



# Weather Display™ User Manual



# Weather Display™

## User Manual

Version 4.12

All specifications subject to change without notice.

Printed in U. S. A.



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# Weather Display User Manual

Catalog Number: 81639

Version 4.12

Printed in U.S.A.

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# Welcome!

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

The Weather Display is a precision monitoring device that requires proper installation and handling.

**Please read this manual completely prior to installation.**



# Shipping Damage

**BEFORE YOU READ ANY FURTHER, please inspect all system components for obvious damage.** The Weather Display is a sensitive electronic instrument 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 Weather Display.

**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 (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 submission to the transport company as a claim.



# SECTION 1: INTRODUCTION

The Weather Display is available for all weather stations from Columbia Weather System to display and monitor weather data in real time.

The Weather Display features a color graphic TFT-LCD (800 x 480 pixels) monitor with a touch screen interface. The display is powered by an 800MHz ARM9 CPU.

## Features and Capabilities

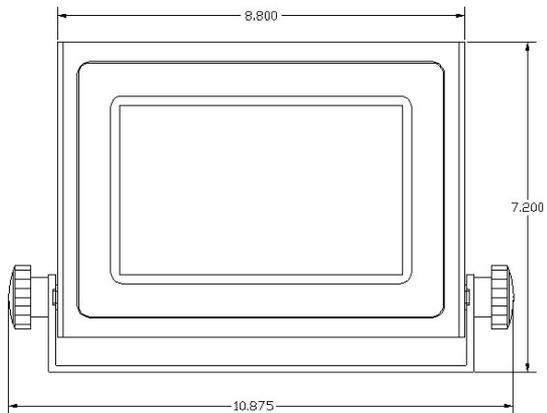
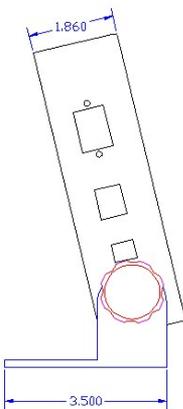
- Displays date and time.
- Displays the values of all sensors from any Columbia Weather Systems weather station, depending on the factory set software configuration.
- Calculates wind chill, dew point, heat index, density altitude and rain rate.
- Displays the rain for the day, the week, the month, and the year.
- Displays wind averages and gusts.
- Displays min/max values and time for all parameters for the current day.
- Displays a daily trend graph for all the parameters.
- Displays weather data in Metric or English units.
- Displays weather data from any Weather MicroServer on the local network.
- Triggers an alarm to sound when a selected parameter value has been surpassed.

The display unit incorporates a Backlight button that turns off the LCD screen backlight. The backlight is turned back on by touching any part of the screen.



# SECTION 2: PHYSICAL DESCRIPTION

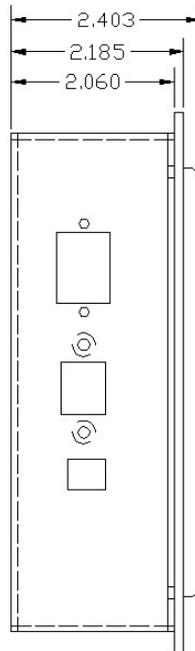
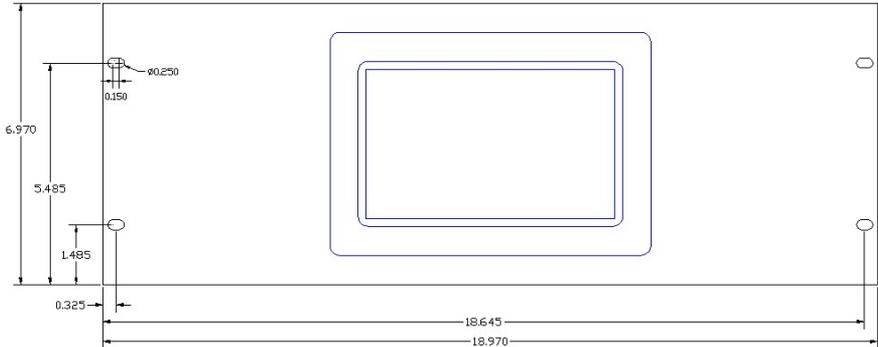
## Desktop Chassis



The Weather Display desktop chassis configuration includes the following:

1. Weather Display chassis and base
2. Wall-mount power supply
3. RS-232 cable to the weather station for Serial Interface
4. Ethernet cable for Ethernet Interface
5. User manual

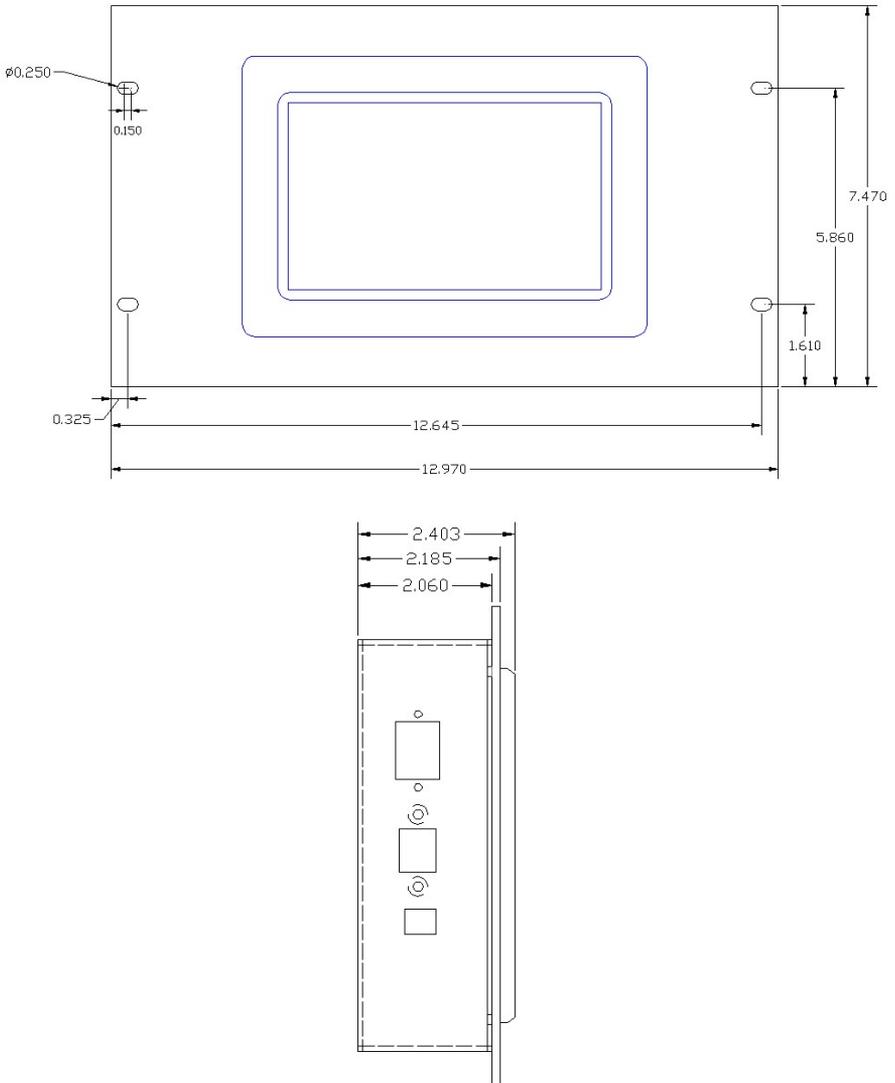
## 19" Rack Mount Chassis



The Weather Display in the 19" rack mount configuration comes with the following:

1. Weather Display mounted on a 4U 19" rack mount panel
2. Wall-mount power supply
3. RS-232 cable to the Weather Station
4. User manual

## Panel Mount Chassis



The Weather Display in the panel mount configuration comes with the following:

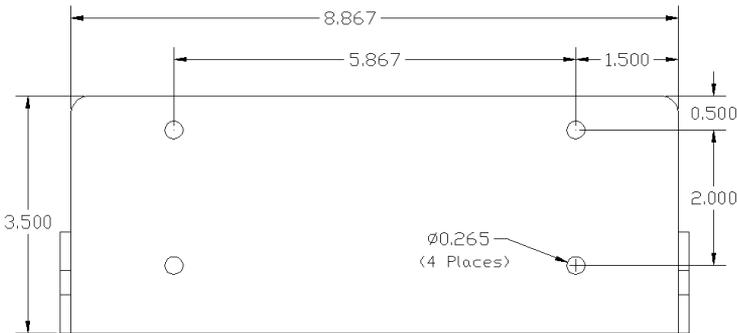
1. Wall-mount power supply
2. RS-232 cable to the Weather Station
3. User manual

# SECTION 3: INSTALLATION

## Location Considerations

Because the Weather Display employs an LCD screen, the viewing angle and glare caused by light reflections must be considered when choosing a location. Install the Weather Display at a height and angle most convenient for the user to see and operate the screen.

## Desktop Chassis Base Installation



The Weather Display base has four holes for permanent installation on a desktop or any other flat surface at various tilt angles.

The base also has four mounting holes to secure it to other surfaces, including a wall.

To secure the base:

1. Remove the chassis from the base by removing both side knobs. **Do not discard** the white shoulder washers.
2. Mark the location of the screw holes on the mounting surface.
3. Drill four holes using the appropriate size drill bit based on the size of screws being used.
4. Secure the mounting base using four screws.
5. Reattach the chassis using the two side knobs. Make sure the shoulder washers are in place.

## Angle Adjustment

To adjust the angle of the desktop chassis:

1. Loosen only one knob while holding the chassis with the other hand (otherwise the chassis might drop).
2. Loosen the second knob while holding the chassis with the other hand.
3. Change the angle of the chassis.
4. Tighten both knobs.

## Power Connection

The Weather Display is shipped with a wall mount switching power supply.

Input: 100V to 240V AC, 50/60 Hz, 0.6 Amp

Output: 12V DC, 1.25 Amp

The Weather Display can also be powered directly using a DC voltage source.

Input: 5 to 30 VDC

Current Consumption: Backlight On: 400mA at 12VDC, Backlight Off: 240mA at 12 VDC

## Ethernet Connection

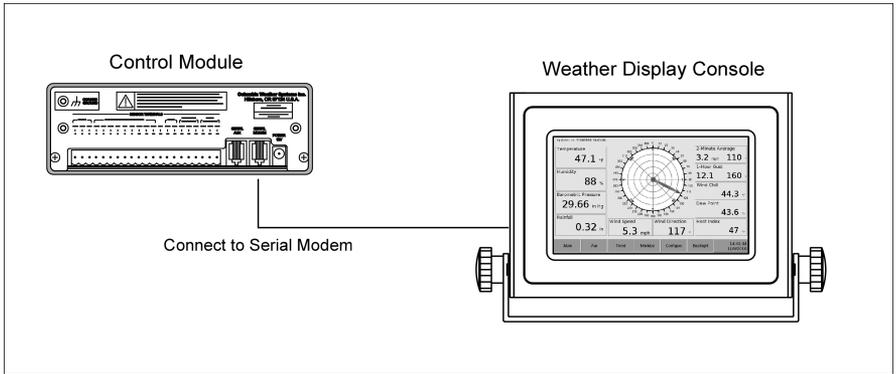
The Weather Display is shipped with a standard 7-foot Ethernet cable for network connection.

## RS-232 Connection

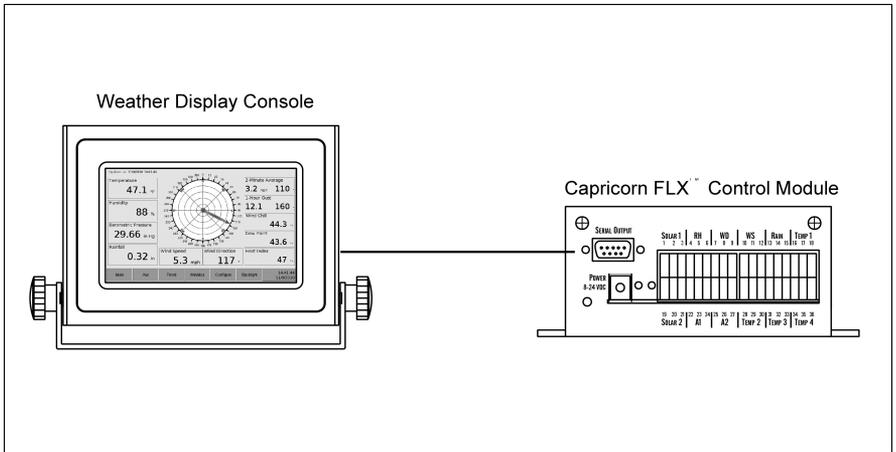
The Weather Display is shipped with a standard 7-foot RS-232 cable. This cable can be factory configured with additional length and has two RJ-11 connectors.

The RS-232 range also can be extended by using RS-485 converters. To eliminate the cable between the Weather Display and the weather station wireless transceivers can be added to the system.

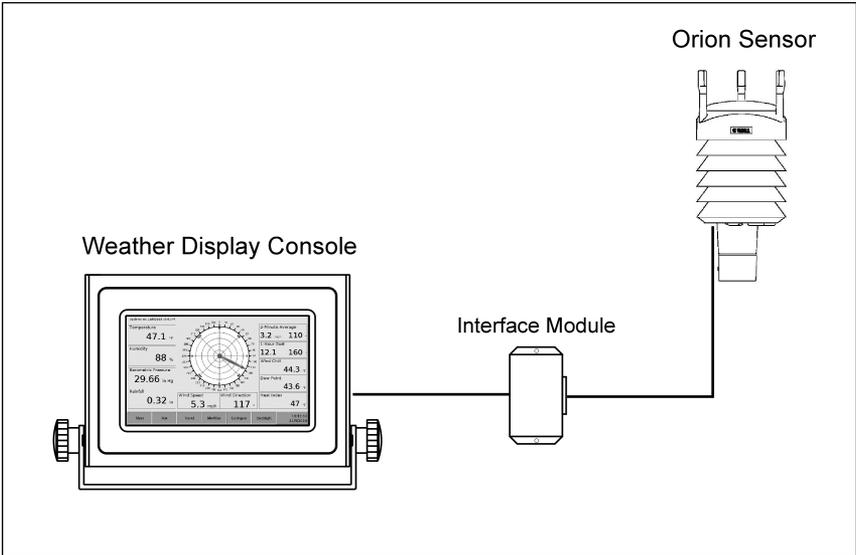
## Capricorn 2000/2000EX, Direct RS-232 Connection



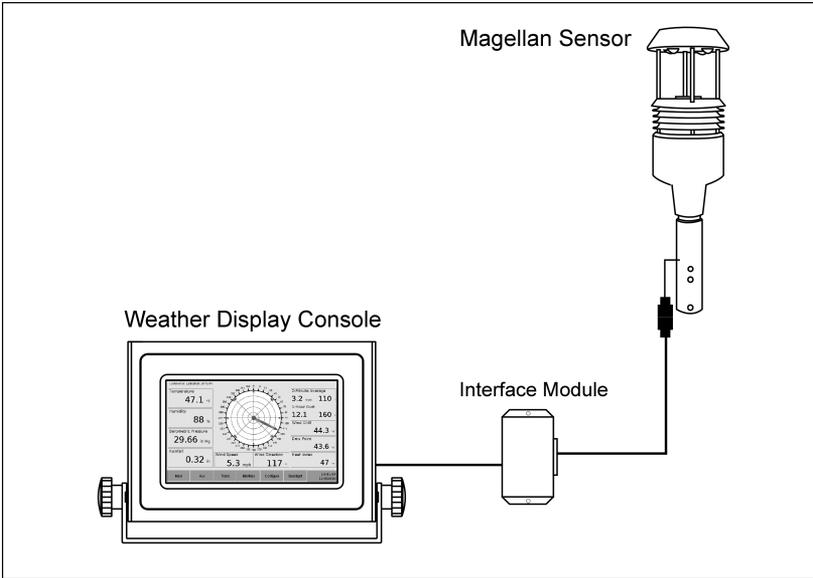
## Capricorn FLX, Direct RS-232 Connection



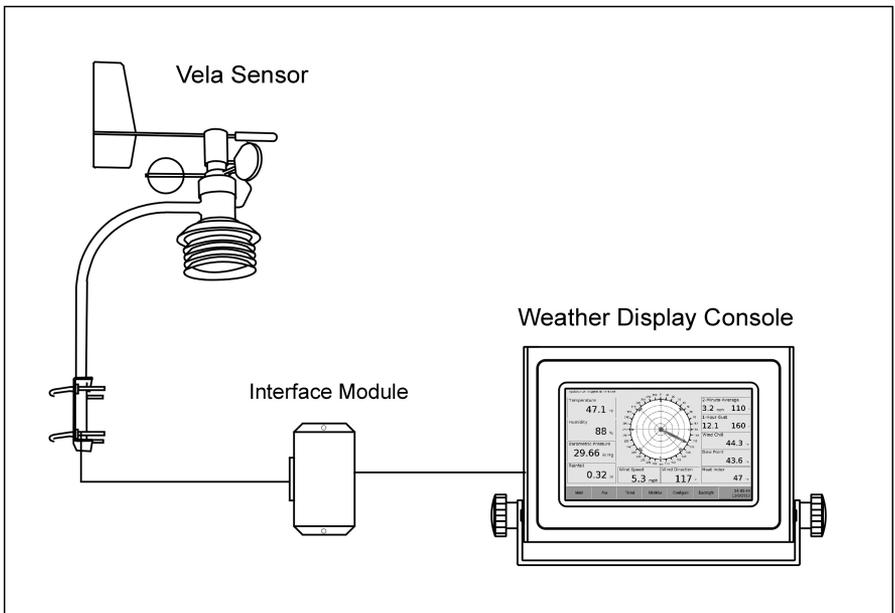
# Orion Weather Station, Direct RS-232 Connection



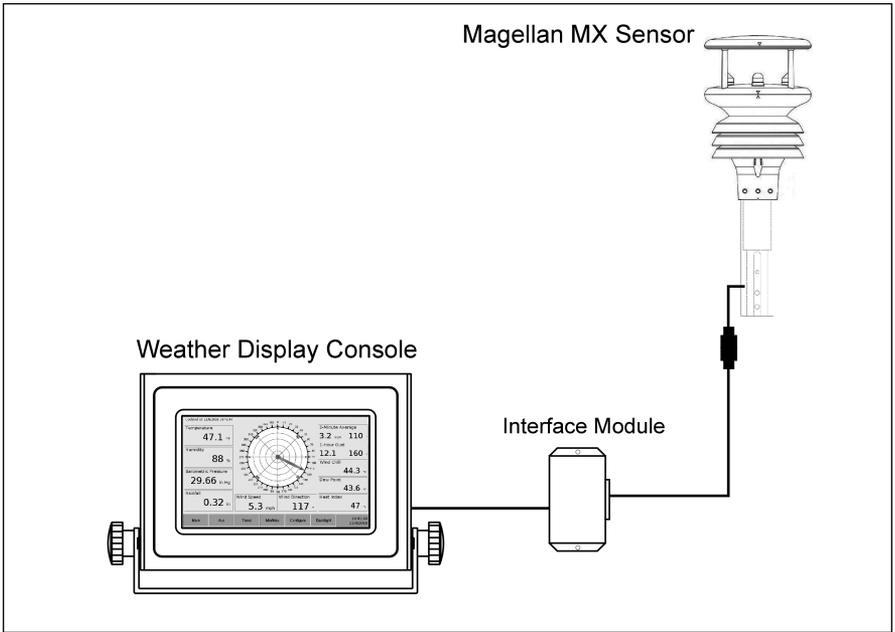
## Magellan Weather Station, Direct RS-232 Connection



## Vela Weather Station, Direct RS-232 Connection

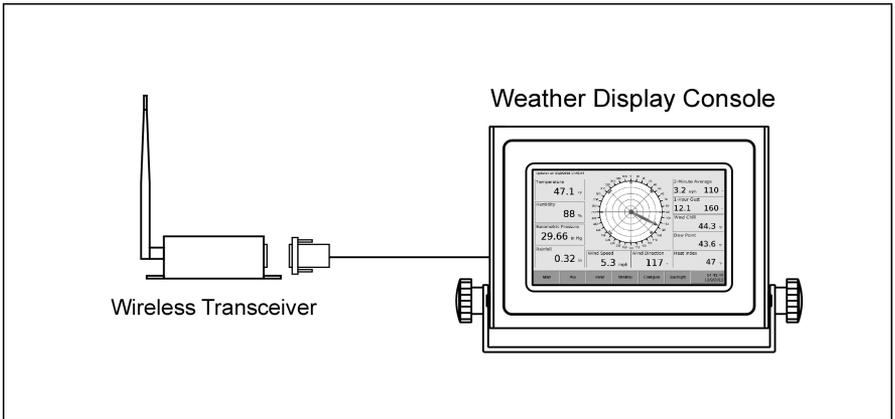


## Magellan MX Weather Station, Direct RS-232 Connection

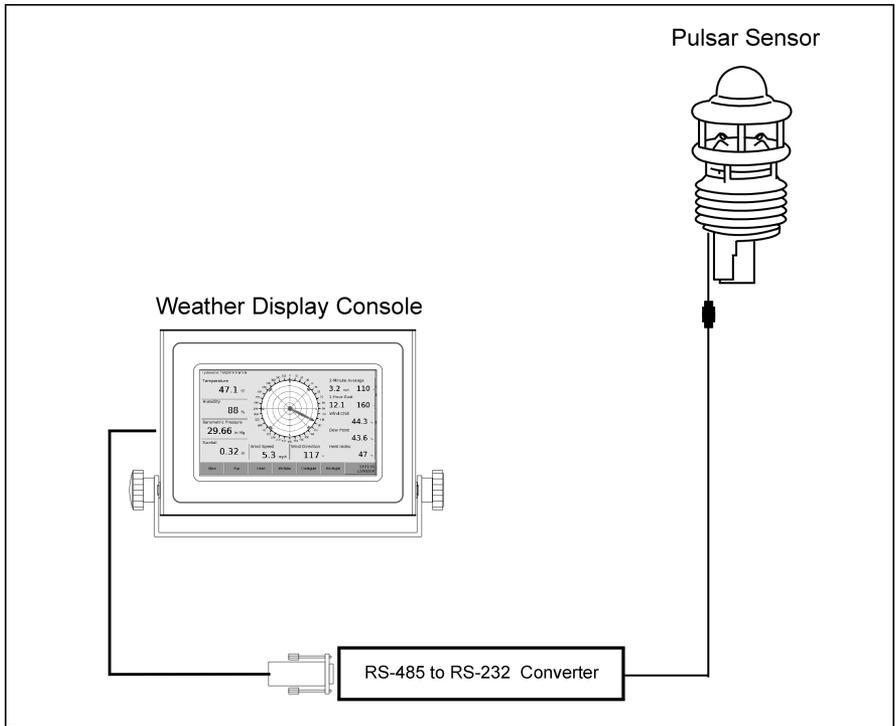


## Wireless Weather Stations

For all wireless and portable Orion, Capricorn/Pegasus, Capricorn FLX, Magellan and Magellan MX weather stations.

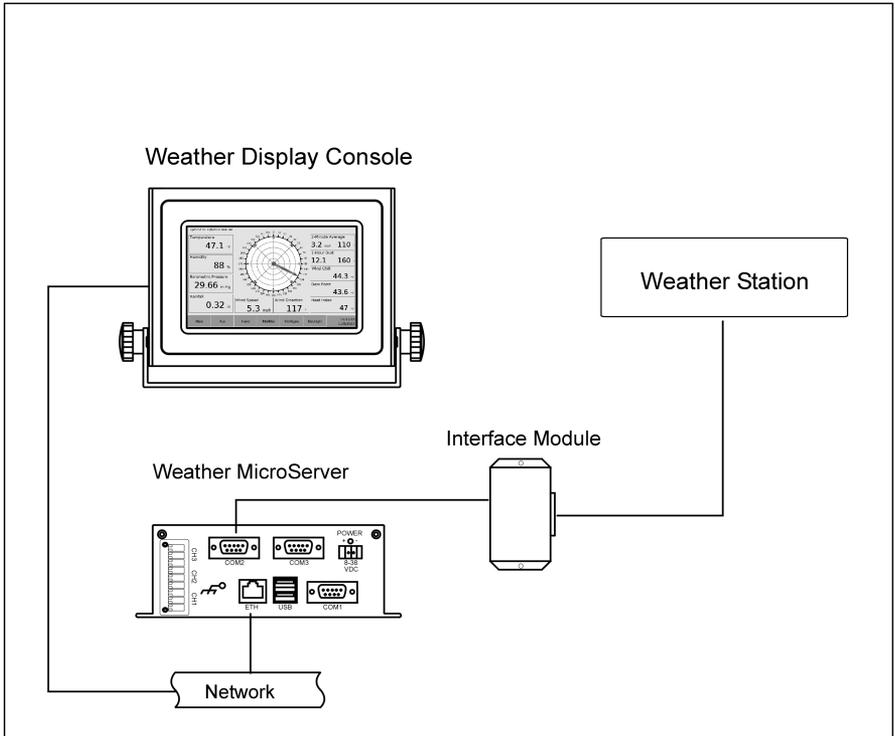


# Pulsar Weather Station, Serial Connection (RS-485 to RS-232 Converter)



## Ethernet Connection

The Weather Display Console can also be connected to the weather station over a network connection through the Weather MicroServer.



---

# SECTION 4: OPERATION

The Weather Display console can communicate over Serial RS-232 and Ethernet TCP/IP.

The Weather Display communicates directly with the weather station via a serial RS-232 connection or through the MicroServer via an Ethernet connection.

## RS-232 Interface

Connect the Weather Display to the weather station using the RS-232 cable, RS-485 cable/converter, or the wireless transceivers.

The weather station should be installed with all the sensors connected and power applied. Please refer to the Weather Station user manual for more information about installation.

Apply power to the Weather Display. Be sure to use the power supply provided with the unit.

The Weather Display will boot up and load the Main monitoring screen.

First time power up:

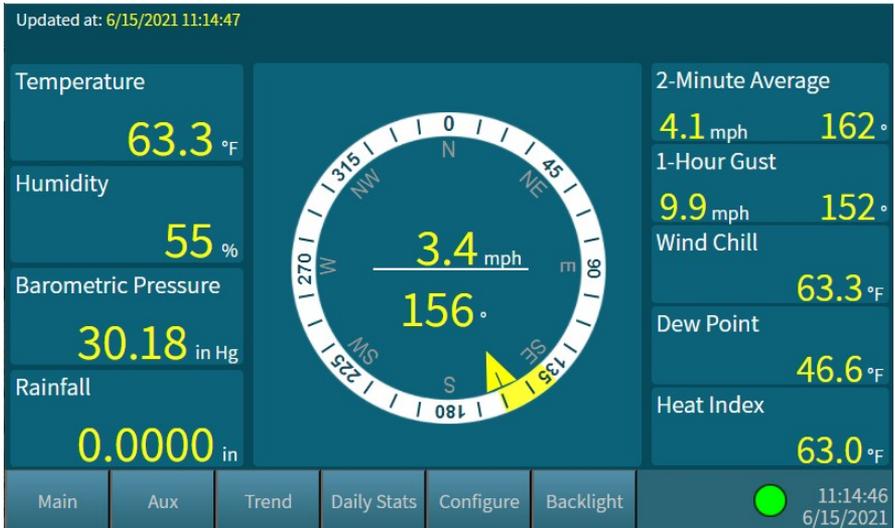
1. The screen will not display any measurements until it receives the first transmission from the weather station. This process can take up to 25 seconds.
2. In the Configure screen select Date/Time. Using the up and down arrow buttons, change the date and time to match your local settings.
3. In the Configure/Units screen select the desired units.

## Ethernet Interface

1. Connect the Weather Display to the network.
2. In the Configure screen, enter the IP address of the MicroServer. Apply changes when done.
3. In the Configure/Network screen change the network settings (if needed) to match your network configuration. The IP address for the Weather Display must be unique. Apply changes when done.
4. The Weather Display will start displaying the weather data from the MicroServer.
5. In the Configure screen select Date/Time. Using the up and down arrow buttons, change the date and time to match your local settings. Apply changes when done.

- In the Configure/Units screen select the desired units. Apply changes when done.

## Main Screen



### Updated Date and Time

Are displayed in the upper left side of the Main screen and all other data screens.

This is the date and time of the last received data set.

### Quick Trend Feature

To access trend data for one of the parameters on the Main screen, press the desired parameter box. For example, pressing the Temperature box displays Temperature Trend.

### Alarm Indicator

The green dot indicates that an alarm can be enabled for the weather station. For more information see the Alarms section.

---

## Temperature

Displays the temperature reading from the main temperature probe connected to the weather station. The value can be displayed in degrees Fahrenheit or Celsius.

Please note that the air temperature reading is accurate only when the temperature probe is located in the shade. This can be done by placing the probe at the north facing side of a building or by using an aspirating radiation shield.

## Relative Humidity

Displays the relative humidity percentage.

## Barometric Pressure

Displays the barometric pressure reading. The value can be displayed in Inches of Mercury (in. Hg.), Millibars (mbar), Kilopascals (kpa), or Hectopascals (hpa).

The barometric pressure reading is affected by the pressure offset and elevation settings in the Configure Screen, based on the QNH formula used by the FAA.

## Rainfall

Displays the rainfall reading for the day. The value can be displayed in inches or millimeters.

The rainfall reading is reset to zero at midnight.

## Wind Speed

Displays wind speed reading. The value can be displayed in Miles per Hour (mph), Kilometers per Hour (kph), Knots or Meters per Seconds (m/s). The wind speed is updated every second.

## Wind Direction

Displays the wind direction reading graphically on a compass rosette and in degrees. The wind direction is updated every second.

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

## 2-Minute Wind Average

Displays the 2-minute wind speed and direction averages.

## 1-Hour Wind Gust

Displays the 1-hour wind speed gust and the wind direction at gust.

## Wind Chill

Displays the wind chill temperature derived from the temperature and the wind speed sensors. The value can be displayed in degrees Fahrenheit or Celsius.

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

## Dew Point

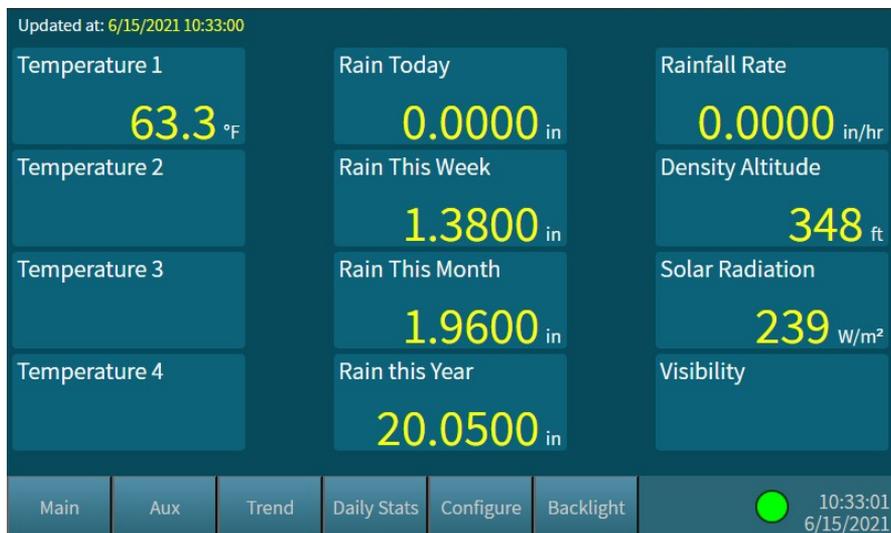
Displays dew point temperature derived from the temperature and the relative humidity sensors. The value can be displayed in degrees Fahrenheit or Celsius.

## Heat Index

Displays the heat index temperature derived from the temperature and the relative humidity sensors. The value can be displayed in degrees Fahrenheit or Celsius.

Heat Index temperature equals real air temperature when real air temperature is less than 70°F.

## Auxiliary Screen



### Temperature 1

Displays the temperature reading from the main temperature probe. The value can be displayed in degrees Fahrenheit or Celsius.

### Temperature 2 through 4

*(Only available with the Capricorn/Pegasus, Capricorn FLX and MicroServer stations.)*

Displays the temperature reading from the second, third and fourth temperature probes connected to the Capricorn/Pegasus, Capricorn FLX or the 8-Channel MicroServer. The values can be displayed in degrees Fahrenheit or Celsius.

The temperature sensor channels can be used for indoor air, soil, solar panel (cell), or outdoor air temperatures at various elevations.

### Rain Today

Displays the rainfall reading for the day. The value can be displayed in inches or millimeters. The rainfall reading is reset to zero at midnight.

### Rain this Week

Displays the rainfall accumulation for the week. This reading is reset to zero at the beginning of the week (Sunday). This value can be displayed in inches or millimeters.

## **Rain this Month**

Displays the rainfall accumulation for the month. This value can be displayed in inches or millimeters and is reset at the beginning of each month.

## **Rain this Year**

Displays the rainfall accumulation for the year. This reading is reset to zero at the beginning of the year (00:00 January 1).

Rain for the year is displayed in inches or millimeters.

## **Rainfall Rate**

Displays the rainfall rate based on the rainfall for the last 5 minutes. This value can be displayed in inches per hour or millimeter per hour.

## **Density Altitude**

Displays the density altitude. The value can be displayed in feet or meters.

The density altitude calculation is based on temperature, relative humidity, barometric pressure and elevation.

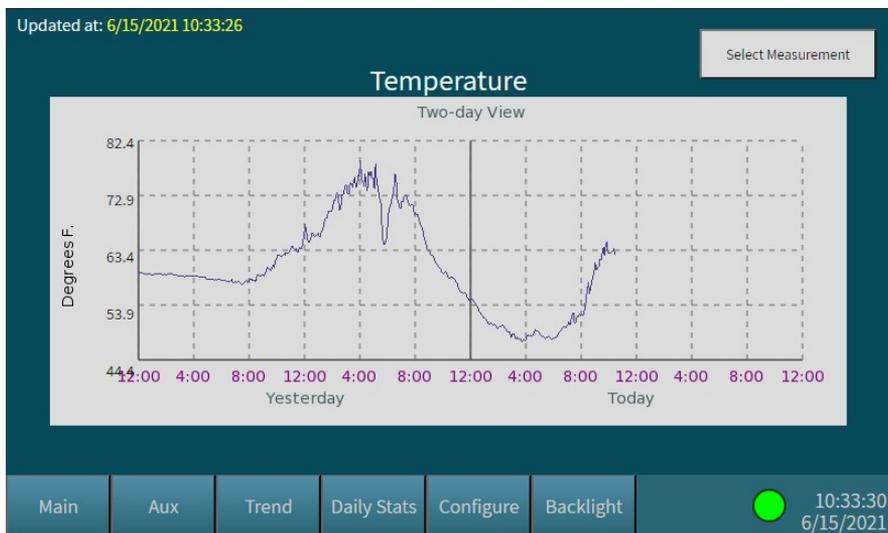
## **Solar Radiation**

Displays the solar radiation. The value is displayed in watts/meter<sup>2</sup>.

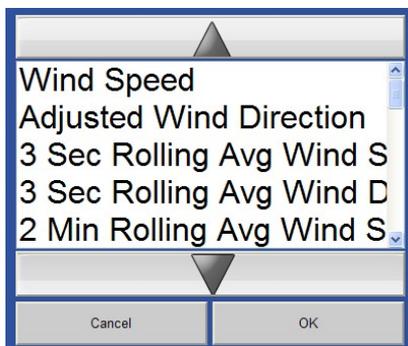
## **Visibility**

Displays the visibility reading in miles or meters.

# Trend Screen



To display the trend of a parameter, select the desired parameter by touching the Select Measurement button.

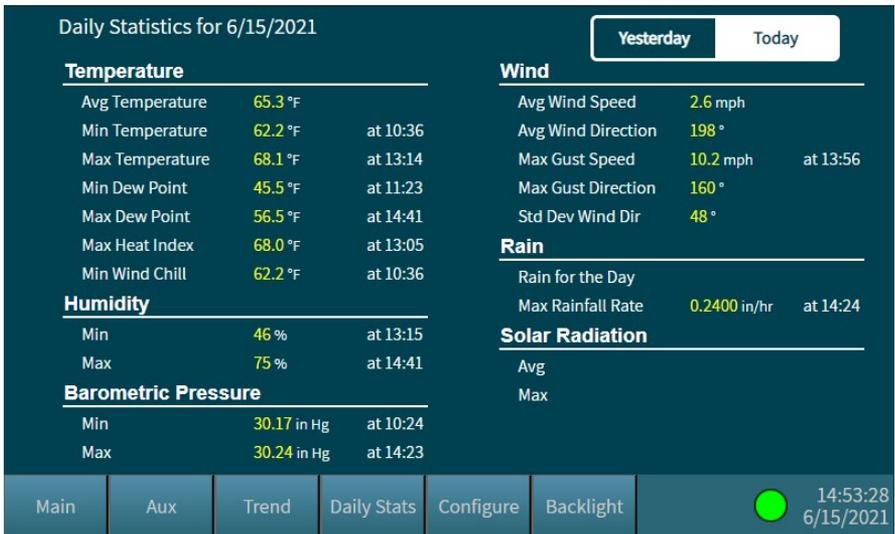


Use the up and down arrows to scroll through the list and touch the OK button to select the measurement.

Cancel will close the dialog without any selection.

The trend graph displays the data for yesterday and today.

# Daily Stats Screen

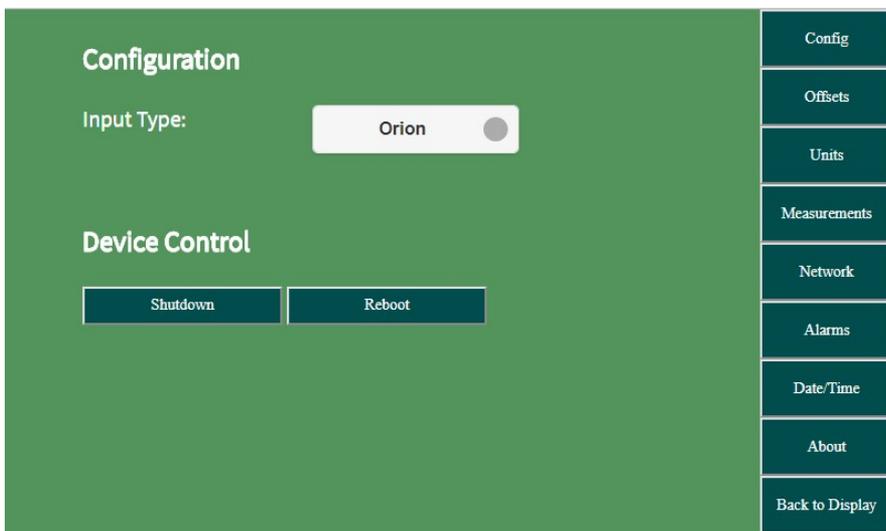


The Daily Stats screen displays the daily minimum and maximum values and time of occurrence for the main parameters.

Touch the Yesterday button to display the minimum and maximum values for yesterday.

The values are displayed in the units defined in the Units screen.

# Configuration Screen



To view this screen, touch the Configure button from any of the data screens (Main, Aux, Trend, and Min/Max) or the Config button from the subset configuration screens. This screen and the associated subset screens allow a variety of configuration options.

Select the Input Type.

For a serial connection, select the type of weather station, Orion, Capricorn, Capricorn FLX, Magellan, Magellan MX, Vela or Pulsar.

For an Ethernet connection, select MicroServer and enter the IP address of the MicroServer. Touch the numerical entry pad icon to enter or edit the IP address.

Apply changes when done.

## Shutdown

To shut down the Weather Display console, touch the Shutdown button and wait until the screen prompts you before disconnecting power.

The console should not be powered off without initiating a shutdown.

## Reboot

To reboot the Weather Display console, touch the Reboot button.

## Offsets

Note: This screen is only available for RS-232 serial connections.

**Offsets**

Altitude (feet): 0

Pressure Offset (in Hg): 0

Temperature Offset (F): 0

Wind Direction Offset: 0

Config

Offsets

Units

Measurements

Network

Alarms

Date/Time

About

Back to Display

Enter an altitude offset in feet to adjust the barometric pressure reading to sea level.

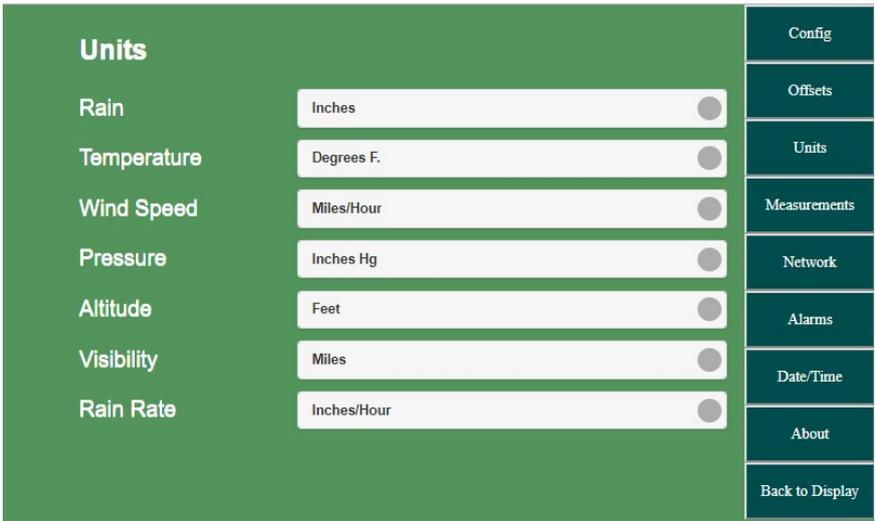
Enter a pressure offset in inches Hg to adjust the barometric pressure calibration.

Enter a temperature offset in °F to adjust the temperature calibration.

Enter a wind direction offset to adjust the wind direction calibration.

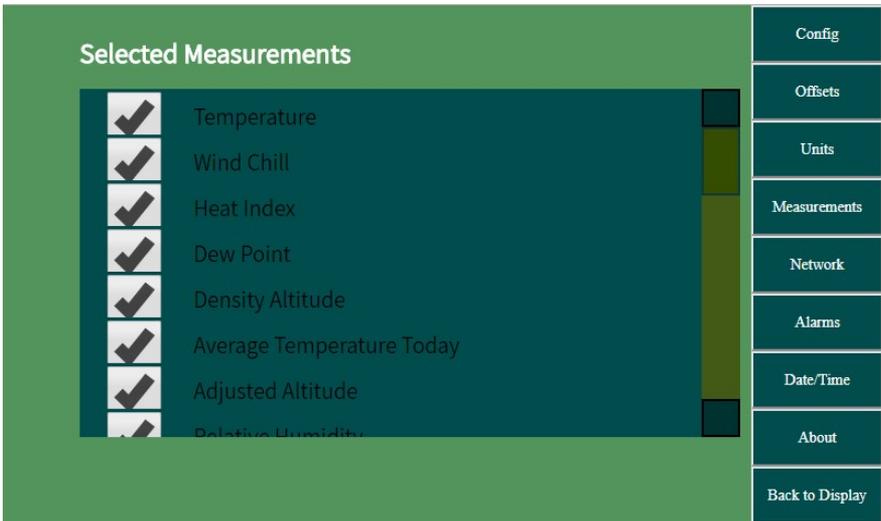
When done, touch Apply Changes for the offsets to take effect.

## Units



The parameter units can be changed per user requirements. Unit change applies to all of the data screens.

## Measurements



The Weather Display console is configured at the factory to match the weather station configuration.

To change the selected parameters, check or uncheck the desired parameter and apply changes when done.

Unselected parameters will not show any readings in the Main and Aux screens and will not be listed in the Trend screen measurement list.

## Network



The Weather Display console is configured at the factory with the following network settings:

IP Address: 192.168.0.40

Subnet Mask: 255.255.255.0

Gateway: 192.168.0.1

DNS Server: 192.168.0.1

To change the network settings, touch Network and use the keypad icon to edit the settings.

Apply changes when done.

The Weather Display can also be browsed using any Internet browser for configuration over the local network.

## Alarms

The screenshot shows the 'Alarms' configuration screen. At the top left, the title 'Alarms' is displayed. Below it, a measurement is selected: 'U-Temperature'. To the right of this selection, there are four configuration options, each with a dropdown menu and a toggle switch:

- Measurement:** Set to 'Temperature'.
- Alarm Type:** Set to 'Upper'.
- Trigger when above:** Set to '32'. A keypad icon is visible to the right of the input field.
- Clear when below:** The input field is empty. A keypad icon is visible to the right of the input field.

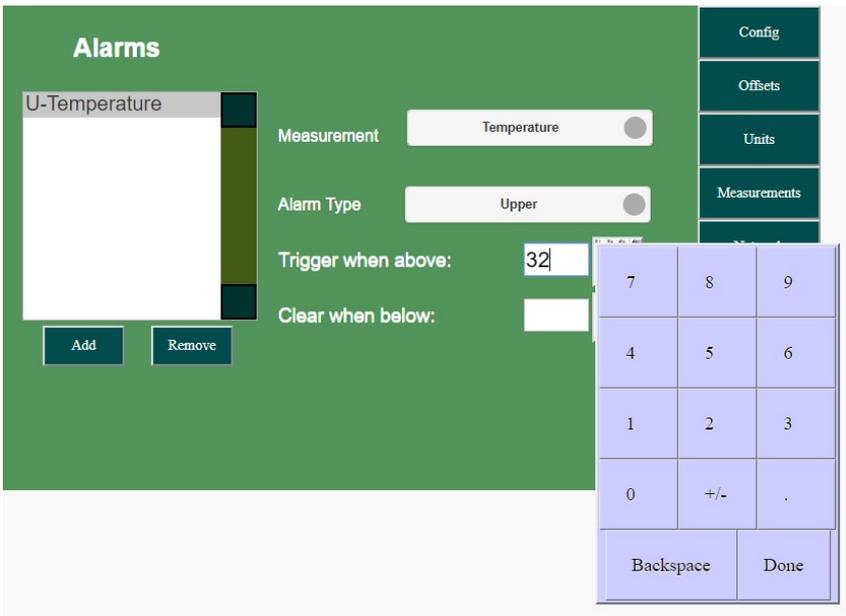
At the bottom left of the configuration area, there are two buttons: 'Add' and 'Remove'. On the right side of the screen, there is a vertical navigation menu with the following items: 'Config', 'Offsets', 'Units', 'Measurements', 'Network', 'Alarms', 'Date/Time', 'About', and 'Back to Display'.

An alarm feature can be enabled for all measurements listed on the Measurements screen.

Please note: Only one alarm per measurement can be enabled.

**To enable an alarm please follow the procedure below:**

1. Press the Add button and choose a measurement from the Measurement drop down menu.
2. In the Alarm Type drop down menu determine whether the alarm will activate when parameters are above (Upper) or below (Lower) a set value.
3. Press the keypad image to choose the appropriate value to Trigger the alarm, then press Done.



4. Press the keyboard image to choose the appropriate value to Clear the alarm, then press Done.

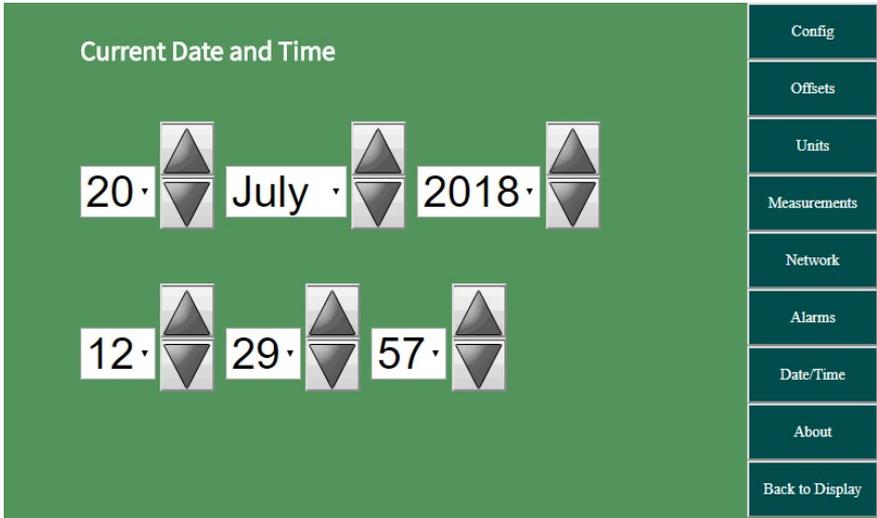
5. Press Apply Changes to save the alarm.

When an alarm is triggered, the green dot on the Main display screen will change to red and a tone will sound. A message will be displayed indicating a parameter has been surpassed. To clear the alarm message on the screen and tone press the Dismiss button.



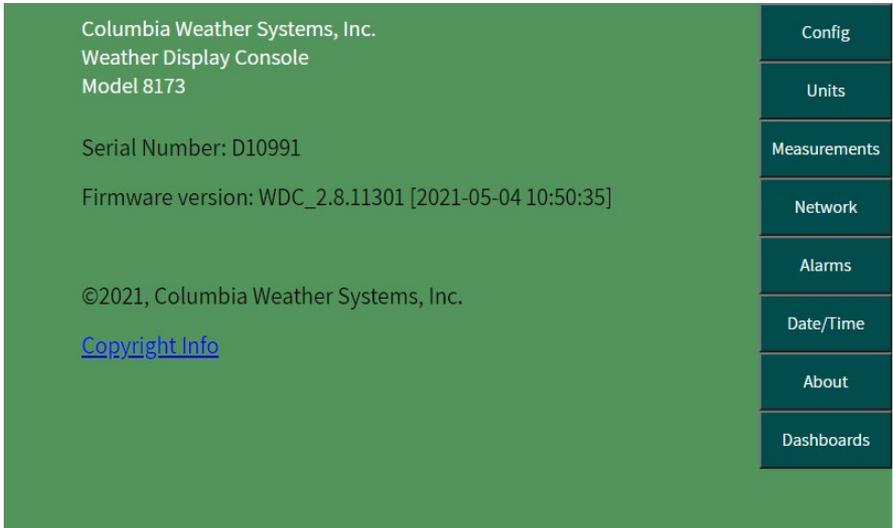
To remove an alarm, select the unwanted measurement on the Alarms screen, press the Remove button and then press Apply Changes.

## Date/Time



To change the date and time, use the up and down arrow buttons. Press Apply Changes when done.

## About



The About screen displays the model number, serial number and firmware version.

## Backlight

To preserve the life of the backlight, turn it off by touching the Backlight button. The Weather Display will still be fully operational.

To restore the backlight, touch any part of the screen.

# SECTION 5: BROWSER USER INTERFACE

The Weather Display Console also utilizes a browser user interface. The Display Console is configured at the factory with IP address 192.168.0.40.

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 Display Console is connected to the network, open an Internet browser such as Chrome and type in the following address:

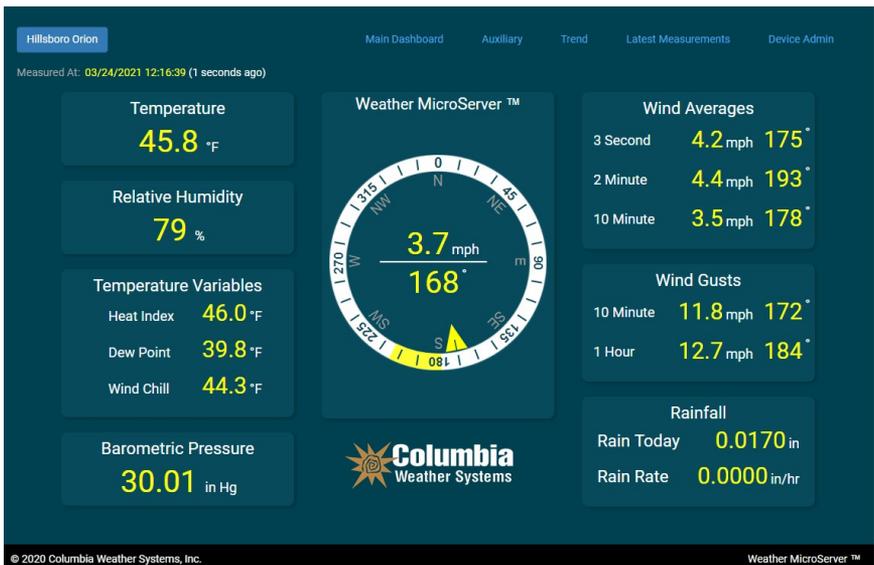
192.168.0.40

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 192.168.0.40 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.

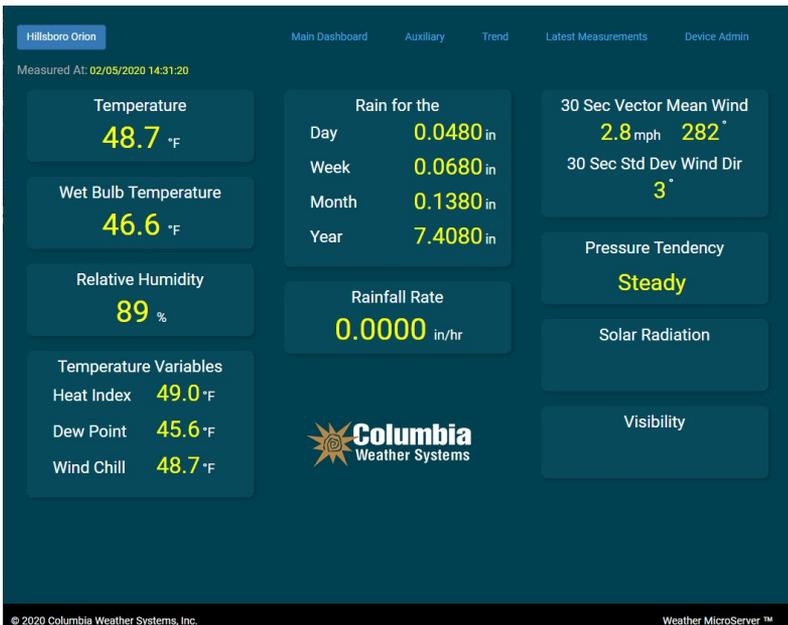
The “Measured At:” displays the date & time of the last measurement and how many seconds since that measurement. If the weather station has lost power, is no longer functioning or has a connection problem, “Measured At:” will show the data & time of the last measurement received, with the seconds since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

Please note that the Main Dashboard page is not compatible with Internet Explorer. Please use Chrome or Firefox web browser.

## 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.

# Latest Measurements

Hillsboro Orion		Main Dashboard	Auxiliary	Trend	Latest Measurements	Device Admin
<b>Latest Measurements</b>						
Sample Timestamp	02/05/2020 15:00:24	2 Min Rolling Avg Wind Direction	308 °			
Temperature	49.2 °F	10 Min Rolling Avg Wind Speed	2.3 mph			
Wind Chill	49.2 °F	10 Min Rolling Avg Wind Direction	296 °			
Heat Index	49.0 °F	60 Min Rolling Avg Wind Speed	1.8 mph			
Dew Point	46.0 °F	60 Min Rolling Avg Wind Direction	292 °			
Degree Days	5716.9 °F	60 Min Gust Wind Direction	282 °			
Density Altitude	-544 ft	60 Min Gust Wind Speed	4.7 mph			
Average Temperature Today	43.4 °F	60 Min Gust Time	02/05/2020 14:56:51			
Wet Bulb Globe Temperature	56.3 °F	10 Min Gust Wind Direction	282 °			
Saturated Vapor Pressure	0.35 in Hg	10 Min Gust Wind Speed	4.7 mph			
Vapor Pressure	0.31 in Hg	10 Min Gust Time	02/05/2020 14:56:51			
Dry Air Pressure	29.65 in Hg	2 Min Gust Wind Direction	289 °			
Dry Air Density	0.0773 lb/ft3	2 Min Gust Wind Speed	2.8 mph			
Absolute Humidity	0.0005 lb/ft3	2 Min Gust Time	02/05/2020 14:58:45			
Air Density Ratio	1 %	1 Min Sustained Wind Speed	1.3 mph			
Adjusted Altitude	-355 ft	30 Sec Rolling VM Wind Dir	309 °			
Wet Air Density	0.0778 lb/ft3	30 Sec Rolling VM Wind Speed	1.4 mph			
Wet Bulb Temperature	46.4 °F	30 Sec Rolling Std Dev Wind Dir	10 °			
Predicted Generation	19.65	Raw Barometric Pressure	29.96 in Hg			
Cloud Base	926 ft	Adjusted Barometric Pressure	30.18 in Hg			
Relative Humidity	89 %	Pressure Tendency	Steady			
Wind Speed	1.2 mph	Rain Today	0.0480 in			
Raw Wind Direction	318 °	Rain this week	0.0680 in			

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Weather MicroServer™

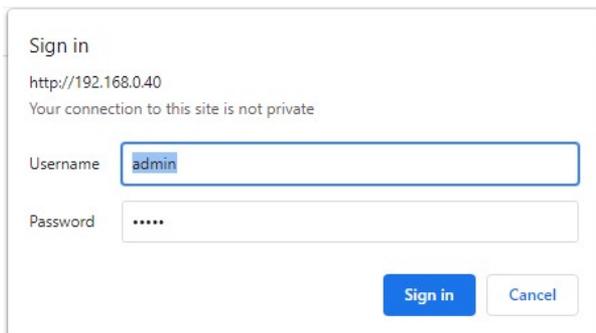
The Latest Measurements page displays the current parameter values in the selected units.

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 username and password.



Sign in  
http://192.168.0.40  
Your connection to this site is not private

Username

Password

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

If the password has been changed and lost, please contact Columbia Weather Systems for assistance.

## Admin Home



**Weather Display Console**

Station Name: New Weather Display Console

Firmware Version: WDC\_2.8.11301 [2021-05-04 10:50:35]

Current Time: 2021-06-15 15:25:41

Serial Number: D10991

Status: Running

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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 Display Console. Be sure to refresh the browser for the current time.

The Display Console 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 Display Console.

## Station Name

### Change Station Name

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 on the Home page and Weather Dashboard pages.

## Firmware Update

### Update Firmware

Current Version: WDC\_2.8.11301 [2021-05-04 10:50:35]

To update firmware, you must enter Recovery Mode by clicking the button below.

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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



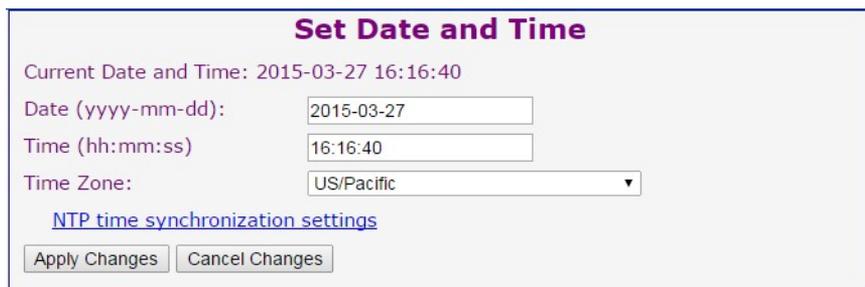
The screenshot shows a window titled "Weather Device Recovery Mode" with a light green background. It contains five buttons stacked vertically: "Update Firmware from USB", "Restore Factory Settings", "Safe Shutdown", "Boot back to Recovery Mode", and "Boot to Run Mode".

To upgrade the Display Console firmware, click on Update Firmware, then click Enter Recovery Mode to boot the Display Console 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 Display Console during this process. Do not attempt firmware update during periods of power uncertainty.**

## Date and Time



The screenshot shows a window titled "Set Date and Time" with a light blue background. It displays the current date and time as "2015-03-27 16:16:40". Below this are three input fields: "Date (yyyy-mm-dd)" with the value "2015-03-27", "Time (hh:mm:ss)" with the value "16:16:40", and "Time Zone:" with a dropdown menu showing "US/Pacific". There is a link for "NTP time synchronization settings" and two buttons at the bottom: "Apply Changes" and "Cancel Changes".

Date and Time page allows the user to change the Display Console 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 Display Console date and time is stamped on all records.

**Reboot the Display Console after the date and time have been set.**

## NTP Time Synchronization

### Time Synchronization Settings

NTP time synchronization:

NTP Server:

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 Display Console 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

IP Address:	<input type="text" value="192.168.0.40"/>
Subnet Mask:	<input type="text" value="255.255.255.0"/>
Gateway:	<input type="text" value="192.168.0.1"/>
DNS Server:	<input type="text" value="192.168.0.1"/>

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

The Display Console factory settings are as follows:

IP address 192.168.0.40

Subnet Mask: 255.255.255.0

Gateway: 192.168.0.1

DNS Server: 192.168.0.1

If the network subnet mask, gateway or DNS server settings are different than the above, the Display Console settings must be changed to match the network in order for the Display Console to be visible on the network.

To change the Display Console network settings:

1. Connect the Display Console to a stand-alone computer (not connected to the network) via a standard or a crossover Ethernet cable.
2. Change the computer network settings to match the Display Console settings shown above with the exception of the IP address. Use IP address 192.168.0.49 for the computer. Contact Network Administrator for assistance.
3. Browse the Display Console at 192.168.0.40
4. In the Display Console User Interface, click on Network Setup and change the settings to match your network.
5. Click on Apply Changes.
6. Disconnect the Display Console from the stand-alone computer and connect it to the network using a standard Ethernet cable.
7. Browse the Display Console from the network to verify that the changes are successful.
8. Change the computer network settings to original settings.

## Change Password

### Change Password

Admin password:

Re-enter password:

Change Password page allows the user to change the Admin password. The minimum password length is zero. The password can be blank. The Maximum password length is 63 characters. Special characters and capital letters are allowed.

## Data Inputs

### Data Inputs

Input Type:

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The Data Inputs page allows the user to configure the station type that is connected to the Display Console.

### Station Type/Primary Serial Port

Select “Orion” if connected to an Orion Weather Station.

Select “Capricorn” if connected to either a Capricorn 2000, Capricorn 2000EX or Pegasus EX Weather Station.

Select “Capricorn FLX” if connected to a Capricorn FLX, or Pegasus FLX Weather Station.

Select “Magellan” if connected to a Magellan Weather Station.

Select “Magellan MX” if connected to a Magellan MX Weather Station.

Select “Vela” if connected to a Vela Weather Station.

Select “Pulsar” if connected to a Pulsar Weather Station.

## Capricorn FLX Analog Sensor Configuration

**Data Inputs**

Input Type: Capricorn FLX ▾

**Capricorn FLX Sensors**

Solar Radiation 1: Disabled ▾

Solar Radiation 2: Disabled ▾

Analog Channel 1: Disabled ▾

Analog Channel 2: Disabled ▾

**Custom Analog Sensors**

Name	Factor	Offset
<span style="border: 1px solid black; padding: 2px;">New Sensor</span>		

Apply Changes
Cancel Changes

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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.

The 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.

IR Surface Temperature - (used in custom applications)

Temperature (2210) - an alternative temperature sensor (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

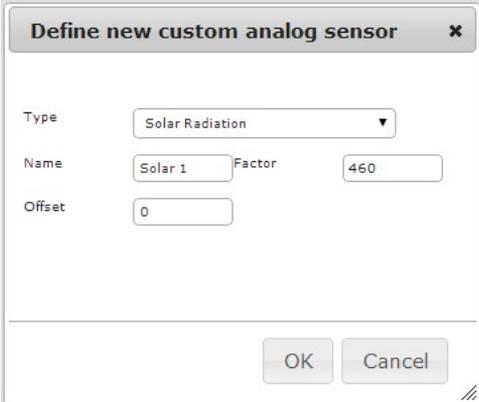
In addition to the standard sensors, the Capricorn FLX can also accept additional sensors that require custom configuration. The following sensor types are available for configuration: temperature, solar radiation, UV radiation, Photosynthetically Active Radiation (PAR), relative humidity, barometric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

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

Click New Sensor.

The window below will be displayed:



The screenshot shows a dialog box titled "Define new custom analog sensor". It contains the following fields and controls:

- Type:** A dropdown menu with "Solar Radiation" selected.
- Name:** A text input field containing "Solar 1".
- Factor:** A text input field containing "460".
- Offset:** A text input field containing "0".
- Buttons:** "OK" and "Cancel" buttons at the bottom right.

Select the type of sensor.

Enter a name for the sensor.

Enter a Factor and Offset.

Click OK when finished.

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

Click Apply Changes when finished.

Please note: Measurements for custom sensors are English units.

## Measurements

### Selected Measurements

**Orion Serial** [Select All](#) [Select None](#) [Show Inputs](#)

<input checked="" type="checkbox"/> Temperature	=> Temperature
<input checked="" type="checkbox"/> Wind Chill	=> Wind Chill
<input checked="" type="checkbox"/> Heat Index	=> Heat Index
<input checked="" type="checkbox"/> Dew Point	=> Dew Point
<input checked="" type="checkbox"/> Degree Days	=> Degree Days
<input checked="" type="checkbox"/> Density Altitude	=> Density Altitude
<input checked="" type="checkbox"/> Average Temperature Today	=> Average Temperature Today
<input checked="" type="checkbox"/> Wet Bulb Globe Temperature	=> Wet Bulb Globe Temperature
<input checked="" type="checkbox"/> Saturated Vapor Pressure	=> Saturated Vapor Pressure

The Selected Measurements page 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 in the Selected Measurements page will be displayed and recorded in the data log files.

To display a measurement on the Latest Measurements page, select the corresponding parameter on the Selected Measurements page.

Click Apply Changes.

### Selected Measurements

**Orion Serial** [Select All](#) [Select None](#) [Hide Inputs](#)

Temperature
 Humidity
 Wind
 Pressure
 Rain
 Hail

The various input types can be quickly selected or deselected using the input feature shown above. This feature allows the user to customize the display of the Latest Measurements page.

---

## Analog Channels

<b>Analog Channel 1</b>	<input checked="" type="checkbox"/> Solar Radiation	=> Solar Radiation
<b>Analog Channel 2</b>	<input checked="" type="checkbox"/> Temperature	=> Temperature 2
<b>Analog Channel 3</b>	<input checked="" type="checkbox"/> PAR	=> PAR

The Selected Measurements page allows the user to select or deselect additional sensors connected to the available analog channels. Once selected, the parameter name will appear to the right of the sensor type.

To display the measurement of a specific sensor on the Latest Measurements page, select the sensor and click Apply Changes on the Selected Measurements page.

# Data Outputs

### Data Outputs

CWS Weather Server: Enabled ▾ Settings

Weather Underground Output Disabled ▾ Settings

Apply Changes Cancel Changes

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## CWS Cloud Weather Server Output:

The screenshot shows the Columbia Weather Systems dashboard. At the top left is the logo and name 'Columbia Weather Systems'. At the top right is 'Columbia Weather Systems, Inc.' Below the logo are navigation buttons for 'Office Weather Station -', 'Main', and 'Auxiliary'. On the right side, there are links for 'Home', 'Preferences', and 'Logout'. The main content area displays weather data as of 10/30/2020 14:29:08 (4 seconds ago). The data is organized into several panels:
 

- Temperature:** 59.5 °F
- Relative Humidity:** 62 %
- Temperature Variables:** Heat Index 60.0 °F, Dew Point 46.6 °F, Wind Chill 59.5 °F
- Wind:** A circular wind speed indicator shows 2.5 mph and 27°. To the right, 'Wind Averages' are listed: 3 Second Average (2.5 mph, 23°), 2 Minute Average (2.2 mph, 5°), and 10 Minute Average (2.5 mph, 288°).
- Wind Gusts:** 10 Minute Gust (7.7 mph, 279°) and 1 Hour Gust (10.8 mph, 275°).
- Barometric Pressure:** 1021 mbar
- Solar Radiation:** Sensor 1 319 W/m², Sensor 2
- Rain Today:** 0.0180 in

 At the bottom left, it says '© 2020 Columbia Weather Systems, Inc.' and at the bottom right, 'Version: 1.2.0.20302'.

To upload the weather data to Columbia Weather Systems' Cloud Weather Server, please send a request to [support@columbiaweather.com](mailto:support@columbiaweather.com)

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

In the Display Console Data Outputs page, select "Enabled" for the CWS WeatherServer.

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

## Weather Underground Output:

To upload the weather data to Weather Underground, please go to: [www.wunderground.com](http://www.wunderground.com), register (create a password and username) and add a station (create a Station ID).

In the Display Console 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 Display Console including the DNS Server and Gateway need to match the LAN network settings for the feature to work properly.

## Units

### Selected Units

Rain:	Millimeters ▼
Temperature:	Degrees F. ▼
Wind Speed:	Miles/Hour ▼
Pressure:	Inches Hg ▼
Altitude:	Feet ▼
Visibility:	Miles ▼
Rain Rate:	Inches/Hour ▼

The Units page allows the user to select the desired units for the weather parameters on the Weather Dashboard, Auxiliary, Trend and Latest Measurements pages.

## Custom Dashboards

### Custom Dashboards

Use this page to load a custom dashboard file. To add a file, use the browse button or drag it from a folder into the target area.

drag & drop dashboard file

-or-

[Browse for dashboard file](#)

### Main Dashboard Information

No custom dashboard installed.

### Touch Dashboard Information

No custom dashboard installed.

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The Main screen on the Display Console can be customized to display additional parameters.

The Main Dashboard available through the browser user interface 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 page contact [support@columbiaweather.com](mailto:support@columbiaweather.com)

# Device Settings Backup and Restore

## Device Settings Backup and Restore

Use this page to backup or restore your device settings.

### Backup

Click the button below to backup your device settings, A device settings backup file will be downloaded to your downloads folder.

Download device settings file

### Restore

drag & drop device settings file

-or-

browse

### Backup and Restore log

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.

## Diagnostics

Firmware Version: WDC\_2.8.11301 [2021-05-04 10:50:35]  
Kernel Version: 4.9.11+gcdcfd0831e1c  
Hardware Model: ts8390-4900  
Serial Number: D10991  
RS485 Available: no  
Current Time: 2021-06-16 09:45:54 PDT  
Hardware Time: Wed Jun 16 09:45:54 2021 0.000000 seconds  
MAC address: 00:D0:69:52:96:C1  
IP address: 192.168.0.40  
Subnet mask: 255.255.255.0  
Gateway: 192.168.0.1  
DNS Server: 192.168.0.1  
Data Manager Status: Running  
Device Status: up 13 days, 22:03, 0 users, load average: 0.66, 0.82, 0.49  
Device running from: flash  
SD card status: ok  
User: 0  
System: 6  
Idle: 94

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## View Log

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

## Serial Debug

```

192.168.0.75/serialdebug/serialdebug.html
0r0, Dm=007D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=038D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=053D, Sm=0, 2S, Sx=0, 3S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=083D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=095D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=077D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=037D, Sm=0, 3S, Sx=0, 5S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=016D, Sm=0, 3S, Sx=0, 5S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=029D, Sm=0, 3S, Sx=0, 5S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=055D, Sm=0, 2S, Sx=0, 5S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=079D, Sm=0, 2S, Sx=0, 3S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=087D, Sm=0, 1S, Sx=0, 3S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=097D, Sm=0, 1S, Sx=0, 3S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=087D, Sm=0, 1S, Sx=0, 3S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
0r0, Dm=065D, Sm=0, 2S, Sx=0, 4S, Ta=69, 6F, Ua=47, 6P, Pa=29, 76I, Rc=0, 000I, Ri=0, 00I, Hc=0I, Hi=0I, Vs=1I
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```

Stop Pause

Debug log file can be downloaded [here](#).

The Serial Debug feature allows the user to display the serial data that is available on the Display Console serial port.

Click Debugging COM2; 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.

## 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 30 seconds 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 Display Console reboots into a separate user interface where the user can update firmware, save device settings, and restore the unit to factory settings. Please note Recovery Mode requires a network connection to the Display Console or a one-to-one connection from the Display Console to a computer over Ethernet.

## Update Firmware

See the Update Firmware section for more information.

## Restore Factory Settings

In the event a problem occurs with the Display Console 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 Display Console 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, or the Display Console has been corrupted the user has the option to manually enter Recovery Mode by following the procedure below:

1. Power down the Display Console.
2. Remove the back panel.
3. Locate the SD Boot pins near the SD Card. There will be a black shunt (jumper) hanging on one pin.
4. Place the shunt on both pins of SD BOOT.
5. Apply power to the Display Console.
6. The Display Console will be available at the default IP address of 192.168.0.40. Enter the default IP address into a browser.
7. The Recovery Mode interface will be displayed along with the current IP Address that the Display Console is configured for.
8. For recovery, follow the instructions on the page by clicking "Perform Shutdown", power the Display Console down then remove the jumper.
9. Re-install the cover.
10. Apply power to the Display Console and refresh your browser page.
11. Once in Recovery Mode follow the instructions above to restore the Display Console to its original factory settings or contact Columbia Weather Systems for further support.

## Copyright Information

To view the software license information, click [Copyright Information](#).

## **SECTION 5: MAINTENANCE**

The Weather Display requires no maintenance other than cleaning the chassis and the LCD touch screen.

To clean the LCD touch screen, turn the unit off, wipe the screen with an LCD screen cleaner.



# SECTION 6: TROUBLESHOOTING

## Communication

If the Weather Display is not displaying current weather data from the weather station or the MicroServer, check the following:

1. Make sure the input type (weather station type) is set correctly in the Configure screen.
2. Verify that measurements are selected in the Measurements screen.
3. Verify that the IP address of the MicroServer has been entered in correctly in the Configuration screen.
4. Login to the MicroServer and verify that it is receiving data by viewing the Latest Measurements page.
5. If the Orion, Magellan, Magellan MX, Vela or Pulsar sensor is part of the weather station locate the Interface Module. The green power LED should be solid and the red signal LED should be blinking once every second. For Capricorn 2000EX or Capricorn FLX stations, the Control Module power LED should be on.
6. Check the RS-232 cable between the Weather Display and the weather station for proper connection and configuration. Use the original cable supplied with the console.



# SECTION: 7 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 Display 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 Display to be free from defects in materials and/or workmanship when operated in accordance with the manufacturer's operating instructions, for two (2) 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 factory 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 unit as follows:
  - A. Packing
    - ◆ Wrap the Weather Display 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.

---

# 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.

### 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.

### 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.

### 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.

### Fahrenheit Temperature Scale

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

### 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.

## 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.

## Pyranometer

It 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.

## Relative Humidity

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

## 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.

## 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.

## Wind Chill

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

---

# 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<sup>2</sup> minutes = 0.00529 x watts/meter<sup>2</sup>

Joules/centimeter<sup>2</sup> minutes = 0.006 x watts/meter<sup>2</sup>

Mega joules/meter<sup>2</sup> day = 11.574 x watts/meter<sup>2</sup>

Langley/minutes = 0.00143 x watts/meter<sup>2</sup>

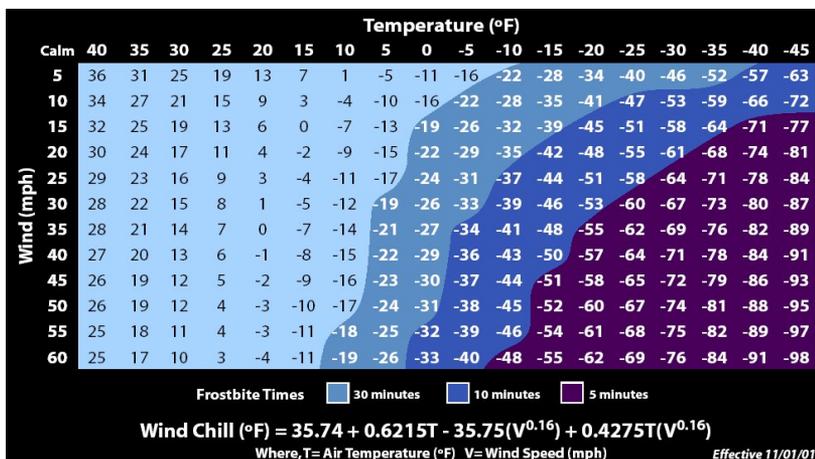
# Tables and Formulas

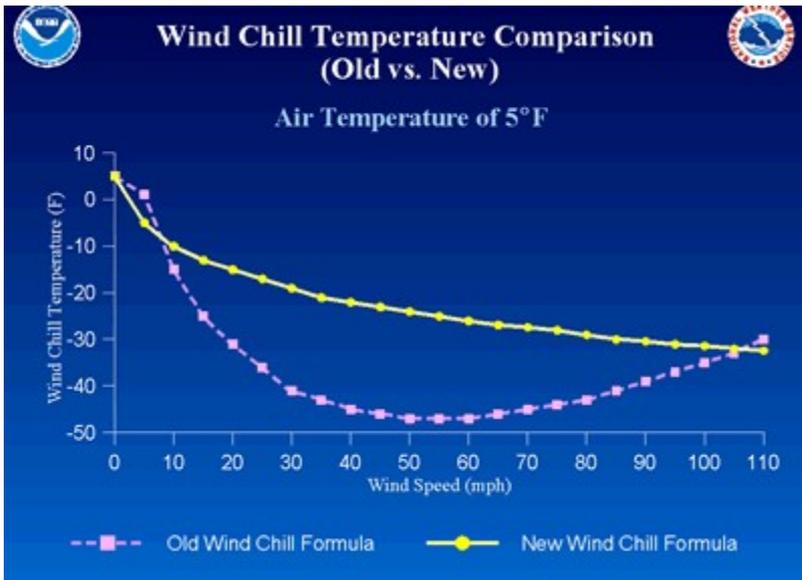
## Wind Chill Chart

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 windchill 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

RH	Temperature in °F													
	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

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

$$\text{Dew Point in } ^\circ\text{C} = (238.3 * B) / (1-B)$$

Where:

RH = Relative Humidity

T = Temperature in  $^\circ\text{C}$

Ln = Natural logarithm



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Catalog Number: 81639

Version 4.12

Printed in U.S.A.