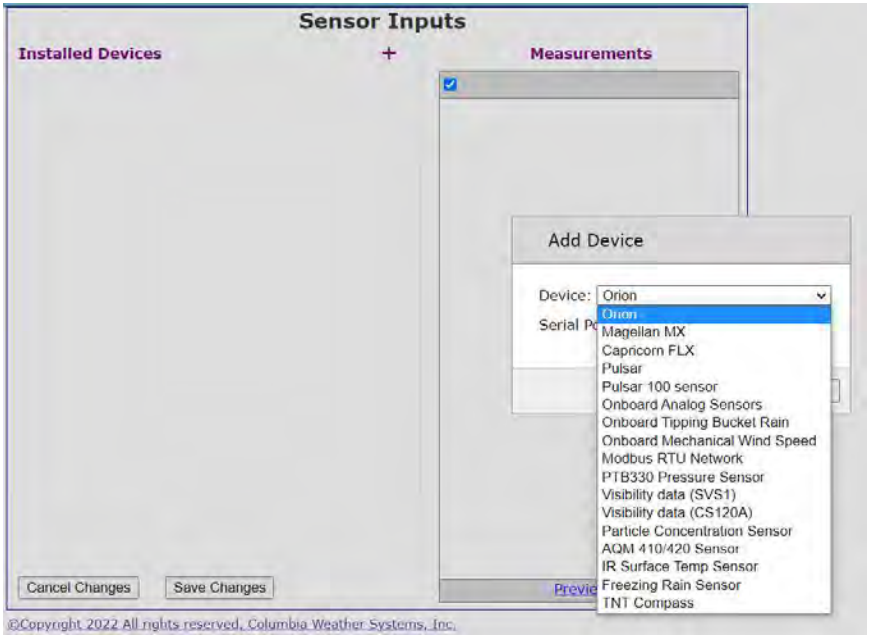
Sensor Inputs



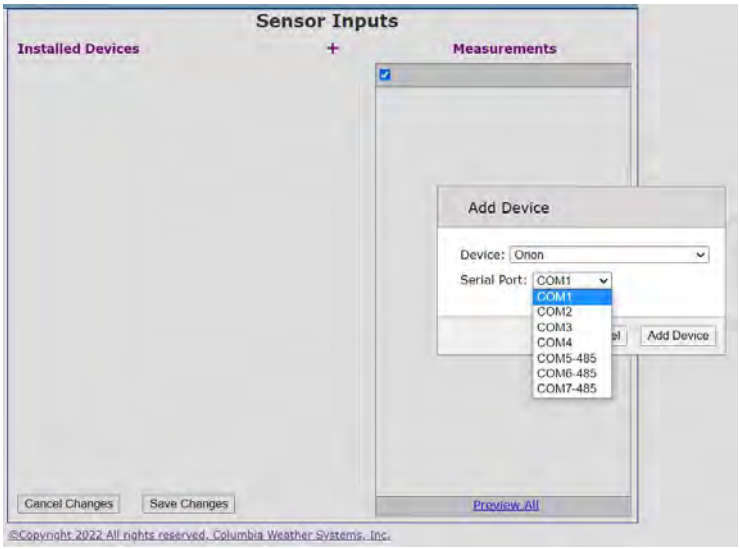
The MicroServer is provided preconfigured from the factory to communicate with the purchased weather station.

If the configuration is lost, follow the steps below to reconfigure the unit.

Next to Installed Devices click the + button.



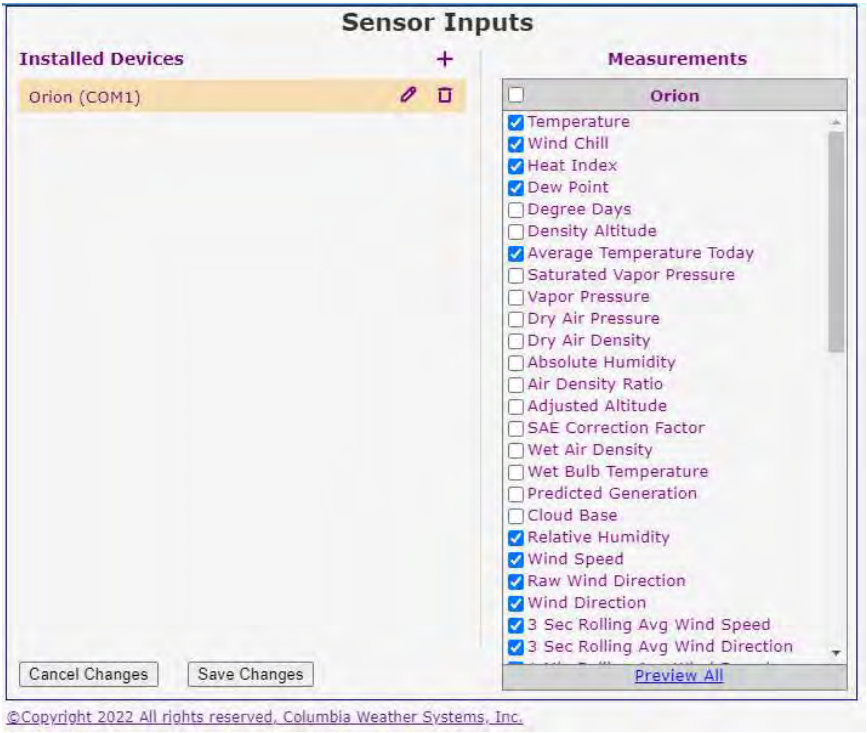
Select the weather station product name that was ordered.



Select the correct COM port for your system.

In most configurations the weather station connects to COM1.

Refer to the laminated system diagram provided with the station if unsure.

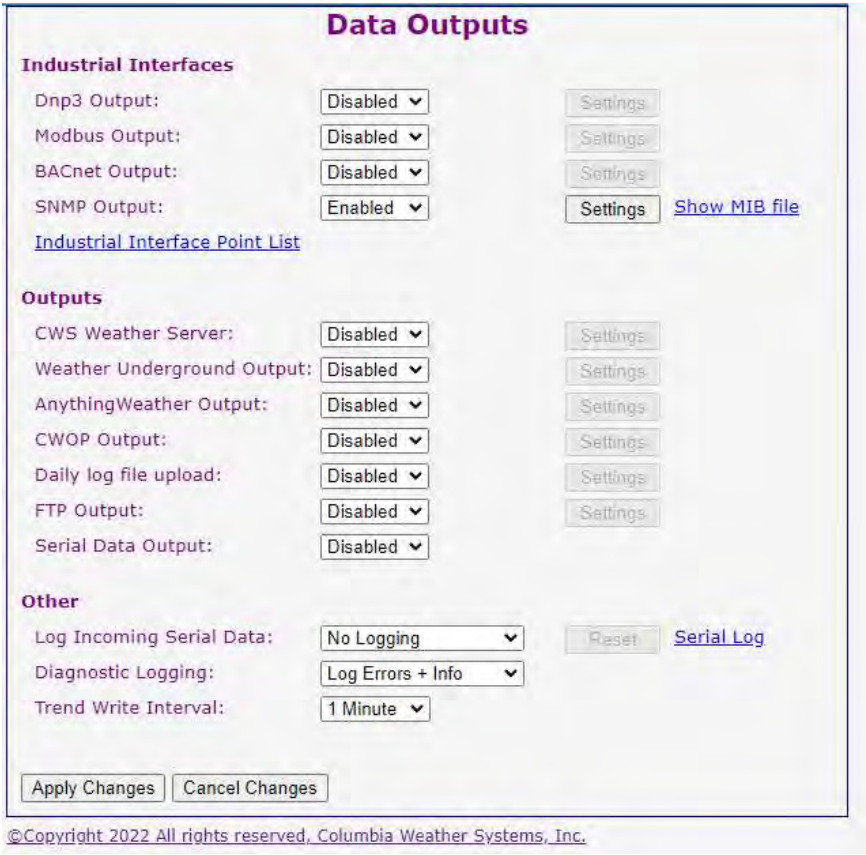


From the Measurements menu on the right select the desired paramaters and click Save Changes.

The Measurements menu allows the user to customize the measurements/parameters that will be displayed on the Latest Measurements page and the Weather Dashboard pages, including Main Dashboard and Auxiliary.

Only the selected parameters will be displayed and recorded in the data log files.

Data Outputs



Modbus Interface

The Weather MicroServer has a built-in Modbus TCP/IP and RTU slave interfaces for communication with industrial automation systems and OPC servers.

The MicroServer offers both 32-bit and 16-bit scaled integer registers.

Modbus registers update every 3 seconds.

All data accessed via read only Input Registers.

All units are U.S. Customary; Temperature - °F, Barometric Pressure - InHg, Wind Speed - MPH, Rain – inches

Byte Order is Little Endian.

Industrial Interface Point List:

The Industrial Interface Point List provides a static point list for the current configuration. It displays the parameter name along with the Modbus register number and the DNP3 index number.

Check the “Show only selected measurements” box to display only the selected measurements.

It also provides dynamic measurements, which are measurements not included in the standard point list. After the point list is mapped to the PLC, SCADA or DCS system the point list can be frozen, by clicking Freeze. This will ensure the register numbers stay the same even when the selected measurements change or if a new sensor is added to the system.

To unfreeze the point list click Unfreeze.

The Industrial Interface Point List does not show the 16-bit Modbus registers.

See Appendix C for the Modbus Point Lists

Modbus TCP/IP

Modbus TCP/IP is available through the Ethernet port.

Select Enabled from the drop-down menu. Click the Settings button, select “TCP” from the Modbus Output drop-down menu, enter in an address number, click OK, and then click Apply Changes.

Modbus RTU

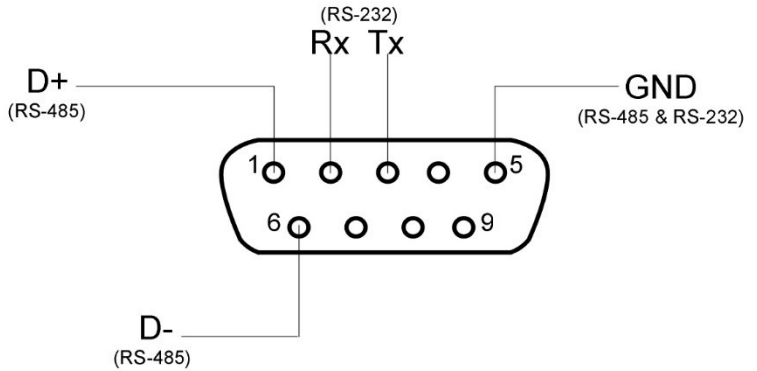
Select Enabled from the drop-down menu. Click the Settings button, select COM5-485 from the Modbus Output drop-down menu, click OK, and then click Apply Changes.

Enter the Modbus address, baud rate, and parity. The data bits are set to 8 and the stop bits are set to 1. This cannot be changed.

Modbus RTU over RS-485 is available on the Top Panel on COM5, COM6 or COM7.

Modbus RTU is also available through the RS-485 port on COM 2. In the Settings select COM6-485.

The RS-485 port is configured as follows:



Pin 1: D+

Pin 5: Ground

Pin 6: D-

Modbus Point List (32-bit)

See Appendix C for the 32-bit register list.

All data is accessed via read only input registers.

[Modbus Function Code 04]

Data type Long = Signed 32 bit value

Data type Float = 32 bit floating point value

For each available measurement, the two registers immediately following the value contain the most recently updated posix time value. For example: the Wind Speed value is stored in registers 5 and 6. The updated timestamp is stored in registers 7 and 8 and is a 32-bit integer value.

The posix time values are 32-bit integers; all the values are Modbus input registers.

For registers that do not contain data, the value of -99999 is used to indicate missing or invalid data.

Modbus Point List (16-bit Scaled Integers)

See Appendix C for the 16-bit register list.

The 16-bit scaled integer registers are available for most parameters.

The 16-bit point list includes a minimum, maximum, factor, and offset value for each parameter.

Parameter value = (unsigned 16-bit Integer + Offset)/Factor

If the register value is negative, you must convert it to an unsigned value using the following formula: unsigned value = 65536 + register value.

If the register value is positive, the unsigned value is the same as the register value.

For example:

Temperature is register 32010
Factor = 256
Offset = -17920

If the register value is -30182
The unsigned value = 65536 - 30182 = 35354

Temperature = (35354 – 17920)/256 = 68°F

Relative Humidity is register 32005
Factor = 590
Offset = 0
If the register value is +21830
Relative humidity = 21830/590 = 37%RH

DNP3 Interface

The Weather MicroServer supports DNP3 Ethernet and Serial communication to interface the weather station with process automation systems. The data updates every 3 seconds.

DNP3 Ethernet

Master address: 1 - 65535

Slave address: 1 - 65535

TCP port: 20000 (default)

Date type: Float

Client access: Read Only

Address: 30.5.X.Explicit, where X = the DNP3 index number

DNP3 Serial (RTU RS-485)

DNP3 Serial is available over RS-485 on the Top Panel on COM5, COM6 or COM7.

Master address: 1 - 65535

Slave address: 1 – 65535

Data bits: 8

Stop bits: 1

Baud rate: 1200, 2400, 9600, 19200

Parity: None

Date type: Group 30 Class 5

Client access: Read Only

See Appendix D for the DNP3 Index List

BACnet Interface

The Weather MicroServer has a built-in BACnet interface for communication with building automation and control systems.

Device ID: 1 – 4194304

UDP: 47808

SNMP Interface

SNMP: Simple Network Management Protocol. The Weather MicroServer has a built-in SNMP interface for communication network management systems. SNMP version 2 and version 3 are supported.

Click on Show MIB file to view the MIB definitions and objects for the MicroServer.

SNMP Version 2

To get all SNMP values use the following command line:

snmpwalk – v 2c –c public –m ALL 192.168.0.50 orionScalarData

To get a specific value use the following command:

snmpget –v 2c –c public –m ALL 192.168.0.50 omAdjWindDir-Value.0

(Other files can be retrieved from the MIB file)

(Use the correct IP address of your MicroServer. Default IP address is used in the examples above.)

Note: Make sure the firewall is not causing interference.

SNMP Version 3

Select the Encryption Style; DES (Data Encryption Standard) or AES (Advanced Encryption Standard).

Create a User Name and Password.

To get all SNMP values use the following command line:

AES Encryption Style:

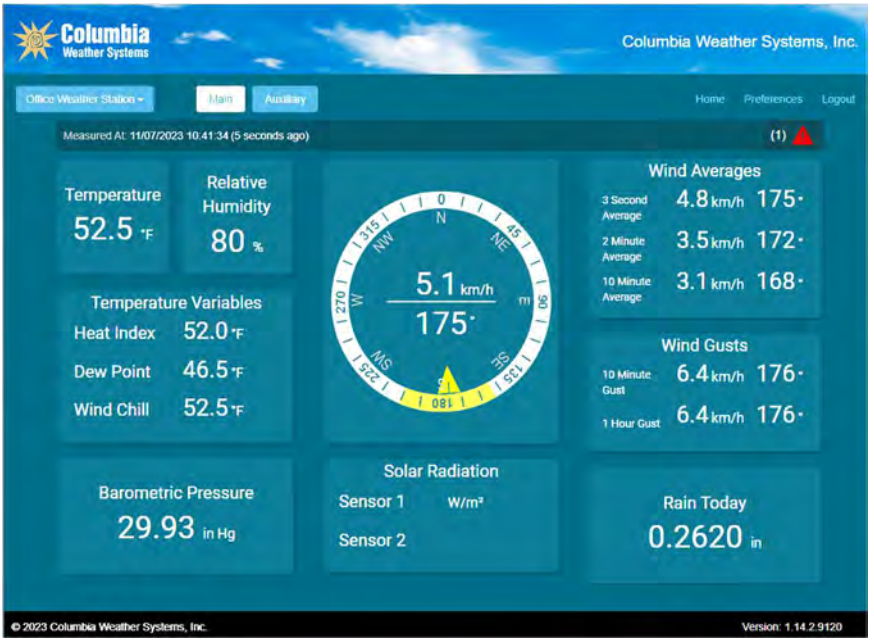
snmpwalk -v 3 -n "" -u username -a SHA -A "password" -x AES -X password -l authPriv -m ALL 192.168.0.50 orionScalarData

DES Encryption Style:

snmpwalk -v 3 -n "" -u username -a SHA -A "password" -x DES -X password -l authPriv -m ALL 192.168.0.50 orionScalarData

(Use the correct IP address of your MicroServer. The default IP address is used in the example above.)

CWS Cloud Weather Server Output:



To upload the weather data to Columbia Weather Systems' Cloud Weather Server, please send a request to support@columbiaweather.com

Columbia Weather will then create an account and respond with an account ID and password.

In the MicroServer Data Outputs page, select "Enabled" for the CWS Weather Server.

Click on Settings to configure the output. Enter the Weather Station ID and Password and click OK.

The MicroServer uploads the data over HTTPS every 5 seconds to the Cloud Weather Server.

Weather Underground Output:

To upload the weather data to Weather Underground, please go to: www.wunderground.com, register (create a password and username station (create a Station ID). For Device Type, choose Columbia Weather Systems Capricorn 2000EX.
In the MicroServer Data Outputs page, select “Enabled” for the Weather Underground Output.

Click on Settings to configure the output. Enter the Weather Station ID and Password and click OK.

Please note all network settings on the MicroServer including the DNS Server and Gateway need to match the LAN network settings for the feature to work properly.

AnythingWeather Output:

To upload the weather data to Anything Weather, please go to: www.anythingweather.com, and join the network by filling out a contact request form.

In the MicroServer Data Outputs page, select “Enabled” for the AnythingWeather Output.

Click on Settings to configure the output. Enter the Weather Station ID and Password and click OK.

CWOP Output:

To upload the weather data to the Citizen Weather Observer Program (CWOP), please go to http://www.findu.com/citizenweather/signup.html

to setup a Call Sign/Station ID (CW number). You will need to fill out and submit a web form to receive the Call Sign (or CW number)

In the Parameter Settings page of the MicroServer, please be sure to enter your station Latitude and Longitude.

To output weather data to CWOP, select “Enabled” in the Data Outputs page.

Click on Settings to configure the output.

Enter the Call Sign/Station ID/CW Number assigned by CWOP (upper case letters).

Enter **cwop.aprs.net** for the Server.

Enter **14580** for the Port (use **23** if you are experiencing issues)

Enter **-1** for the password. This is the Validation Number.

Click OK and then Apply Changes.

CWOP updates every 400 seconds, approximately every 6 minutes.

Daily Log File Upload

The daily log file is generated at the start of each day (or when there is a change in parameter selection) and is uploaded at the end of each day at midnight.

Enable the Daily log file upload and click on the Settings button.

Enter in the FTP Host/Directory/, User Name, and Password then click OK.

Do not include the ftp:// protocol in the FTP Host name. Simply enter the host name.

Include a trailing forward slash after the directory name.

Click Apply Changes.

FTP Output

The FTP output enables the MicroServer to send weather data files to FTP servers over the Internet.

Enter the FTP URL, include the ftp:// protocol in the URL.

Enter the user, and password. If the FTP site is not secure and does not require a username and password, enter **anonymous** for the user name and leave the password blank.

The URL (Uniform Resource Locator) is the FTP server address or name and it should end in /*filename*

Filename: The file name that will be uploaded to the FTP server with the proper extension. If the output format is XML, the extension is .xml. If the output is CSV, the extension is .csv or .txt.

Choose the desired output format. The output format is dependent on how the data will be used at the FTP server.

XML (Extensible Markup Language) is a data description file that also contains the data. The XML file will contain the current measurements. This format is useful for generating web pages containing weather data and for interfacing with other software programs.

Standard XML includes the selected parameters with U.S. customary units. The units are implied and are not included in the file.

Enhanced XML includes the selected parameters with the user selected units. The units are included in the file.

CSV (comma-separated values) file contains the data separated by commas. The field order in the record is based on the same order of the selected measurements in the Selected Measurements page. Two output formats are available:

CSV-append data format will generate a file with comma-separated records every 15 seconds without overwriting the previous data.

Note: The append data option only works if your FTP server will accept it.

CSV-overwrite data format will generate a file with one (the latest) comma-separated record. This file will update every 15 seconds and overwrite the previous record.

The CSV file is in U.S. customary units.

Serial Data Output:

COM 2 can be configured to output ASCII serial data for other serial devices including the Weather Display Console.

Below is a sample data output record:

CW-MS,Dm=241D,Sm=3.3S,Ua=44.2P,Pa=29.900I,TA=70.5F,
Tw=56.7F,Dp=47.6F,Rc=0.000I,IuM

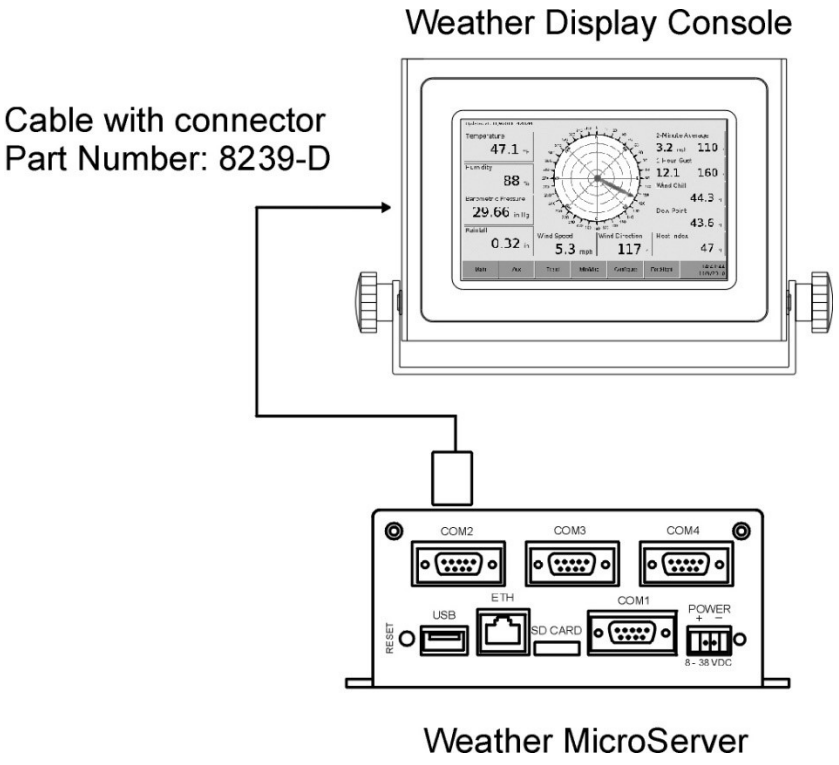
Fields definitions:

Dm: Wind Direction (Degrees)
Sm: Wind Speed (Mph)
Ua: Relative Humidity (RH%)
Pa: Barometric Pressure (Inches Mercury)
TA: Temperature (Fahrenheit)
Tw: Wet Bulb Temperature (Fahrenheit)
Dp: Dew Point (Fahrenheit)
Rc: Rainfall Accumulation for the day (Inches)
IuM: Checksum

Below are the communication settings for the serial data output:

Baud rate: 9600
Data bits: 8
Stop bits:1
Parity: None
Flow control: None

Note: In order for the Weather Display Console to communicate with COM2 on the MicroServer, the Display Console needs to be set to Orion or Capricorn FLX input type. Also, the proper DB-9 connector and RJ-11 cable are required. Please contact Columbia Weather Systems to order the correct parts.



Serial Data Logging

In addition to the daily data log files, the MicroServer can also log the weather data received by the primary weather station connected to COM1. The data is logged at a one-second interval and includes a time stamp.

To enable the feature, select Log COM1 Data from the Serial Data Logging drop down menu. Click Apply changes to begin capturing.

Once data capture begins, a Serial Log link becomes available. Click on the link to view and save the file.

The log file is also available on the Data Logs page under COM1_data.txt

To reset the Serial Log file click Reset on the Data Outputs page.

Please note clicking OK will reset the serial log file, deleting previously collected serial data.

Diagnostic Logging

Is set to Verbose Logging by default. The diagnostic logging is used by Technical Support to troubleshoot problems with the MicroServer.

Trend Write Interval

Is set to 1 Minute by default. The data can also be logged at 1 Second.

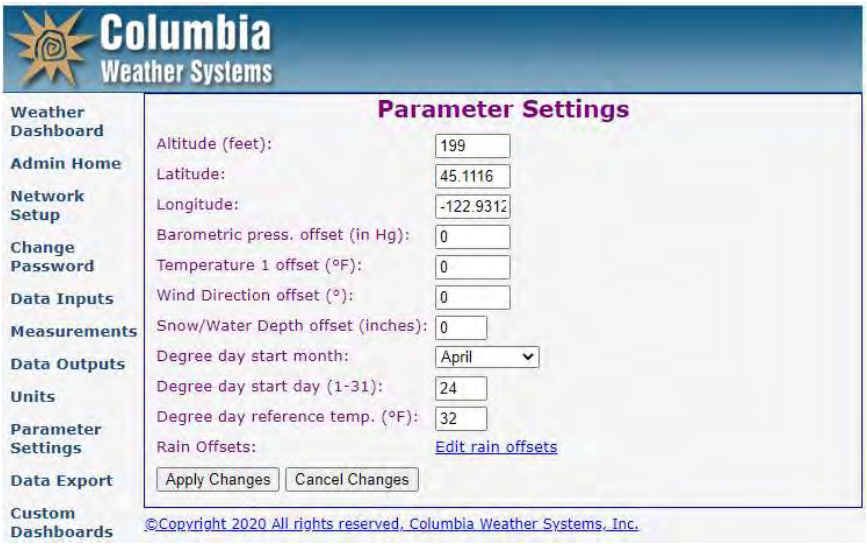
Please note if you are using WeatherMaster Software with the Trend Write Interval set to 1 second, the data will not be imported into the WeatherMaster database. Data can be manually exported from the Data Export page of the MicroServer. See Data Export section below.

Units

The Units page allows the user to select the desired units for the weather parameters in the Enhanced XML output as well as the Weather Dashboard, Auxiliary, Trend and the Latest Measurements pages.

Please note that the data log files, and the Standard XML and CSV outputs always use U.S. customary units. In addition, Modbus, DNP3, BACnet and SNMP interfaces report only in U.S. customary units.

Parameter Settings



The Parameter Settings page allows the user to enter station specific data.

Altitude: The elevation of the station, specifically the sensor transmitter. This setting will change the adjusted Barometric Pressure reading. Altitude is in feet.

Latitude and Longitude: Enter both values in decimal format. These two values are used in the CWOP output. For west and south, enter as negative values.

Barometric pressure offset: This offset allows the user to calibrate the barometric pressure sensor to match a local standard. Barometric Pressure Offset is set in Inches Hg.

Temperature 1 offset: This offset allows the user to adjust the temperature reading. The offset is in °F.

Wind Direction offset: This offset allows the user to adjust the wind direction reading. The offset is in degrees (°).

Snow/Water Depth offset: If a Snow Depth/ Water Level Sensor was ordered and it will be installed at the default height, then the offset 216 is entered here at the factory. If the sensor will be installed at a different height, then the new value will be entered here in inches.

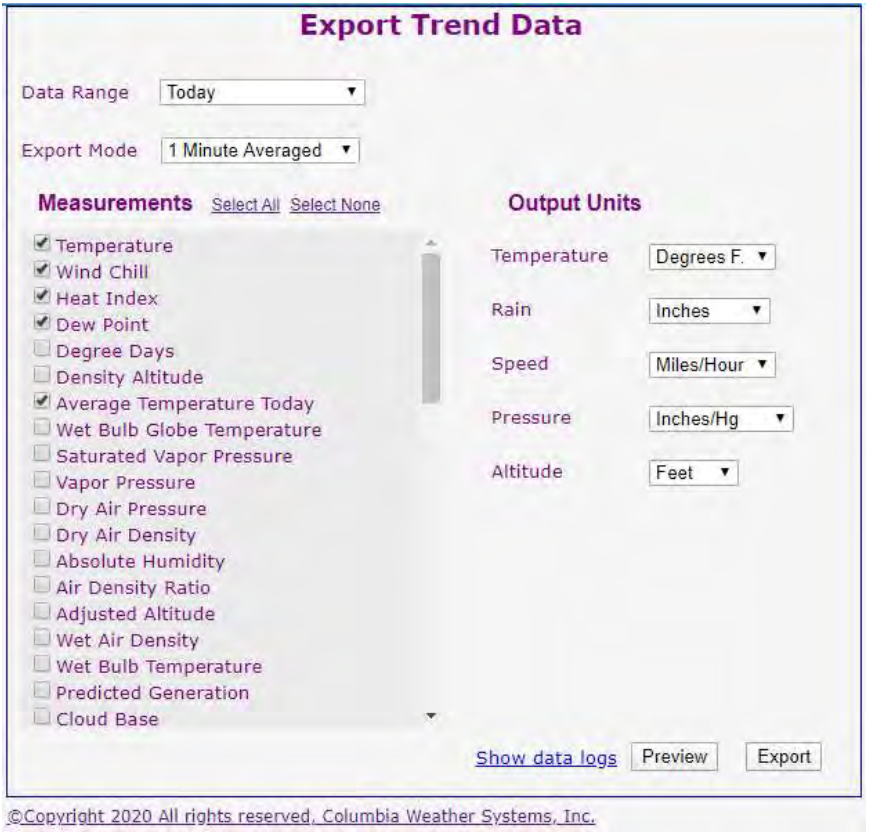
Degree Day: For degree day calculations, enter the start month, start day and reference temperature.

Rain Offsets

This page displays the rain accumulation for the week, month, and year (excluding today's rain accumulation).

The rain values can be adjusted for any day that has rain accumulation during the current month by clicking on the inches recorded.

Data Export



The Export Trend Data page allows the user to export the selected data from the data log files to a CSV file.

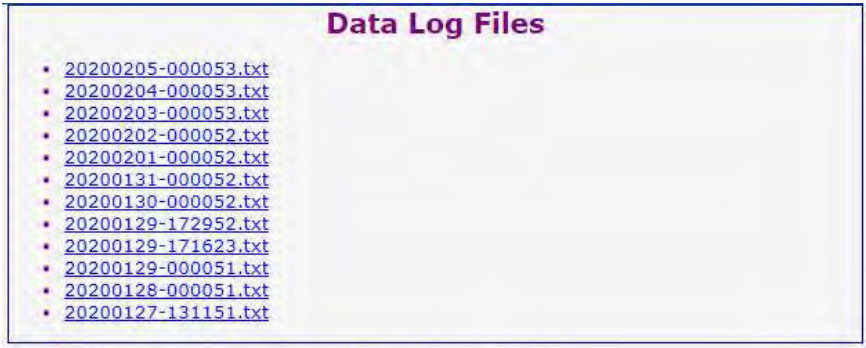
The following modes can be exported; 1 Minute Sampled, 1 Minute Averaged, 10 Minute Sampled, 10 Minute Averaged,1 Hour Sampled, 1 Hour Averaged.

To export the data, select a data range from the Data Range drop-down menu. Select an Export Mode, desired Measurements and Units. Click Export to download the data to the downloads folder. To see the first 10 lines of data, click Preview.

To save the selected settings use the browser's bookmark feature.

To view the Data Logs page click Show data logs.

Data Logs



The Weather MicroServer automatically saves a complete record of all the selected parameters every minute by default. The data is saved in a daily record. If a change is made to the list of selected parameters, a new file for the day is generated. The data can also be saved every second. This change can be made from the Data Outputs page.

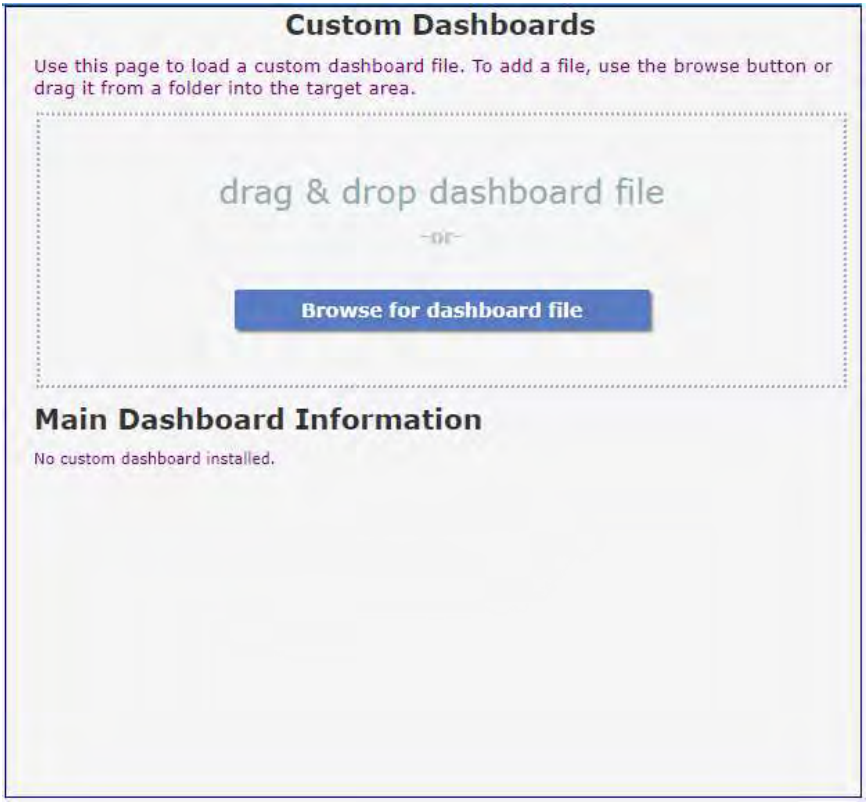
The Data Log files are comma delimited text files. Each file has a header with all the parameter names.

The Data Log file names are based on year-month-day-time format.

The MicroServer stores approximately one years' worth of data. When data log memory is full, the oldest file is deleted as the new file is stored.

Please note: An abrupt power failure could damage the SD Card and the data will be lost. It's recommended to back up the Data Log files through the Data Export feature periodically.

Custom Dashboards



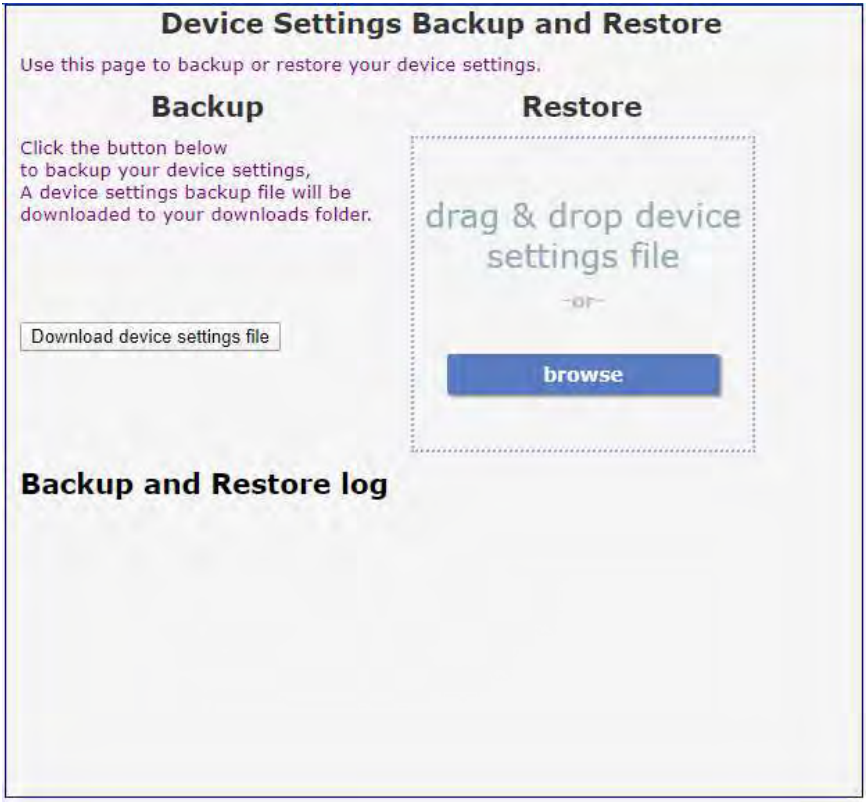
The Main Dashboard page can be customized to display additional parameters.

The Custom Dashboards page allows the user to upload a custom dashboard file.

The uploaded file is encoded to ensure device security.

To request a custom Dashboard contact support@columbiaweather.com

Device Settings Backup and Restore



Use this page to backup or restore your device settings.

Device settings include the Configuration File, Network Settings, Serial Number and Password.

The uploaded file is encoded to ensure device security.

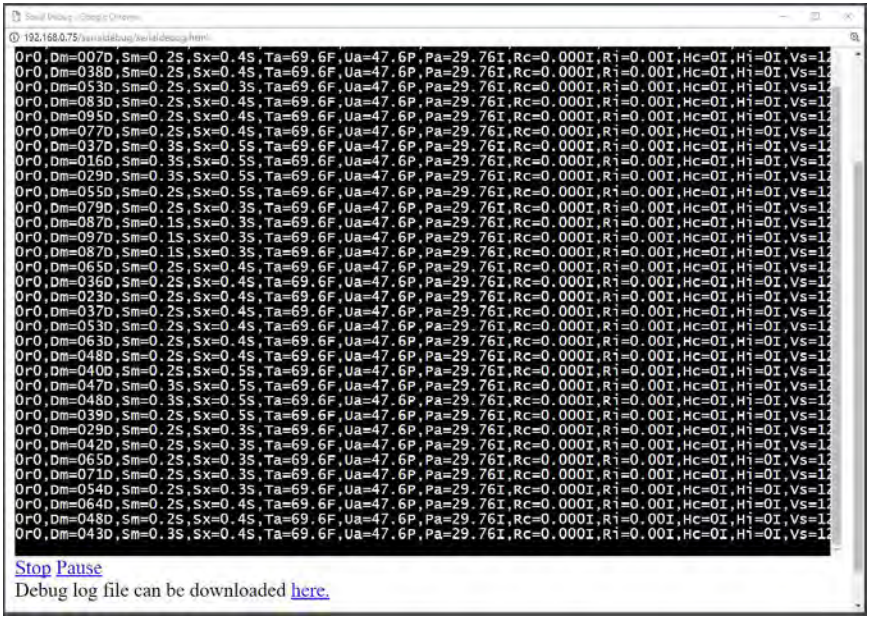
Diagnostics

The Diagnostics page displays system information.

View Log

View Log displays the Data Manager Log. The information contained in the logs can be helpful for troubleshooting problems with the MicroServer.

Serial Debug



The Serial Debug feature allows the user to display the serial data that is available on the MicroServer serial ports.

To begin debugging select the COM port from the Selected Serial Port drop-down menu, click Begin Debugging.

If the weather station is transmitting, data will be displayed in the terminal window.

The debug log file can be downloaded to send to Columbia Weather for analysis by clicking the “here” link on the debug window.

To exit serial debugging mode click Exit Serial Debugging.

Note: Serial debugging will stop all weather data collection.

Note: Serial debug is not available for all sensors.

Start Data Manager

The Data Manager software starts automatically on power up. In the event the software has been stopped, click Start Data Manager to start the software.

Stop Data Manager

Click on Stop Data Manager to stop the software. The user will still have access to the User Interface after the software is stopped.

Restart Data Manager

Click on Restart Data Manager to stop the software and then start it again.

Reboot

Reboot button restarts the operating system. Please wait 1 minute before clicking the Continue button to allow the system to fully boot back up.

Format SD Card

In the event that the SD card has been corrupted or lost, the user has the option to format the SD Card.

Please note: Formatting the SD Card will delete all the data on the card.

Recovery Mode

By clicking Enter Recovery Mode the MicroServer reboots into a separate user interface where the user can update firmware, save device settings, and restore the unit to factory settings.

Update Firmware

See the Update Firmware section for more information.

Restore Factory Settings

In the event a problem occurs with the MicroServer the user can enter Recovery Mode and restore the factory settings by clicking Restore Factory Settings. This action will revert the unit back to the default IP address of 192.168.0.50.

Safe Shutdown

Click Safe Shutdown to properly shut down the MicroServer before disconnecting power.

Boot back to Recovery Mode

If a firmware upgrade is required and the unit has been in recovery mode longer than five minutes the unit will need to be rebooted by clicking Boot back to Recovery Mode.

Boot to Run Mode

To boot the unit back into the main user interface click Boot to Run Mode.

Manual Recovery Mode Entry

In the event that configuration settings are lost, the IP Address is forgotten or the MicroServer has been corrupted, the user has the option to manually enter Recovery Mode by following the procedure below:

1. Remove power from the MicroServer.
2. Hold in the Reset button on the Front Panel and apply power to the MicroServer.
3. Continue to hold the Reset Button for the next 30 seconds while the MicroServer boots up.
4. The unit will now be in Recovery Mode and available at the default IP address of 192.168.0.50

Copyright Information

To view the software license information, click Copyright Information.

SECTION 5: USER SUPPORT INFORMATION

This section consists of the following items:

1. Two-Year Limited Warranty: Please read this document carefully.
2. Return for Repair Procedure: This procedure is for your convenience in the event you must return your Weather MicroServer for repair or replacement. Follow the packing instructions carefully to protect your instrument in transit.

Limited Warranty

Columbia Weather Systems, Inc. (CWS), warrants the Weather MicroServer to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions, for one (1) years from date of purchase, subject to the provisions contained herein. CWS warranty shall extend to the original purchaser only and shall be limited to factory repair or replacement of defective parts.

EXCLUSIONS

Certain parts are not manufactured by CWS (i.e., certain purchased options, etc.) and are therefore not covered by this warranty. These parts may be covered by warranties issued by their respective manufacturers and although CWS will not warrant these parts, CWS will act as agent for the administration of any such independent warranties during the term of this warranty. This warranty does not cover normal maintenance, damage resulting from improper use or repair, or abuse by the operator. Damage caused by lightning or other electrical discharge is specifically excluded. This warranty extends only to repair or replacement, and shall in no event extend to consequential damages. In the event of operator repair or replacement, this warranty shall cover neither the advisability of the repair undertaken, nor the sufficiency of the repair itself.

THIS DOCUMENT REFLECTS THE ENTIRE AND EXCLUSIVE UNDERSTANDING OF THE PARTIES, AND EXCEPT AS OTHERWISE PROVIDED HEREIN, ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, PARTICULARLY THE WARRANTIES OF MERCHANT ABILITY AND/OR FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Return for Repair Procedure

1. In the event of defects or damage to your unit, first call the Service Department Monday through Friday, 8:30 am to 4:00 pm PST, (503) 629-0887 to determine the advisability of factory repair. The Service Department will issue an RMA number (Return Merchandise Authorization) to help us identify the package when received. Please place that number on the outside of the box.

2. In the event factory service is required, return your Weather MicroServer as follows:

   A. Packing

   - Wrap the MicroServer in a plastic bag first.
   - Pack in original shipping carton or a sturdy oversized carton.
   - Use plenty of packing material.

   B. Include:

   - A brief description of the problem with all known symptoms.
   - Your phone number.
   - Your return street shipping address (UPS will not deliver to a P.O. Box).
   - Write the RMA number on the outside of the box.

   C. Shipping

   - Send freight prepaid (UPS recommended).
   - Insurance is recommended. (The factory can provide the current replacement value of the item being shipped for insurance purposes.)

   D. Send to:

   Columbia Weather Systems, Inc.
   5285 NE Elam Young Parkway, Suite C100
   Hillsboro, Oregon 97124

   E. C.O.D. shipments will not be accepted.

3. If your unit is under warranty, after repair or replacement has been completed, it will be returned by a carrier and method chosen by Columbia Weather, Inc. to any destination within the continental U.S.A. If you desire some other specific form of conveyance or if you are located beyond these borders, then you must bear the additional cost of return shipment.

4. If your unit is not under warranty, we will call you with an estimate of the charges. If approved, your repaired unit will be returned after all charges, including parts, labor and return shipping and handling, have been paid. If not approved, your unit will be returned as is via UPS COD for the amount of the UPS COD freight charges.

Appendix A

Measurements Definition

Sample Timestamp

Definition: Time and date of measurement

XML parameter: mtSampTime

Wind Speed

Definition: Wind speed reading from primary sensor

XML parameter: mtWindSpeed

Units: MPH

Adjusted Wind Direction

Definition: Wind direction with offset applied (zero by default)

XML parameter: mtAdjWindDir

Units: Degrees

3 Second Rolling Average Wind Speed

Definition: 3 second rolling average of wind speed reading

XML parameter: mt3SecRollAvgWindSpeed

Units: MPH

3 Second Rolling Average Wind Direction

Definition: 3 second rolling average of adjusted wind direction reading

XML parameter: mt3SecRollAvgWindDir

Units: Degrees

2 Minute Rolling Average Wind Speed

Definition: 2 minute rolling average of wind speed reading

XML parameter: mt2MinRollAvgWindSpeed

Units: MPH

2 Minute Rolling Average Wind Direction

Definition: 2 minute rolling average of adjusted wind direction reading

XML parameter: mt2MinRollAvgWindDir

Units: Degrees

10 Minute Rolling Average Wind Speed

Definition: 10 minute rolling average of wind speed reading

XML parameter: mt10MinRollAvgWindSpeed

Units: MPH

10 Minute Rolling Average Wind Direction
Definition: 10 minute rolling average of adjusted wind direction reading
XML parameter: mt10MinRollAvgWindDir
Units: Degrees
10 Minute Gust Wind Direction
Definition: 10 minute rolling wind direction at maximum wind speed.
XML parameter: mt10MinWindGustDir
Units: MPH
10 Minute Gust Wind Speed
Definition: 10 minute rolling maximum wind speed.
XML parameter: mt10MinWindGustSpeed
Units: MPH
10 Minute Gust Time
Definition: Gust time stamp during the last 10 minutes.
XML parameter: mt10MinWindGustTime
Units: date and time
60 Minute Gust Wind Direction
Definition: 60 minute rolling wind direction at maximum wind speed.
XML parameter: mt60MinWindGustDir
Units: MPH
60 Minute Gust Wind Speed
Definition: 60 minute rolling maximum wind speed.
XML parameter: mt60MinWindGustSpeed
Units: MPH
60 Minute Gust Time
Definition: Gust time stamp during the last 60 minutes.
XML parameter: mt60MinWindGustTime
Units: date and time
60 Minute Rolling Average Wind Speed
Definition: 60 minute rolling average of wind speed reading.
XML parameter: mt60MinRollAvgWindSpeed
Units: MPH
60 Minute Rolling Average Wind Direction
Definition: 60 minute rolling average of wind direction reading.
XML parameter: mt60MinRollAvgWindDir
Units: MPH

2 Minute Gust Wind Direction

Definition: 2 minute rolling wind direction at maximum wind speed.

XML parameter: mt2MinWindGustDir

Units: Degrees

2 Minute Gust Wind Speed

Definition: 2 minute rolling maximum wind speed.

XML parameter: mt2MinWindGustSpeed

Units: MPH

2 Minute Gust Time

Definition: Gust time stamp during the last 2 minutes.

XML parameter: mt2MinWindGustTime

Units: date and time

Temperature 1

Definition: Instantaneous temperature reading

XML parameter: mtTemp1

Units: °F

Temperature 2

Definition: Instantaneous temperature reading

XML parameter: mtTemp_2

Units: °F

Temperature 3

Definition: Instantaneous temperature reading

XML parameter: mtTemp_3

Units: °F

Temperature 4

Definition: Instantaneous temperature reading (Capricorn/Pegasus and MicroServer with additional analog channels only)

XML parameter: mtTemp_4

Units: °F

Relative Humidity

Definition: One second relative humidity reading

XML parameter: mtRelHumidity

Units: %

Solar Radiation

Definition: Instantaneous solar radiation reading

XML parameter: mtSolarRadiation

Units: W/m^2

Wind Chill

Definition: Calculated using temperature 1 and wind speed.

XML parameter: mtWindChill

Units: °F

Heat Index

Definition: Calculated using temperature 1 and relative humidity

XML parameter: mtHeatIndex

Units: °F

Dew Point

Definition: Calculated using temperature 1 and relative humidity

XML parameter: mtDewPoint

Units: °F

Degree Days:

Definition: Calculated using temperature 1

XML parameter: mtDegreeDay

Units: °F

Average Temperature Today

Definition: Calculated using temperature 1

XML parameter: mtAvgTempToday

Units: °F

Degree Day Start

Definition: Start date for degree day calculation

XML parameter: mtDegreeDayStart

Raw Barometric Pressure

Definition: One second barometric pressure reading

XML parameter: mtRawBaromPress

Units: Inches Hg

Adjusted Barometric Pressure

Definition: Raw barometric pressure with altitude and offset applied

XML parameter: mtAdjBaromPress

Units: Inches Hg

Pressure Tendency

Definition: Barometric Pressure Trend

1 = Rising

-1 = Falling

0 = Steady

-99 = Unknown

XML parameter: mtPressureTendency

Units: none

Density Altitude

Definition: Calculated using adjusted barometric pressure, temperature 1, relative humidity and altitude.

XML parameter: mtDensityAltitude

Units: Feet

Wet Bulb Globe Temperature

Definition: A composite temperature used to estimate the effect of temperature, humidity, and solar radiation on humans. The MicroServer uses a specific formula to calculate WBGT. See the Tables and Formulas section.

XML parameter: mtWetBulbGlobeTemp

Units: °F

Wet Bulb Temperature

Definition: Wet bulb temperature derived using a lookup table of temperature and relative humidity.

XML parameter: mtWetBulbTemp

Units: °F

Saturated Vapor Pressure

Definition: The pressure of a vapor in equilibrium with its non-vapor phases when air is saturated with water vapor.

XML parameter: mtSaturatedVaporPressure

Units: Inches Hg

Vapor Pressure

Definition: The pressure of a vapor in equilibrium with its non-vapor phases.

XML parameter: mtVaporPressure

Units: Inches Hg

Dry Air Pressure

Definition: Barometric pressure minus vapor pressure.

XML parameter: mtDryAirPressure

Units: Inches Hg

Dry Air Density

Definition: The air's density depending on temperature and pressure.

XML parameter: mtDryAirDensity

Units: lbm/ft3

Wet Air Density

Definition: The air's density depending on temperature, humidity, and pressure.

XML parameter: mtWetAirDensity

Units: lbm/ft3

Absolute Humidity

Definition: Actual amount of water vapor in the air.

XML parameter: mtAbsoluteHumidity

Units: lbm/ft3

Air Density Ratio

Definition: Dry air density with the added effect of water vapor displacement of oxygen.

XML parameter: mtAirDensityRatio

Units: %

Adjusted Altitude

Definition: Calculated using dry air density. Used for horsepower correction and prediction of vehicle performance.

XML parameter: mtAdjustedAltitude

Units: Feet

SAE Correction Factor

Definition: Society of Automotive Engineers (SAE) calculation using temperature, pressure, and vapor pressure

XML parameter: mtSAECorrectionFactor

Units: none

Rain Today

Definition: Accumulated rain for the day

XML parameter: mtRainToday

Units: Inches

Rain this week

Definition: Accumulated rain for the week

XML parameter: mtRainThisWeek

Units: Inches

Rain this month

Definition: Accumulated rain for the month

XML parameter: mtRainThisMonth

Units: Inches

Rain this year

Definition: Accumulated rain for the year

XML parameter: mtRainThisYear

Units: Inches

Rain Rate

Definition: Running 5-minute rain rate

XML parameter: mtRainRate

Units: Inches/Hour

Rain Last Hour

Definition: Accumulated rain for the last hour

XML parameter: mtRainLastHr

Units: Inches/Hour

Hail Today

Definition: Cumulative amount of hits against collecting surface for the day (Orion Sensor only)

XML parameter: mtHailToday

Units: Hits/in2

Hail Rate

Definition: Running 5-minute hail rate (Orion Sensor only)

XML parameter: mtHailRate

Units: Hits/in2/hour

Units: km^{-1}

Visibility

Definition: Visibility

XML parameter: mtVisibility

Units: miles

Extinction Coefficient

Definition: Fraction of light lost to scattering and absorption

XML parameter: mtExtinctionCoefficient

Units: km^{-1}

Lux

Definition: Day/Night meter

XML parameter: mtLux

Units: Lux

PAR

Definition: PAR

XML parameter: mtPAR

Units: µmol/m-2/s

Particle Concentration

Definition: Amount of particulate concentration

XML parameter: mtParticleConc

Units: mg/m3

Wind Speed – Sensor 2

Definition: 3 second rolling average of 250 millisecond samples

XML parameter: mtWindspeed_2

Units: MPH

Adjusted Wind Direction – Sensor 2

Definition: Wind direction with offset applied (zero by default)

XML parameter: mtAdjWindDir_2

Units: Degrees

3 Second Rolling Average Wind Speed – Sensor 2

Definition: 3 second rolling average of wind speed reading

XML parameter: mt3SecRollAvgWindSpeed_2

Units: MPH

3 Second Rolling Average Wind Direction – Sensor 2

Definition: 3 second rolling average of adjusted wind direction reading

XML parameter: mt3SecRollAvgWindDir_2

Units: Degrees

2 Minute Rolling Average Wind Speed – Sensor 2

Definition: 2 minute rolling average of wind speed reading

XML parameter: mt2MinRollAvgWindSpeed_2

Units: MPH

2 Minute Rolling Average Wind Direction – Sensor 2

Definition: 2 minute rolling average of adjusted wind direction reading

XML parameter: mt2MinRollAvgWindDir_2

Units: Degrees

10 Minute Rolling Average Wind Speed – Sensor 2

Definition: 10 minute rolling average of wind speed reading

XML parameter: mt10MinRollAvgWindSpeed_2

Units: MPH

10 Minute Rolling Average Wind Direction – Sensor 2
Definition: 10 minute rolling average of adjusted wind direction reading
XML parameter: mt10MinRollAvgWindDir_2
Units: Degrees
10 Minute Gust Wind Direction – Sensor 2
Definition: 10 minute rolling wind direction at maximum wind speed.
XML parameter: mt10MinWindGustDir_2
Units: Degrees
10 Minute Gust Wind Speed – Sensor 2
Definition: 10 minute rolling maximum wind speed.
XML parameter: mt10MinWindGustSpeed_2
Units: MPH
10 Minute Gust Time – Sensor 2
Definition: Gust time stamp during the last 10 minutes.
XML parameter: mt10MinWindGustTime_2
Units: date and time
60 Minute Gust Wind Direction – Sensor 2
Definition: 60 minute rolling wind direction at maximum wind speed.
XML parameter: mt60MinWindGustDir_2
Units: Degrees
60 Minute Gust Wind Speed – Sensor 2
Definition: 60 minute rolling maximum wind speed.
XML parameter: mt60MinWindGustSpeed_2
Units: MPH
60 Minute Gust Time – Sensor 2
Definition: Gust time stamp during the last 60 minutes.
XML parameter: mt60MinWindGustTime_2
Units: date and time
60 Minute Rolling Average Wind Speed – Sensor 2
Definition: 60 minute rolling average of wind speed reading.
XML parameter: mt60MinRollAvgWindSpeed
Units: MPH
60 Minute Rolling Average Wind Direction – Sensor 2
Definition: 60 minute rolling average of wind direction reading.
XML parameter: mt60MinRollAvgWindDir
Units: Degrees

2 Minute Gust Wind Direction – Sensor 2

Definition: 2 minute rolling wind direction at maximum wind speed.

XML parameter: mt2MinWindGustDir_2

Units: Degrees

2 Minute Gust Wind Speed – Sensor 2

Definition: 2 minute rolling maximum wind speed.

XML parameter: mt2MinWindGustSpeed_2

Units: MPH

2 Minute Gust Time – Sensor 2

Definition: Gust time stamp during the last 2 minutes.

XML parameter: mt2MinWindGustTime_2

Units: date and time

NO2 - Nitrogen Dioxide

Definition: Instantaneous Nitrogen Dioxide reading

XML parameter: mdtNitrogenDioxide

Units: ppb

CO - Carbon Monoxide

Definition: Instantaneous Carbon Monoxide reading

XML parameter: mdtCarbonMonoxide

Units: ppb

NO - Nitric Oxide

Definition: Instantaneous Nitric Oxide reading

XML parameter: mdtNitricOxide

Units: ppb

O3 - Ozone

Definition: Instantaneous Ozone reading

XML parameter: mdtOzone

Units: ppb

PM10 Micron Count

Definition: Concentration of particulate matter; between 0.6 and 10 micrometers in diameter

XML parameter: mtPM10

Units: µg/m3

PM2.5 Micron Count

Definition: Concentration of particulate matter; between 0.6 and 2.5 micrometers in diameter

XML parameter: mtPM2pt5

Units: µg/m3

Air Quality Index

Definition: Overall Air Quality Index for pollutant with highest concentration

XML parameter: mdtOverallAQI

Units: none

AQI Criteria

Definition: Parameter used to calculate AQI

XML parameter: mdtAQICriteria

Units: none

Main Pollutant

Definition: Pollutant with highest concentration

XML parameter: cmtMainPollutant

Units: none

Gas Measurement Validity

Definition: Gas measurement validity

XML parameter: mdtGasMeasValid

Units: none

Device Health Index

Definition: Combined percentage of usage of sensor cells

XML parameter: mdtDeviceHealthIndex

Units: none

Device Status

Definition: Status reported by the AQM530/560

XML parameter: mdtAqmDeviceStatus

Units: none

Elapsed Seconds

Definition: Seconds elapsed after last measurement data update

XML parameter: mdtElapsedSeconds

Units: seconds

Thermal Work Limit

Definition: Calculates the maximum safe metabolic rate (energy expenditure) for workers while maintaining a safe core body temperature and sweat rate; measured in watts per square meter (W/m²)

XML parameter: mtThermalWorkLimit

Units: W/m^2

Appendix B

Standard XML Web Server

The Weather MicroServer includes an XML Web Server available for other programs to access weather data.

The Standard XML page address is:

http://192.168.0.50/latestsampledata.xml

The field order in the XML file is based on the same order as the selected measurements in the Selected Measurements page.

With all the measurements selected, the XML file will be structured as follows:

<oriondata station="Hillsboro Orion">

<meas name="mtSampTime">2015/04/01 15:39:40</meas>

<meas name="mtTemp1">47.3</meas>

<meas name="mtWindChill">47.3</meas>

<meas name="mtHeatIndex">47.0</meas>

<meas name="mtDewPoint">39.5</meas>

<meas name="mtDegreeDay">1153.6</meas>

<meas name="mtDensityAltitude">-852</meas>

<meas name="mtAvgTempToday">41.8</meas>

<meas name="mtWetBulbGlobeTemp">53.6</meas>

<meas name="mtSaturatedVaporPressure">0.33</meas>

<meas name="mtVaporPressure">0.24</meas>

<meas name="mtDryAirPressure">29.85</meas>

<meas name="mtDryAirDensity">0.0781</meas>

<meas name="mtAbsoluteHumidity">0.0004</meas>

<meas name="mtAirDensityRatio">1</meas>

<meas name="mtAdjustedAltitude">-667</meas>

<meas name="mtSAECorrectionFactor">0.951843</meas>

<meas name="mtWetAirDensity">0.0785</meas>

<meas name="mtWetBulbTemp">42.6</meas>

<meas name="mtRelHumidity">74</meas>

<meas name="mtWindSpeed">1.8</meas>
<meas name="mtAdjWindDir">264</meas>
<meas name="mt3SecRollAvgWindSpeed">1.6</meas>
<meas name="mt3SecRollAvgWindDir">253</meas>
<meas name="mt2MinRollAvgWindSpeed">1.2</meas>
<meas name="mt2MinRollAvgWindDir">259</meas>
<meas name="mt10MinRollAvgWindSpeed">1.6</meas>
<meas name="mt10MinRollAvgWindDir">310</meas>
<meas name="mt60MinRollAvgWindSpeed">2.8</meas>
<meas name="mt60MinRollAvgWindDir">271</meas>
<meas name="mt60MinWindGustDir">196</meas>
<meas name="mt60MinWindGustSpeed">10.0</meas>
<meas name="mt60MinWindGustTime">2015/04/01 14:43:54</meas>
<meas name="mt10MinWindGustDir">342</meas>
<meas name="mt10MinWindGustSpeed">4.0</meas>
<meas name="mt10MinWindGustTime">2015/04/01 15:33:33</meas>
<meas name="mt2MinWindGustDir">245</meas>
<meas name="mt2MinWindGustSpeed">2.6</meas>
<meas name="mt2MinWindGustTime">2015/04/01 15:38:48</meas>
<meas name="mtRawBaromPress">30.09</meas>
<meas name="mtAdjBaromPress">30.31</meas>
<meas name="mtPressureTendency">0</meas>
<meas name="mtRainToday">0.0700</meas>
<meas name="mtRainThisWeek">0.2800</meas>
<meas name="mtRainThisMonth">0.0700</meas>
<meas name="mtRainThisYear">7.3900</meas>
<meas name="mtRainRate">0.0000</meas>
<meas name="mtRainLastHr">0.0100</meas>
<meas name="mtPrecipType">0.000000</meas>
<meas name="mtHailRate">0</meas>
<meas name="mtHailToday">0</meas></oriondata>

Enhanced XML Web Server

The Enhanced XML page address is:

http://192.168.0.50/tmp/latestsampledata_u.xml

The field order in the XML file is based on the same order as the selected measurements in the Selected Measurements page.

The Enhanced XML file will be structured as follows:

<oriondata version="1.1" station="Hillsboro Orion">

<meas name="mtSampTime">2015/04/01 15:48:57</meas>

<meas name="mtTemp1" unit="degreeF">47.6</meas>

<meas name="mtWindChill" unit="degreeF">47.6</meas>

<meas name="mtHeatIndex" unit="degreeF">48.0</meas>

<meas name="mtDewPoint" unit="degreeF">39.4</meas>

<meas name="mtDegreeDay" unit="degreeF">1153.6</meas>

<meas name="mtDensityAltitude" unit="feetAlt">-820</meas>

<meas name="mtAvgTempToday" unit="degreeF">41.8</meas>

<meas name="mtWetBulbGlobeTemp" unit="degreeF">53.7</meas>

<meas name="mtSaturatedVaporPressure"

unit="inchesHg">0.33</meas>

<meas name="mtVaporPressure" unit="inchesHg">0.24</meas>

<meas name="mtDryAirPressure" unit="inchesHg">29.84</meas>

<meas name="mtDryAirDensity" unit="poundsPerFt3">0.0780</meas>

<meas name="mtAbsoluteHumidity"

unit="poundsPerFt3">0.0004</meas>

<meas name="mtAirDensityRatio" unit="percent">1</meas>

<meas name="mtAdjustedAltitude" unit="feetAlt">-640</meas>

<meas name="mtSAECorrectionFactor">0.952</meas>

<meas name="mtWetAirDensity" unit="poundsPerFt3">0.0784</meas>

<meas name="mtWetBulbTemp" unit="degreeF">42.5</meas>

<meas name="mtRelHumidity" unit="percent">73</meas>

<meas name="mtWindSpeed" unit="mph">1.7</meas>

<meas name="mtAdjWindDir" unit="degrees">330</meas>

<meas name="mt3SecRollAvgWindSpeed" unit="mph">1.7</meas>
<meas name="mt3SecRollAvgWindDir" unit="degrees">326</meas>
<meas name="mt2MinRollAvgWindSpeed" unit="mph">2.3</meas>
<meas name="mt2MinRollAvgWindDir" unit="degrees">354</meas>
<meas name="mt10MinRollAvgWindSpeed" unit="mph">1.3</meas>
<meas name="mt10MinRollAvgWindDir" unit="degrees">304</meas>
<meas name="mt60MinRollAvgWindSpeed" unit="mph">2.4</meas>
<meas name="mt60MinRollAvgWindDir" unit="degrees">289</meas>
<meas name="mt60MinWindGustDir" unit="degrees">245</meas>
<meas name="mt60MinWindGustSpeed" unit="mph">9.5</meas>
<meas name="mt60MinWindGustTime">2015/04/01 14:51:57</meas>
<meas name="mt10MinWindGustDir" unit="degrees">351</meas>
<meas name="mt10MinWindGustSpeed" unit="mph">3.9</meas>
<meas name="mt10MinWindGustTime">2015/04/01 15:47:36</meas>
<meas name="mt2MinWindGustDir" unit="degrees">351</meas>
<meas name="mt2MinWindGustSpeed" unit="mph">3.9</meas>
<meas name="mt2MinWindGustTime">2015/04/01 15:47:36</meas>
<meas name="mtRawBaromPress" unit="inchesHg">30.08</meas>
<meas name="mtAdjBaromPress" unit="inchesHg">30.30</meas>
<meas name="mtPressureTendency" unit="unitless">0</meas>
<meas name="mtRainToday" unit="inchesRain">0.0700</meas>
<meas name="mtRainThisWeek" unit="inchesRain">0.2800</meas>
<meas name="mtRainThisMonth" unit="inchesRain">0.0700</meas>
<meas name="mtRainThisYear" unit="inchesRain">7.3900</meas>
<meas name="mtRainRate" unit="inchesPerHour">0.0000</meas>
<meas name="mtRainLastHr" unit="inchesPerHour">0.0100</meas>
<meas name="mtPrecipType">0.000000</meas>
<meas name="mtHailRate" unit="hitsPerInch2PerHour">0</meas>
<meas name="mtHailToday" unit="hitsPerInch2">0</meas>
</oriondata>

Appendix C

Modbus Point List

Weather MicroServer with Modbus TCP/IP Slave Interface or

Modbus/RTU over COM2 (RS-485)

All units are U.S. Customary; Temperature - °F, Barometric Pressure - InHg, Wind Speed - MPH, Rain - inches

32-Bit Registers

All data accessed via (read only) Input Registers

Data type Long = Signed 32 bit value

Data type Float = 32 bit floating point value

Node 1

Byte Order is Little Endian.

Time of Last Measurement is a 32-bit integer data type.

For each available measurement, the two registers immediately following the value contain the most recently updated posix time value. For example: the Wind Speed value is stored in registers 5 and 6. The last updated timestamp is stored in registers 7 and 8 and is a 32-bit integer value.

Measurement	Description	Modbus Address
umtLastMeasTime	Time of last measurement	30001
	Last measurement time stamp	30003
umtWindSpeed	Wind speed	30005
	Wind speed time stamp	30007
umtAdjWindDir	Wind direction	30013
	Wind direction time stamp	30015
umtRelHumidity	Relative humidity	30017
	Relative humidity time stamp	30019
umtRawBaromPress	Barometric pressure - unadjusted	30021

	Barometric pressure - unadjusted time stamp	30023
umtAdjBaromPress	Barometric pressure	30025
	Barometric pressure time stamp	30027
umtTrueNorthOffset	Electronics Compass wind direction offset	30029
	Electronics Compass wind direction offset time stamp	30031
umtTemp1	Air temperature	30037
	Air temperature time stamp	30039
umtWindChill	Wind chill	30041
	Wind chill time stamp	30043
umtHeatIndex	Heat index	30045
	Heat index time stamp	30047
umtDewPoint	Dew Point	30049
	Dew Point time stamp	30051
umtDensityAltitude	Density Altitude	30053
	Density Altitude time stamp	30055
umt3SecRollAvgWindSpeed	3-sec avg of wind speed	30057
	3-sec avg of wind speed time stamp	30059
umt3SecRollAvgWindDir	3-sec avg of wind direction	30061
	3-sec avg of wind direction time stamp	30063
umt2MinRollAvgWindSpeed	2-min avg of wind speed	30065
	2-min avg of wind speed time stamp	30067
umt2MinRollAvgWindDir	2-min avg of adjusted wind direction	30069
	2-min avg of adjusted wind direction time stamp	30071
umt10MinRollAvgWindSpeed	10-min avg of wind speed	30073
	10-min avg of wind speed time stamp	30075
umt10MinRollAvgWindDir	10-min avg of adjusted wind direction	30077

	10-min avg of adjusted wind direction time stamp	30079
umt10MinWindGustDir	10-min wind direction at max wind speed	30081
	10-min wind direction at max wind speed time stamp	30083
umt10MinWindGustSpeed	10-min max wind speed	30085
	10-min max wind speed time stamp	30087
umt10MinWindGustTime	Time of 10-min max wind speed	30089
	Time of 10-min max wind speed time stamp	30091
umt60MinWindGustDir	60-min wind direction at max wind speed	30093
	60-min wind direction at max wind speed time stamp	30095
umt60MinWindGustSpeed	60-min max wind speed	30097
	60-min max wind speed time stamp	30099
umt60MinWindGustTime	Gust time stamp during the last 60 min	30101
	Gust time stamp during the last 60 min time stamp	30103
umtRainToday	Rain for the day	30105
	Rain for the day time stamp	30107
umtRainThisWeek	Rain for the week	30109
	Rain for the week time stamp	30111
umtRainThisMonth	Rain for the month	30113
	Rain for the month time stamp	30115
umtRainThisYear	Rain for the year	30117
	Rain for the year time stamp	30119
umtRainRate	Rain rate	30121
	Rain rate time stamp	30123
umtHailToday	Hail today	30125
	Hail today time stamp	30127
umtHailRate	Hail rate	30133

	Hail rate time stamp	30135
umtSaturatedVaporPressure	Saturated vapor pressure	30141
	Saturated vapor pressure time stamp	30143
umtVaporPressure	Vapor pressure	30145
	Vapor pressure time stamp	30147
umtDryAirPressure	Dry air pressure	30149
	Dry air pressure time stamp	30151
umtDryAirDensity	Dry air density	30153
	Dry air density time stamp	30155
umtAbsoluteHumidity	Absolute humidity	30157
	Absolute humidity time stamp	30159
umtAirDensityRatio	Air density ratio	30161
	Air density ratio time stamp	30163
umtAdjustedAltitude	Adjusted altitude	30165
	Adjusted altitude time stamp	30167
umtSAECorrectionFactor	SAE correction factor	30169
	SAE correction factor time stamp	30171
umtWetAirDensity	Wet air density	30173
	Wet air density time stamp	30175
umtWetBulbTemp	Wet bulb temperature	30177
	Wet bulb temperature time stamp	30179
umtExtinctionCoefficient	Visibility extinction coefficient	30181
	Visibility extinction coefficient time stamp	30183
umtVisibility	Visibility in miles	30185
	Visibility time stamp	30187
umtLux	Visibility sensor light meter reading	30189
	Light meter reading time stamp	30191
umtDayNight	Visibility sensor day/night indicator	30193

	Day/Night indicator time stamp	30195
umtWindSpeed_2	Wind speed - 2nd sensor	30197
	Wind speed - 2nd sensor time stamp	30199
umtAdjWindDir_2	Wind direction - 2nd sensor	30201
	Wind direction time stamp - 2nd sensor	30203
umt3SecRollAvgWindSpeed_2	3-sec avg of wind speed - 2nd sensor	30205
	3-sec avg of wind speed time stamp - 2nd sensor	30207
umt3SecRollAvgWindDir_2	3-sec avg of wind direction - 2nd sensor	30209
	3-sec avg of wind direction time stamp - 2nd sensor	30211
umt2MinRollAvgWindSpeed_2	2-min avg of wind speed - 2nd sensor	30213
	2-min avg of wind speed time stamp - 2nd sensor	30215
umt2MinRollAvgWindDir_2	2-min avg of wind direction - 2nd sensor	30217
	2-min avg of wind direction time stamp - 2nd sensor	30219
umt10MinRollAvgWindSpeed_2	10-min avg of wind speed - 2nd sensor	30221
	10-min avg of wind speed time stamp - 2nd sensor	30223
umt10MinRollAvgWindDir_2	10-min avg of wind direction - 2nd sensor	30225
	10-min avg of wind direction time stamp - 2nd sensor	30227
umt60MinWindGustDir_2	60-min wind direction at max wind speed - 2nd sensor	30229
	60-min wind direction at max wind speed time stamp - 2nd sensor	30231

umt60MinWindGustSpeed_2	60-min max wind speed - 2nd sensor	30233
	60-min max wind speed time stamp- 2nd sensor	30235
umt60MinWindGustTime_2	Gust time stamp during the last 60 min - 2nd sensor	30237
	Gust time stamp during the last 60 min time stamp - 2nd sensor	30239
umt10MinWindGustDir_2	10-min wind direction at max wind speed - 2nd sensor	30241
	10-min wind direction at max wind speed time stamp - 2nd sensor	30243
umt10MinWindGustSpeed_2	10-min max wind speed - 2nd sensor	30245
	10-min max wind speed time stamp- 2nd sensor	30247
umt10MinWindGustTime_2	Gust time stamp during the last 10 min - 2nd sensor	30249
	Gust time stamp during the last 10 min time stamp - 2nd sensor	30251
umtTemp2	Temperature 2	30253
	Temperature 2 time stamp	30255
umtTemp3	Temperature 3	30257
	Temperature 3 time stamp	30259
umtTemp4	Temperature 4	30261
	Temperature 4 time stamp	30263
umtSolarRadiation	Solar Radiation	30265
	Solar Radiation time stamp	30267
umtSolarRadiation_2	Solar Radiation 2	30269
	Solar Radiation 2 time stamp	30271
umtSolarRadiation_3	Solar Radiation 3	30273
	Solar Radiation 3 time stamp	30275
umtSolarRadiation_4	Solar Radiation 4	30277

	Solar Radiation 4 time stamp	30279
umtRainToday_2	Rain for the day - 2nd sensor	30289
	Rain for the day time stamp - 2nd sensor	30291
umtRainThisWeek_2	Rain for the week - 2nd sensor	30293
	Rain for the week time stamp - 2nd sensor	30295
umtRainThisMonth_2	Rain for the month - 2nd sensor	30297
	Rain for the month time stamp - 2nd sensor	30299
umtRainThisYear_2	Rain for the year - 2nd sensor	30301
	Rain for the year time stamp - 2nd sensor	30303
umtRainRate_2	Rain rate - 2nd sensor	30305
	Rain rate time stamp - 2nd sensor	30307
umtPAR	PAR	30309
	PAR time stamp	30311
umtPAR_2	PAR - 2nd sensor	30313
	PAR time stamp - 2nd sensor	30315
umtRelHumidity_2	Relative Humidity - 2nd sensor	30317
	Relative Humidity time stamp - 2nd sensor	30319
umtRawBaromPress_2	Raw Barometric Pressure - 2nd sensor	30321
	Raw barometric Pressure time stamp - 2nd sensor	30323
umtPrecipType	Precipitation Type	30325
	Precipitation Type time stamp	30327
umtPressureTendency	PressureTendency	30329
	Pressure Tendency time stamp	30331
umtSnowDepth	Snow Depth	30333
	Snow Depth time stamp	30335

umtEvapotranspiration	Evapotranspiration	30337
	Evapotranspiration time stamp	30339
umt2MinWindGustDir	2-min wind direction at max wind speed	30341
	2-min wind direction at max wind speed time stamp	30343
umt2MinWindGustSpeed	2-min max wind speed	30345
	2-min max wind speed time stamp	30347
umt2MinWindGustTime	Gust time stamp during the last 2 min	30349
	Gust time stamp during the last 2 min time stamp	30351
umt2MinWindGustDir_2	2-min wind direction at max wind speed - 2nd sensor	30353
	2-min wind direction at max wind speed time stamp - 2nd sensor	30355
umt2MinWindGustSpeed_2	2-min max wind speed - 2nd sensor	30357
	2-min max wind speed time stamp- 2nd sensor	30359
umt2MinWindGustTime_2	Gust time stamp during the last 2 min - 2nd sensor	30361
	Gust time stamp during the last 2 min time stamp - 2nd sensor	30363
umtVolts	Raw voltage (0-5)	30365
	Raw voltage (0-5) time stamp	30367
umtVolts_2	Raw voltage (0-5) – 2nd Sensor	30369
	Raw voltage (0-5) time stamp – 2nd Sensor	30371
umtUVRadiation	UV Radiation	30373
	UV Radiation time stamp	30375
umtUVRadiation_2	UV Radiation – 2nd Sensor	30377
	UV Radiation time stamp – 2nd Sensor	30379

umtParticleConc	Particle Concentration	30381
	Particle Concentration time stamp	30383
umtWaterLevel	Water Level	30385
	Water Level time stamp	30387
umtLongitude	Longitude	30389
	Longitude time stamp	30391
umtLatitude	Latitude	30393
	Latitude time stamp	30395
umtGpsElevation	GPS Elevation	30397
	GPS Elevation time stamp	30399
umtGpsSpeed	GPS Speed	30401
	GPS Speed time stamp	30403
umtGpsHeading	GPS Heading	30405
	GPS Heading time stamp	30407
umtCO2Concentration	CO2 Concentration	30409
	CO2 Concentration time stamp	30411
umtEvaporatorEff	Evaporator Efficiency	30413
	Evaporator Efficiency time stamp	30415
umtCompressorInletTemp	Compressor Inlet Temp	30417
	Compressor Inlet Temp time stamp	30419
umtPredictedGeneration	Predicted Generation	30421
	Predicted Generation time stamp	30423
umtCloudBase	Cloud Base (Height)	30425
	Cloud Base time stamp	30427
umt1MinRollAvgWindSpeed	1-min avg of wind speed	30429
	1-min avg of wind speed time stamp	30431
umt1MinRollAvgWindDir	1-min avg of wind dir	30433
	1-min avg of wind dir time stamp	30435
umt1MinSustWindSpeed	1-min sustained wind speed	30437
	1-min sustained wind speed time stamp	30439
umt1MinLightningEventCount	1-min lightning count	30441

	1-min lightning count time stamp	30443
umt30MinLightningEventCount	30-min lightning count	30445
	30-min lightning count time stamp	30447
umtUvIndex	Ultraviolet Index	30449
	Ultraviolet Index time stamp	30451

Register numbers for the AQM, PTB330 Sensor, Freezing Rain Sensor, Custom Analog Sensors, some Derived Measurements, and the following measurements are considered Dynamic Measurements and will be assigned a register number when selected in the MicroServer:

- 30 Sec Rolling Std Dev Wind Dir
- 30 Sec Rolling VM Wind Dir
- 30 Sec Rolling VM Wind Speed
- 60 Min Rolling Avg Wind Direction
- Average Temperature Today
- Degree Days

For more information on Dynamic Measurements see the Data Outputs section.

A complete Modbus Point List for your system can be viewed from the Industrial Interface Point List link on the Data Outputs page of the MicroServer.

16-Bit Registers

The 16-bit unsigned scaled integer registers

Data type: Unsigned scaled integers

Parameter value = (unsigned 16-bit integer + Offset)/Factor

Measurement	Description	Register	Factor	Offset
umtLastMeasTime		32001		
umtWindSpeed	Wind speed	32002	368	0
umtAdjWindDir	Adjusted wind direction	32004	163	0
umtRelHumidity	Relative humidity	32005	590	0
umtRawBaromPress	Raw barometric pressure	32006	2950	44250
umtAdjBaromPress,	Adjusted barometric pressure	32007	2950	44250
umtTrueNorthOffset		32008		
umtTemp1	Temperature 1	32010	256	-17920
umtWindChill	Wind chill	32011	256	-17920
umtHeatIndex	Heat index	32012	256	-17920
umtDewPoint	Dew point	32013	256	-17920
umtDensityAltitude		32014		
umt3SecRollAvgWindSpeed	3-sec avg of wind speed	32015	368	0
umt3SecRollAvgWindDir	3-sec avg of wind direction	32016	163	0
umt2MinRollAvgWindSpeed	2-min avg of wind speed	32017	368	0
umt2MinRollAvgWindDir	2-min avg of adjusted wind direction	32018	163	0
umt10MinRollAvgWindSpeed	10-min avg of wind speed	32019	368	0
umt10MinRollAvgWindDir	10-min avg of adjusted wind direction	32020	163	0
umt10MinWindGustDir	10-min wind direction at max wind speed	32021	163	0
umt10MinWindGustSpeed	10-min max wind speed	32022	368	0
umt10MinWindGustTime		32023		

umt60MinWindGustDir	60-min wind direction at max wind speed	32024	163	0
umt60MinWindGustSpeed	60-min max wind speed	32025	368	0
umt60MinWindGustTime		32026		
umtRainToday	Rain for the day	32027	118	0
umtRainThisWeek	Rain for the week	32028	118	0
umtRainThisMonth	Rain for the month	32029	118	0
umtRainThisYear	Rain for the year	32030	118	0
umtRainRate	Rain rate	32031	2950	0
umtHailToday		32032		
umtHailRate		32034		
umtSaturatedVaporPressure		32036		
umtVaporPressure		32037		
umtDryAirPressure		32038		
umtDryAirDensity		32039		
umtAbsoluteHumidity		32040		
umtAirDensityRatio		32041		
umtAdjustedAltitude		32042		
umtSAECorrectionFactor		32043		
umtWetAirDensity		32044		
umtWetBulbTemp	Wet bulb Temperature	32045	256	-17920
umtExtinctionCoefficient		32046		
umtVisibility		32047		
umtLux		32048		
umtDayNight		32049		
umtWindSpeed_2	Wind speed - 2nd sensor	32050	368	0
umtAdjWindDir_2	Wind Direction – 2nd sensor	32051	163	0
umt3SecRollAvgWindSpeed_2	3-sec avg of wind speed - 2nd sensor	32052	368	0
umt3SecRollAvgWindDir_2	3-sec avg of wind direction - 2nd sensor	32053	163	0
umt2MinRollAvgWindSpeed_2	2-min avg of wind speed - 2nd sensor	32054	368	0
umt2MinRollAvgWindDir_2	2-min avg of wind direction - 2nd sensor	32055	163	0

umt10MinRollAvgWindSpeed_2	10-min avg of wind speed - 2nd sensor	32056	368	0
umt10MinRollAvgWindDir_2	10-min avg of wind direction - 2nd sensor	32057	163	0
umt60MinWindGustDir_2	60-min wind direction at max wind speed - 2nd sensor	32058	163	0
umt60MinWindGustSpeed_2	60-min max wind speed - 2nd sensor	32059	368	0
umt60MinWindGustTime_2	Gust time stamp during the last 60 min - 2nd sensor	32060		
umt10MinWindGustDir_2	10-min wind direction at max wind speed - 2nd sensor	32061	163	0
umt10MinWindGustSpeed_2	10-min max wind speed - 2nd sensor	32062	368	0
umt10MinWindGustTime_2	Gust time stamp during the last 10 min - 2nd sensor	32063		
umtTemp2	Temperature 2	32064	256	-17920
umtTemp3	Temperature 3	32065	256	-17920
umtTemp4	Temperature 4	32066	256	-17920
umtSolarRadiation	Solar Radiation	32067	29	0
umtSolarRadiation_2	Solar Radiation 2	32068	29	0
umtSolarRadiation_3	Solar Radiation 3	32069	29	0
umtSolarRadiation_4	Solar Radiation 4	32070	29	0
umtRainLastHr	Rain Last Hour	32071	1475	0
umtRainLastHr_2	Rain Last Hour - 2nd sensor	2072	1475	0
umtRainToday_2	Rain for the day - 2nd sensor	2073	118	0
umtRainThisWeek_2	Rain for the week - 2nd sensor	2074	118	0
umtRainThisMonth_2	Rain for the month - 2nd sensor	2075	118	0
umtRainThisYear_2	Rain for the year - 2nd sensor	2076	118	0

umtRainRate_2	Rain rate - 2nd sensor	2077	2950	0
umtPAR	PAR	2078	19	0
umtPAR_2	PAR - 2nd sensor	2079	19	0
umtRelHumidity_2	Relative Humidity - 2nd sensor	2080	590	0
umtRawBaromPress_2	Raw Barometric Pressure - 2nd sensor	2081	2950	44250
umtPrecipType	Precipitation Type	2082	1	0
umtPressureTendency	Pressure Tendency	2083	1	0
umtSnowDepth	Snow Depth	2084	245	0
umtEvapotranspiration	Evaoptranspiration	2085	11800	5
umt2MinWindGustDir	2-min wind direction at max wind speed	2086	163	0
umt2MinWindGustSpeed	2-min max wind speed	2087	368	0
umt2MinWindGustTime	Gust time stamp during the last 2 min	2088		
umt2MinWindGustDir_2	2-min wind direction at max wind speed - 2nd sensor	2089	163	0
umt2MinWindGustSpeed_2	2-min max wind speed - 2nd sensor	2090	368	0
umt2MinWindGustTime_2	Gust time stamp during the last 2 min - 2nd sensor	2091		
umtVolts	Raw voltage	2092	11800	0
umtVolts_2	Voltage 2	2093	11800	0
umtUVRadiation	UV Radiation	2094	19	0
umtUVRadiation_2	UV Radiation – 2nd Sensor	2095	19	0
umtParticleConc	Particle Concentration	2096	491	0
umtWaterLevel	Water Level	2097	29	0
umtLatitude	Latitude	2098	327	0
umtLongitude	Longitude	2099	163	0
umtGpsElevation	GPS Elevation	2100	1	-1000
umtGpsSpeed	GPS Speed	2101	368	0
umtGpsHeading	GPS Heading	2102	163	0

umtCO2Concentration	CO2 Concentration	2103	5	0
umtEvaporatorEff	Evaporator Efficiency	2104	59000	0
umtCompressorInletTemp	Compressor Inlet Temp	2105	256	0
umtPredictedGeneration	Predicted Generation	2106	590	0

Appendix D

DNP3 Ethernet or Serial (RS485)

Master address: 1-65535
Slave address: 1 - 65535
TCP port: 20000 (default)
Date type: Float
Client access: Read Only

Measurement	Description	DNP3 index
umtLastMeasTime	Time of last measurement	1
umtWindSpeed	Wind speed	2
umtAdjWindDir	Wind direction	4
umtRelHumidity	Relative humidity	5
umtRawBaromPress	Barometric pressure - unadjusted	6
umtAdjBaromPress	Barometric pressure	7
umtTrueNorthOffset	Electronics Compass wind direction offset	8
umtTemp1	Air temperature	10
umtWindChill	Wind chill	11
umtHeatIndex	Heat index	12
umtDewPoint	Dew Point	13
umtDensityAltitude	Density Altitude	14
umt3SecRollAvgWindSpeed	3-sec avg of wind speed	15
umt3SecRollAvgWindDir	3-sec avg of wind direction	16
umt2MinRollAvgWindSpeed	2-min avg of wind speed	17
umt2MinRollAvgWindDir	2-min avg of adjusted wind direction	18
	2-min avg of adjusted wind direction time stamp	
umt10MinRollAvgWindSpeed	10-min avg of wind speed	19
	10-min avg of wind speed time stamp	
umt10MinRollAvgWindDir	10-min avg of adjusted wind direction	20
umt10MinWindGustDir	10-min wind direction at max wind speed	21
umt10MinWindGustSpeed	10-min max wind speed	22
umt10MinWindGustTime	Time of 10-min max wind speed	23

umt60MinWindGustDir	60-min wind direction at max wind speed	24
umt60MinWindGustSpeed	60-min max wind speed	25
umt60MinWindGustTime	Gust time stamp during the last 60 min	26
umtRainToday	Rain for the day	27
umtRainThisWeek	Rain for the week	28
umtRainThisMonth	Rain for the month	29
umtRainThisYear	Rain for the year	30
umtRainRate	Rain rate	31
umtHailToday	Hail today	32
umtHailRate	Hail rate	34
umtSaturatedVaporPressure	Saturated vapor pressure	36
umtVaporPressure	Vapor pressure	37
umtDryAirPressure	Dry air pressure	38
umtDryAirDensity	Dry air density	39
umtAbsoluteHumidity	Absolute humidity	40
umtAirDensityRatio	Air density ratio	41
umtAdjustedAltitude	Adjusted altitude	42
umtSAECorrectionFactor	SAE correction factor	43
umtWetAirDensity	Wet air density	44
umtWetBulbTemp	Wet bulb temperature	45
umtExtinctionCoefficient	Visibility extinction coefficient	46
umtVisibility	Visibility in miles	47
umtLux	Visibility sensor light meter reading	48
umtDayNight	Visibility sensor day/night indicator	49
umtWindSpeed_2	Wind speed - 2nd sensor	50
umtAdjWindDir_2	Wind direction - 2nd sensor	51
umt3SecRollAvgWindSpeed_2	3-sec avg of wind speed - 2nd sensor	52
umt3SecRollAvgWindDir_2	3-sec avg of wind direction - 2nd sensor	53
umt2MinRollAvgWindSpeed_2	2-min avg of wind speed - 2nd sensor	54
umt2MinRollAvgWindDir_2	2-min avg of wind direction - 2nd sensor	55
umt10MinRollAvgWindSpeed_2	10-min avg of wind speed - 2nd sensor	56
umt10MinRollAvgWindDir_2	10-min avg of wind direction - 2nd sensor	57

umt60MinWindGustDir_2	60-min wind direction at max wind speed - 2nd sensor	58
umt60MinWindGustSpeed_2	60-min max wind speed - 2nd sensor	59
umt60MinWindGustTime_2	Gust time stamp during the last 60 min - 2nd sensor	60
umt10MinWindGustDir_2	10-min wind direction at max wind speed - 2nd sensor	61
umt10MinWindGustSpeed_2	10-min max wind speed - 2nd sensor	62
umt10MinWindGustTime_2	Gust time stamp during the last 10 min - 2nd sensor	63
umtTemp2	Temperature 2	64
umtTemp3	Temperature 3	65
umtTemp4	Temperature 4	66
umtSolarRadiation	Solar Radiation	67
umtSolarRadiation_2	Solar Radiation 2	68
umtSolarRadiation_3	Solar Radiation 3	69
umtSolarRadiation_4	Solar Radiation 4	70
umtRainLastHr	Rain Last Hour	71
umtRainLastHr_2	Rain Last Hour - 2nd sensor	72
umtRainToday_2	Rain for the day - 2nd sensor	73
umtRainThisWeek_2	Rain for the week - 2nd sensor	74
umtRainThisMonth_2	Rain for the month - 2nd sensor	75
umtRainThisYear_2	Rain for the year - 2nd sensor	76
umtRainRate_2	Rain rate - 2nd sensor	77
umtPAR	PAR	78
umtPAR_2	PAR - 2nd sensor	79
umtRelHumidity_2	Relative Humidity - 2nd sensor	80
umtRawBaromPress_2	Raw Barometric Pressure - 2nd sensor	81
umtPrecipType	Precipitation Type	82
umtPressureTendency	Pressure Tendency	83
umtSnowDepth	Snow Depth	84
umtEvapotranspiration	Evapotranspiration	85
umt2MinWindGustDir	2-min wind direction at max wind speed	86

umt2MinWindGustSpeed	2-min max wind speed	87
umt2MinWindGustTime	Gust time stamp during the last 2 min	88
umt2MinWindGustDir_2	2-min wind direction at max wind speed - 2nd sensor	89
umt2MinWindGustSpeed_2	2-min max wind speed - 2nd sensor	90
umt2MinWindGustTime_2	Gust time stamp during the last 2 min - 2nd sensor	91
umtVolts	Raw voltage (0-5)	92
umtVolts_2	Raw voltage (0-5) – 2nd Sensor	93
umtUVRadiation	UV Radiation	94
umtUVRadiation_2	UV Radiation – 2nd Sensor	95
umtParticleConc	Particle Concentration	96
umtWaterLevel	Water Level	97
umtLongitude	Longitude	98
umtLatitude	Latitude	99
mtGpsElevation	GPS Elevation	100
mtGpsSpeed	GPS Speed	101
mtGpsHeading	GPS Heading	102
mtCO2Concentration	CO2 Concentration	103
umtEvaporatorEff	Evaporator Efficiency	104
umtCompressorInletTemp	Compressor Inlet Temp	105
umtPredictedGeneration	Predicted Generation	106
umtCloudBase	Cloud Base (Height)	107
umt1MinRollAvgWindSpeed	1-min avg of wind speed	108
umt1MinRollAvgWindDir	1-min avg of wind direction	109
umt1MinSustWindSpeed	1-min sustained wind direction	110
umt1MinLightningEventCount	1-min Lightning Event Count	111
umt30MinLightningEventCount	30-min Lightning Event Count	112
umtUvIndex	Ultraviolet Index	113

Index numbers for the AQM, PTB330 Sensor, Freezing Rain Sensor, Custom Analog Sensors, some Derived Measurements, and the following measurements are considered Dynamic Measurements and will be assigned a register number when selected:

- 30 Sec Rolling Std Dev Wind Dir
- 30 Sec Rolling VM Wind Dir
- 30 Sec Rolling VM Wind Speed
- 60 Min Rolling Avg Wind Direction

- Average Temperature Today
- Degree Days

For more information on Dynamic Measurements see the Data Outputs section.

A complete DNP3 Point List for your system can be viewed from the Industrial Interface Point List link on the Data Outputs page of the MicroServer.

Reference

Glossary

Aspirating Radiation Shield

A device used to shield a sensor such as a temperature probe from direct and indirect radiation and rain while providing access for ventilation.

Fahrenheit Temperature Scale

A temperature scale with the ice point at 32 degrees and the boiling point of water at 212 degrees.

Celsius Temperature Scale

A temperature scale with the ice point at 0 degrees and the boiling point of water at 100 degrees.

Dew Point

The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur. When this temperature is below 0°C, it is sometimes called the frost point.

Heat Index

The heat index or apparent temperature is a measure of discomfort due to the combination of heat and high humidity. It was developed in 1979 and is based on studies of evaporative skin cooling for combinations of temperature and humidity.

Relative Humidity

Popularly called humidity. The ratio of the actual vapor pressure of the air to the saturation vapor pressure.

Wind Chill

That part of the total cooling of a body caused by air motion.

Wet Bulb Temperature

Wet bulb temperature is calculated from ambient temperature (dry bulb) and relative humidity using a recursive formula.

Wet Bulb Globe Temperature (WBGT)

The determination of WBGT requires the use of a black globe temperature sensor, relative humidity sensor, and a dry-bulb (ambient) temperature sensor. See below in the Tables and Formulas section.

Density Altitude

Density altitude is a meteorological variable that is important to pilots, especially during the summer. The density altitude is the altitude in a standard atmosphere where the density is the same as the given atmospheric density. During a hot muggy summer day, a pilot begins take off from an airport with an elevation of 2500 feet. Because of the warm temperature and the moisture in the air, the airplane has to work as if it was taking off at an airport at an elevation of 6000 feet resulting in the plane needing more power and a longer roll down the runway to take off.

Barometric Pressure

The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the “column” of air lying directly above the point in question.

Sea Level Pressure

The atmospheric pressure at mean sea level, either directly measured or, most commonly, empirically determined from the observed station pressure.

In regions where the earth’s surface pressure is above sea level, it is standard observational practice to reduce the observed surface pressure to the value that would exist at a point at sea level directly below.

Global Radiation

The total of direct solar radiation and diffused sky radiation received by a unit horizontal surface. Global radiation is measured by a Pyranometer.

Pyranometer

Measures the combined intensity of incoming direct solar radiation and diffused sky radiation. The Pyranometer consists of a radiation-sensing element, which is mounted so that it views the entire sky.

Solar Radiation

The total electromagnetic radiation emitted by the sun. 99% of the sun’s energy output falls within the wavelength interval from 0.15 microns to 4.0 microns, with peak intensity near 0.47 microns. About one-half of the total energy in the solar beam is contained within the visible spectrum from 0.4 to 0.7 microns, and most of the other half lies near infrared, a small additional portion lying in the ultraviolet.

Evapotranspiration

The combined processes through which water is transferred to the atmosphere from open water and ice surfaces, bare soil and vegetation that make up the Earth’s surface.

Unit Conversion

Speed

Kilometers per hour = 1.610 x miles per hour

Knots = 0.869 x miles per hour

Meters per second = 0.448 x miles per hour

Feet per second = 1.467 x miles per hour

Temperature

Temperature in °C = 5/9 (temperature in °F - 32)

Temperature in °F = (1.8 x temperature in °C) + 32

Distance

Millimeters = 25.4 x inches

Pressure

Millibars = 33.86 x inches of mercury

Kilopascals = 3.386 x inches of mercury

Pounds per square inch = 0.49 x inches of mercury

Standard atmospheres = 0.0334 x inches of mercury

Solar Radiation

BTU/foot^2 minutes = 0.00529 x watts/meter^2

Joules/centimeter^2 minutes = 0.006 x watts/meter^2

Mega joules/meter^2 day = 11.574 x watts/meter^2

Langleys/minutes = 0.00143 x watts/meter^2

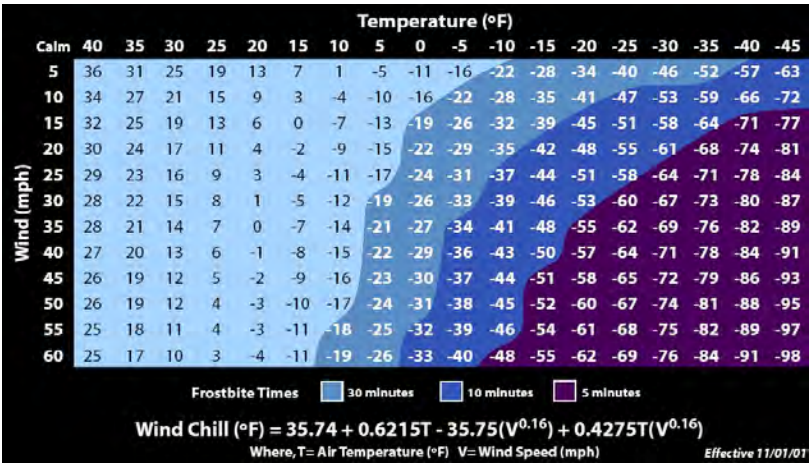
Tables and Formulas

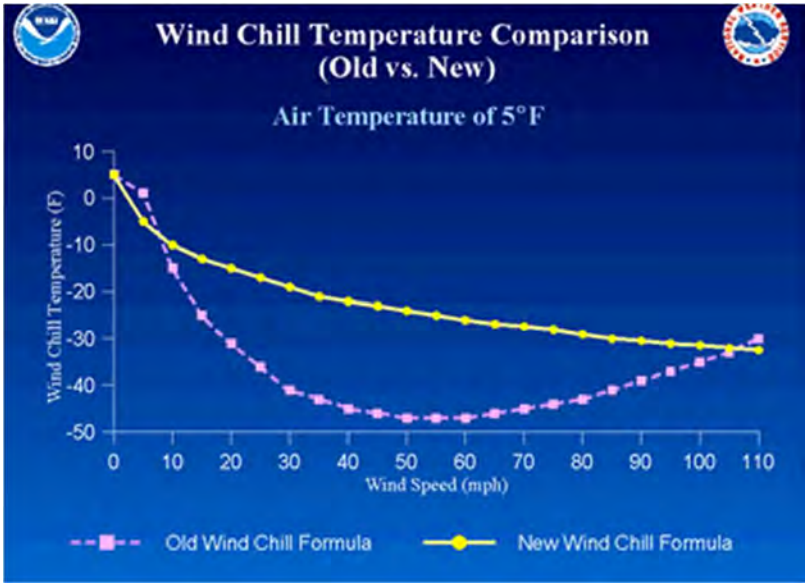
Wind Chill Chart

In 2001, NWS implemented an updated Wind chill Temperature (WCT) index. The change improves upon the former WCT Index used by the NWS and the Meteorological Services of Canada, which was based on the 1945 Siple and Passel Index.

In the fall of 2000, the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) formed a group consisting of several Federal agencies, MSC, the academic community (Indiana University-Purdue University in Indianapolis (IUPUI), University of Delaware and University of Missouri), and the International Society of Biometeorology to evaluate and improve the wind chill formula. The group, chaired by the NWS, is called the Joint Action Group for temperature Indices (JAG/TI). JAG/TI's goal is to upgrade and standardize the index for temperature extremes internationally (e.g. Wind chill Index).

The current formula uses advances in science, technology, and computer modeling to provide a more accurate, understandable, and useful formula for calculating the dangers from winter winds and freezing temperatures.





Wind Chill Equation

$WC = 35.74 + 0.6215\ T - 35.75(V^{0.16}) + 0.4275\ T(V^{0.16})$

Where:

WC = wind chill temperature in °F

V = wind velocity in mph

T = air temperature in °F

Note: *Wind chill Temperature is only defined for temperatures at or below 50 degrees F and wind speeds above 3 mph.*

Heat Index

Heat index is calculated using the following formula:

HI= -42.379 + 2.04901523*T + 10.14333127*RH - .22475541*T*RH - .00683783*T*T - .05481717*RH*RH + .00122874*T*T*RH + .00085282*T*RH*RH - .00000199*T*T*RH*RH

Where T is temperature in degrees F and RH is relative humidity in percent.

HI is the heat index expressed as an apparent temperature in degrees F.

Heat Index look up table (printed for reference)

	Temperature in °F													
RH	70	75	80	85	90	95	100	105	110	115	120	125	130	135
0	64	66	73	78	83	87	91	95	99	103	107	111	117	120
5	64	69	74	79	84	88	93	97	102	107	111	116	122	126
10	65	70	75	80	85	90	95	100	105	111	116	123	131	
15	65	71	76	81	86	91	97	102	108	115	123	131		
20	66	72	77	82	87	93	99	105	112	120	130	141		
25	66	72	77	83	88	94	101	109	117	127	139			
30	67	73	78	84	90	96	104	113	123	135	148			
35	67	73	79	85	91	98	107	118	130	143				
40	68	74	79	86	93	101	110	123	137	151				
45	68	74	80	87	95	104	115	129	143					
50	69	75	81	88	96	107	120	135	150					
55	69	75	81	89	98	110	126	142						
60	70	76	82	90	100	114	132	149						
65	70	76	83	91	102	119	138							
70	70	77	84	93	106	124	144							
75	70	77	85	95	109	130	150							
80	71	78	86	97	113	136								
85	71	78	87	99	117	140								
90	71	79	88	102	122	150								
95	71	79	89	105	126									
100	72	80	90	108	131									

Dew Point

B = (ln (RH/100) + ((17.2694*T) / (238.3+T))) / 17.2694

Dew Point in °C = (238.3 * B) / (1-B)

Where:

RH = Relative Humidity

T = Temperature in °C

Ln = Natural logarithm

Wet Bulb Globe Temperature (WBGT)

Equation for WBGT (Outdoors with solar load)

$WBGT = 0.7NWB + 0.2GT + 0.1DB$

where:

WBGT = Wet Bulb Globe Temperature Index

NWB = Natural Wet-Bulb Temperature

DB = Dry-Bulb (air) Temperature

GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe temperature sensor, relative humidity sensor, and a dry-bulb (ambient) temperature sensor.

Thermal Work Limit (TWL)

TWL calculates the maximum safe metabolic rate (energy expenditure) for workers while maintaining a safe core body temperature and sweat rate. It incorporates:

- Dry bulb temperature
- Wet bulb temperature
- Globe thermometer temperature
- Wind speed
- Atmospheric pressure

Calculated using the information in the following article:
Brake, Derrick J. and Bates, Graham P. (2002) 'Limiting Metabolic Rate (Thermal Work Limit) as an Index of Thermal Stress', Applied Occupational and Environmental Hygiene, 17:3, 176 - 186

Evapotranspiration

Provides the Evapotranspiration (ET) reading for the day.

For the MicroServer to calculate ET it requires the measurement of the following parameters:

- Air Temperature
- Relative Humidity
- Wind Speed
- Solar Radiation
- Barometric Pressure

The Weather MicroServer uses the 1982 Kimberly-Penman equation as applied in the U.S. Bureau of Reclamation's Pacific Northwest AgriMet Program.

Since it was first derived by H. L. Penman in 1948, the original Penman equation has been modified a number of times. WeatherMaster 2000 software uses the 1982 Kimberly-Penman equation adapted by Dr. James L. Wright of the ARS through his research performed in Kimberly, Idaho. The 1982 Kimberly-Penman uses alfalfa as the reference crop with reference conditions established as well-watered with 30 to 50 cm of top growth. The Penman equation is as follows:

$$\lambda ET_I = \frac{\Delta}{\Delta+\gamma}(R_n - G) + \frac{\gamma}{\Delta+\gamma} 6.43 W_f (e_s - e_a)$$

with units in MJ/m^2/d.

The Penman equation is known as a "combination equation" because it combines net radiation (the heat function) and advective energy transfer (the wind function) into one energy balance equation.

The sum of the two terms:

$$\frac{\Delta}{\Delta+\gamma} and \frac{\gamma}{\Delta+\gamma}$$

is equal to one. These terms represent weighting factors that assess the relative effects of the heat function and the wind function on evaporation. These weightings are approximately 75% heat function and 25% wind function for the general climatic conditions during the growing season in the Pacific Northwest.

Air quality

AQM530 Main Pollutant Codes

-1 = AQI calculation failed

0 = O3 8-h average

1 = O3 1-h average

2 = PM2.5 24-h average

3 = PM10 24-h average

4 = CO 8-h average

5 = SO2 1-h average

6 = SO2 24-h average

7 = NO2 1-h average

AQM400 Main Pollutant Codes

0 = PM2.5

1 = PM10

2 = Carbon Monoxide

3 = Sulfur Dioxide

4 = Ozone

5 = Nitrogen Dioxide

AQM400 Sensor Status Codes

Status reported by device

0 = invalid data

1 = valid data

AQM400 Sensor Status Codes

Status reported by device

0 = Unknown. Status information not yet available, starting up

1 = Operating normally

Device Health Index (AQT530 & AQT560)

Combined percentage of usage of sensor cells, decreases from 100%

100% = Full health

0% = All sensors need to be replaced

Gas Measurement Validity (AQT530 & AQT560)

0 = Measurement is not valid

1 = Measurement is valid (includes 24-hour stabilization time after power-up and temperature is within valid range; below 100°F (38.0 °C).

Device Status (AQT530 & AQT560)

Status reported by device

0 = Unknown. Status information not yet available, starting up

1 = Operating normally

2 = Degraded. Operating but functionality degraded

3 = Faulty

Air quality index criteria

-1 = AQI calculation failed

0 = O3 8-h average

1 = O3 1-h average

2 = PM2.5 24-h average

3 = PM10 24-h average

4 = CO 8-h average

5 = SO2 1-h average

6 = SO2 24-h average

7 = NO2 1-h average

Air quality index

0 to 500

−1 (AQI calculation failed)

Air Quality Index (AQI)

Computing the AQI

The air quality index is a piecewise linear function of the pollutant concentration. At the boundary between AQI categories, there is a discontinuous jump of one AQI unit. To convert from concentration to AQI this equation is used:

$$I = \frac{I_{high} - I_{low}}{C_{high} - C_{low}}(C - C_{low}) + I_{low}$$

where:

I = the (Air Quality) index,

C = the pollutant concentration,

C_{low} = the concentration breakpoint that is ≤ C,

C_{high} = the concentration breakpoint that is ≥ C,

I_{low} = the index breakpoint corresponding to C_{low},

I_{high} = the index breakpoint corresponding to C_{high}.

EPA's table of breakpoints is:

O_3 (ppb)	O_3 (ppb)	$PM_{2.5}$ (µg/m^3)	PM_{10} (µg/m^3)	CO (ppm)	SO_2 (ppb)	NO_2 (ppb)
C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low}- C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)	C_{low} - C_{high} (avg)
0-54 (8-hr)	-	0.0-12.0 (24-hr)	0-54 (24-hr)	0.0-4.4 (8-hr)	0-35 (1-hr)	0-53 (1-hr)
55-70 (8-hr)	-	12.1-35.4 (24-hr)	55-154 (24-hr)	4.5-9.4 (8-hr)	36-75 (1-hr)	54-100 (1-hr)
71-85 (8-hr)	125-164 (1-hr)	35.5-55.4 (24-hr)	155-254 (24-hr)	9.5-12.4 (8-hr)	76-185 (1-hr)	101-360 (1-hr)
86-105 (8-hr)	165-204 (1-hr)	55.5-150.4 (24-hr)	255-354 (24-hr)	12.5-15.4 (8-hr)	186-304 (1-hr)	361-649 (1-hr)
106-200 (8-hr)	205-404 (1-hr)	150.5-250.4 (24-hr)	355-424 (24-hr)	15.5-30.4 (8-hr)	305-604 (24-hr)	650-1249 (1-hr)
-	405-504 (1-hr)	250.5-350.4 (24-hr)	425-504 (24-hr)	30.5-40.4 (8-hr)	605-804 (24-hr)	1250-1649 (1-hr)
-	505-604 (1-hr)	350.5-500.4 (24-hr)	505-604 (24-hr)	40.5-50.4 (8-hr)	805-1004 (24-hr)	1650-2049 (1-hr)

Suppose a monitor records a 24-hour average fine particle (PM2.5) concentration of 12.0 micrograms per cubic meter. The equation above results in an AQI of:

$$\frac{50-0}{12.0-0}(12.0-0)+0=50,$$

corresponding to air quality in the "Good" range.

AQI	Category
0-50	Good
51-100	Moderate
101-150	Unhealthy for Sensitive Groups
151-200	Unhealthy
201-300	Very Unhealthy
301-500	Hazardous

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