

# INSTRUCTION MANUAL



## ***CM106 Tripod***

Revision: 7/13



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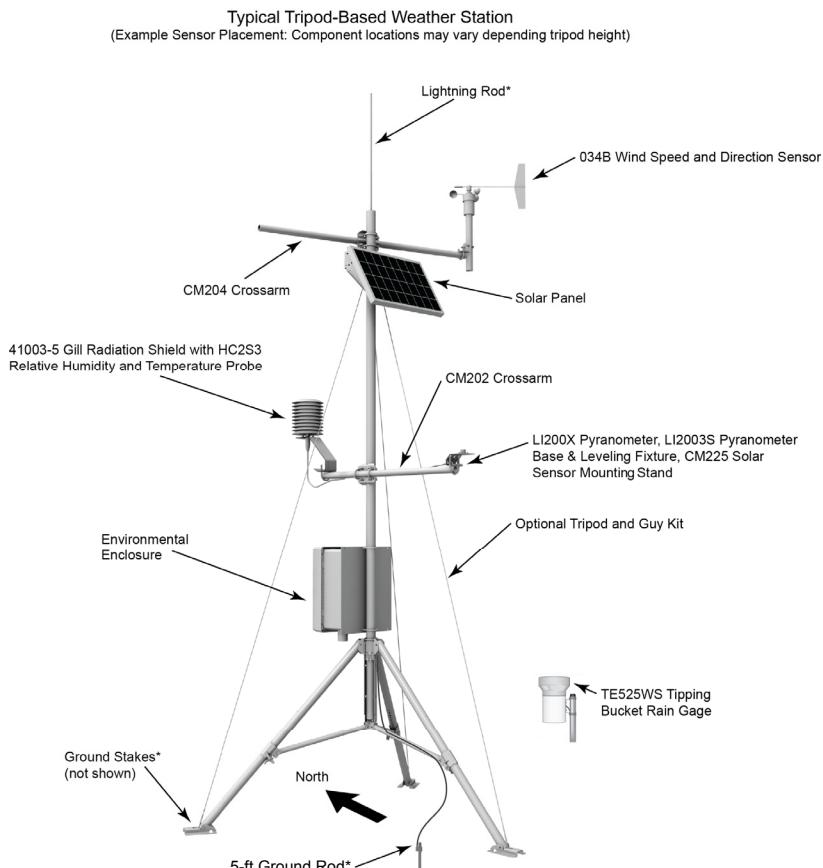
# **CM106 Tripod**

## **1. General**

The CM106 is a general purpose tripod that can be used for mounting sensors, solar panels, antennas, and instrument enclosures (see FIGURE 1-1). The CM106 is constructed from galvanized steel, with individually adjustable legs that allow installation over uneven terrain. Height of the mast is 2.1 m (7 ft), or 3 m (10 ft) with the mast extension.

The CM106 includes lightning and ground rods, ground cables, UV resistant cable ties, and stakes for securing the tripod feet to the ground. An optional guy kit is recommended for sites that experience high wind speeds (see Section 2, *Specifications*). Instrument enclosures can be purchased with mounting brackets that attach to either the mast or leg section as shown in Section 5.7, *Enclosure Attachment*.

The CM106 can be used for a variety of applications. For meteorological stations, sensors are mounted to the tripod using mounting brackets appropriate for the model of sensor. For non-meteorological applications, the tripod can be used to mount instrument enclosures, solar panels, junction boxes, or antennas.



**FIGURE 1-1. Typical tripod-based weather station**

## 2. Specifications

<b>Measurement Height</b>	
<b>Upper Mast Retracted:</b>	2.1 m (7 ft)
<b>Upper Mast Extended:</b>	3 m (10 ft)
<b>Vertical Load Limit:</b>	45 kg (100 lb)
<b>Mast Outer Diameter</b>	
<b>Main Lower Mast:</b>	48 mm (1.90 in)
<b>Retractable Upper:</b>	44 mm (1.74 in)
<b>Base Diameter:</b>	2.8 m (9.3 ft)
<b>Leveling Adjustment:</b>	Slide collars on each leg, adjust individually
<b>Leg Base:</b>	4 in. by 5 in. with four 0.62 in. holes for stakes
<b>Portability:</b>	Collapsible to 8 in. diameter by 6 ft length
<b>Weight with Mast:</b>	18 kg (40 lb)
<b>Maximum Slope Angle:</b>	22° or 40% grade (assuming leg clamp pins are engaged in holes under the legs and that one leg points downhill while the other two legs point uphill)

### Allowable Wind Speeds\*

Tripod Configuration	Sustained Wind	Wind Gust
Mast Extended, Unguyed	65 mph (29 m s <sup>-1</sup> )	84 mph (38 m s <sup>-1</sup> )
Mast Retracted, Unguyed	80 mph (36 m s <sup>-1</sup> )	104 mph (46 m s <sup>-1</sup> )
Mast Extended, Guyed	100 mph (45 m s <sup>-1</sup> )	130 mph (58 m s <sup>-1</sup> )
Mast Retracted, Guyed	115 mph (51 m s <sup>-1</sup> )	150 mph (67 m s <sup>-1</sup> )

\*Allowable wind speed values assume:

- 14 x 16 in. enclosure at mast base
- 10.5 x 16.5 in. solar panel at mast base
- Crossarm and sensors (1.4 ft<sup>2</sup> projected area) at mast top
- Adequate ground anchors (stakes can pull out at lower wind speeds)

## 3. Tools List (for tripod, mast, enclosures, and crossarms)

1/2-in. and 7/16-in. open end wrenches  
adjustable wrench  
Phillips head screw drivers (medium, small)  
Straight bit screwdrivers (large, medium)  
12-in. 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. The tripod base is packaged with the mast, mast extension, ground rod, lightning rod, and (6) stakes. The ground rod clamp, lightning rod, lightning rod clamp, cable ties, and ground wires are enclosed in a bag. The optional guy kit is packaged separately.

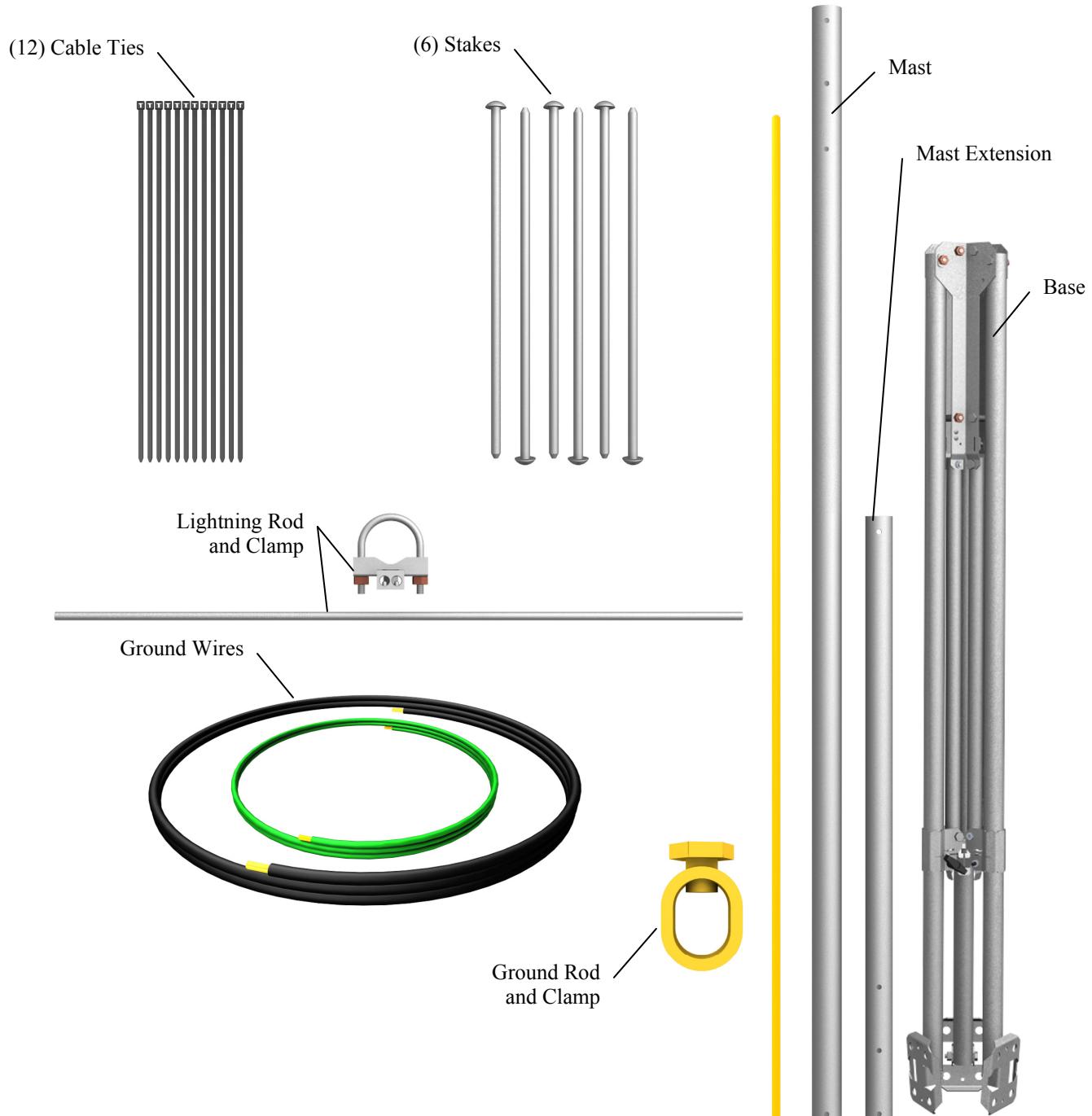


FIGURE 4-1. Tripod components

## 5. Tripod Installation

### 5.1 Tripod Base

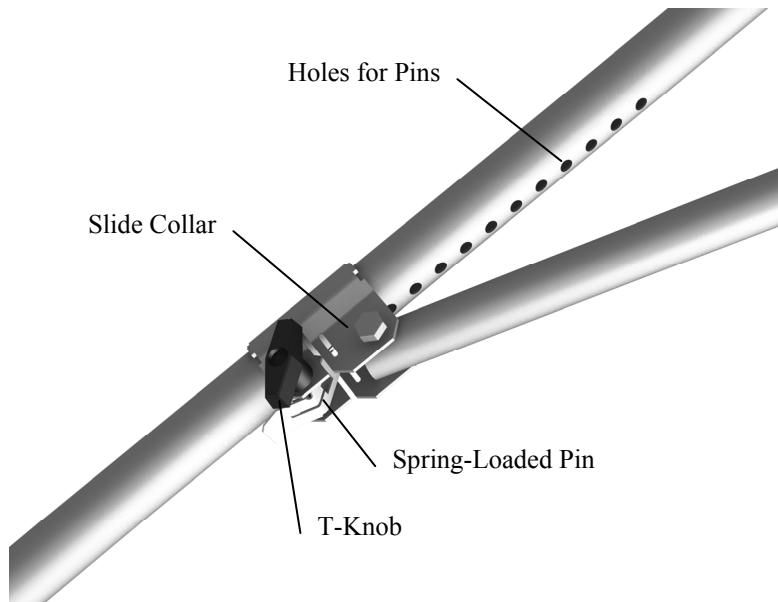
**WARNING**

**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.**

The tripod base has three independently adjustable legs allowing the tripod to be installed over non-level terrain.

Prepare the area where the tripod will be installed. The tripod requires an area approximately 9.3 ft (2.8 m) 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.



*FIGURE 5-1. Tripod leg, slide collar components*

#### 5.1.1 Mounting on a Relatively Flat Area

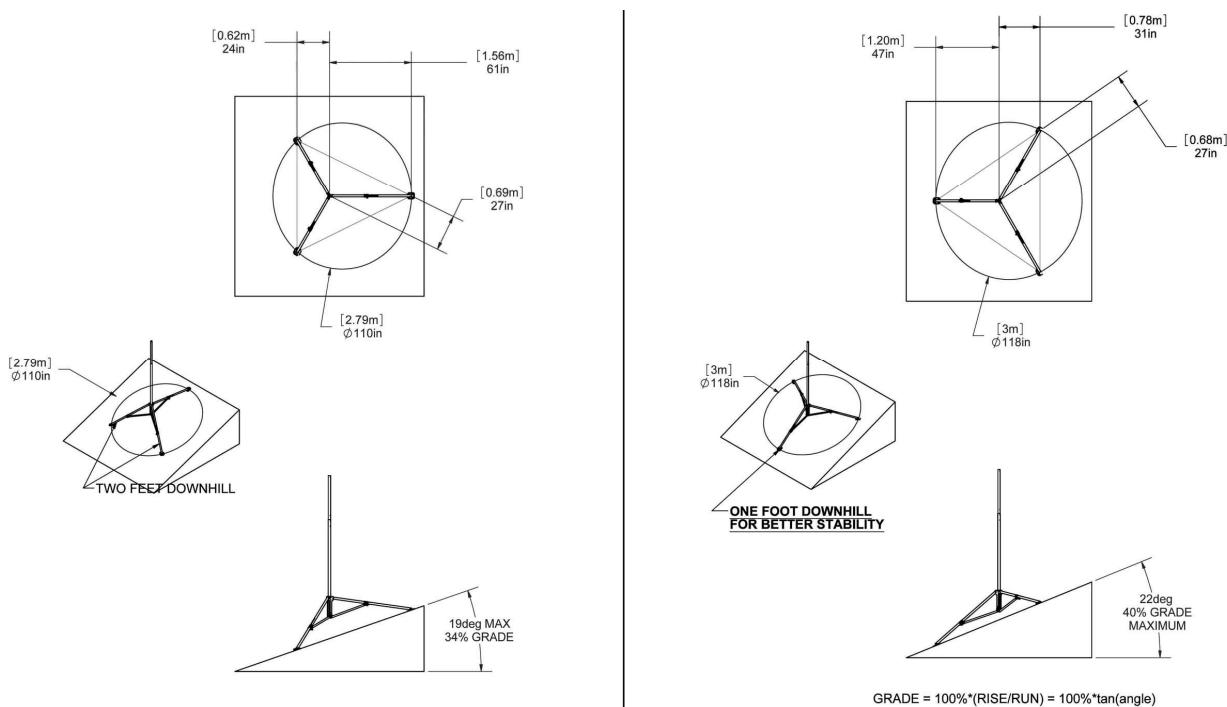
Loosen the T-knob and extend each leg until the pin engages in a hole (depress the tab to disengage the pin from a hole). With the legs extended, orient the tripod so that one of the legs points South (assuming the instrument enclosure with -MM Mast Mount bracket will face North). If the instrument enclosure has the -LM Leg Mount bracket, orient the tripod so the enclosure will mount

to one of the three leg mount positions on the tripod, facing the desired direction. The tripod is typically plumbed after the mast has been installed, as described in Section 5.2, *Mast*.

### 5.1.2 Mounting on an Incline

Loosen the T-knob and 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 one leg points downhill and the other two legs point uphill. The tripod is more stable with only one leg pointed downhill because the mast is closer to the center of the footprint (see FIGURE 5-2).

The tripod is typically plumbed after the mast has been installed, as described in Section 5.2, *Mast*.



*FIGURE 5-2. Comparison of one leg pointing downhill (right) versus two legs pointing downhill*

## 5.2 Mast

The CM106 includes a mast extension that can be fully extended for a 3 m (10 ft) height, or partially extended for a 2.1 m (7 ft) height. Remove the bolts in the extension, align the holes in the insert with holes in the mast, and install the four bolts previously removed. Two additional holes spaced 4 in. apart were added to the mast extension 9/2012. The additional holes make it possible for the extension to extend 8 in. or 12 in., or 20 in., 24 in., or 28 in. above the mast depending on which end is inserted in the mast.

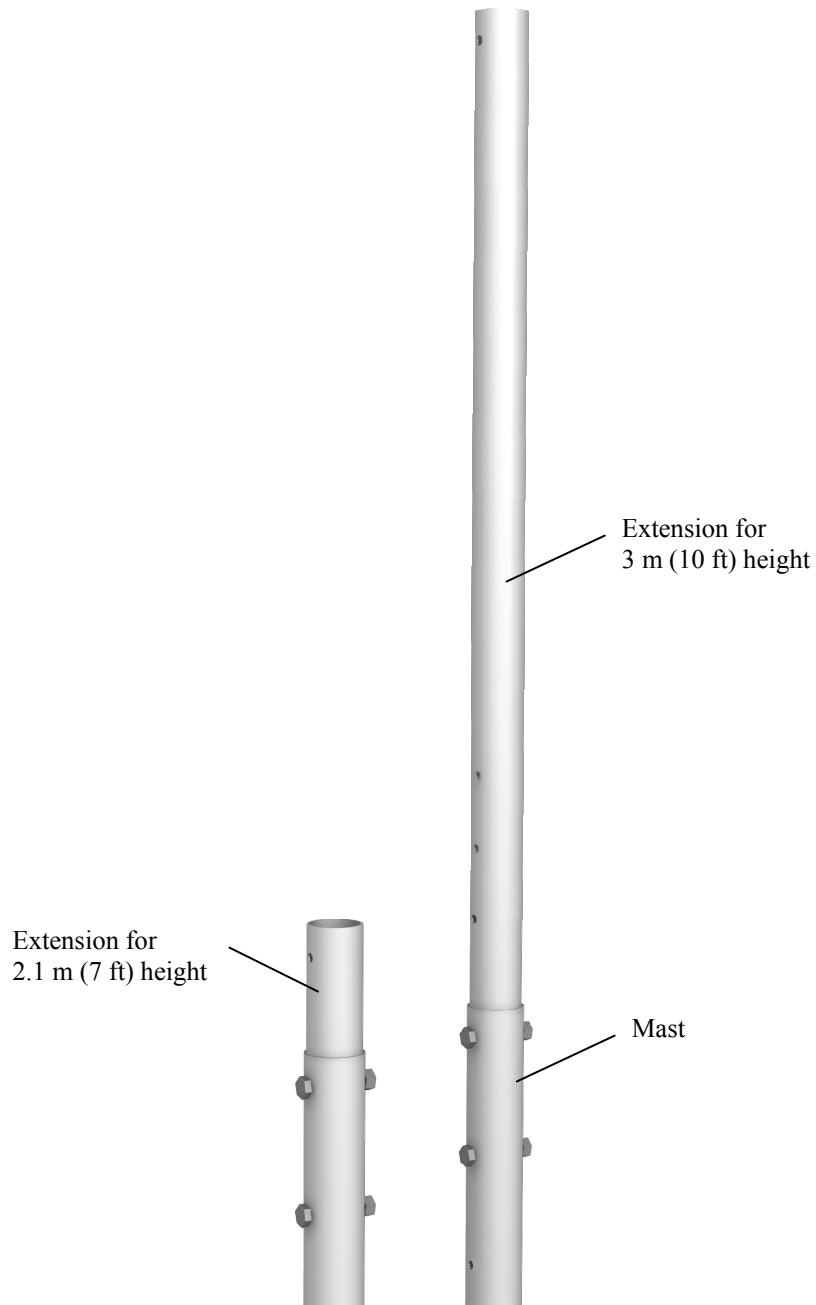
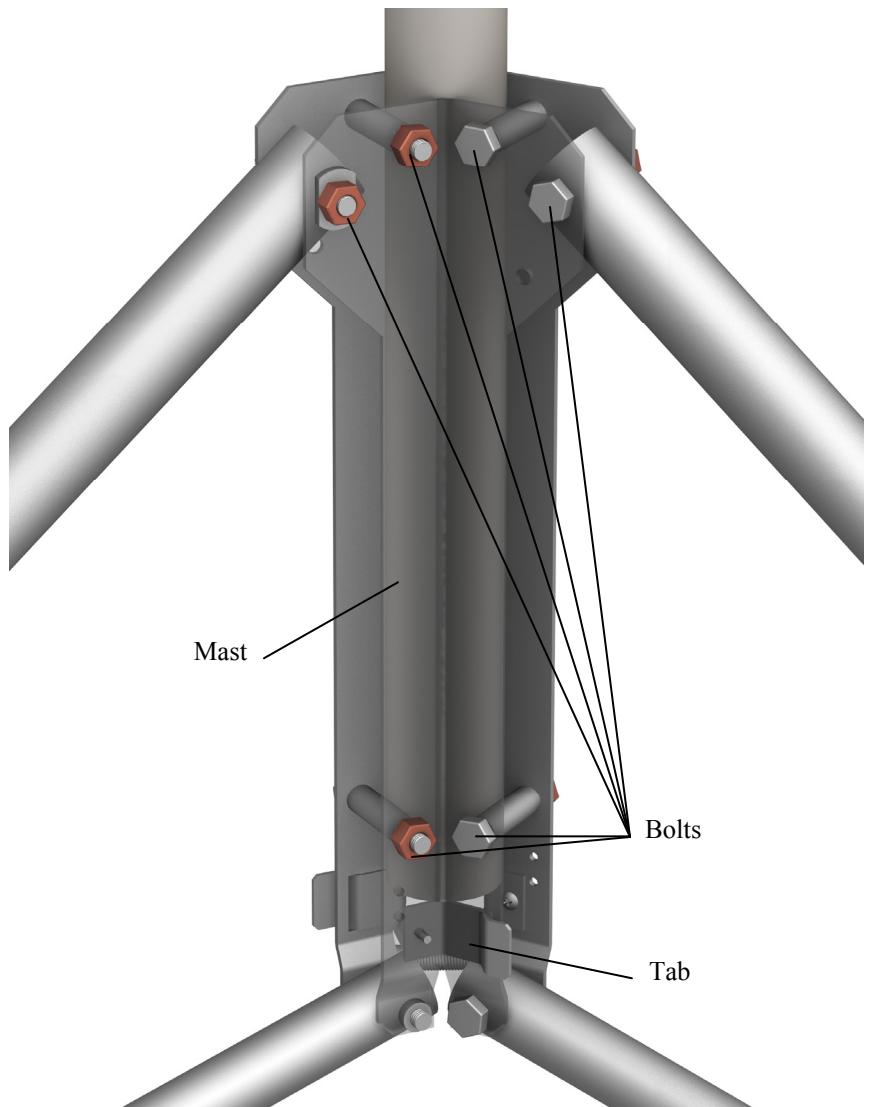


FIGURE 5-3. Tripod mast and insert



*FIGURE 5-4. Mast attachment to tripod base*

Loosen the nine bolts on the tripod base. FIGURE 5-4 shows the location of six of these bolts. The remaining bolts are in the same position on the third tripod leg. Slide the mast into the tripod base, making sure that it extends below the lower bolts and rests on the tab. Tighten the six bolts to secure the mast.

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. Tighten the T-knobs after the adjustments have been made.

### 5.3 Installing the Optional Guy Kit

Part 27117, *CM106 Guy Kit*, can be ordered separately for areas that experience high wind speeds (Section 2, *Specifications*). Install the guy brackets to the mast as shown in FIGURE 5-5. Attach the three guy wires to the guy collar and slide the collar over the mast so that the collar butts against the brackets.

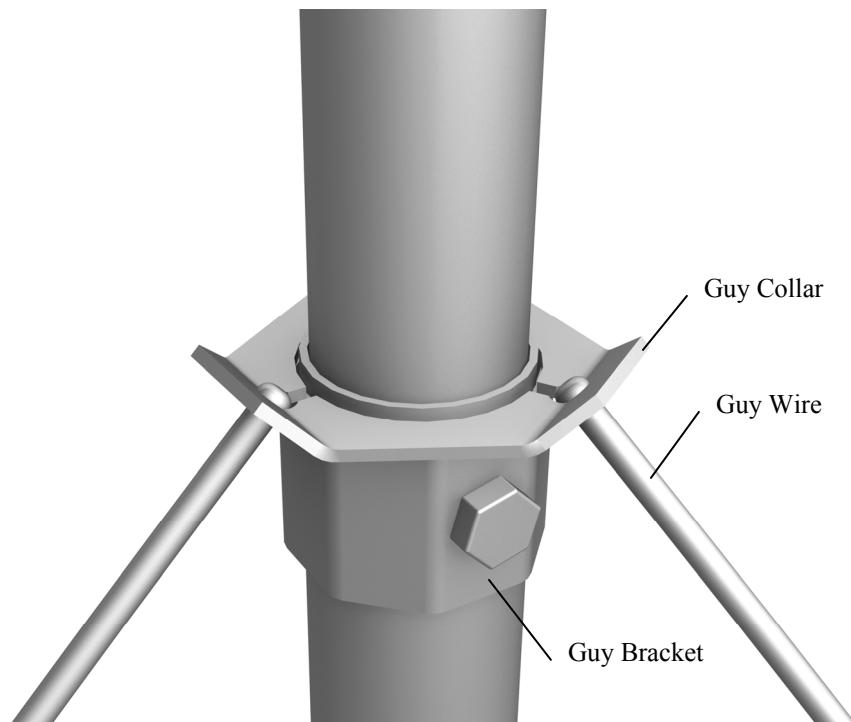
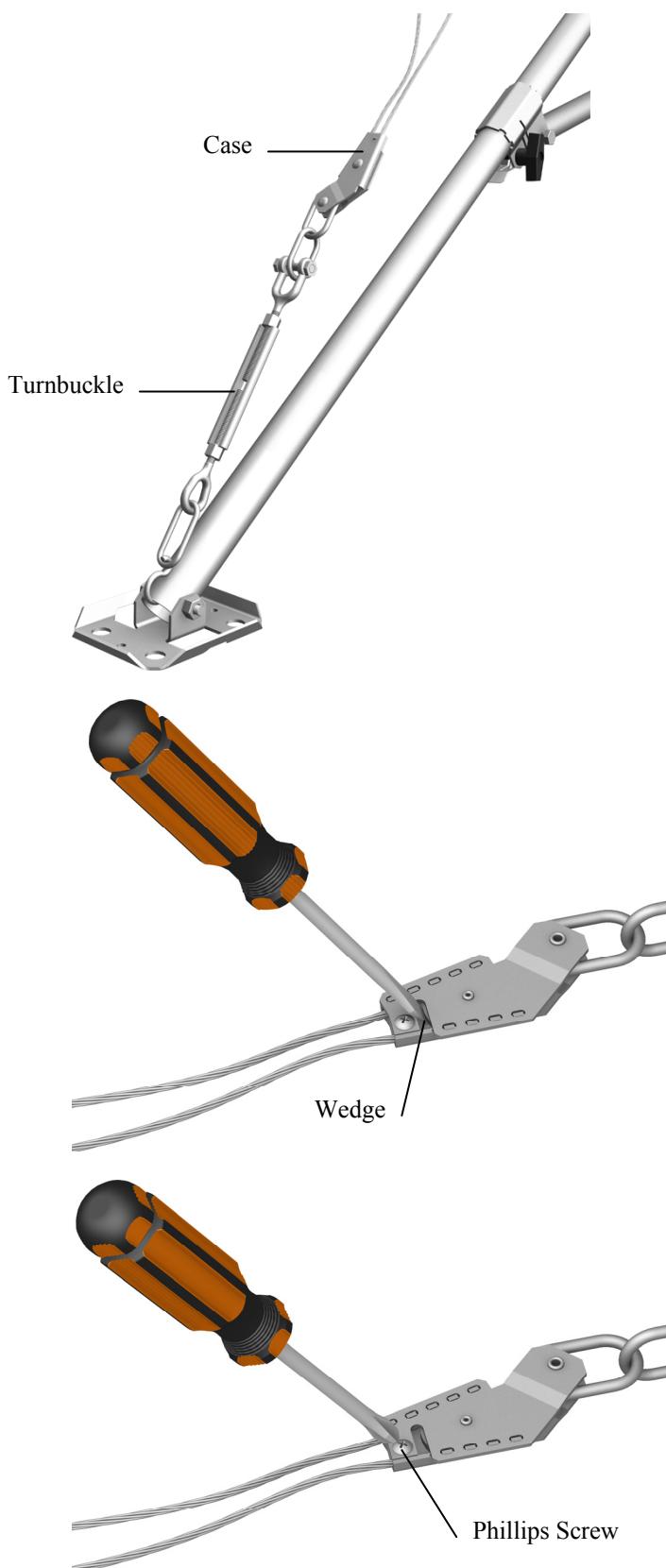


FIGURE 5-5. Guy collar

On the end of each guy line is a case and hardware to attach to the turnbuckles. Unscrew the turnbuckles so that only 1/2 in. of thread extends beyond the inside of the turnbuckle body. Attach the case and turnbuckle 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. If the load end of the guy wire can't be fed through the case, use a small flat screwdriver to push the wedge forward into the case to disengage wedge.

After the slack has been removed from the guy lines, tighten the Phillips screws and tighten the turnbuckles to tension the guy lines.



*FIGURE 5-6. Leg attachment*

## 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 5-7.

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 5-7. 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 in. 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 5-8.

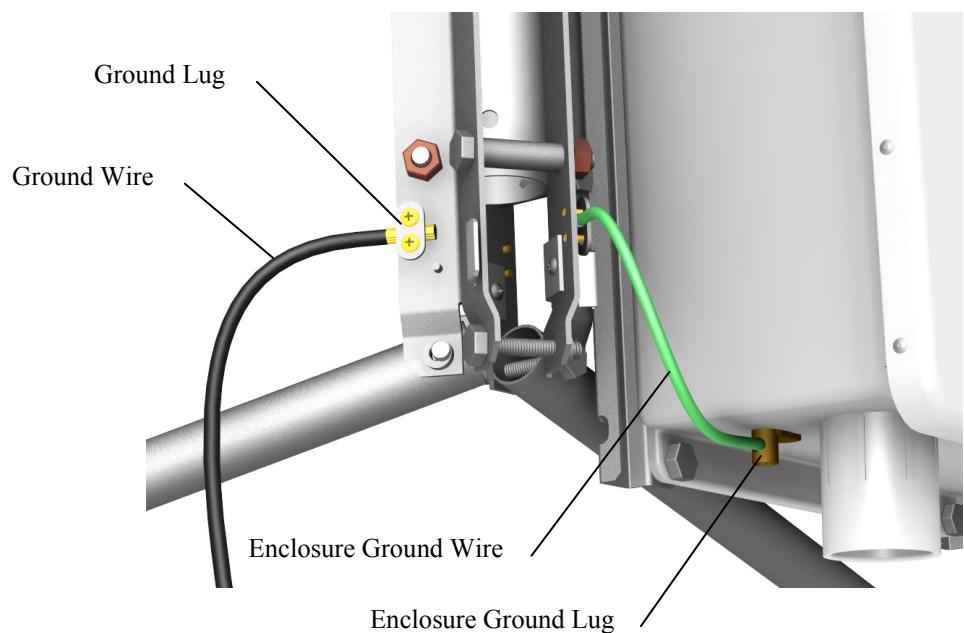
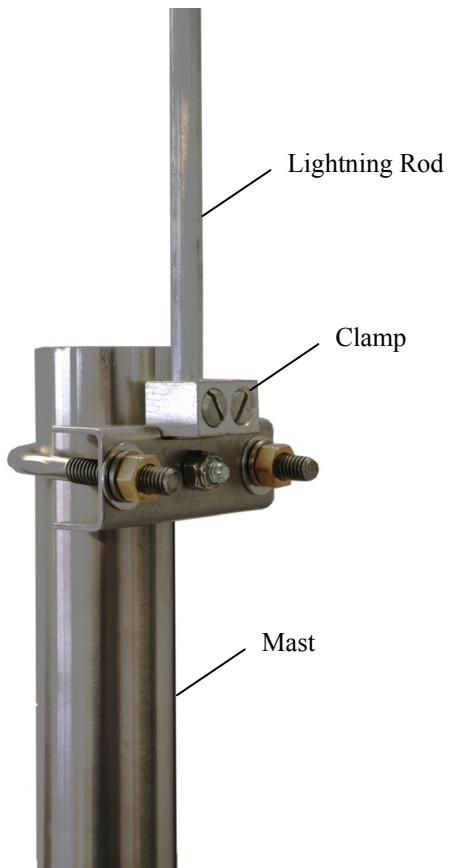


FIGURE 5-8. Ground rod and clamp

Strip 1/2 in. 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 5-8.

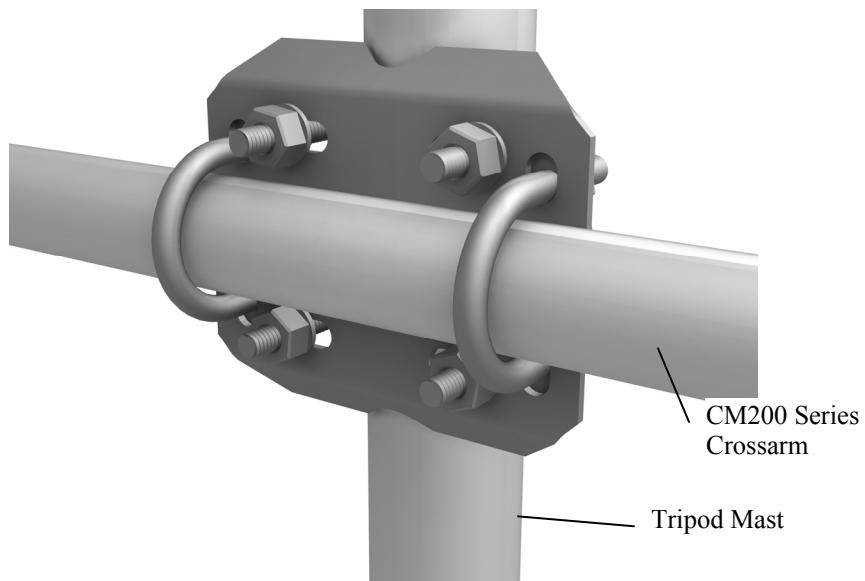
Mount the lightning rod and clamp to the tripod mast with pointed tip up, and notch at bottom (FIGURE 5-9).



*FIGURE 5-9. Lightning rod and tripod ground lug*

## 5.6 Crossarm Attachment

Attach the CM202 (0.6 m, 2 ft), CM204 (1.2 m, 4 ft), or CM206 (1.8 m, 6 ft) crossarm to the tripod mast as shown in FIGURE 5-10. For wind sensors, the crossarm should be approximately 103 in. above the ground for a 3 m mounting height, or 64 in. for a 2 m mounting height. Typically the crossarm is oriented East/West for wind sensors, North/South for pyranometers.



*FIGURE 5-10. CM204 Crossarm*

## 5.7 Enclosure Attachment

The ENC10/12, ENC12/14, ENC14/16, and ENC16/18 enclosures can be ordered with mounting brackets for the CM106 tripod. 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 ENC16/18 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 (FIGURE 5-11). Tighten the nuts until the lock washers are compressed.

Route the 14 AWG wire from the ground lug on the bottom side of the enclosure to the ground lug on the base of the tripod (FIGURE 5-8). Strip 1/2 in. of insulation from each end of the wire. Insert wire ends into the ground lugs and tighten.

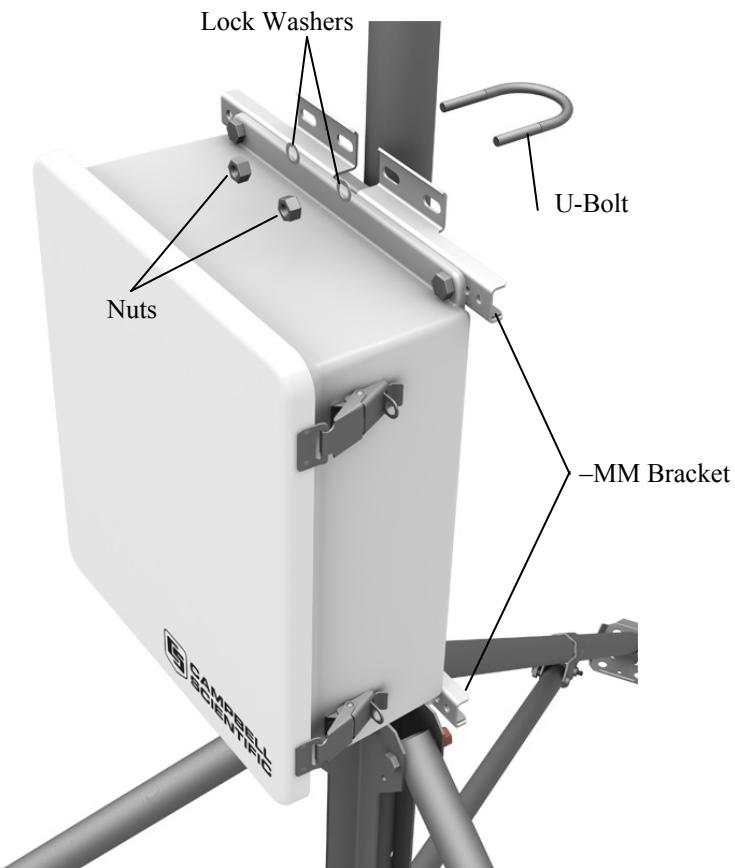


FIGURE 5-11. Enclosure with the –MM bracket

### 5.7.2 Enclosure Mounting to Tripod Leg

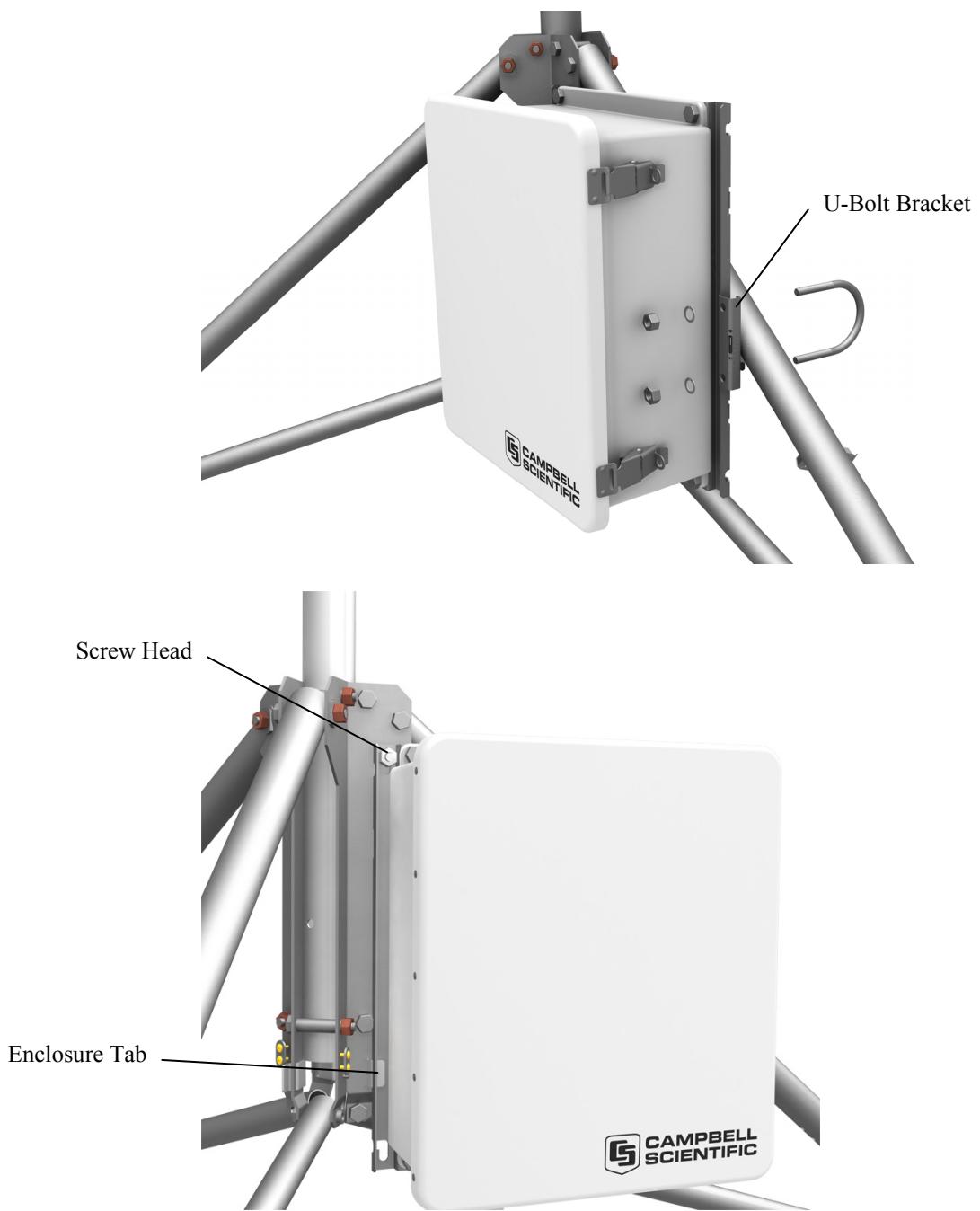
An enclosure ordered with the –LM bracket has a bracket on each side of the enclosure, and a U-bolt bracket for securing the enclosure to a tripod leg.

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

Slide the keyhole notch in upper corner of the –LM bracket over the extended screw head located on the tripod base as shown in FIGURE 5-12, and engage the notch in the lower corner of the –LM bracket with the enclosure tab. There are two places on the tripod base with provisions for mounting enclosures with the –LM brackets.

Remove the washers, nuts, and U-bolt from the U-bolt bracket. Install the bracket as shown in FIGURE 5-12 (top). Tighten the nuts on the U-bolt until the lock washers are compressed.

Route the 14 AWG wire from the ground lug on the bottom side of the enclosure to the ground lug on the base of the tripod (FIGURE 5-8). Strip 1/2 in. of insulation from each end of the wire. Insert wire ends into the ground lugs and tighten.



*FIGURE 5-12. 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-in. U-bolt	1.0 – 1.5	25.4 – 38.1	$\frac{3}{4}$ – 1
2-in. U-bolt	1.3 – 2.1	33.0 – 53.3	1 – 1 $\frac{1}{2}$
2-in. U-bolt with plastic V-block	1.0 – 2.1	25.4 – 53.3	$\frac{3}{4}$ – 1 $\frac{1}{2}$

Some of the brackets (for example, the CM210) include 1.5-in. and 2-in. U-bolts to extend the range of pipe diameters that the bracket can accommodate. Brackets with holes for a 1.5-in. U-bolt will accept a user-supplied 1.75-in. 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-in. to 1.5-in. OD) to a mast or tower leg (1.0-in. to 2.1-in. OD), or to attach a crossarm to two tower legs.

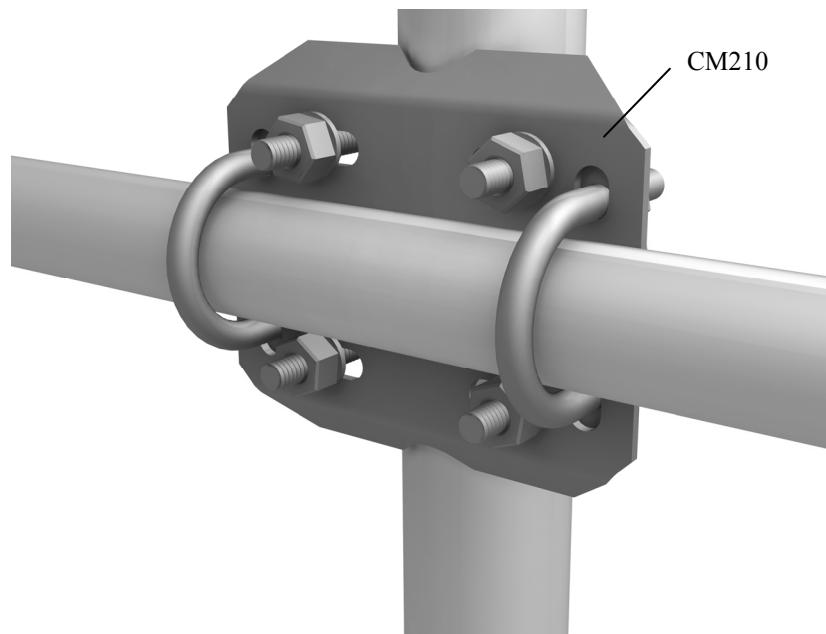


FIGURE 6-1. CM210 Crossarm Mounting Kit (shown with user-supplied pipe)

## **6.2 CM216 Mast Mounting Kit**

The CM216 attaches to the top of the mast, and provides a 3/4-in. or 1-in. mounting pipe (1.05-in. or 1.32-in. OD) that extends 4 in. 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-in. to 1.5-in. OD) to the CM200-series crossarms or horizontal pipe (1.0-in. to 1.5-in. 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-in. to 2.1-in. OD) or vertical pole (1.0-in. to 2.1-in. 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.

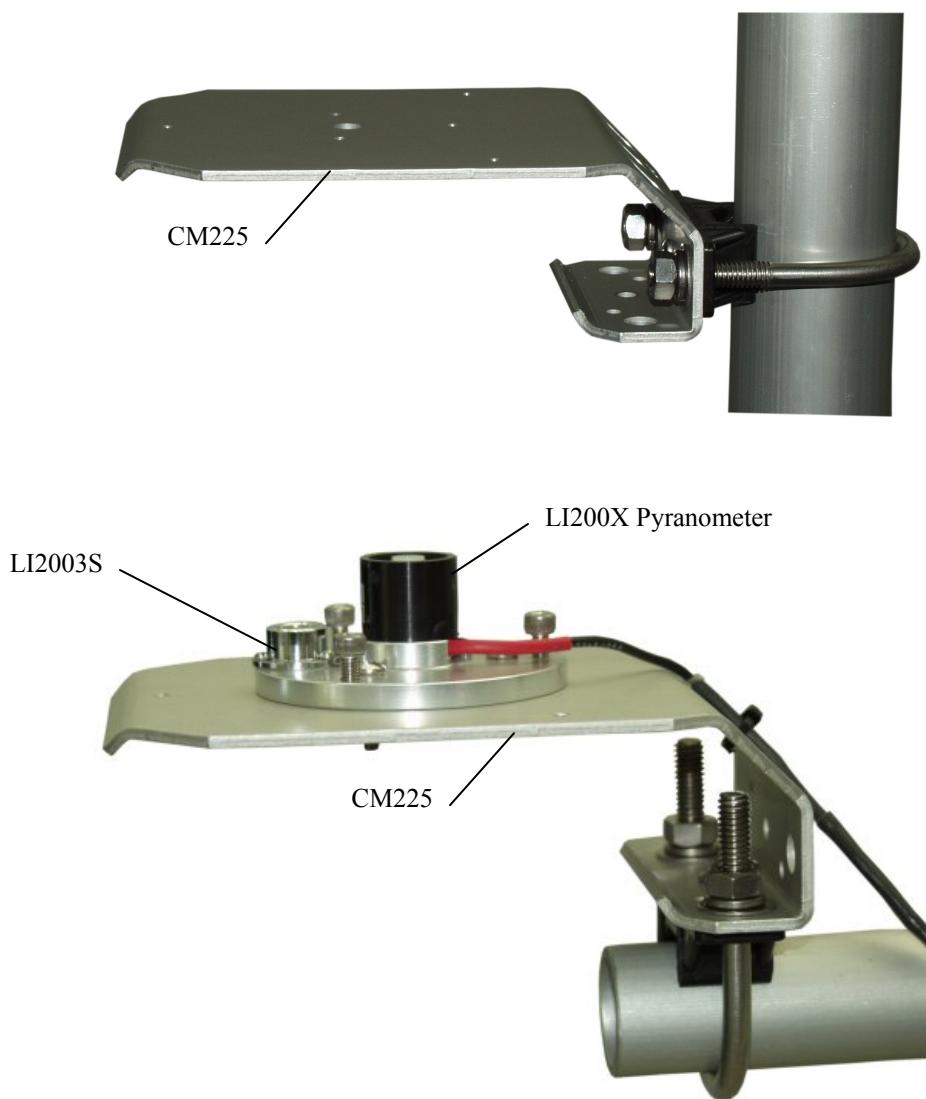
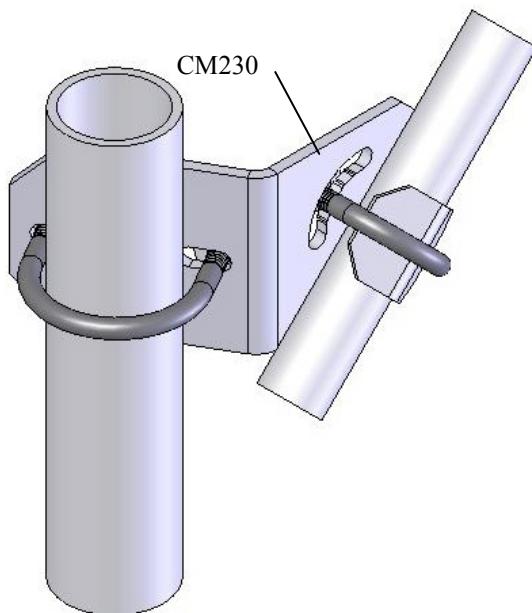


FIGURE 6-4. CM225 Pyranometer Mounting Stand

## **6.5 CM230 Adjustable Angle Mounting Kit**

The CM230 mounts an antenna (1.0-in. to 1.5-in. OD) to a mast or vertical pipe (1.3-in. to 2.1-in. 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

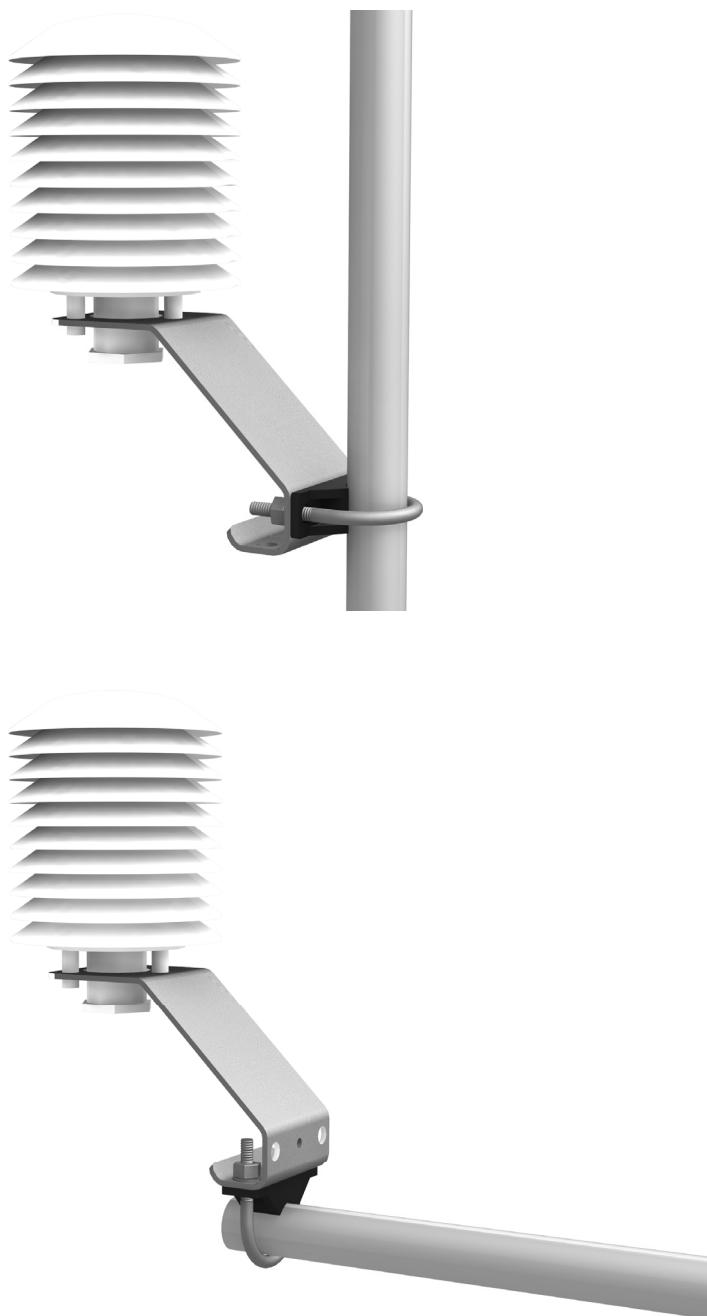
The CM235 provides a 8.8 cm (3.5 in) square platform for mounting magnetic base antennas. The CM235 attaches to horizontal or vertical pipes (1.0-in. to 2.1-in. OD) as shown in FIGURE 6-6.



*FIGURE 6-6. CM235 Magnetic Mounting Stand*

## **6.7 R.M. Young Gill Radiation Shields**

R.M. Young Gill Radiation Shields are used to house and attach temperature and relative humidity sensors to the tripod mast (1.0-in. to 2.1-in. 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. R.M. Young Gill Radiation Shield*



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