385D/386D/387D/389D
12” RAIN GAUGE

OPERATION MANUAL

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1 INTRODUCTION

1.1 About This Manual

This document is organized with the most important information toward the front of the manual. All users should read and understand the sections on setup, operation, and field audits. Toward the back are sections that provide in-depth information on subjects such as diagnostics and accessories. These sections should be consulted as needed.

This manual is periodically revised for maximum accuracy and to incorporate new features or updates. User feedback is welcome. Electronic versions of this manual are available upon request.

1.2 Technical Service

Should you require support, please consult your printed documentation or our website www.metone.com to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours;

Monday – Friday 7:00 a.m. to 4:00 p.m. Pacific Time.

Voice: (541) 471-7111

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E-Mail: service@metone.com

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Please have the instrument serial number available when contacting the manufacturer. On most models manufactured by Met One Instruments, it will be located on a silver product label on the unit, and also printed on the calibration certificate. The serial number will begin with a letter and be followed by a unique five digit number such as X10026.

1.3 Model 385D, 386D, 387D, and 389D Heated 12 Inch Rain Gauges

Figure 1-1 385D

This series of rain gauges contains heating elements inside the sensor to prevent the tipping bucket freezing in place and to melt snowfall. This allows the gauges to be used to monitor precipitation year-round in locations that fall below freezing.

The Model 385D, 386D, 387D, and 389D Tipping Bucket Rain Gauges are virtually the same. There are two primary differences between the four sensors. First, the 385D and the 387D can have multiple calibration rates whereas the 386D and the 389D are calibrated specifically for 0.1 mm of rainfall per tip. The second difference is that the 385D and the 386D use 110 VAC heater elements whereas the 387D and 389D use 220 VAC elements. For simplicity, the rest of this manual will only reference model number 385D, except where notable differences occur.

The 385D is an accurate, sensitive, and low-maintenance sensor designed to measure rainfall and snowfall on a continuous basis. Water is not retained in the sensor. It is drained each time an internal bucket fills with 0.01 inches of rainfall (standard calibration). As the bucket tips over and pours the water out the base of the sensor, a switch closure pulse is sent to a connected translator module or datalogger for counting.

1.4 Signal and Power Cables

The sensor signal cable is part number 1566. It is a vinyl-jacketed two conductor shielded cable that is connected to the sensor via an internal terminal strip. The cable length XX is designated as 1566–XX on each cable part number label. It includes a strain relief that screws into the base of the sensor.

The AC power cable is part number 2517. It is a three conductor seoprene jacketed cable that is connected to the sensor inside the junction box located on the base of the gauge. See section 3.2.2 for instructions on connecting the power cable. The cable length XX is designated as 2517-XX on each cable part number label.

1.5 Specifications

PARAMETER	SPECIFICATION
Measurement Principle:	Tipping bucket
Orifice:	12 inches
Switch Type:	Magnet & Reed
Switch Specification:	500 mA, 200 VDC maximum*
Operating Temperature:	-50 Deg. C to +70 Deg. C Ambient Temperature
Calibration (standard)	0.01 inches per switch closure
Calibration (options)	0.2 mm, 0.25 mm per switch closure
Calibration (386D and 389D)	0.1 mm per switch closure
Accuracy:	±1% at 1” per hour at 70°F
Deployed Dimensions:	21-¼” high, 12” diameter, 12” diameter at base excluding mounting pads
Mounting:	3 Pads for ¼ “bolts on 9-21/32” (9.66”) circle diameter
Power (385D and 387D):	110 VAC, 50/60 Hz, 300 W
Power (386D and 389D):	220 VAC, 50/60 Hz, 300 W
Weight:	7.5 lbs/ 3.4 kg without cabling
Shipping Weight:	Approximately 11 lbs with cabling

*Typical applications use approximately 0.5 mA at 5 VDC as lower voltage and current values provide longer switch life.

Specifications may be subject to change without notice.

2 SITE SELECTION and POSITIONING CRITERIA

Choose a site where the height of any nearby trees or other objects above the sensor is no more than about twice their distance from the sensor. A uniform surrounding of objects (such as an orchard) is beneficial as a windbreak. Nonuniform surroundings (such as a nearby building) create turbulence, which affects the accuracy of the sensor.

3 SETUP

Use the following information to correctly assemble, configure, and deploy the 385D Rain Gauge. Installation of the 385D should ideally be performed by personnel familiar with environmental monitoring equipment. There are no special precautions or handling concerns except for the normal level of care required for handling scientific equipment. Refer to the instructions and diagrams on the following pages.

3.1 Unpacking

Unpack the gauge and inspect it. Damage incurred to the equipment during shipping is the responsibility of the carrier. If any damage to the shipment is noticed before unpacking, **a claim must be filed with the commercial carrier immediately**. Follow any special unpacking instructions provided by the carrier as sensor is carefully removed from the container and inspected. It is recommended to document and photograph all damaged packages and items before, during, and after unpacking them. Contact Met One Instruments (see section 1.2 of this manual) to arrange for any replacement items needed.

3.2 Instrument Assembly and Deployment

The 385D is designed for easy setup and deployment. Once the sensor is placed in the desired sample location, the following steps should be performed to properly install the instrument.

3.2.1 Mount the Gauge

Use the following steps to properly mount and prepare the 385D for operation.

1. Remove the outer housing assembly. This will expose the tipping mechanism, terminal block, and built-in level on the base of the gauge. Do NOT remove the shipping restraint securing the tipping bucket in place.

2. Mount the sensor on an appropriate platform or tower. Three ¼” diameter bolts are used to mount the sensor on a 9-21/32” bolt circle. The gauge must be mounted as level as possible. Use washers (customer provided) for shims and the built-in level as an aid. Met One Instruments offers an optional mounting platform (part number 3119) that attaches to a vertical 2" IPS pipe (pipe not included).

3. Remove shipping restraint (this may be tape, a rubber band, or other similar item) from sensor bucket and verify that bucket moves freely and that all adjusting screws are tight.

4. Route the signal cable through the access in the base of the sensor then connect the lugs to terminals 1 and 3 (the outer terminals) of the terminal strip. Polarity is not important.

5. Tighten the included strain relief fitting to secure the cable in place and provide support on the outside of the sensor.

6. If snowfall is expected, connect appropriate AC power to the heating elements. See section 3.2.2 for details.

7. Replace the sensor housing assembly making sure to tighten the screws at base. Note that the housing should be positioned between the base and the nylon washers. The screw heads should not press directly against the housing assembly.

8. Remove the upper and lower debris screens from the collection funnel. Remove the security tape (and any residue) from the screens and the collection surface and then place the screens back in position.

9. Route the signal cable to a translator or datalogger and connect it as appropriate. If this rain gauge was purchased as part of a Met One Instruments weather station, refer to System Interconnect Diagram included with the system for connection details.

3.2.2 Using the Gauge to Measure Snowfall

The upper funnel assembly contains a heater affixed to the underside of the collection surface. When the temperature of the funnel surface falls below approximately 40 Deg F (4 Deg C), the heating element energizes to melt any snowfall that may occur. When the surface temperature of the funnel collection area reaches approximately 60 Deg F (15 Deg C), the heating element is turned off.

A separate heating element is mounted beneath the tipping bucket assembly to prevent it from freezing in place and being unable to tip. This element uses the same set points for operation.

If snowfall is expected, the upper and lower funnel assembly screens must both be removed. If these screens remain in place, snow will accumulate on them and not come into contact with the heated funnel collection surface. If this happens, it will not melt and will instead create a barrier preventing any snowfall from being measured.

The heaters will require either a 110 VAC 50/60Hz or 220 VAC 50/60 Hz source. Before proceeding with electrical connections, review the following:

Ensure that site AC power (voltage and frequency) is compatible with the version of rain gauge being used. See section 1.5.

All electrical connections must be in accordance with local and national codes. Always use grounded receptacles and power cords.

Electrical connections should only be made by qualified personnel.

When the 2517 power cable is already connected to the rain gauge, simply connect the other end to the AC power source.

When using site provided cabling, or if the 2517 power cable is not already connected to the rain gauge, the following steps should be used:

1. Mount the gauge and remove the housing assembly as directed in section 3.2.1.

2. Remove the cover of the junction box located on the side of the gauge base.

3. Loosen the cord grip fitting of the junction box located on the side of the gauge base.
4. Insert the appropriate AC power cable through the cord grip fitting.
5. Using the supplied wire nuts, connect the AC wiring as follows:
    a. Ground to green
    b. Neutral to white
    c. Hot to black
6. Tuck all wires securely inside the junction box, replace the junction box cover, and tighten the cord grip fitting.
7. Insert the black waterproof power connector from the funnel housing assembly heating element into to its complimentary connector extending from the AC junction box.
8. Replace the housing and continue installation as directed in section 3.2.1
9. Connect the other end of the heater power cable to the AC power source.

4 CALIBRATION

The sensor is factory calibrated; recalibration is not required unless damage has occurred or the adjustment screws have loosened. To check or recalibrate, perform the following steps.

1. Remove the outer housing assembly. This will expose the tipping mechanism, terminal block, and built-in level on the base of the gauge.

2. Verify the sensor is level using the built-in level in the base of the sensor.

3. Wet the mechanism and tipping bucket assembly by pouring water (in a controlled manner) through the inner funnel and into the tipping bucket until it tips. Repeat this for the other half of the bucket. Tip the bucket one more time by hand to allow any excess water to drain. ***Do not wipe out or dry off any residual water droplets!***

4. Using a graduated cylinder, slowly pour the measured quantity of water shown in Table 4-1 through the inner funnel to the tipping bucket, which should then tip. Repeat for the alternate bucket. If both buckets tip when filled with the measured quantity of water, the sensor is properly calibrated. If they do not, recalibrate as follows:

    a. Release the lock nuts on the cup adjustments.

    b. Move the adjustment screws down to a position that would place the bucket far out of calibration.

    c. Allow the measured quantity of water to enter the bucket.

    d. Turn the cup adjustment screw up until the bucket assembly tips. Tighten the lock nut.

    e. Repeat steps 3 and 4 for the opposite bucket.

    f. Measure the quantity of water necessary to tip each bucket several times to ensure proper calibration.

    g. After verification or calibration (as needed), replace the sensor housing assembly making sure to tighten the screws at base. Note that the housing should be positioned between the base and the nylon washers. The screw heads should not press directly against the housing assembly.

Tip Calibration	Water Quantity
0.01” (standard)	18.53 milliliters
0.20 mm	14.6 milliliters
0.25 mm	18.24 milliliters
0.10 mm (386D and 389D)	7.3 milliliters

Table 4-1 Calibration Quantities

5 MAINTENANCE AND TROUBLESHOOTING

The following maintenance should be performed on the 385D at six-month intervals.*

1. Remove and clean the upper and lower debris screens.
2. Remove the sensor housing assembly and thoroughly clean the collection funnel.
3. Carefully clean both sides of the tipping bucket assembly.
4. Clean the lower drain screen in the base of the sensor.
5. Do **NOT** lubricate the pivot shafts, as any lubricant may attract dust and dirt.
6. Verify the bucket moves freely and that the translator card or datalogger registers 0.01” (or as calibrated) for each bucket tip.

*Based on average to adverse environments.

6 SPARE PARTS and ACCESSORIES

The following parts are available from Met One Instruments for maintenance, replacement, service, and upgrades. If unsure about a part, please contact the Service department and provide the serial number of the rain gauge. Some of these parts may require technical skills or special considerations before use or installation.

Item No.	Part No.	Description
1	10825	Assembly, Tip Bucket (0.1 mm, 387D, 389D)
1	10837	Assembly, Tip Bucket (0.01”, 0.2 mm, 0.25 mm)
2	10840	Pivot Block Assembly
3	340070	Barrier, Strip – 3 pos
4	480210	Nut, Crown, Nylon #8-32
5	2598	Screen, Base
6	2503	Screen, Primary Top
7	480510	Clamp, Liquid-Tight
8	2934	Reed Switch Cartridge
9	2936	Adjustable Magnet Bracket
10	2937	Lightning Protection Diode
11	1566	Standard Cable Assembly
12	2504	Screen, Secondary
13	10183	Assembly, Housing/Funnel, 12 inch, Heated 220 VAC
13	2398	Assembly, Housing/Funnel, 12 inch, Heated 110 VAC
14	2516	Foot

Table 6-1 Replacement Parts

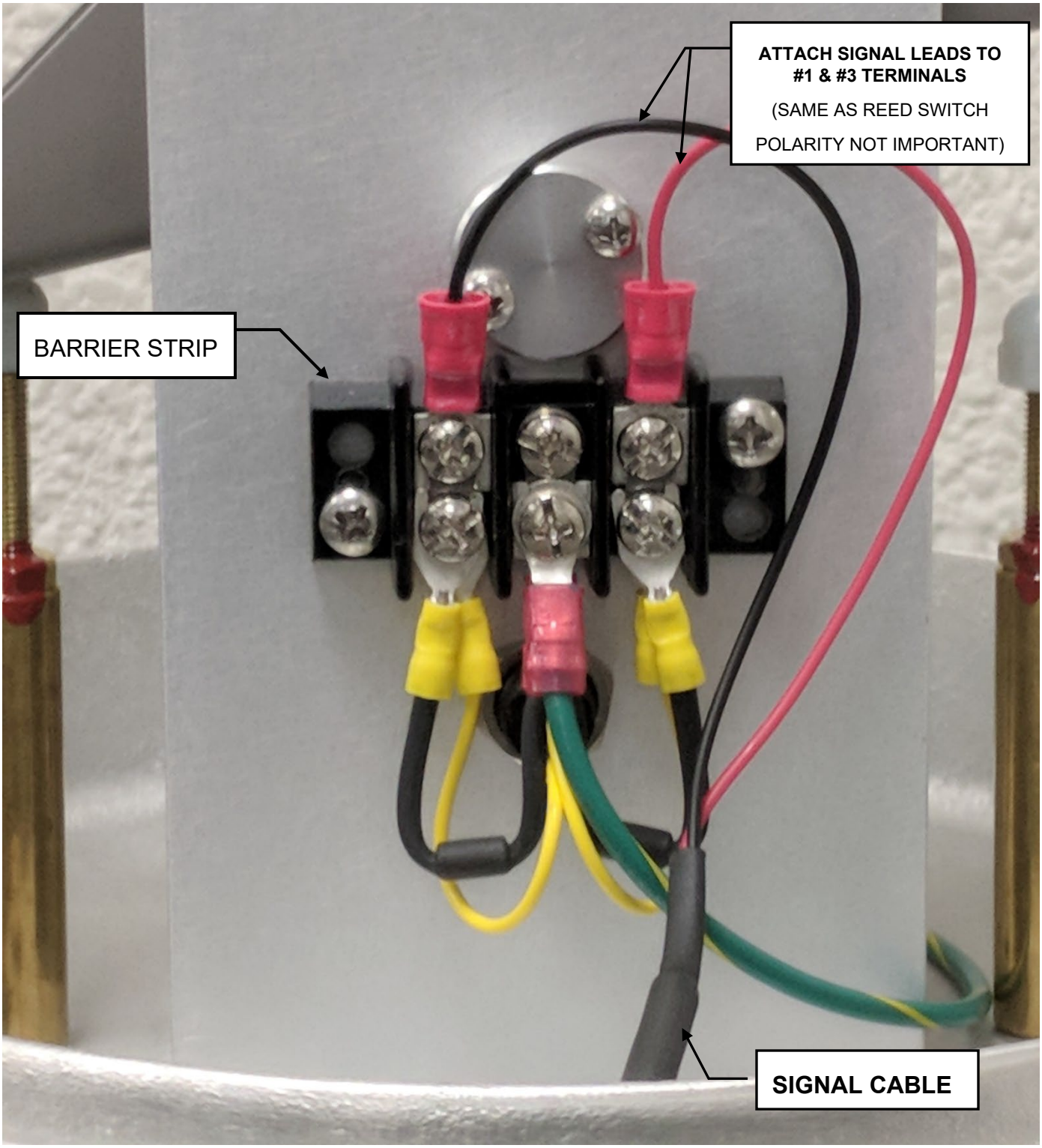

Figure 6-1 385D Internal Wiring

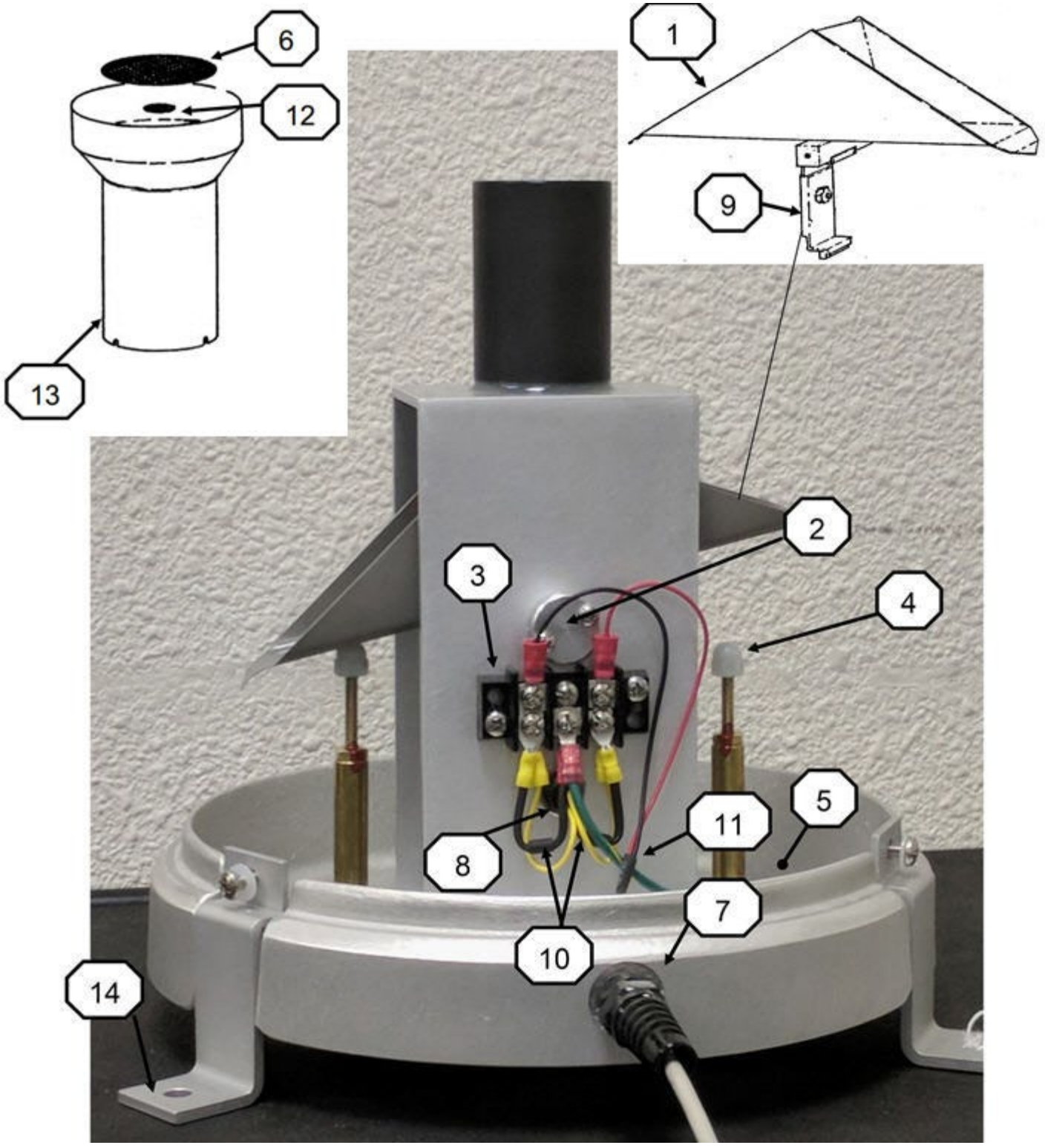

Figure 6-2 385D Parts (Heater AC Power Junction Box Not Shown)

Manual Notes: