

INSTRUCTION MANUAL



Tripod Installation Manual *Models CM110, CM115, CM120*

Revision: 5/10



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About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. (CSI) primarily for the US market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in² (square inch) = 645 mm²

Length: 1 in. (inch) = 25.4 mm
1 ft (foot) = 304.8 mm
1 yard = 0.914 m
1 mile = 1.609 km

Mass: 1 oz. (ounce) = 28.35 g
1 lb (pound weight) = 0.454 kg

Pressure: 1 psi (lb/in²) = 68.95 mb

Volume: 1 US gallon = 3.785 litres

In addition, part ordering numbers may vary. For example, the CABLE5CBL is a CSI part number and known as a FIN5COND at Campbell Scientific Canada (CSC). CSC Technical Support will be pleased to assist with any questions.

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Tripod Installation Manual

Models CM110, CM115, CM120

1. General

The CM110 (10 feet), CM115 (15 feet), and CM120 (20 feet) tripods are corrosion-resistant stainless steel instrument mounts that support the attachment of sensors, solar panels, and environmental enclosures. A guy kit is included with the CM115 and CM120 models, and is an option for the CM110. A durable Tripod Tote Bag is available as an option.



FIGURE 1-1. CM110 Tripod with Optional Guy Kit

2. Specifications

	<u>CM110</u>	<u>CM115 (see note 3)</u>	<u>CM120 (see note 3)</u>
Height w/mast insert:	10' (3 m)	15.5' (4.7 m)	21.0' (6.4 m)
Weight:	34 lbs (15 kg)	40 lbs (18 kg)	46 lbs (21 kg)
Base diameter w/legs extended:	7 ft (2 m)	7 ft (2 m)	7 ft (2 m)
Dimensions of collapsed tripod:	6" x 6" x 57" (15 x 15 x 145 cm)	6" x 6" x 57" (15 x 15 x 145 cm)	6" x 6" x 57" (15 x 15 x 145 cm)
Vertical load limit:	100 lb (45 kg)	100 lb (45 kg)	100 lb (45 kg)
Mast description			
Number of sections:	1	2	3
Length:	4.6' (1.4m)	9.3' (2.8 m)	14.0' (4.3 m)
Length w/insert:	8.6' (2.6 m)	13.3' (4.1 m)	18.0' (5.5 m)
OD:	1.9" (4.8 cm)	1.9" (4.8 cm)	1.9" (4.8 cm)
Insert OD:	1.75" (4.45 cm)	1.75" (4.45 cm)	1.75" (4.45 cm)
Mounting hole in tripod foot:	0.75" diameter hole for user-supplied 0.5" J-bolts	0.75" diameter hole for user-supplied 0.5" J-bolts	0.75" diameter hole for user-supplied 0.5" J-bolts
Wind load recommendations			
Sustained wind (mph):	*75 (unguyed) 80 (guyed at feet)	*56.25 (guyed at feet) 75 (guyed at 60°)	*42.25 (guyed at feet) 65 (guyed at 60°)
Gust tolerance (mph):	95 (unguyed) 100 (guyed at feet)	71.25 (guyed at feet) 95 (guyed at 60°)	55.25 (guyed at feet) 85 (guyed at 60°)
Tote bag dimensions:	8" (20 cm) diameter, 60" (152 cm) length	8" (20 cm) diameter, 60" (152 cm) length	8" (20 cm) diameter, 60" (152 cm) length

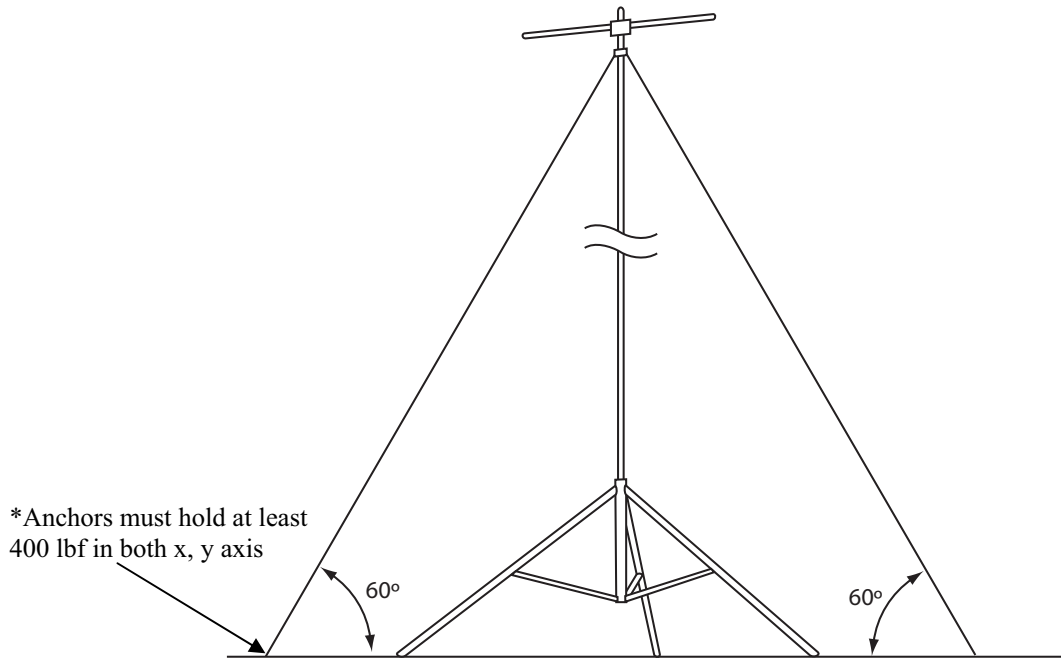


FIGURE 2-1. 60-Degree Guy Angle

3. Tools List (for tripod, mast and crossarm)

- 1/2" and 7/16" open end wrenches
- adjustable wrench
- socket wrench with 1/2" and 7/16" deep sockets (optional)
- Phillips head screw driver (medium)
- Straight bit screwdriver (large)
- 12" torpedo level
- side-cut pliers
- pencil
- tape measure
- compass and site declination angle
- shovel
- sledge hammer (for driving ground rod and stakes)
- step ladder

4. Tripod Components

Figure 4-1 shows the tripod components packaged for shipment. The tripod base is packaged with the mast, ground rod, lightning rod and (6) stakes. The ground rod clamp, lightning rod, and grounding wires are enclosed in a bag. The guy kit (optional for the CM110), and tripod tote bag (optional) are packaged separately. The CM115 and CM120 tripods include additional mast sections. A diagram showing how to stow the components inside the tote bag is shown in Appendix A.



FIGURE 4-1. Tripod Components

5. Tripod Installation

5.1 Tripod Base

WARNING

Tripod installation near power lines is dangerous. The minimum safe recommended distance from overhead power lines is 2 times the height of the tripod and mast combined. Call Blue Stakes to locate buried utilities prior to installation.

All three models of tripods use the same tripod base. Each leg is adjustable, which allows the tripod to be adjusted for non-level terrain.

Prepare the area where the tripod will be installed. The tripod requires an area approximately 7 feet in diameter. Natural vegetation and the ground surface should be disturbed as little as possible, but brush and tall weeds should be removed.

Stand the tripod base up on end, and rotate the feet perpendicular to the legs. Each leg has a slide collar and T-knob with a spring loaded pin that locks into holes located on the underside of the leg as shown in Figure 5-1.

Extend each leg until the pin engages in a hole (depress the tab to disengage the pin from a hole). With the legs extended, orient the tripod so that the open channel of the tripod base faces North. The tripod is typically plumbed after the mast has been installed, as described in Section 5.2.

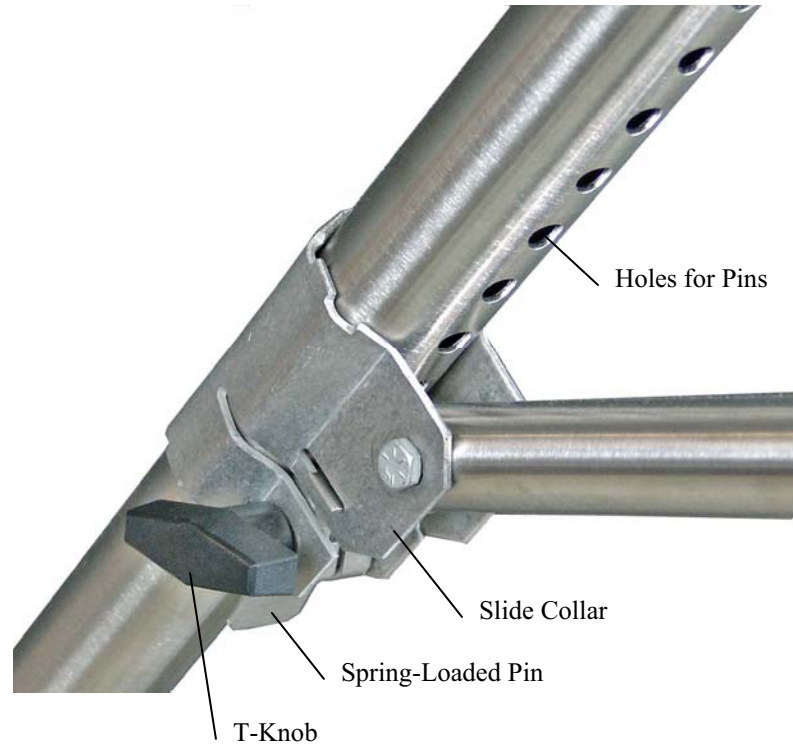


FIGURE 5-1. Tripod Leg, Slide Collar Components

5.2 Mast

The CM110, CM115 and CM120 tripods have one, two or three mast sections respectively. The top mast section has a 48" long insert with a series of holes that can be extended to lengthen the mast. Remove the bolt that secures the insert to the inside of the mast, and slide the insert out from the mast to see the different hole locations. Slide the insert back into the mast, aligning the appropriate holes of the insert with holes in the mast, and replace the bolt.

Additional 56" mast section(s) included with the CM115 and CM120 tripods have a 16" long insert that is used to connect the mast sections together. Remove the bolt that secures the insert to the inside of the mast and extend the insert 8". Align the holes and replace the bolt. Attach additional mast sections by sliding the bottom of the next mast section over the insert of a lower section, aligning the holes and installing the bolt. Typically the bottom mast section is attached to the tripod and tilted down to a horizontal position, and the additional mast sections bolted to the bottom section.



FIGURE 5-2. Tripod Mast and Insert

The tripod base has two sets of right-angled holes for attaching the mast; typically the lower set is used (Figure 5-3A). The mast is attached to the base with a pin, and secured in the upright position with a locking bracket. Both the pin and the locking bracket are secured with a lanyard.

To attach the lower mast section, hold the mast upright and align the hole in the bottom of the mast with the holes in the tripod base. Insert the pin through the holes, and rotate the wire retainer over the end of the pin as shown in Figure 5-3B. The pin should be seated in the bottom of the hole when the mast is upright. Lift the mast up so that the pin is in the upper end of the hole to allow the mast to be tilted down to a horizontal position.

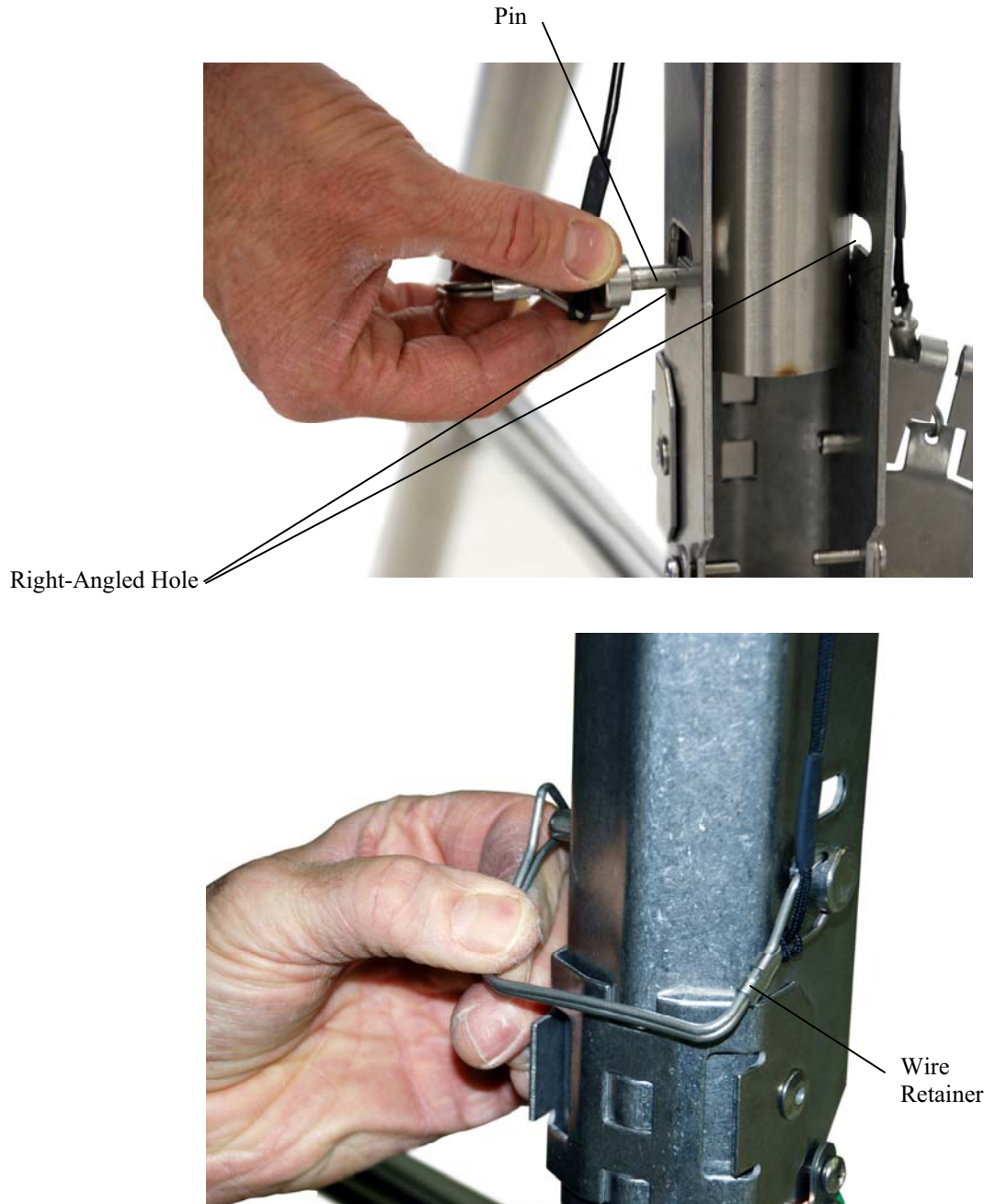


FIGURE 5-3. Mast Attachment to Tripod Base

Secure the mast in the upright position by installing the locking bracket (Figure 5-4A). Insert the top of the bracket into the notches in the tripod base, and using both thumbs, press the bracket into the body of the base until the lower tabs lock into position. Install the pin as shown in Figure 5-4C. To remove the bracket, remove the pin and squeeze the lower part of the bracket to disengage the tabs, then rotate the bracket out and up.

Plumb the tripod by adjusting the northeast and south facing legs. With a level on the East side of the mast, adjust the Northeast leg for plumb. With the level on the South side of the mast, adjust the South leg for plumb.

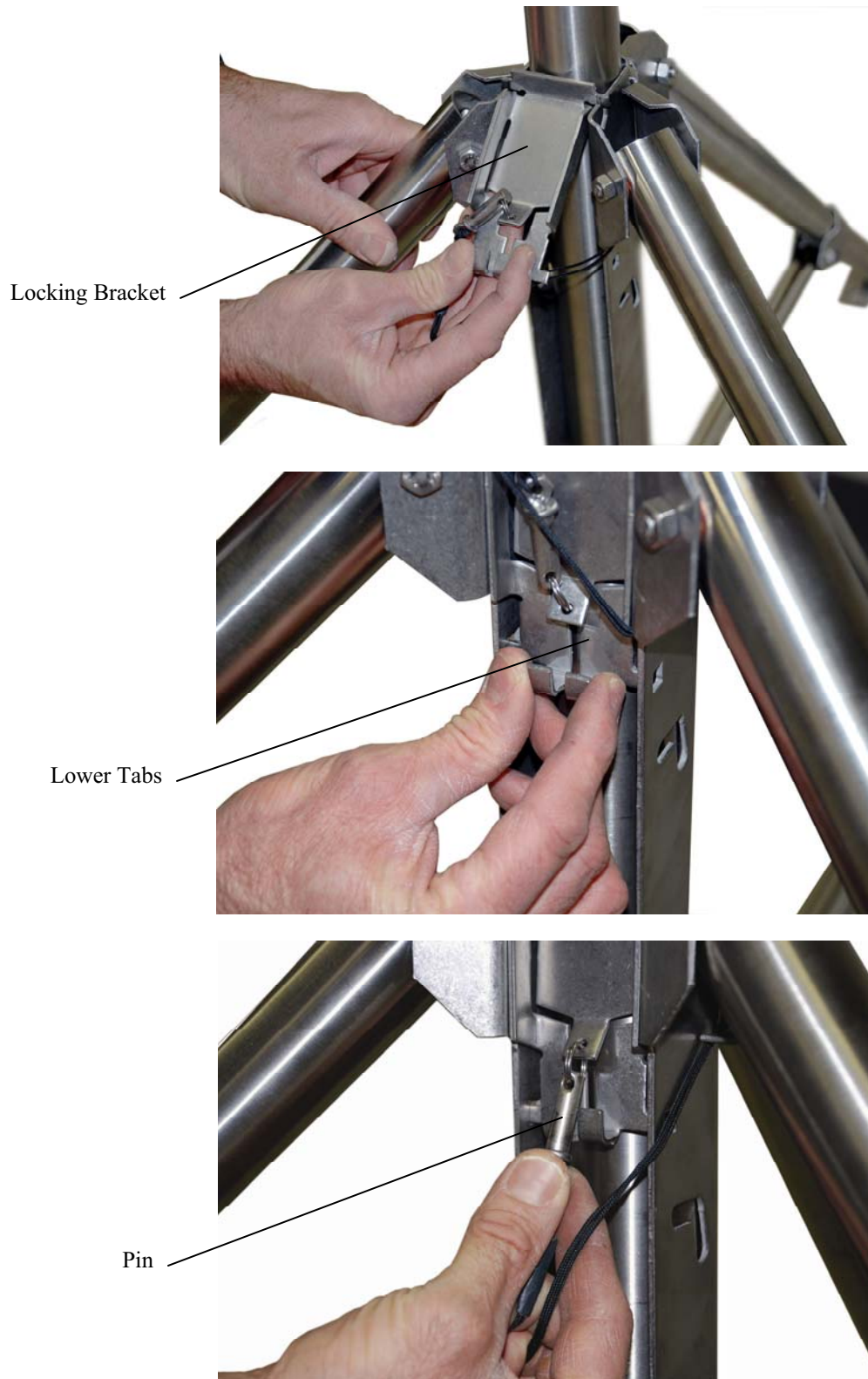


FIGURE 5-4. Mast Lock Bracket

5.3 Installing the Guy Kit

The CM115 and CM120 tripods include a guy kit; the guy kit is an option for the CM110. With the mast tilted down in the horizontal position, install the guy collar over the mast insert, and attach the guy wires as shown in Figure 5-5. Return the mast to the upright position and install the locking bracket.

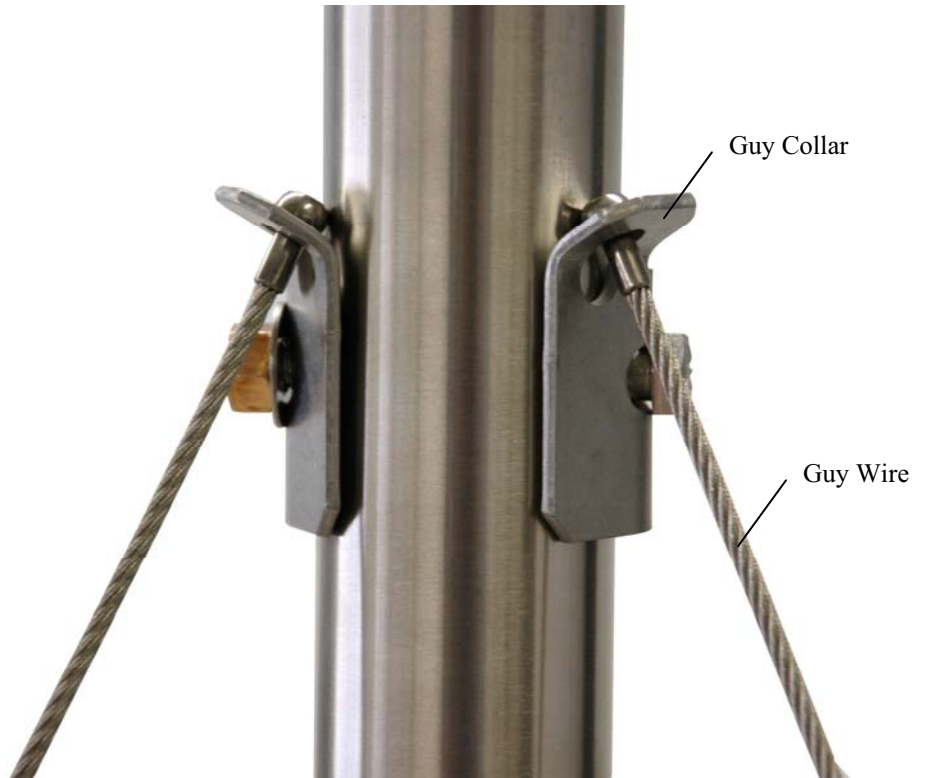


FIGURE 5-5. Guy Collar

On the end of each guy line is a case consisting of a hook, clamp, and lever arm. Rotate the lever arm to the “open” position, and attach the hook to the tripod leg as shown in Figure 5-6. Loosen the Phillips screw, and remove the slack in the guy line by feeding the load end of the guy wire through the wedge while pulling up on the dead end (Figure 5-7).

After the slack has been removed from the guy lines, tighten the Phillips screws and rotate the lever arms to “closed” position to tension the guy lines.

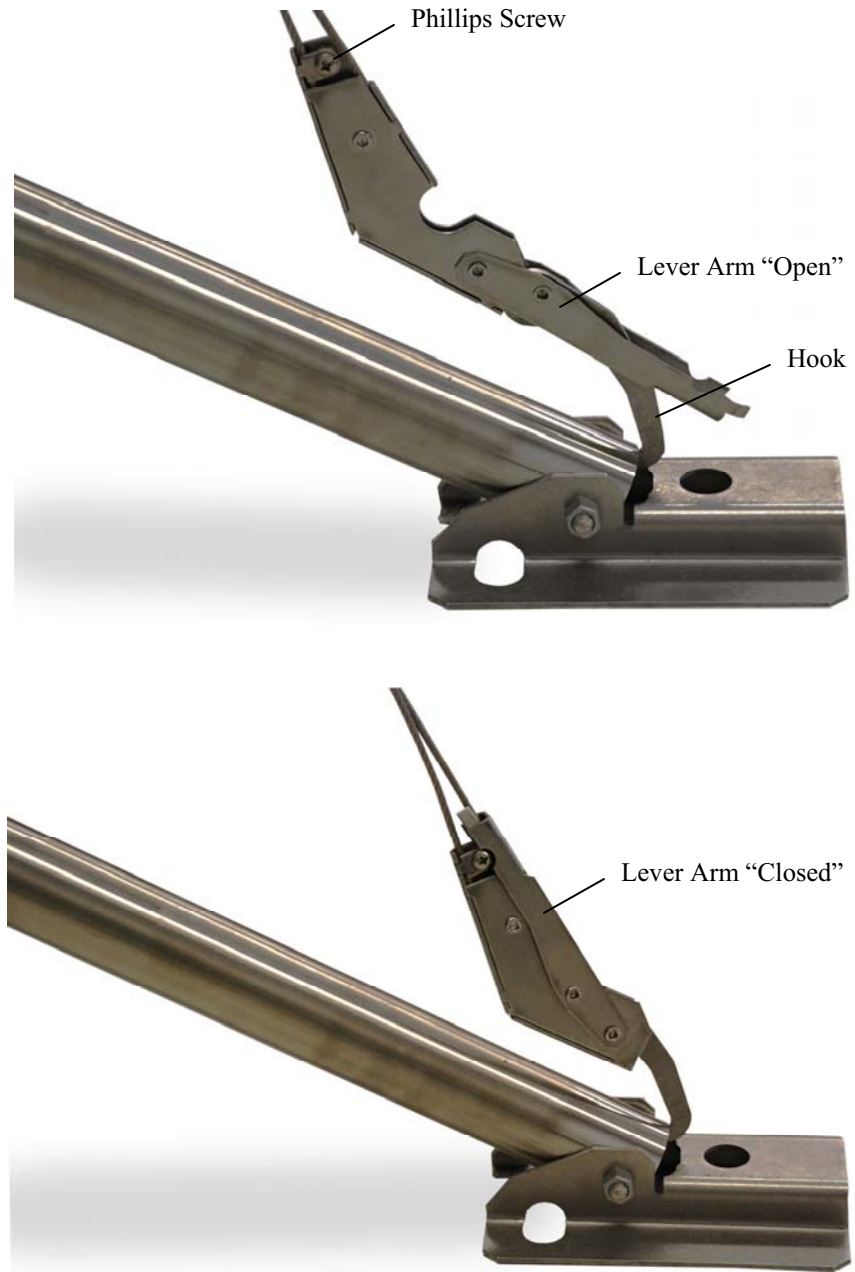


FIGURE 5-6. Guy Cinch and Lever Arm

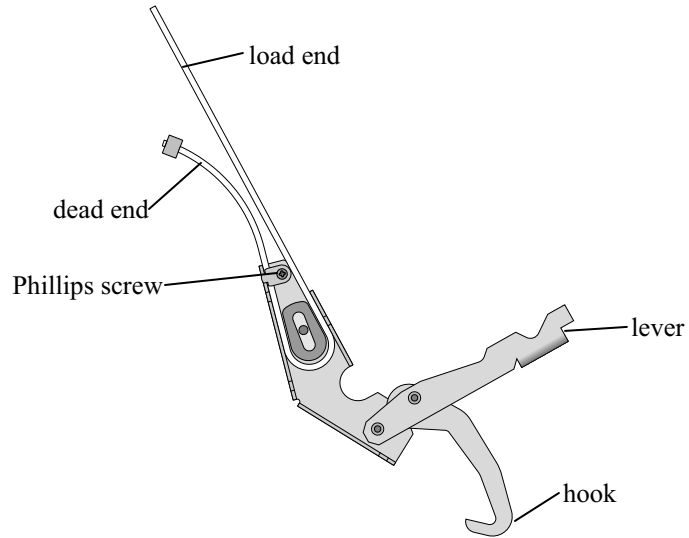


FIGURE 5-7. Mechanical Drawing of Guy Hook and Case

5.3.1 Guy Duckbill Anchor Kits

Duckbill anchors are recommended for areas subjected to higher winds. They allow the guy wires to be anchored at points beyond the feet, thereby increasing the rating of the tripod for higher winds.

Two duckbill anchor kits are offered for these lightweight tripods. The 19282 Guy Duckbill Standard Anchor Kit is for standard soils, and the 25699 Guy Duckbill Heavy Duty Kit is for aggressive soils. Aggressive soils have:

- Resistivity of less than 3000 ohm-cm
- pH of less than 5
- Chloride of greater than 1000 ppm
- Sulfate of greater than 500 ppm
- Poor aeration

The 19282 and 25699 have their own drive bar. The 19282 also has three duckbill anchors with a cable attached to each of them. At the end of the cable is a loop for connecting the guy wires. The 25699 has a threaded rod attached to each of the three duckbill anchors instead of the cable. At the end of the threaded rod is a metal ring for connecting the guy wires.

The duckbill anchors are driven to the ground at a 60-degree guy angle as shown in Figure 5-8. Locate the anchors on a 7.5' radius for the CM115, or a 10' radius for the CM120 as shown in Figure 5-9. Specifications for sustained wind speed and gust tolerance are given based on guy angle, and the ability of the anchors to hold at least 400 lbf.

NOTE

Duckbill anchors are not suitable for rocky or sandy soils; the UTEYE anchors should be considered for these types of soils.

It is important that the anchors be driven at the same angle as the guy wires. Insert the drive bar into the anchor body and drive the anchor into the ground using a sledgehammer until only the top half of the loop or metal ring remains above the ground. Place a bar or highlift jack through the loop or metal ring and jack the anchor up about four inches to rotate the anchor into the load-lock position.

WARNING

Failure to install and lock the anchor at the correct angle will result in the anchor cable cutting through the soil until the angles equalize, causing slack

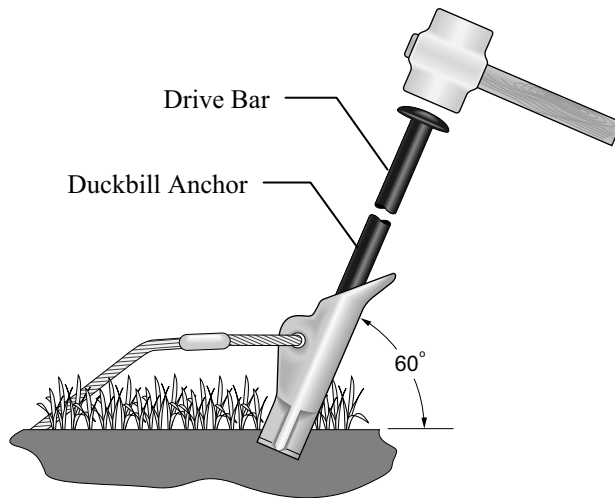
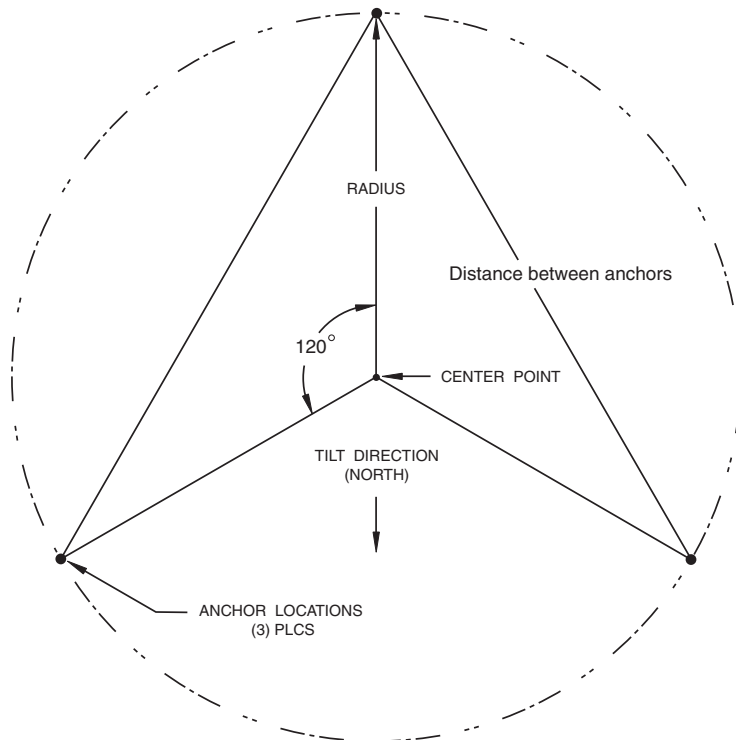


FIGURE 5-8. Duckbill Guy Anchor



	Radius	Distance Between Anchors
CM115	7.5'	13'
CM120	10'	17.3'

FIGURE 5-9. Top View and Guy Anchor Layout

5.3.2 Lowering Mast after Attaching Guy Wires

Once the guy lines have been adjusted the lever arms can be “opened” and the guy hooks removed to allow the mast to be lowered to the horizontal position.

5.4 Staking the Tripod Feet

Six stakes are provided for securing the tripod feet to the ground. Drive two stakes through holes in each foot at an angle as shown in Figure 5-10.

Stakes may not be adequate depending on soil structure, maximum wind speeds experienced at the site, mast height, or wind load from the instrumentation. For questionable situations, additional stakes (PN 17049) or even concrete footings for the tripod feet and guy anchors should be considered.



FIGURE 5-10. Staking the Tripod Feet

5.5 Tripod Grounding

Place the clamp over the ground rod and drive the rod (close to the center of the tripod) using a sledge hammer or fence post driver. Strip 1/2" inch of insulation from both ends of the black 4 AWG ground wire. Insert one end of the ground wire between the clamp and ground rod and tighten the bolt on the clamp. Attach the other end of the ground wire to the lug on the tripod base as shown in Figure 5-12.



FIGURE 5-11. Ground Rod and Clamp

Strip 1/2" of insulation from the ends of the green 12 AWG wire. Attach one end of the wire to the tripod ground lug, and the other end to the enclosure ground lug as shown in Figure 5-12.

Mount the lightning rod and clamp to the tripod mast as shown in Figure 5-12.

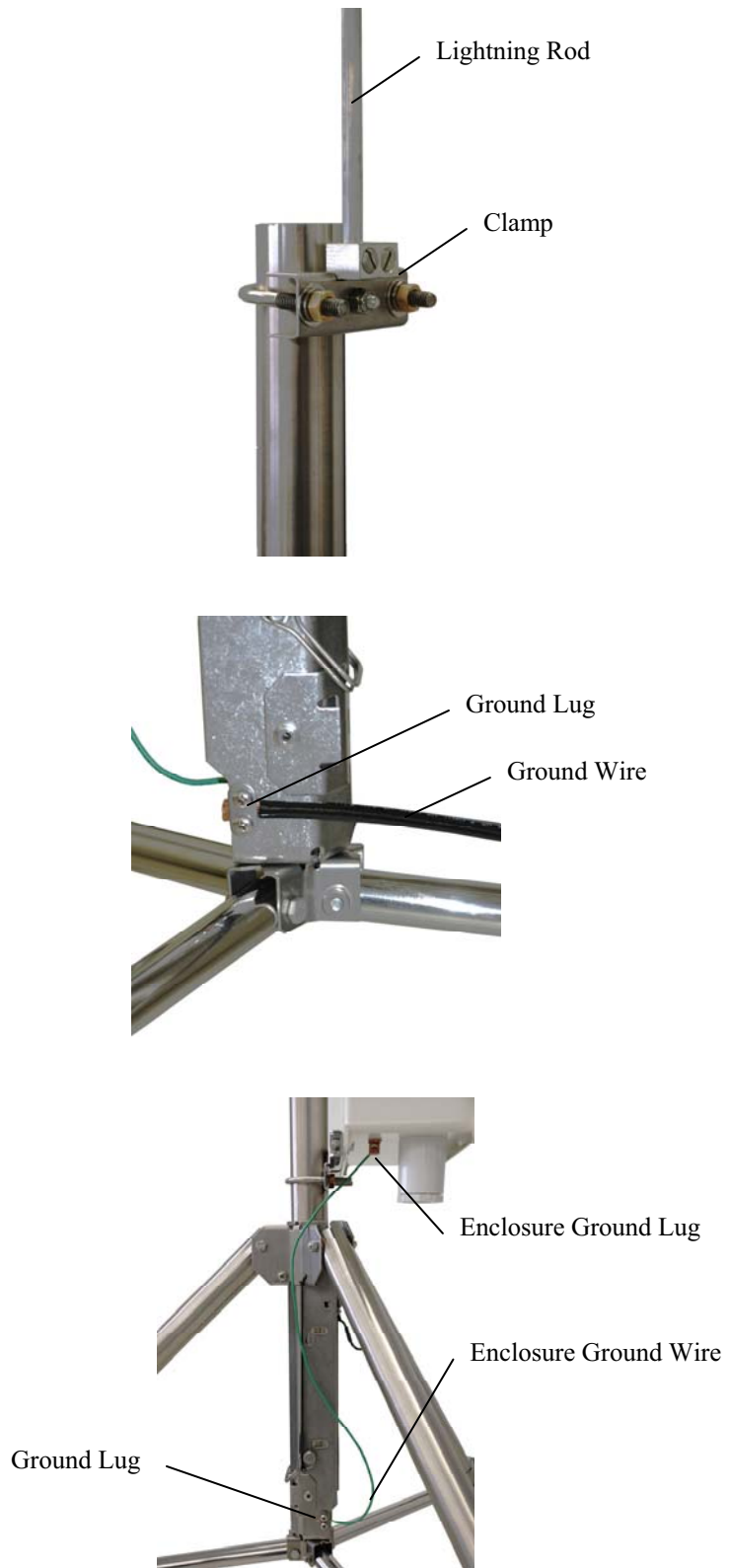


FIGURE 5-12. Lightning Rod and Tripod Grounding Lug

5.6 Crossarm Attachment

Attach the CM202 (2 ft, 0.6m), CM204 (4 ft, 1.2m), or CM206 (6 ft, 1.8m) crossarm to the tripod mast as shown in Figure 5-13. For wind sensors, the crossarm should be approximately 103 inches above the ground for a 3m mounting height, or 64 inches for a 2m mounting height. Typically the crossarm is oriented East/West for wind sensors, North/South for pyranometers.

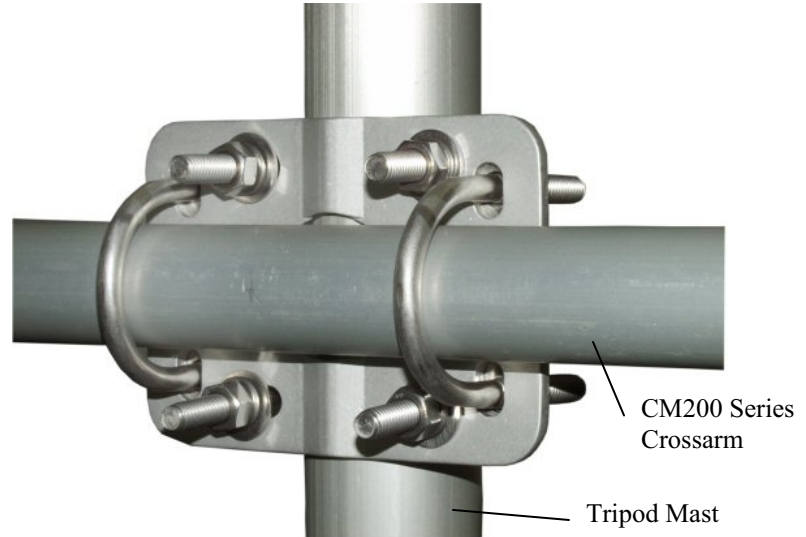


FIGURE 5-13. CM204 Crossarm

5.7 Enclosure Attachment

The ENC 10/12, ENC 12/14, ENC 14/16, and ENC 16/18 enclosures can be ordered with mounting brackets for the CM100 series tripods. All enclosure models can be mounted to the tripod mast (above the legs) with the –MM Mast Mount bracket option. All enclosure models except the ENC 16/18 can be mounted to the tripod base and leg with the –LM Leg Mount bracket option. Two enclosures with the –LM brackets can be mounted in a “back to back” configuration.

5.7.1 Enclosure Mounting to Tripod Mast

An enclosure ordered with the –MM bracket has a three-piece top and bottom brackets with a U-bolt for each bracket.

Attach an enclosure with the –MM mounting bracket to the tripod mast as follows:

Remove the U-bolts washers and nuts from the brackets.

Position the enclosure against the tripod’s mast (North side recommended).

Install the U-bolts, flat washers, lock washers, and nuts. Tighten the nuts until the lock washers are compressed.

Route the 14 AWG wire from the grounding lug on the bottom side of the enclosure to the grounding lug on the base of the tripod (Figure 5-14). Strip 1/2" of insulation from each end of the wire. Insert wire ends into the grounding lugs and tighten.



FIGURE 5-14. Enclosure with the -MM Bracket

5.7.2 Enclosure Mounting to Tripod Leg

An enclosure ordered with the -LM bracket has a bracket on each side of the enclosure, and a U-bolt bracket for securing the enclosure to a tripod leg.

Attach an enclosure with the -LM mounting bracket to the tripod base as follows:

Slide the keyhole notches in the upper and lower corners of the -LM bracket over the two extended Phillips head screws located on the tripod base as shown in Figure 5-15B.

Remove the washers, nuts and U-bolt from the U-bolt bracket. Install the bracket as shown in Figure 5-15C. Tighten the nuts on the U-bolt until the lock washers are compressed.

Route the 14 AWG wire from the grounding lug on the bottom side of the enclosure to the grounding lug on the base of the tripod (Figure 5-15). Strip 1/2" of insulation from each end of the wire. Insert wire ends into the grounding lugs and tighten.

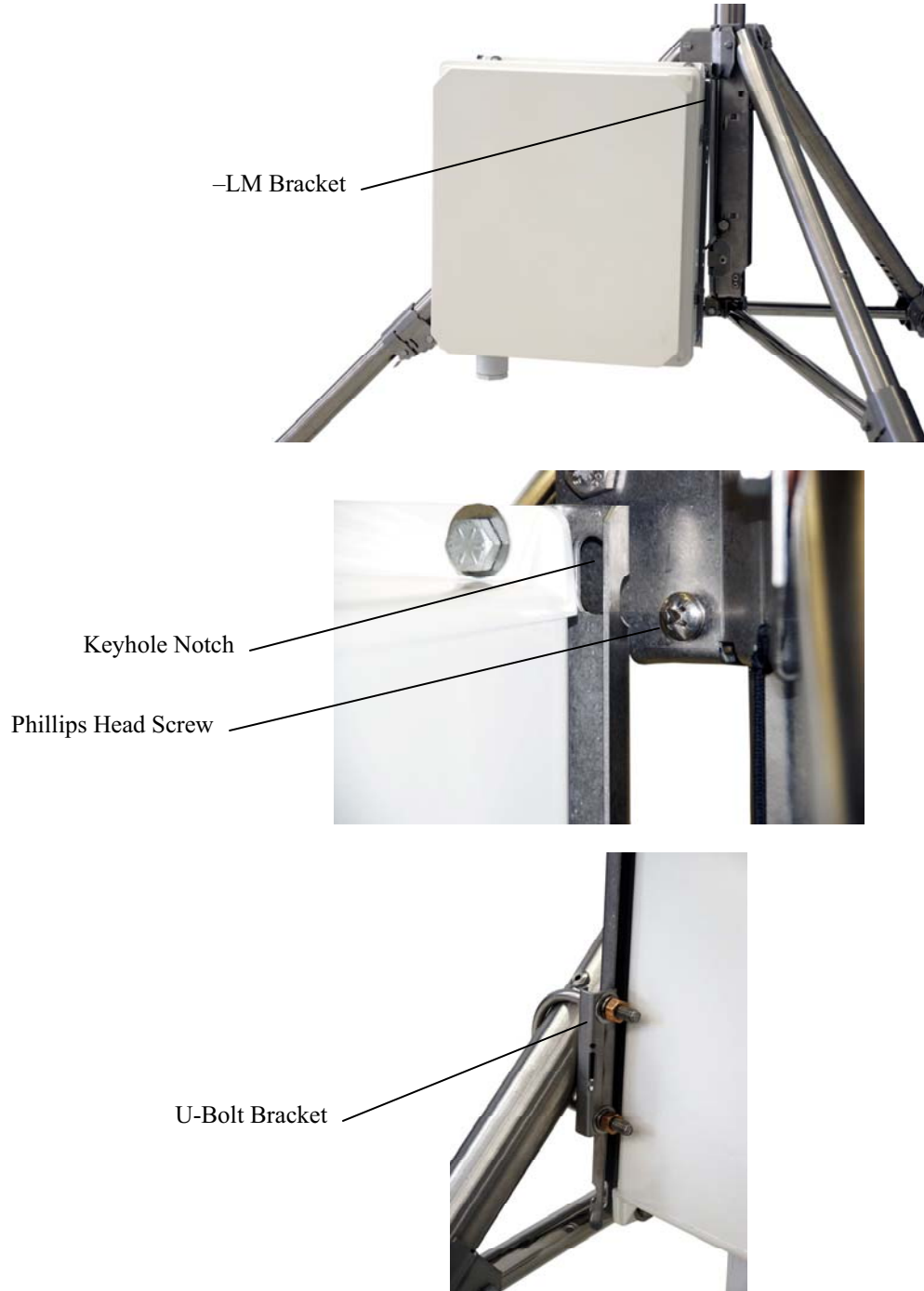


FIGURE 5-15. Enclosure with the -LM Bracket

6. Mounting Brackets

Mounting brackets covered in this section have U-bolts that attach to vertical and/or horizontal pipes with the following ranges of outside diameters:

	inches	mm	Nominal Pipe Size (inches)
1.5" U-bolt	1.0 – 1.5	25.4 – 38.1	¾ – 1
2" U-bolt	1.3 – 2.1	33.0 – 53.3	1 – 1 ½
2" U-bolt with plastic V-block	1.0 – 2.1	25.4 – 53.3	¾ – 1 ½

Some of the brackets (e.g. the CM210) include 1.5" and 2" U-bolts to extend the range of pipe diameters that the bracket can accommodate. Brackets with holes for a 1.5" U-bolt will accept a user-supplied 1.75" U-bolt.

6.1 CM210 Crossarm Mounting Kit

CM200 series crossarms include a CM210 bracket as shown in Figure 6-1. The CM210 can be ordered separately to attach a user-supplied pipe (1.0 – 1.5" OD) to a mast or tower leg (1.0 – 2.1" OD), or to attach a crossarm to two tower legs.

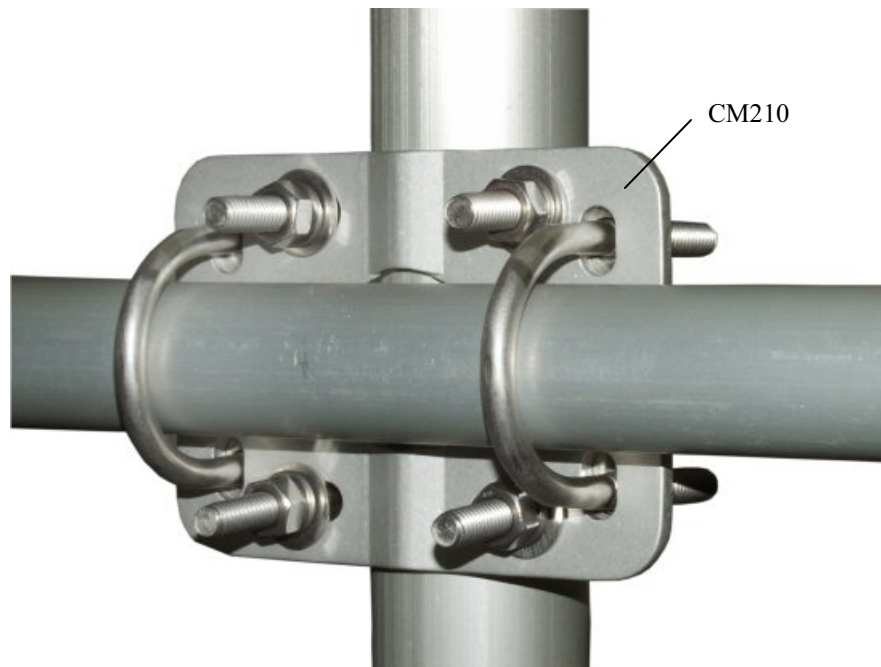


FIGURE 6-1. CM210 Crossarm Mounting Kit
(shown with user-supplied pipe)

6.2 CM216 Mast Mounting Kit

The CM216 attaches to the top of the mast, and provides a 3/4" or 1" mounting pipe (1.05" or 1.32" OD) that extends 4" above the mast, as shown in Figure 6-2.



FIGURE 6-2. CM216 Mast Mounting Kit

6.3 CM220 Right Angle Mounting Kit

The CM220 attaches a vertical pipe (1.0 – 1.5” OD) to the CM200 series crossarms or horizontal pipe (1.0 – 1.5” OD) as shown in Figure 6-3.



FIGURE 6-3. CM220 Right Angle Mounting Kit

6.4 CM225 and 18098 Pyranometer Mounting Stand

The CM225 is used to attach a pyranometer or quantum sensor to a horizontal pipe (1.0 to 2.1" OD) or vertical pole (1.0 to 2.1" OD).

The LI200X pyranometer and LI190SB quantum sensor mount to the CM225 via the LI200S leveling base (see Figure 6-4). The CS300 pyranometer mounts to the CM225 via the 18356 leveling base. The CMP3 and LP02 pyranometers include their own bubble level and leveling screws allowing them to mount directly to the CM225.

The 18098 provides a larger surface for mounting a user-supplied Eppley pyranometer.

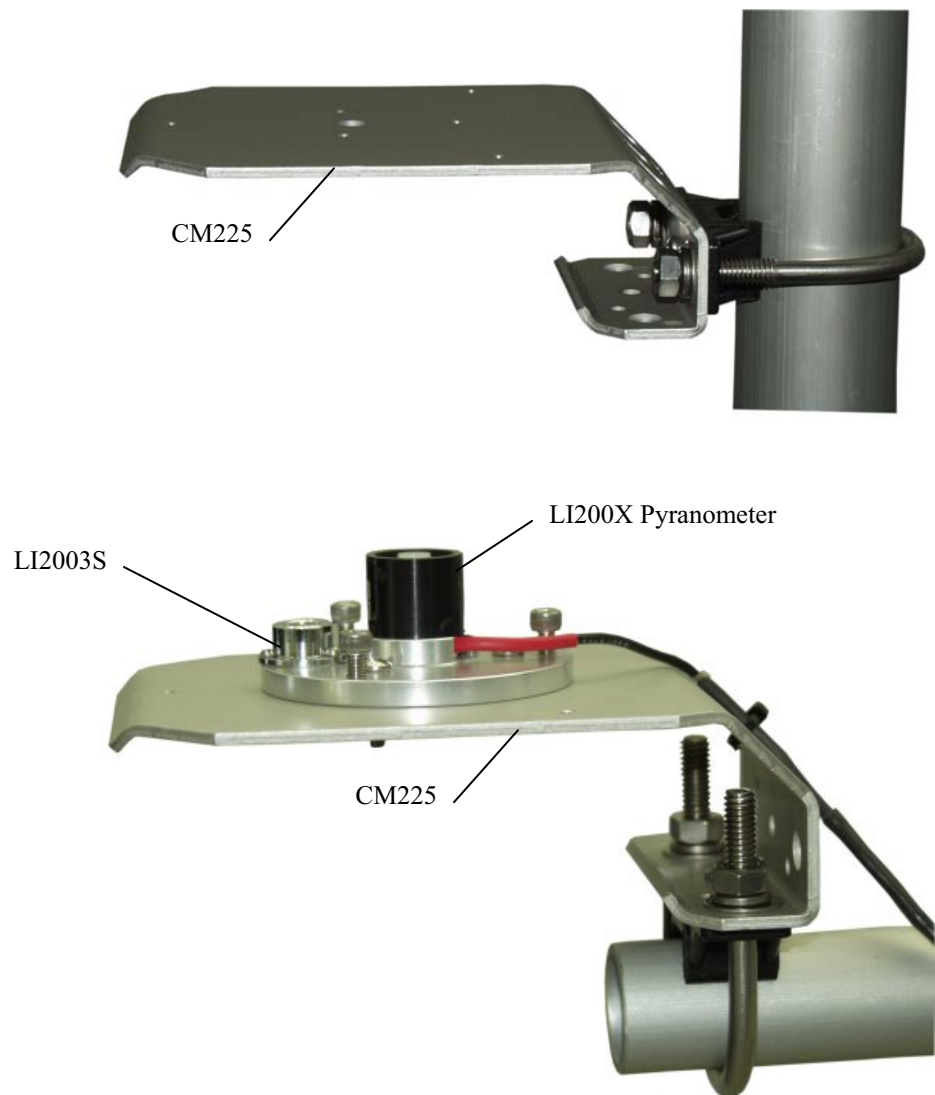


FIGURE 6-4. CM225 Pyranometer Mounting Stand

6.5 CM230 Adjustable Angle Mounting Kit

The CM230 mounts an antenna (1.0 – 1.5” OD) to a mast or vertical pipe (1.3 – 2.1” OD) as shown in Figure 6-5. The bracket allows the antenna to be adjusted for different angles.

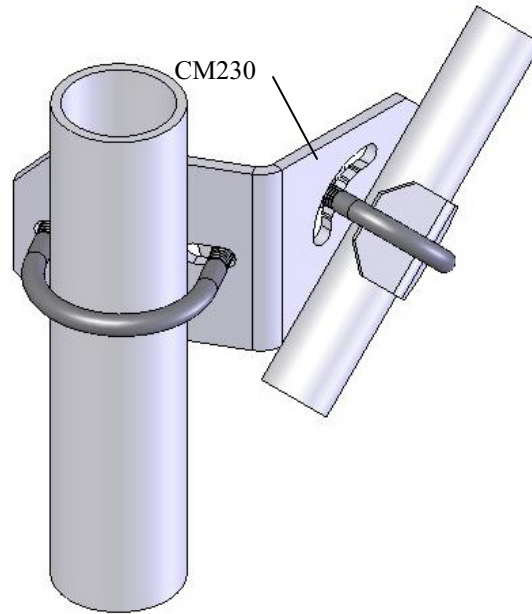


FIGURE 6-5. CM230 Adjustable Angle Mounting Kit

6.6 CM235 Magnetic Mounting Stand

The CM235 provides a 3.5" (8.8 cm) square platform for mounting magnetic base antennas. The CM235 attaches to horizontal or vertical pipes (1.0 – 2.1" OD) as shown in Figure 6-6.



FIGURE 6-6. CM235 Magnetic Mounting Stand

6.7 RM Young Gill Radiation Shields

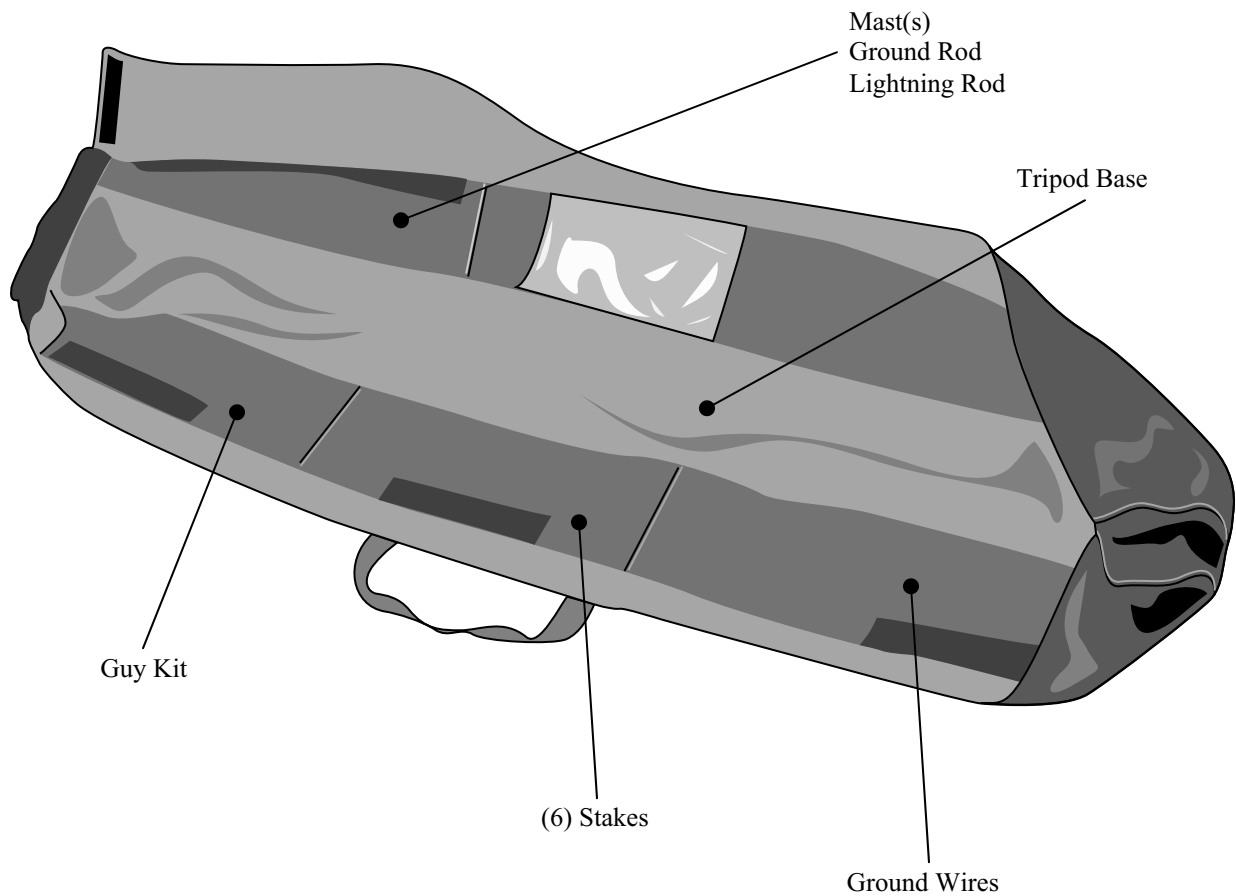
RM Young Gill Radiation Shields are used to house and attach temperature and relative humidity sensors to the tripod mast (1.0 – 2.1” OD) or crossarm as shown in Figure 6-7. Radiation shields ship with the U-bolt configured for attachment to a vertical pipe. To attach the radiation shield to a horizontal pipe, the U-bolt and plastic V-block must be moved to the other set of holes.



FIGURE 6-7. RM Young Gill Radiation Shield

Appendix A. Tripod Tote Bag

The Tripod Tote Bag is an option for the CM110 series tripods. The bag is constructed of nylon, with a main compartment for the tripod base, and pockets for stowing the other components as shown below:



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