Model 6030
Optical Rain Gauge

User's Manual

Rev. E

allweatherinc
All Weather Inc. • 1165 National Drive • Sacramento, CA 95834 • USA • 800.824.5873 • www.allweatherinc.com

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The information and specifications described in this manual are subject to change without notice.

All Weather, Inc.
1165 National Drive
Sacramento, CA 95834
Tel.: (916) 928-1000
Fax: (916) 928-1165

Contact Customer Service

- **Phone** support is available from 8:00am - 4:30pm PT, Monday through Friday. Call 916-928-1000 and ask for "Service."
- **Online** support is available by filling out a request at www.allweatherinc.com/support/online-support/
- **E-mail** your support request to support@allweatherinc.com

Revision History

Revision	Date	Summary of Changes
B	2011 Oct 31	Removed references to OEM part numbers, replaced installation drawing with diagrams in the Installation chapter, and better explained options and wiring details
C	2015 July 31	Updated electronics enclosure to use UPCM instead of Serial Sensor Interface and AC Interface Board
D	2015 Sept 22	Updated Figure 1 and corrected responses to poll commands
E	2016 Nov 28	Added alternative cable wire colors for the sensor head in Figures 8 and 9

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1. OVERVIEW

The Model 6030 Optical Rain Gauge optically measures precipitation-induced scintillation and applies algorithms to determine the precipitation occurrence, type, rate, and water equivalent accumulation automatically.

The Model 6030 Optical Rain Gauge measures precipitation by detecting the optical irregularities — known as scintillations — induced by particles falling through a beam of partially coherent infrared light in the sample volume. The induced scintillations are related to the characteristics to the precipitation, and the precipitation rate is determined based on the intensity of these scintillations. In turn, the precipitation rate can be used to determine precipitation accumulation.

The Model 6030 Optical Rain Gauge is not affected by many of the environmental factors that cause significant errors with traditional rain gauges. Model 6030 Optical Rain Gauge offers these features.

- ✓ Easy Installation
- ✓ High Sensitivity
- ✓ Low Maintenance
- ✓ Minimal Wind Effects
- ✓ Wide Dynamic Range
- ✓ Works on Ships and Buoys
- ✓ No Evaporation or Splash Errors
- ✓ Not Affected by Insects, Debris, Dust

Applications using traditional tipping bucket rain gauges can all be upgraded easily to use the Model 6030 Optical Rain Gauge.

The electro-optical design provides for an extremely reliable sensor with a calculated MTBF in excess of 60,000 hours. Unlike mechanical gauges, which collect the precipitation to measure it, the Model 6030 Optical Rain Gauge has no collectors or buckets to corrode or clog. The sensors use automatic gain control circuitry to eliminate the effects of LED output power or dirty optics. In fact, sensor performance is maintained even when over 75% of the light is blocked! Diagnostics alert the user if the signal strength is too low for normal operation. Preventative maintenance, suggested every 6 months, is as simple as cleaning the two optical windows on the unit.

1.1 ACCESSORIES

The following accessories and replacement parts are available for the Model 6030 Optical Rain Gauge.

Part Number	Description
2715	Universal Power and Communication Module
M442089-00	10 A 250 V, 5x20 mm slow blow fuse
M438130-00	Backup Battery

2. SYSTEM DESCRIPTION

2.1 MAJOR COMPONENTS

2.1.1 Sensor Head

The 6030 sensor head uses a compact optical system to measure precipitation.

The sensor head frame is an all-aluminum, welded design. The small box (TX) is the transmitter unit and contains an infrared LED and lens with a disk heater. The large box (RX) contains a receiver assembly consisting of a photo diode, a lens with an aperture slit, a disk heater, electronics, an external thermistor probe, and a connector for the signal/power cable. The wiring between the two heads is inside the welded head frame.

The transmit and receive lenses are heated by self-regulating positive temperature coefficient (PTC) thermistor disks to a temperature above the ambient temperature to reduce dew and frost on the lenses. Depending on the ambient temperature, the current drain for the lens heaters can change more than 200 mA.

The sensor head is completely sealed from water intrusion at the factory. Exercise care should to avoid drilling or otherwise puncturing the frame.

A 15 m cable is supplied to connect the sensor head frame to the electronics enclosure.

A mounting plate, an integral part of the sensor head cross arm, is provided to install the head to a user-supplied mast. Two sets of holes in the mounting plate allow the U-bolts supplied with the head to clamp the head to either a vertical or horizontal pipe up to 50 mm in diameter.

N o t e:

The sensor head frame contains no user serviceable parts - opening the head will void the warranty!

2.1.2 Electronics Enclosure

The electronics enclosure contains the processing electronics, power supplies, and surge protection circuits.

The electronics enclosure is a fiberglass NEMA-4X type box with a hinged access door. One power supply, and AC and RS-485 interface modules with surge protection are mounted to the base plate of the enclosure. Figure 7 shows the locations of these components inside the enclosure.

All the units in the enclosure are field-replaceable.

The electronics enclosure is mounted with the supplied fastener hardware using the four (4) mounting holes on the enclosure.

N o t e:

Exercise care to avoid drilling or otherwise puncturing the electronics enclosure.

2.1.3 Universal Power and Communication Module (UPCM)

The Universal Power and Communication Module is built in to the Optical Rain Gauge, and provides power and a serial interface for the Optical Rain Gauge.

3. THEORY OF OPERATION

3.1 SENSOR HEAD

The sensor head is a self-contained unit consisting of electro-optical components, heaters, a microprocessor, and integral cabling to connect with the electronics enclosure.

The sensor measures precipitation by detecting the optical irregularities induced by particles falling through a beam of partially coherent infrared light (in the sample volume). These irregularities are known as scintillation. The twinkling of stars is a familiar example of scintillation. By detecting the intensity of the scintillations which are characteristic of precipitation, the precipitation rate is determined. Precipitation is measured using the sensor head "in-beam" optics.

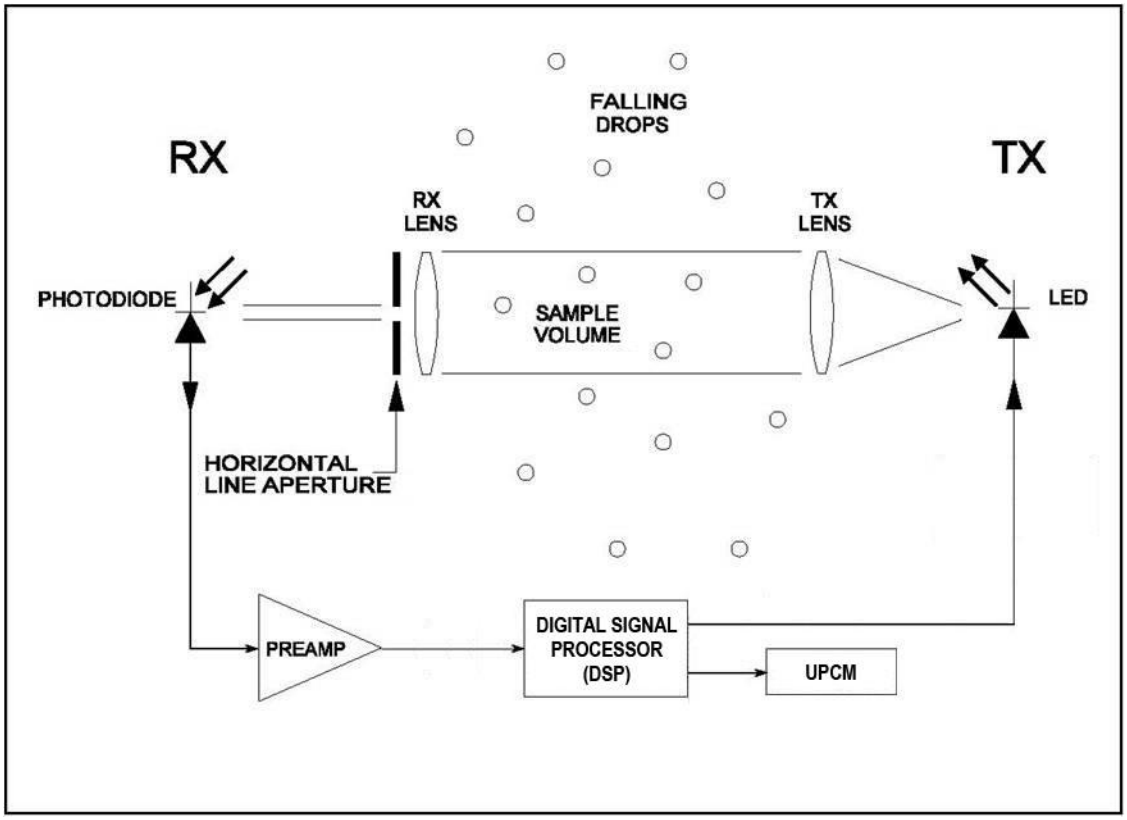

Figure 1. Optical Rain Gauge Theory of Operation

The Model 6030 Optical Rain Gauge consists of these components.

- A transmit modulator and infrared LED (TX)
- A transmitter optical lens assembly
- A receiver optical lens assembly
- A photo detector and preamplifier (RX)

- An Automatic Gain Controlled (AGC) normalizer
- A signal processor
- A temperature probe
- A microprocessor and communications subsystem

The transmitter portion of the sensor head uses an infrared LED as a light source that is modulated to eliminate interference in the system caused by background light. The LED has a very long life time, has a relatively low power draw, is invisible to the eye, and presents no radiation hazard to the user.

The LED is housed in the smaller of the sensor head boxes. A lens is used to collimate the LED's carrier-wave modulated light into a slightly diverged beam. The transmit and receive lenses are both heated by self-regulating positive temperature coefficient (PTC) thermistor disks to a temperature just above the ambient temperature to reduce dew and frost on the lenses.

The larger sensor head rectangular box houses receive optics, DC regulator, the AGC, signal processing electronics, temperature probe, and microprocessor. The receive lens focuses the transmitted light onto a photo diode. The scintillations in light intensity are thus detected and amplified. A wide dynamic range Automatic Gain Control (AGC) circuit normalizes the precipitation-induced scintillation signal to the carrier-wave modulated light. Thus errors from variations in the source intensity caused by LED aging or dirt on the lenses are eliminated. The demodulated scintillation signal is then further filtered, processed, and averaged. The statistical average of the measured scintillation signals gives an accurate measurement of instantaneous precipitation rates.

The microprocessor uses an adaptive baseline technique to optimize the sensitivity of the Optical Rain Gauge continuously. This technique ensures that the sensitivity is not affected by normal atmospheric turbulence, and it minimizes the chance of false alarms (such as reporting precipitation when none occurs). The processor uses the scintillation signal and temperature probe data to determine the precipitation type and calculates the total water equivalent with the following formula.

$$W\ (\text{mm}) = k \times RR\ (\text{mm/h}) \times Time\ (\text{h})$$

RR is the precipitation intensity, and *k* is a constant that depends on the ambient temperature, *T*, as follows.

$T > 3°\text{C}$	$k = 1$
$T <= 4°\text{C}$	$k = 0.607$
$-40°\text{C} < T < 30°\text{C}$	$k = \exp\left(\frac{T-3}{12}\right)$

The microprocessor also provides diagnostic data about the condition of the sensor. The output is an RS-232 data string that is converted to RS-485 by the Serial Sensor Processor in the electronics enclosure.

4. INSTALLATION

4.1 SITING AND INSTALLATION GUIDELINES

The Model 6030 Optical Rain Gauge may be installed almost anywhere outdoors. An area free and clear of obstructions and contamination sources will help insure good sensor performance.

In general, the sensor should be located on level or slightly sloping ground where the sensor site will be exposed to the same environment as the area around it. Ideally, the area around the site should be free of buildings, trees, and other obstructions.

All Weather, Inc. recommends that the siting and installation follow the general guidelines established by the Office of the Federal Coordinator for Meteorology (OFCM). The *Federal Standard for Siting Meteorological Sensors at Airports,* OFCM document # FSM-S4-1987, makes the following recommendations.

1. Distance from Obstructions — The distance between the sensor and obstructions such as trees or buildings should be at least 2 times the height of the obstruction on all sides. For example, if a tree20 m high is located alongside the sensor, the sensor should be at least 40 m away from the tree. This restriction reduces the effects of wind turbulence created by the nearby obstruction and makes the precipitation measurement more representative. Do not locate the sensor where tree branches or wires will hang over the sensor!
2. Separation from Turbulence and Contamination Sources — Do not mount the sensor near building exhaust vents, strobe lights, or sources of smoke or steam. Where possible, locate the unit as far away from runways and roads as possible to reduce optics fouling from wind-blown road dirt. An ideal minimum distance is at least 30 m.
3. Sensor Height, Rigidity, Verticality, and Orientation — The OFCM recommends that the Optical Rain Gauge be mounted at a height of 10 ft (3 m). This height is not always possible because of constraints imposed by the site. Mounting the sensor head lower than 2 m or higher than 5 m is not generally recommended.
4. For AWOS installations, All Weather, Inc. recommends that the sensor head should be mounted on a mast with a diameter of 50 mm (2") that is set in a concrete foundation is recommended. The electronics enclosure should be nearby, keeping in mind that the cable extending from the sensor head is 15 m long.

   The installation must be rigid so that wind-induced vibration does not cause false alarms. This can be accomplished by mounting the sensor to a thick wall pipe such as "Schedule 40" type or to a rigid boom arm 1 m in length or shorter. The Optical Rain Gauge may be mounted on the top of a building if it located near the center of the building away from the wind turbulence that may occur near the edges.

   The sensor head must be mounted vertical within ±2 degrees so that the line aperture on the in-beam lens is horizontal.

5. The sensor head is generally oriented with the transmitter head on the north side (in the Northern hemisphere) so that the receiver optics face north. Align the sensor head so that the receive lens faces north. If the orientation can be altered to either side of north to obtain a "view" with fewer or more distant obstructions, it is generally acceptable to alter the orientation up to ±30 degrees from north.

SUGGESTION: Take a picture at the installation site in each direction (north, east, south, and west) to record the topography and obstructions for future reference.

4.2 MECHANICAL INSTALLATION

4.2.1 Preparation

The sensor and site should be readied prior to beginning the installation.

SITING GUIDELINES

- ✓ Sensor head mounted 2–5 m above ground
- ✓ Rigid mounting pole
- ✓ In-beam lens aperture horizontal to ±2 degrees
- ✓ Receiving (RX) lens facing away from sun (north in Northern Hemisphere)
- ✓ No overhanging trees, wires, or roof lines
- ✓ Distance between sensor and closest obstruction at least 2 times obstruction height
- ✓ As far from road, runway, and contamination sources as possible

The 6030 Optical Rain Gauge is packed in two heavy-walled corrugated cartons. One carton contains the electronics enclosure and the larger, narrow carton contains the sensor head and cables. Also packed in this carton are the sensor head U-bolt mounting hardware, and electronics enclosure mounting hardware. When opening the cartons, be careful to avoid spilling the contents.

Report any shortages or shipping damage to All Weather Inc. within 3 days.

CAUTION!

Do NOT drill holes in any portion of the sensor head or electronics enclosure! Doing so will void the warranty and may allow water to enter the enclosure!

Site Preparation

1. Choose the site using the guidelines in Section 4.2.1.
2. Following applicable electrical and building codes, install a concrete mounting base, mast or tower, AC power cable, RS-485 signal cable, and ground rod.

4.2.2 Mount the Sensor Head

The sensor must be securely installed and correctly oriented to work properly.

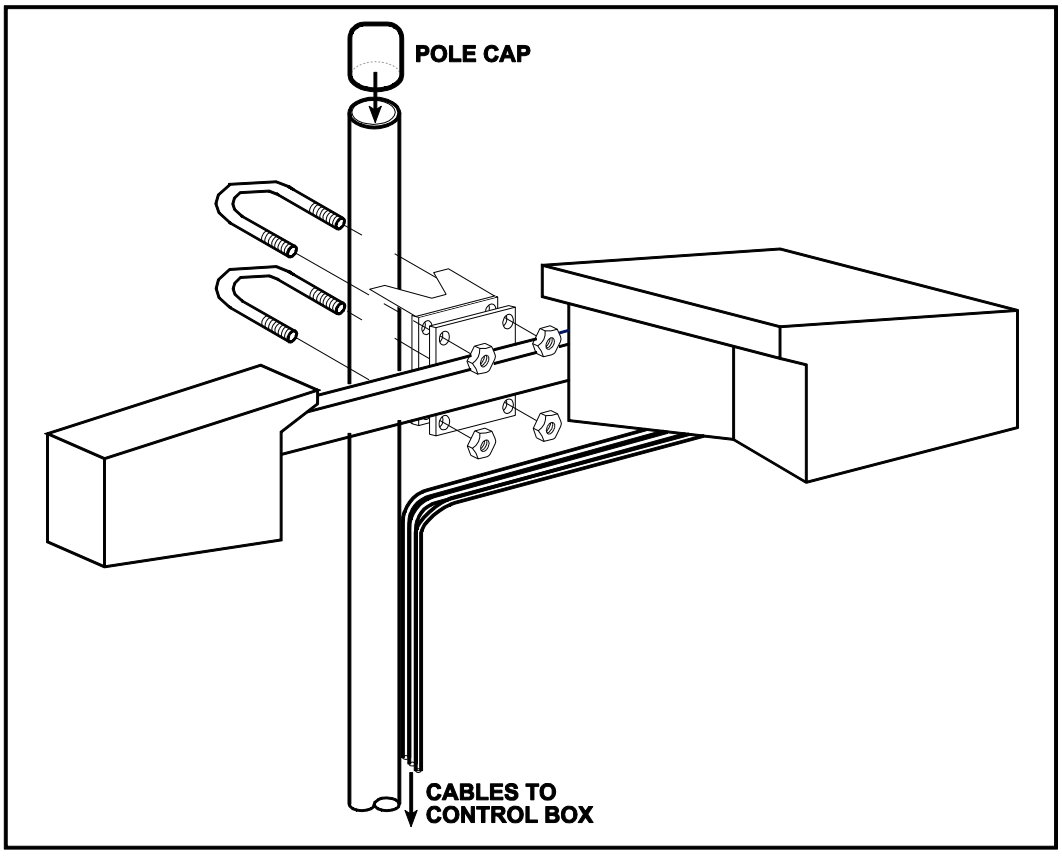

Figure 2. Mounting Sensor Head

1. Attach the sensor head using the two U-bolts to connect the mounting plate on the sensor head and the mounting bracket with the ¼-20 hex locking nuts as shown in Figure 2. To mount the head to a vertical mast or tower section, install the U-bolts and mounting bracket horizontally. To mount to a horizontal tower section or boom arm, install them vertically using the same holes.

   Note that the metallurgy of the stainless U-bolts will cause the nuts to seize to the U-bolts and twist them off. Lubricate the threads with anti-seize compound before assembling.

   Do not tighten the nuts completely until the sensor head is installed on the mast or tower and is oriented on the north-south axis as shown in Figure 3.

2. Rotate the sensor head until the receive lens is facing north.

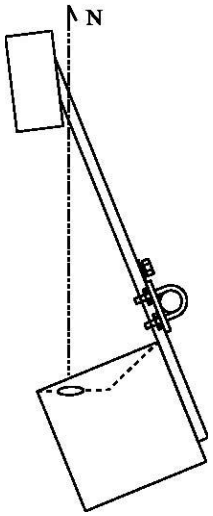

Figure 3. Sensor Head Orientation

When mounting the sensor head on a tower, choose the tower leg that gives the larger head an unobstructed view to the North without rotating the head assembly into the tower. The head assembly should be completely outside the tower as much as possible.

3. Tighten the U-bolt nuts when the orientation is correct. (Do not overtighten such that the mounting plate is bent).
4. Use a large-diameter (8–12 AWG) ground wire to connect the ¼-20 ground stud on the bottom of the sensor head to a copper-clad ground rod close to the base of the mast (see Figure 4).
5. Route the cables along the mast or tower to the electronics enclosure and secure them to the mast or tower every meter using tie-wraps or other straps.

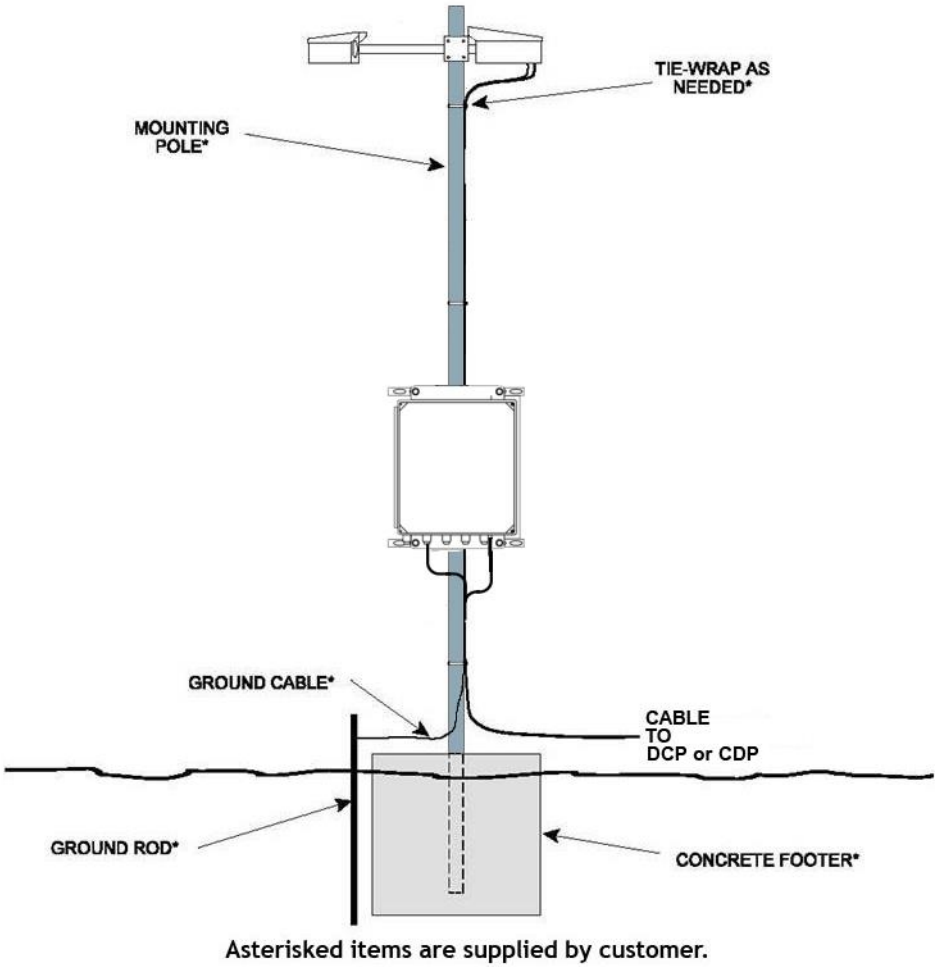

Figure 4. Installation of Ground Cable

4.2.3 Install the Electronics Enclosure

The Electronics Enclosure mounts on the mast below the sensor using the mounting hardware included with the enclosure.

In installations where a non-frangible tower is used, mount the Electronics Enclosure on the mast with the top of the enclosure 5'6" (167 cm) from ground level, or at least 3 ft (1 m) above maximum snow level. In installations where a frangible tower is used, mount the Electronics Enclosure on the mast with the top of the enclosure 3'6" (107 cm) from ground level. Attach the Electronics Enclosure to the mast using mounting hardware as shown in Figure 5.

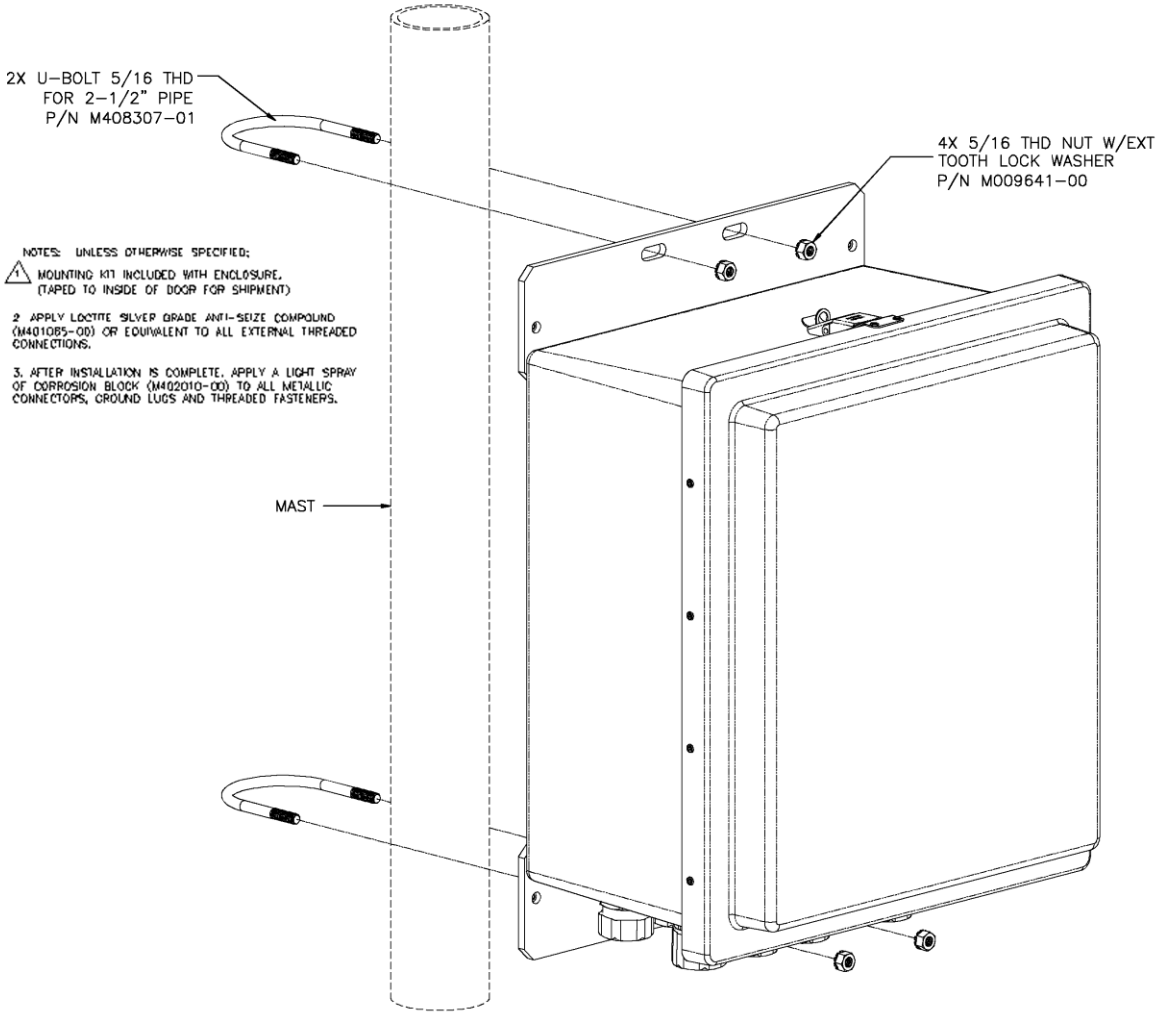

Figure 5. Mounting Enclosure on Mast

These additional steps will help keep the mounting secure and corrosion-resistant.

- Apply anti-seize compound to all external threaded connections.
- Once the installation of the enclosure has been completed, apply a light spray of corrosion block to all metallic connectors and threaded fasteners.

4.3 ELECTRICAL CONNECTIONS

Figure 6 shows the external connections at the bottom of the enclosure.

- AC power conduit.
- Signal cables from sensor head.
- Serial connection to DCP.

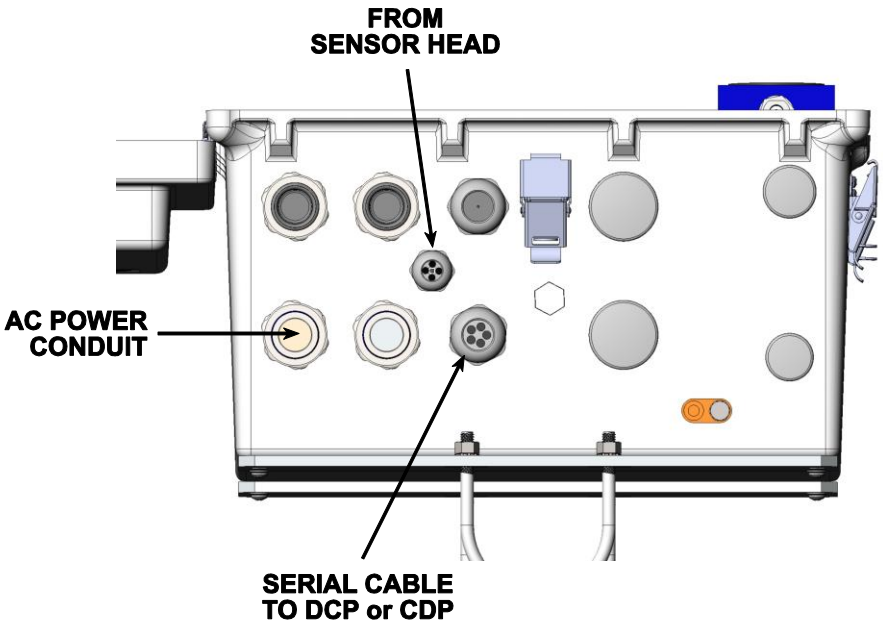

Figure 6. External Connections at Enclosure Bottom

Route the cable from the sensor head to the bottom of the electronics enclosure. Secure the cable to the mast using tie-wraps or other straps.

1. Route the cable from the sensor head into the electronics enclosure using the cable gland and grommet shown in Figure 6.
2. Connect the wires to the connector on the DIN rail shown in Figure 7 according to the wiring diagram in Figure 8.

Figure 7 shows the layout of the various electronics subassemblies inside the electronics enclosure.

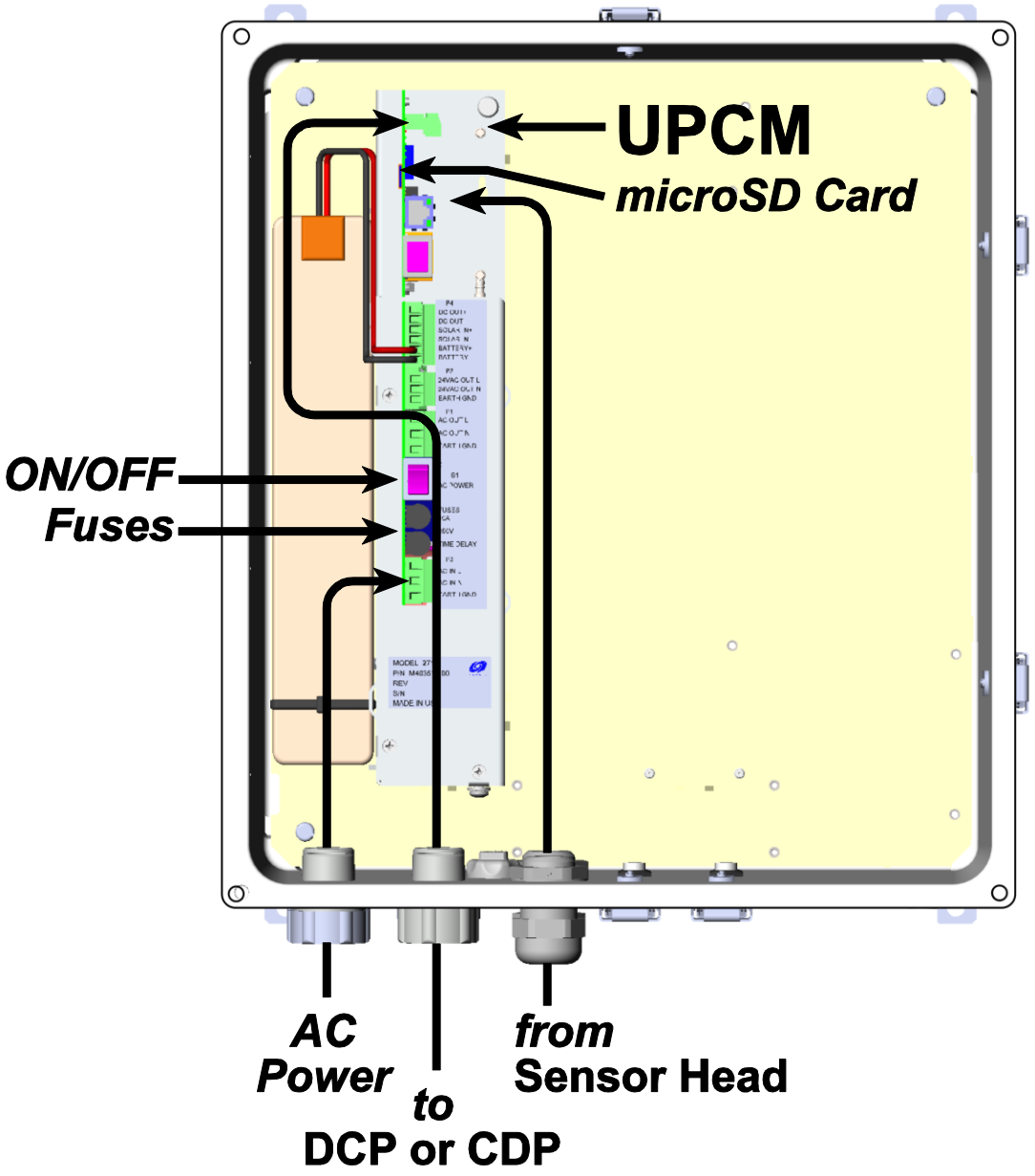

Figure 7. UPCM Connections Inside Enclosure

Figure 8 and Figure 9 summarize signal and power wiring for the Model 6030 Optical Rain Gauge.

Sensor Head Heater (UPCM P4)	Function	Color
1	DCOUT	YELLOW
2	POWER GROUND	GRAY
Sensor Head (Serial Output 2 Pin)	**Function**	**Color**
1	DCOUT	RED
2	POWER GROUND	BLACK
4	RS-232 Tx	GREEN
5	SIGNAL GROUND	BROWN
7	RS-232 Rx	WHITE
AC Line Input	**Function**	**Color**
1	HOT	BLACK or BROWN
2	NEUTRAL	WHITE or BLUE
3	GROUND	GREEN

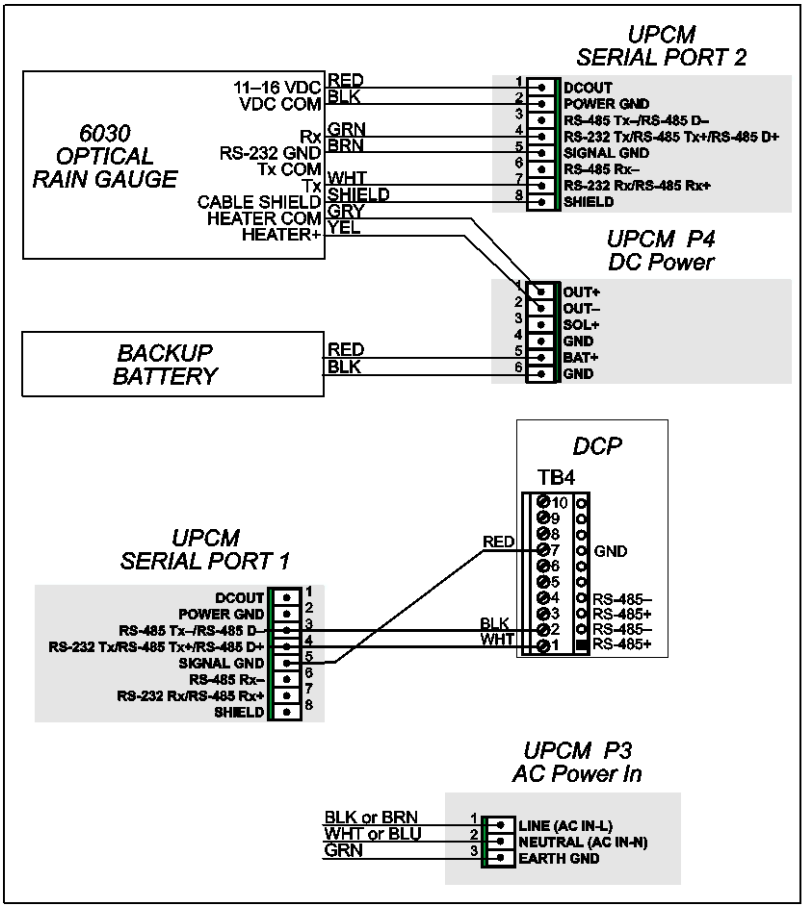

Figure 8. Optical Rain Gauge Signal and Power Wiring (non-twisted-pair sensor wiring)

Sensor Head Heater (UPCM P4)	Function	Color
1	DCOUT	YELLOW
2	POWER GROUND	BLACK
Sensor Head (Serial Output 2 Pin)	**Function**	**Color**
1	DCOUT	RED
2	POWER GROUND	BLACK
4	RS-232 Tx	BLUE
5	SIGNAL GROUND	BLACK (2 wires)
7	RS-232 Rx	GREEN
AC Line Input	**Function**	**Color**
1	HOT	BLACK or BROWN
2	NEUTRAL	WHITE or BLUE
3	GROUND	GREEN

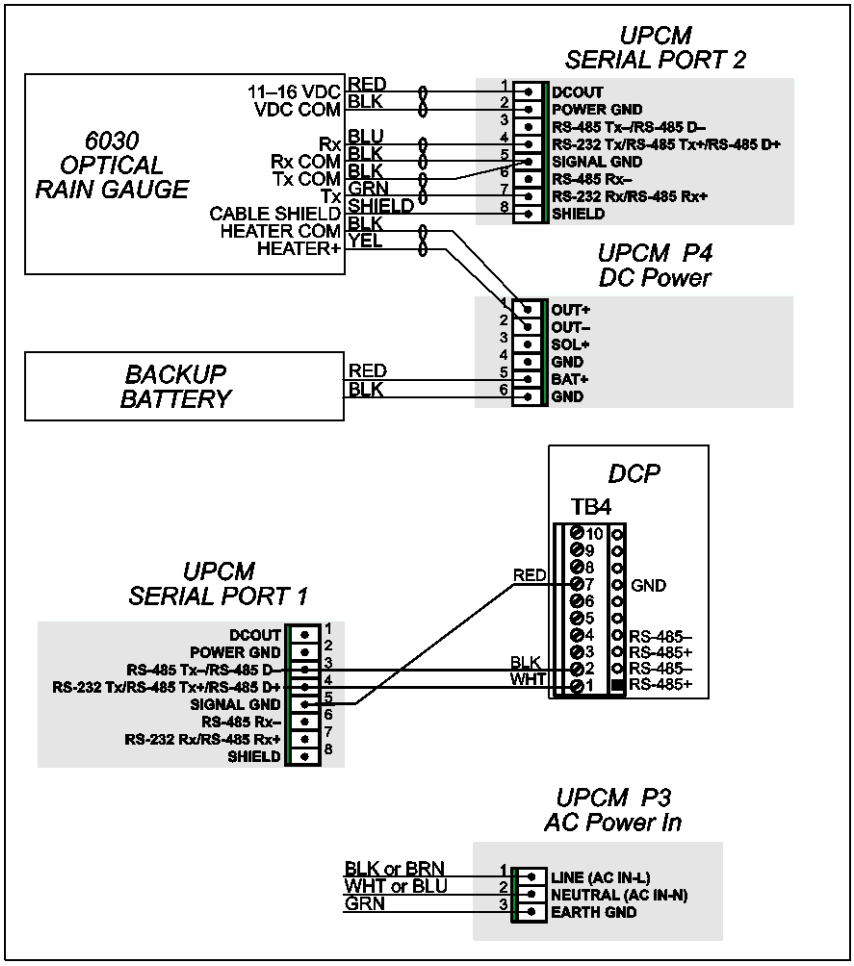

Figure 9. Optical Rain Gauge Signal and Power Wiring (twisted-pair sensor wiring)

4.3.1 Sensor Connections

Note that the AC power switch on the UPCM should be in the OFF position while these connections are being made.

1. Connect the RS-232 connections from the sensor head to Serial Port 2 on the UPCM. Pay attention to the twisted pairs of wires so that the correct pairs of wires are used.
2. Connect the yellow and black heater wires from the sensor head to the DC Power (P4) terminal block on the UPCM.
3. Connect the RS-485 output from Serial Port 1 on the UPCM to where the data will be collected. A sample connection to the Data Collection Platform (DCP) is shown.
4. When connecting the RS-485 wires to the DCP, route the cable through a cable gland on the DCP and connect the three wires inside the DCP to TB4 pins 1 (WHITE), 2 (BLACK), and 7 (RED). A lightning surge suppressor may be wired inside the DCP for additional lightning surge protection.
5. Ensure that none of the wires are stressed, then hand-tighten the gland seals on the DCP enclosure and on the Model 6030 Optical Rain Gauge enclosure.

4.3.2 Connecting the Sensor to the AC Power Line

Connections are made to the UPCM inside the electronics enclosure.

AC power connections are made to the UPCM located inside the electronics enclosure. A 3-wire, single-phase AC source is required consisting of hot, neutral, and earth ground connections.

WARNING

Turn off electrical power at the source before making the electrical connections to the sensor!

1. Install a conduit fitting at the location shown in Figure 6. Feed the power cable through the conduit fitting. A 3-wire 16 to 18 AWG cable is recommended.
2. Connect the three power cable wires to a terminal block plug if this has not already been done 1 (LINE), 2 (NEUTRAL), and 3 (GND).
3. Plug the terminal block plug into P3, the AC Power In on the UPCM. Verify that the wire colors match those shown in Figure 8 before turning the power switch ON.

4.4 UPCM CONFIGURATION

The microSD card containing the configuration file is normally kept in the microSD card slot. Figure 7 shows where the microSD card is located and shows the on/off switch referred to in this below. If it becomes necessary to change or review the configuration, you may remove the existing microSD card, place it in an adapter or a USB microSD card device, and use your computer to edit or review the configuration file using a text editor such as Notepad.

These steps explain how to remove and replace the microSD card containing the configuration file. The configuration file name is myfile.txt.

1. Turn the DC power supply *off* (DC on/off switch).
2. Remove the microSD card containing the configuration file.
3. Replace the microSD card containing the new configuration file.
4. Turn the DC power supply *on* (DC on/off switch).
5. The status LEDs are above the microSD card slot. The red status LED blinks rapidly (approximately ten times per second) for a few seconds after being powered on. Wait until the red status LED begins to blink slowly (approximately once per second).

If the red status LED does not blink as expected, check the microSD card.

The default configuration for the serial ports shown below is set at the factory. In all cases, the = sign separates the parameter and its configuration value.

All parameters must be specified for a valid configuration file.

Parameter	Configuration	Parameter	Configuration
SER0_PROT=2 SER0_BAUD=1 SER0_DATA=8 SER0_PAR=78 SER0_STOP=1 SER0_TE=0	Protocol RS-485 Half Duplex Baud Rate 4800 bps Data Bits 8 No parity Stop Bits 1 Termination Off	SER1_PROT=0 SER1_BAUD=7 SER1_DATA=8 SER1_PAR=78 SER1_STOP=1 SER1_TE=0	Protocol RS-232 Baud Rate 1200 bps Data Bits 8 No parity Stop Bits 1 Termination Off
SER2_CONFIG=0 SER2_PROT=2 SER2_BAUD=3 SER2_DATA=8 SER2_PAR=78 SER2_STOP=1 SER2_TE=0	No Serial Port 2 Module Protocol RS-485 Half Duplex Baud Rate 19200 bps Data Bits 8 No parity Stop Bits 1 Termination Off	EN_DCOUT=1 EN_ACOUT=2 EN_CHRGR=1 PORT1_MODE=9 PORT2_MODE=255 MIN_TEMP=0 MAX_TEMP=1	DC Output enabled at boot AC Output used with thermostat at boot Battery Charger enabled Serial Port 1 cnx to Model 6030 No Serial Port 2 Module Minimum thermostat setting 0³C Minimum thermostat setting 1³C
PSU_ADDR_H=0 PSU_ADDR_L=0	Power supply address upper nibble Power supply address lower nibble		FORCE_220V=0 Power supply switches automatically

Additional details are provided in the ***Model 2715 Universal Power and Communication Module User's Manual***.

5. OPERATION WITH AN AWOS DATA COLLECTION PLATFORM

When the Model 6030 Optical Rain Gauge is connected directly to a CDP or other data processing system, UPCM poll commands can be used. These are described in the ***Model 2715 Universal Power and Communication Module User's Manual***.

The details in the rest of this chapter are for when the sensor is connected to a DCP.

5.1 SENSOR INTERFACE

The Model 6030 Optical Rain Gauge responds to a poll from the DCP for the setup, operation, and status of the sensor.

5.1.1 Physical Level

The serial signal output from the UPCM consists of a three-wire RS-485 connection.

5.1.2 Link Level

Data transfer across the interface is implemented via a serial, ASCII encoded, half-duplex, 4800 bps, asynchronous transfer link. Data transfer in the DCP-to-sensor direction is limited to a poll command ("PRWX00\r\n"). Data transfers in the sensor-to-DCP direction are fixed-format ASCII strings terminated with a carriage return (<CR>).

5.1.3 Frame Format

The standard output frame format is described in Section 5.2. Each of the transmitted characters are eight (8) bit (msb - bit 7 - always 0), no parity ASCII (decimal codes 0 to 127), with 1 stop bit. The status code and other information, is formatted in this way as printable ASCII characters to aid in system debugging and field maintenance.

5.1.4 Protocol

In order to keep the interface design effective and simple, the protocol does not support unsolicited messages to the DCP. In other words, the only time the sensor is allowed to transmit a message to the DCP via this link is in direct response to a poll transmission from the DCP, which requires the return of the standard data reply string.

Note that the sensor is sampling data continually (every 5 seconds) and processing the precipitation algorithm (once a minute typical). In most cases, the sensor's response time to a poll will begin within a second or two after receiving the poll, but the response time could be several seconds in unusual circumstances. Avoid these hang-ups by waiting at least 10 seconds before timing out and trying another poll.

5.2 DATA FORMAT

The data frame that is transmitted in response to a poll is 40 characters long and is formatted as follows.

Data	**S**	**S**		**R**	**R**	**R**	**R**		**A**	**A**	**A**	**-**	**A**	**A**	**A**	
	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í
Byte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Data	**0**	**1**	*****	*****		**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**		**X**
	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í	Í
Byte	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Data	**X**	**X**	**X**		**X**	**X**	**X**	**[CR]**								
	Í	Í	Í	Í	Í	Í	Í	Í								
Byte	33	34	35	36	37	38	39	40								

The various fixed fields used in the above poll response are explained here.

Byte	Description	Value
1–2	NWS Present Weather condition code	SS
3	Separator space	
4–7	Instantaneous precipitation rate	RRRR
8	Separator space	
9–15	Precipitation accumulation with fixed decimal point at position 12	AAA.AAA
16	Separator space	
17–18	Not Used, always 01	01
19–20	Reserved for future use	
21	Separator space	
22–39	Diagnostic data	X…X
40	Carriage Return	[CR]

At power-on the following response is returned for the first 30 seconds.

**** ---- ----.---- 01** 0000 4999 40 - 40**

5.2.1 Weather Codes

SS is a two-byte field indicating the present weather condition in the NWS weather code format. This field will be blank when there is no precipitation detected. The present weather data field is updated once per minute.

R-	Light Rain	R	Moderate Rain	R+	Heavy Rain
S-	Light Snow	S	Moderate Snow	S+	Heavy Snow
P-	Light Precipitation	P	Moderate Precipitation	P+	Heavy Precipitation

A P (precipitation) is output when the Optical Rain Gauge cannot determine with certainty whether the precipitation is rain or snow.

If an error condition exists (usually something obscuring the optics), the output will be ER.

RRRR is a four-byte field indicating the instantaneous (one-minute block average) rain rate or liquid water equivalent for frozen precipitation in millimeters per hour. It is a four-digit floating-point number that will vary from 0.000 to "9999. This output is updated once a minute.

AAA.AAA is a seven-byte field indicating the total accumulation of precipitation in millimeters. The number is a fixed decimal point that will vary from 000.000 to 999.999. The accumulation is reset automatically at power on or when the accumulation exceeds 999.999 (i.e., rolls over). This output is updated once a minute.

5.2.2 Status Codes

Bytes 21–39 contain system diagnostic information.

Bytes 22–25 are the carrier channel signal strength (typical value is 4999). Dust accumulation on the lenses and LED aging will cause this value to drop over time from 4999. Acceptable values during times of no precipitation range from 3000 to 4999. The Optical Rain Gauge will report ER in the present weather field when the the carrier channel signal strength is <1000.

Bytes 27–30 contain the one-minute averaged raw data. The value is typically <100 when there is no precipitation.

Bytes 32–35 contain the rain channel adaptive baseline data. This value is typically 40 when the sensor is first powered up. When precipitation begins, this field locks on and does not begin to adjust adaptively until the precipitation ends.

Bytes 37–39 are the temperature data from the probe located on the underside of the Optical Rain Gauge. The data are displayed in degrees C with the first byte reserved for the plus (+) or minus (-) sign. This temperature should not be used as the meteorological temperature.

6. MAINTENANCE

The Model 6030 Optical Rain Gauge is designed for high reliability and low operator maintenance. The only scheduled maintenance is to periodically clean the lenses. In most locations, cleaning the lenses every four months is recommended. Historically, the sensors have operated unattended for several years without any degradation in performance. Use the table provided to record the maintenance performed.

Equipment Required

- Clean Cotton Cloth or Lens Tissue
- Common Household Glass Cleaner

6.1 TRIANNUAL MAINTENANCE

1. Clean Lenses

   Cleaning the lenses should be done with lint-free cloth and cleaning solution. Clean the lenses by first spraying the lens cleaner on the lens and then wipe gently to prevent scratching the glass optics. In actual practice, moderate dust buildup and scratches on the lenses will not have any discernible effect on the instrument.

2. Check Lens Heaters

   With a clean finger, touch the lenses in front of the disk-shaped heater that is bonded to the lower inside surface of both lenses. The lens surfaces should be slightly warmer to the touch than the ambient temperature.

3. Comb Test

   Using a pocket comb, stroke it up and down vertically in front of the receiver lens as shown in Figure 10 for ~1 minute. Do not block the beam for any length of time. Look at the data on the DCP screen to make sure it varies as the comb is moved around.

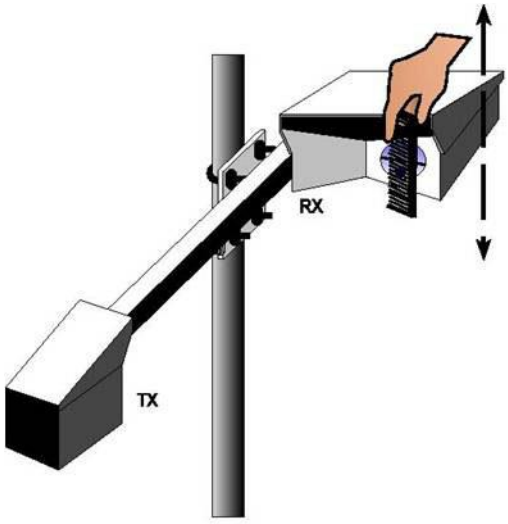

Figure 10. Comb Test Illustration

Maintenance Log

	Date	Date	Date
Clean Lenses			
Verify Lens Heaters			
Comb Test			

7. SPECIFICATIONS

Parameter	Specification
Rain Dynamic Range	0.1 – 500 mm/h
Rain Accumulation	0.1–999,999 mm
Rain Accumulation Resolution	0.001 mm
Rain Accumulation Accuracy	5% of accumulation
Snow Dynamic Range	0.01–50 mm/h water equivalent
Snow Accumulation	0.001–999,999 mm water equivalent
Snow Accumulation Resolution	0.001 mm
Snow Accumulation Accuracy	10% of accumulation
Time Constant	10 s
Data Update Rate	Once per minute
Serial Output	RS-485
Output Format	ASCII characters
Baud Rate	4800 bps
Serial Port Parameter Setting	8-N-1 (8 data bits, no parity, 1 stop bit)
Power Requirements	
Supply Voltage	115/230 V AC, 50/60 Hz, 50 W
Transient Protection	AC power and RS-485 signal lines fully protected
Environmental	
Operating Temperature	-40 to +50ºC (-40 to +122ºF)
Storage Temperature	-50 to +60ºC (-58 to +140ºF)
Relative Humidity	0–100%, noncondensing

Parameter		Specification
Mechanical		
Controller Assembly Enclosure		NEMA 4X fiberglass
Mounting	Sensor Assembly	2.5" (6.35 cm) dia. mast
	Controller Enclosure	Unistrut mounted
Dimensions	Sensor Assembly	11.5 cm H × 26.4 cm W × 73.0 cm D (4.5" H × 10.4" W × 28.75"D)
	Controller Enclosure	39 cm W × 53 cm H × 28 cm D (15.5" W × 20.75" H × 11" D)
Weight	Sensor Assembly	4 kg (8.8 lb)
	Electronics Enclosure	10 kg (22 lb)
Shipping Weight (2 boxes)		16 kg (35 lb)

8. WARRANTY

This equipment has been manufactured and will perform in accordance with requirements of FAA Advisory Circular 150/5220-16B. Any defect in design, materials, or workmanship which may occur during proper and normal use during a period of 1 year from date of installation or a maximum of 2 years from shipment will be corrected by repair or replacement by All Weather Inc.

allweatherinc
All Weather Inc.
1165 National Drive
Sacramento, CA 95818
Fax: 916.928.1165
Phone: 916.928.1000
Toll Free: 800.824.5873

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