Automatic Weather Station with ATW3 Tower

Installation Manual

Issued 24.5.10

CSL 267

Guarantee

This equipment is guaranteed against defects in materials and workmanship. This guarantee applies for twelve months from date of delivery. We will repair or replace products which prove to be defective during the guarantee period provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

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Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

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PLEASE READ FIRST

About this manual

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

Some useful conversion factors:

Area:	1 in^2 (square inch) = 645 mm^2	**Mass:**	1 oz. (ounce) = 28.35 g 1 lb (pound weight) = 0.454 kg
Length:	1 in. (inch) = 25.4 mm 1 ft (foot) = 304.8 mm 1 yard = 0.914 m 1 mile = 1.609 km	**Pressure:**	1 psi (lb/in^2) = 68.95 mb
		Volume:	1 UK pint = 568.3 ml 1 UK gallon = 4.546 litres 1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a "#" symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information

At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.

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Automatic Weather Station with ATW3 3-metre Tower

Thank you for buying a Campbell Scientific Automatic Weather Station (AWS). Please read this Installation Manual carefully before attempting to use the AWS, as it contains important information about siting, assembly, and maintenance.

The manual also includes introductory information about programming. Using this information and the other instruction manuals provided, you should be able to start making measurements fairly quickly. Please remember, however, that the AWS is sophisticated scientific equipment, and as such it may take some time for you to become familiar with its use.

We recommend that you begin by reading through the manual to become familiar with its content, identifying the parts of the AWS as you do so. When you are ready for assembly, go back a second time, following the instructions given.

1. Choosing the Location

The siting of the Automatic Weather Station is crucial. This section briefly describes several factors which can affect the results obtained. Please read through this information before deciding where to locate your AWS.

NOTE The descriptions in this Section are not exhaustive; for further information please refer to meteorological publications.

The objective of any data collection exercise is to obtain data that is accurate, reliable and representative. Accuracy and reliability depend mostly on the correct selection and use of sensors. Data 'representativeness' refers to the extent to which the values recorded are typical of the site or location in which the sensors are placed.

Automatic weather stations are often used to provide local meteorological measurements that otherwise could only be obtained from a 'standard' meteoro-logical site, perhaps some inconvenient distance away. In this case the AWS should be exposed in a similar way to the instruments on the standard site, i.e. over a short grass surface that is level and not shielded by trees or buildings. The standard site is designed to allow representative measurements of local weather and not of a specific microclimate. It is important that the instruments are positioned at a similar height to those on other meteorological sites; in the UK, measurements of air temperature and humidity are normally made with a Stevenson Screen at 1.2m above the ground. A standard height for anemometers on such a site is 10m, but 2-3m is considered acceptable for semi-permanent installations.

In other cases, an AWS is required to measure the true conditions at a site — possibly to determine how much these differ from the standard conditions measured over a regional network of meteorological stations. Here, the AWS should be exposed over a relatively uniform area of terrain. Some care is required in interpreting the measurements obtained, however, because gradients of air temperature, humidity and wind speed increase as the distance from the surface decreases.

As an example, consider an AWS sited in a crop of newly planted corn with the anemometer 2m above the ground. The measured wind speed will decrease markedly as the crop grows because the distance between the instrument and the surface is continually reducing. At harvest the anemometer may be only 20 or 30cm above the upper foliage and the measured wind speed will be slow. This is a true representation of conditions at the height of the anemometer; it is effectively a microclimatic measurement that is not representative of the general conditions in the region.

1.1 The Effects of Varying Environmental Conditions

This section describes three ways in which local conditions such as moisture or the presence of vegetation can affect the measurements taken by an AWS. These effects are well documented and further details can be found in the meteorological literature.

1.1.1 The Clothesline Effect

The clothesline effect in its simplest form describes the effect of air passing from dry, unvegetated surfaces to moist, vegetated surfaces and the consequent effect on vapour gradients and heat transfer. This should be carefully considered when siting an AWS in crops or near trees when the wind direction is mostly towards the vegetation.

1.1.2 The Leading Edge Effect

This effect occurs when air moves over a surface that differs in temperature, moisture content, roughness or some other characteristic from an adjacent surface. The line of discontinuity is known as the leading edge. As air passes over the leading edge its characteristics gradually adjust to the new surface. This internal boundary layer varies in vertical extent with distance from the leading edge. A transitional zone exists where the air is modified but not adjusted to the new surface. These effects become most pronounced when advection (horizontal air flow) is strongest. There are no universally accepted figures for the height of this internal boundary layer as it is influenced by the nature of the surface and the extent of any advection.

1.1.3 The Oasis Effect

The oasis effect occurs when an isolated moisture source is surrounded by an otherwise arid region. If the wind direction is such that moist air is drawn from the surface of the water body (or other water source such as a glacier or area of vegetation), then the relative humidity measurements do not represent the general conditions in the region.

1.2 Obstructions

Whenever possible, the AWS should be located away from windbreaks or shelterbelts. Several zones have been identified upwind and downwind of a windbreak in which the airflow is unrepresentative of the general speed and direction. Eddies are generated in the lee of the windbreak and air is displaced upwind of it. The height and depth of these affected zones varies with the height and to some extent the density of the obstacle.

Generally, a structure disturbs the airflow in an upwind direction for a distance of about twice the height of the structure, and in a downwind direction for a distance of about six times the height. The airflow is also affected to a vertical distance of about twice the height of the structure. Ideally, therefore, the AWS should be located outside this zone of influence in order to obtain representative values for the region (see Figure 1).

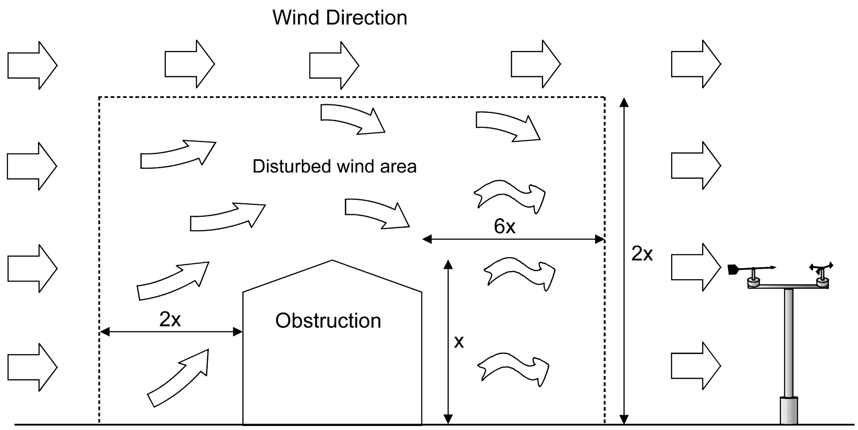

Figure 1 Effect of Structure on Air Flow

1.3 Siting on Roofs

Automatic weather stations are commonly located on roof surfaces and interrogated from a room below. There are several inherent problems with this. The urban environment can generate its own climate and even smaller scale microclimates are possible, depending on the building materials and design. High air temperatures caused by heat convected or conducted from the surface of the building are the most obvious source of error. Also, the physical and radiative properties of the building fabric are important, for example, in determining heat loading. Thus, a high albedo (surface reflectivity) may cause high irradiance values as incoming solar radiation is reflected onto the sensor from the surrounding walls.

NOTE Before mounting any equipment onto a roof, a careful survey must be made of the suitability of the roof structure to carry such equipment. A roof mounting kit can be supplied for the ATW3 Weather Station – please contact Campbell Scientific for details.

1.4 The Effects of an Urban Environment

- If your weather station has a net radiometer be particularly cautious when siting it in a built-up area as building temperature, sky view factors and other variables affect the short-wave and long-wave components of the calculation of net radiation.
- The impervious nature of an urban surface compared to surrounding rural areas, together with the efficient channelling of water as surface run-off, leads to a generally drier environment. However, the ponding of water that occurs, for example, on flat roofs, can also lead to local areas of high relative humidity.
- Wind speeds are generally lower in urban areas compared to more exposed rural locations. However, aspects of city design and building geometry can combine to create areas of high or low wind speeds because of the funnelling of air.

2. Preparation

A typical automatic weather station consists of:

- CR1000 datalogger
- ATW3 3m Aluminium Tower and steel mounting legs (or roof mounting kit)
- ENC 12/14 White GRP Enclosure with an integral power supply
- HMP45C Temperature and Relative Humidity Probe with URS1 Unaspirated Radiation Shield
- 05103 R M Young Wind Monitor
- SP1110 Pyranometer and SKE211 Pyranometer Levelling Fixture
- 018E Pyranometer and Wind Monitor Mounting Arm
- ARG100 Tipping Bucket Raingauge

NOTE This equipment list represents a typical configuration. Your weather station may have different or additional sensors, or you may have a lead-acid power supply with a solar panel. If you have any difficulty assembling or using your weather station after reading this Installation Manual please contact Campbell Scientific for help.

To install the station you will need:

- A spirit level
- A tape measure
- Rustproofing compound (user supplied such as `Waxoyl')
- An adjustable spanner
- A range of standard and Phillips screwdrivers
- A compass (for wind direction orientation)
- Cable ties (supplied)
- A set of Allen hex keys (at least a 6mm for the tri-clamps)
- Suitable lengths of appropriate cable for:
  a) The connection of the AC adaptors (AC-ADAPT and AC-ADAPT2) to the PS100E charger and power supply unit
  b) The interconnection of short haul modems
  c) The extension of telephone cables to the datalogger enclosure

If you do not have a remote communications link to the weather station, you will need the following items to test a CR1000-based system:

Either

- A CR100KD Keyboard/Display (connected to the datalogger with an SC12 cable)

or

- A laptop PC running appropriate Campbell Scientific datalogger Support Software and connection cable.

Other items may be needed depending on the nature of the installation. These include:

- Silicone rubber sealant
- A protractor (for adjusting solar panel angle)
- Step ladders (for installing sensors and levelling pyranometer)

Under normal conditions, assembly should take one person less than one day (depending on the curing time for the concrete base). All steps in the assembly procedure can be undertaken by one person, although some tasks, such as setting the wind sensor to true north, are easier with two. Ensure that the base is fully hardened before commissioning the station.

3. Tower Assembly

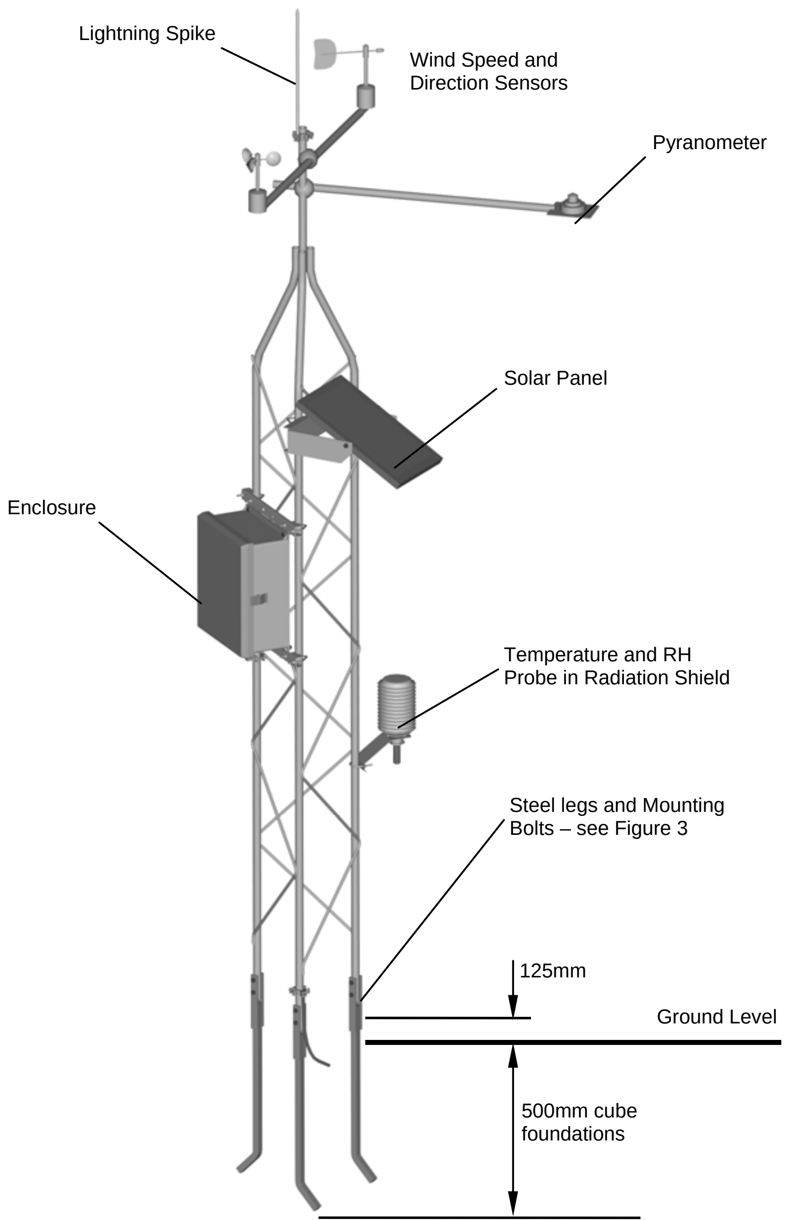

Figure 2 Typical ATW3 Weather Station

3.1 Prepare the Site

3.1.1 Ground Mounting

The tower is supplied with three steel legs which must be concreted into the ground.

Excavate a hole in the ground in the position where the tower is to be erected. The dimensions of the hole depend on site conditions and the texture of the soil. As a general guide, in reasonable soil conditions, a hole 0.5m by 0.5m square by 0.5m deep is big enough for the ATW3 tower. In light sandy soils increase these dimensions by about 50% to ensure that the tower is securely anchored at its base.

The volume of concrete can be calculated from the hole dimensions. Again as a general guide, wet concrete mixture weighs about 2.2 tonnes per cubic metre. A hole 0.5m x 0.5m x 0.5m will need 0.125m^3, i.e. about 275kg of mixture.

3.1.2 Roof Mounting

A mounting assembly enabling the ATW3 to be mounted on a flat roof is available to special order. Before considering this option, please ensure that the roof has been surveyed to verify its suitability both for physical mounting requirements and induced stress caused by wind loading on the structure. Please contact Campbell Scientific for further details.

3.2 Position the Tower

1. After the hole has been excavated, secure the steel legs to the aluminium tower using the bolts provided, ensuring that the bent portions at the lower end of the legs face outwards. The legs are designed so that they can act as a pivot, allowing the tower to be tilted to the ground if required. If you will need to tilt the tower, make sure that you set the legs so that the tower can be installed and tilted in the required direction. Tilting is achieved by removing both bolts in the rear leg and the lower bolts in the other two legs, as shown in Figure 3, below.

2. Place the tower, with legs fitted, in an upright position in the centre of the hole. If the hole is 0.5m deep the steel legs can rest on the bottom of the hole but if the hole is deeper than 0.5m it may be necessary to either provide a support for the legs or pour some of the concrete mixture to provide a base.

NOTE If you will be tilting the tower at some future date, ensure that the direction of tilt is in the direction required.

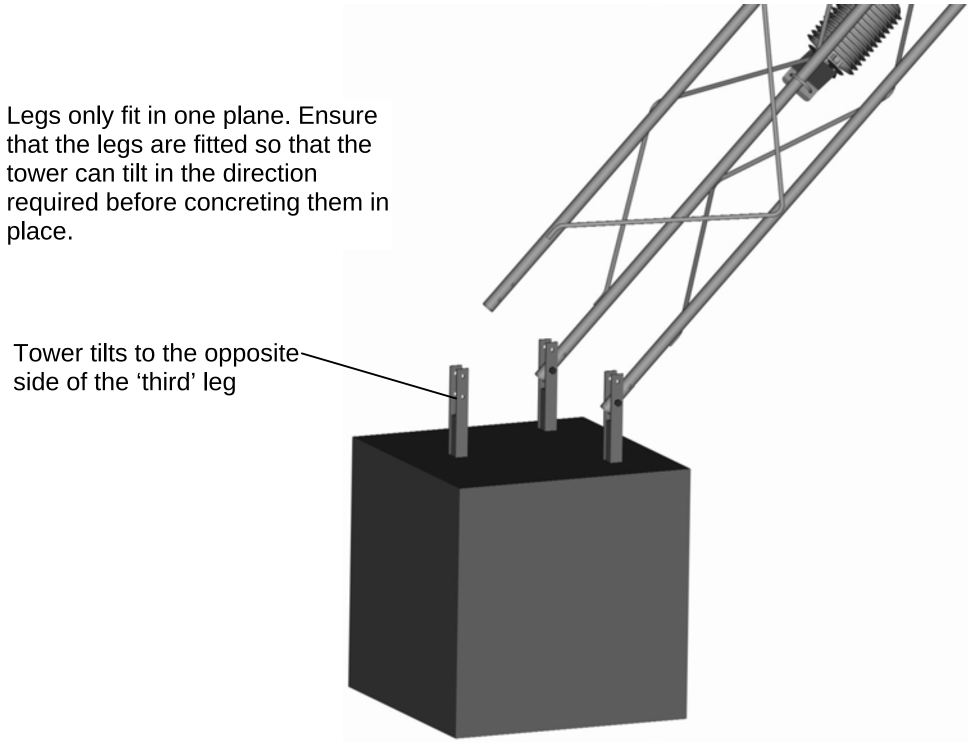

Figure 3 Fitting the Tower to the Legs

3. Pour the concrete mixture into the hole and check that the tower is upright using a spirit level. Ensure that the bolts securing the tower to the legs are at least 125mm above the final surface of the concrete mixture (see Figure 4).

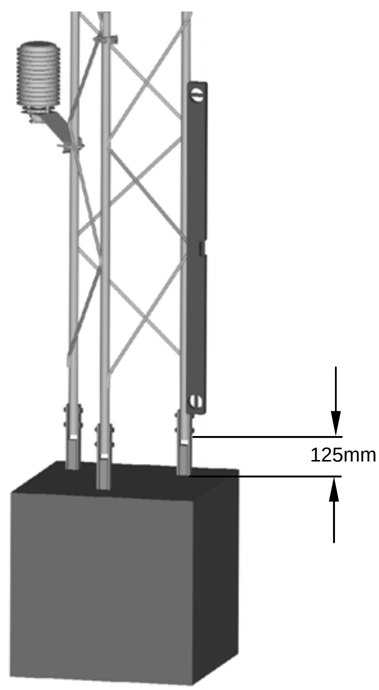

Figure 4 Levelling the Tower

It may help to use guy ropes or other supports to secure the tower until the concrete mixture sets. If the mixture is relatively dry (which is stronger than being too wet), tap the legs lightly with a hammer to encourage the mixture to settle around the legs and sides of the hole. Compact the concrete and level with a trowel.

4. System Assembly

Allow the base to set completely (allow at least 24 hours) before attempting to assemble the system. The instructions in this section assume that assembly will be done with the tower upright, either by reaching from the ground or by using a step ladder. If assembly is done with the tower on the ground, levelling operations must be done separately after erecting the completed weather station.

The steel legs are galvanised and do not require treating with rustproofing compounds.

4.1 Enclosure mounting

The tower mount enclosure option is used to attach our enclosures to the ATW3 tower. An enclosure ordered with the tower mount option will be shipped with a three-piece bracket for fitting to the top of the enclosure and an identical three-piece bracket for fitting to the bottom of the enclosure. For the ATW3 the distance between the centres of each flange needs to be 31 cm (see Figures 5, 6, and 7).

Attach the enclosure to the tower as follows:

1. Remove the bolts and nuts connecting the bracket to the enclosure.
2. Slide out the flange sections so that the distance between the centres of each flange is 31 cm (see Figure 5).
3. Reattach the bracket to the enclosure using the original bolts and nuts.
4. Position the enclosure on the north side of the mast.
5. Place the enclosure at the desired height. Please note that the recommended lead lengths for our sensors assume the bottom of the enclosure is 90 cm from the ground.
6. Use the furnished 46 mm centre u-bolts to secure the enclosure to the tower legs.

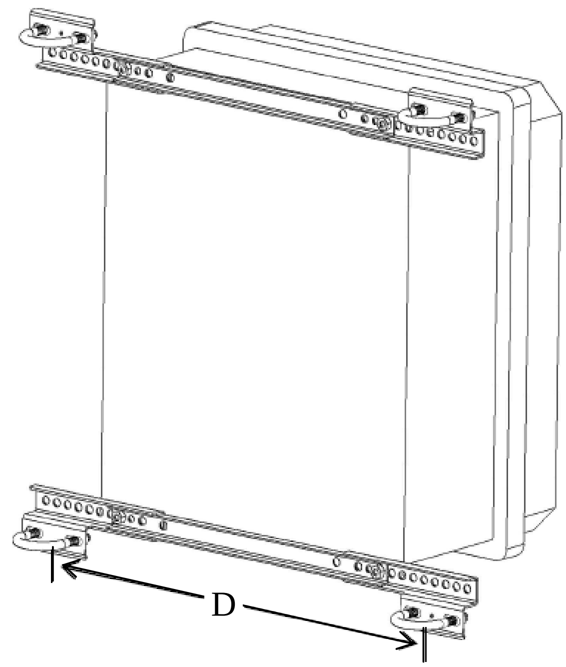

Figure 5. Enclosure brackets configured for a tower mount.

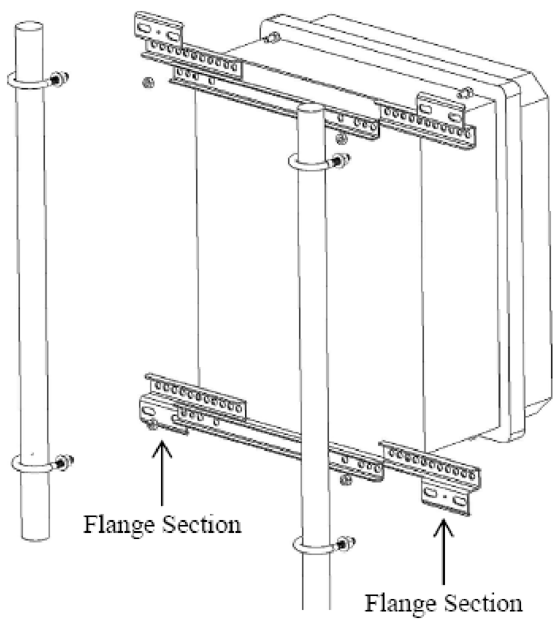

Figure 6. This exploded view shows the components of a tower mount bracket option.

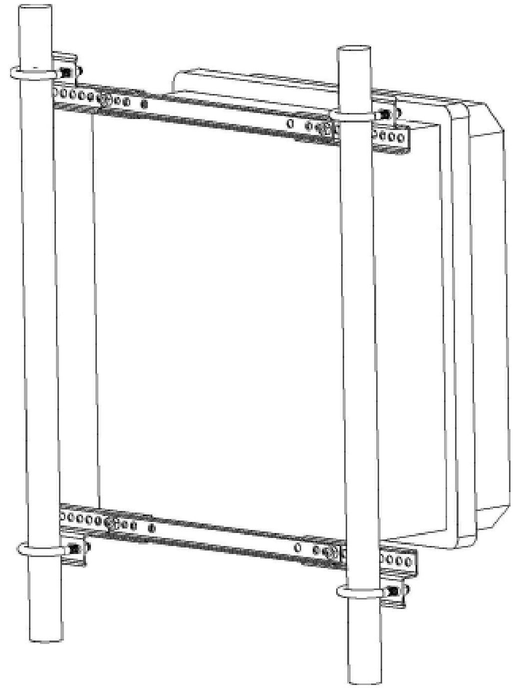

Figure 7. An enclosure attached to two tower legs.

4.2 Sensors, arms and brackets

This section describes a range of crossarms and brackets that are used to mount sensors on the tripod or mast. Typically, one or more crossarms are used with sensors mounted at the end of the arms, using brackets which are attached to the arms.

NOTE

1. This section does not cover sensors which may not be mounted on the mast (e.g. tipping bucket raingauge) or which are not part of a standard weather station (e.g. snow depth gauge). For installation details for these sensors please refer to the manuals provided or contact Campbell Scientific for assistance.

2. This Section describes four different sensor mounting arms. Most weather stations will only use one or two of these arms. When there is more than one arm, ensure that wind sensors are on the higher arm so that the other arm does not affect the wind measurements.

4.2.1 Mounting Brackets

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

V-bolt Description	OD Range
46 mm	25 to 38 mm
62 mm	33 to 54 mm
62 m w/plastic V-block	25 to 54 mm

Some of the brackets (e.g. the CM210) include 38 mm and 50 mm V-bolts to extend the range of pipe diameters that the bracket can accommodate. Brackets with holes for a 38 mm V-bolt will accept a user-supplied 44 mm V-bolt.

4.2.2 CM200E Crossarms and the CM210E Crossarm Mounting Kit

CM200E series crossarms include a CM210E bracket as shown in Figure 8.

Attach the CM202E (0.6 m, 2ft), CM204E (1.2 m, 4ft), or CM206E (1.8 m, 6 ft) crossarm to the tower as shown in Figure 8. For wind sensors, the crossarm should be approximately 2.62 m above the ground for a 3 m mounting height. Typically, the crossarm is oriented East/West for wind sensors, North/South for pyranometers.

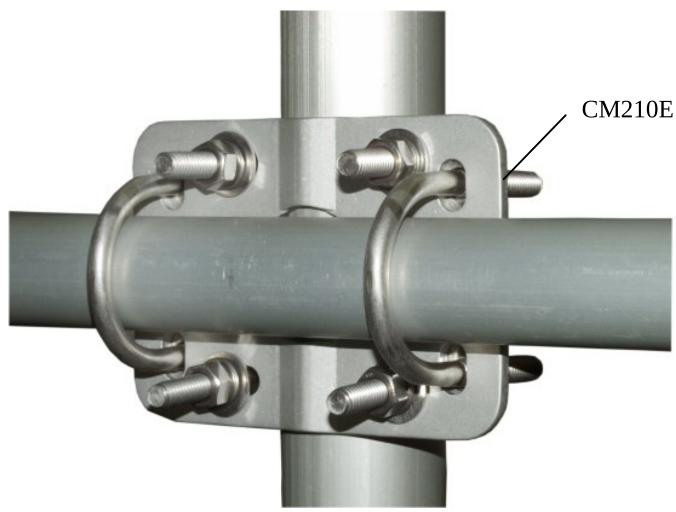

Figure 8. CM210E Crossarm Mounting Kit (shown with user-supplied pipe)

4.2.3 Mounting the Wind Monitor, Wind Sentry or the WXT520 Sensor

These sensors are normally mounted at the end of a crossarm on a 33 mm OD vertical pipe supplied with the sensor. One of two types of brackets are used to mount the pipe.

1) Campbell Scientific offers NU-RAIL® Slip-on Crossover fittings that can be used to mount a sensor with a vertical pipe mount on to a CM202E, CM204E, or CM206E crossarm. Part 008285 is required for sensors that have a 33 mm OD (1” IPS) mounting pipe.

NU-RAIL® Sensor Compatibility
Sensors supplied with 33 mm OD (1" IPS) mounting pipe:

03001 Wind Sentry Set
05103 Wind Monitor
05106 Wind Monitor Marine
05305 Wind Monitor
WXT520

The NU-RAIL® fitting is slid onto the tubes and fixed in place by tightening the `Allen' grub screws (four in total) using the `Allen' key supplied.

Figure 9. NU-RAIL® Fitting

2) An alternative to the NU-RAIL® bracket, is the CM220 bracket, fitted in a similar way as shown in Figure 10 below.

Figure 10. CM220 Right Angle Bracket with a Wind Monitor and vertical pipe

4.2.4 Vector Instruments Wind Speed/Direction Sensors and the 011E Crossarm

The 011E crossarm sensor mount is also supplied with a CM210E bracket. The mast/tripod and 011E arm are normally adjusted so that the cups and vane of the windset are at 3 m height above the ground. Orient the 011E at 90° to the arm with any solar radiation sensor on it. It is recommended that the 011E arm is mounted in an approximately East-West direction to make it easier for wind sensor adjustment – see Appendix A. The crossarm is normally mounted at its midpoint.

Once the wind sensors are mounted, you may need to rotate them to ensure correct wind direction readings or to move the cable to a convenient position. A pair of spacers and long screws are included with the 011E to allow this. In addition, a nylon washer is supplied which can be used to stop the spacer and screw falling out of the crossarm during installation.

Ensure that the crossarm is level in both directions using the spirit level. Mount the wind sensors as follows:

1. Take the stainless steel washer supplied with the sensor and place it over one of the long screws.
2. Push the screw through the 011E from below.
3. Put the spacer over the screw from the top, with the end with the smaller internal diameter facing downwards.
4. Screw the nylon washer onto the free end of the screw for a few threads; it will be a tight fit but can be screwed on by hand. You can now release the screw and spacer without them falling out.
5. Fit the wind sensor onto the screw, orient it appropriately (see below) and tighten the screw to lock it into position. This will push the nylon washer into the recess in the spacer.

NOTE The vane of the direction sensor should be locked into position on the spindle and the body of the sensor oriented so that it points to *true* North — please refer to Appendix A for further details.

CAUTION

1. Ensure that the rotor of the Vector wind speed sensor and the vane of the wind direction sensor are correctly fitted, as described in the sensor manuals. Failure to do so can lead to false measurements or damage to the sensors.
2. Do not attempt to remove the rotor of the wind speed sensor or the vane of the wind direction sensor with the sensors fixed to the crossarm. The correct procedure is described in the sensor manuals.

4.2.5 Pyranometers and Solarimeters using the CM225E Pyranometer Mounting Stand

The CM225E Pyranometer Mounting Stand includes one 62 mm V-bolt with plastic V-block for attaching a solar radiation sensor to a crossarm or mast. Compatible sensors include the SP110, SKP215, CMP3, LP02, SR11 and CS300.

Typically, the CM225E and sensor is mounted at the end of a CM200 series arm in a position where the sensor is not shaded throughout the day. The CM225E can be mounted on a short arm (CM202E) or at the end of a longer arm (CM206E), with a wind sensor at the opposite end on the other side of the mast.

The CM225E stand can also be used with the GPS16X-sensor.

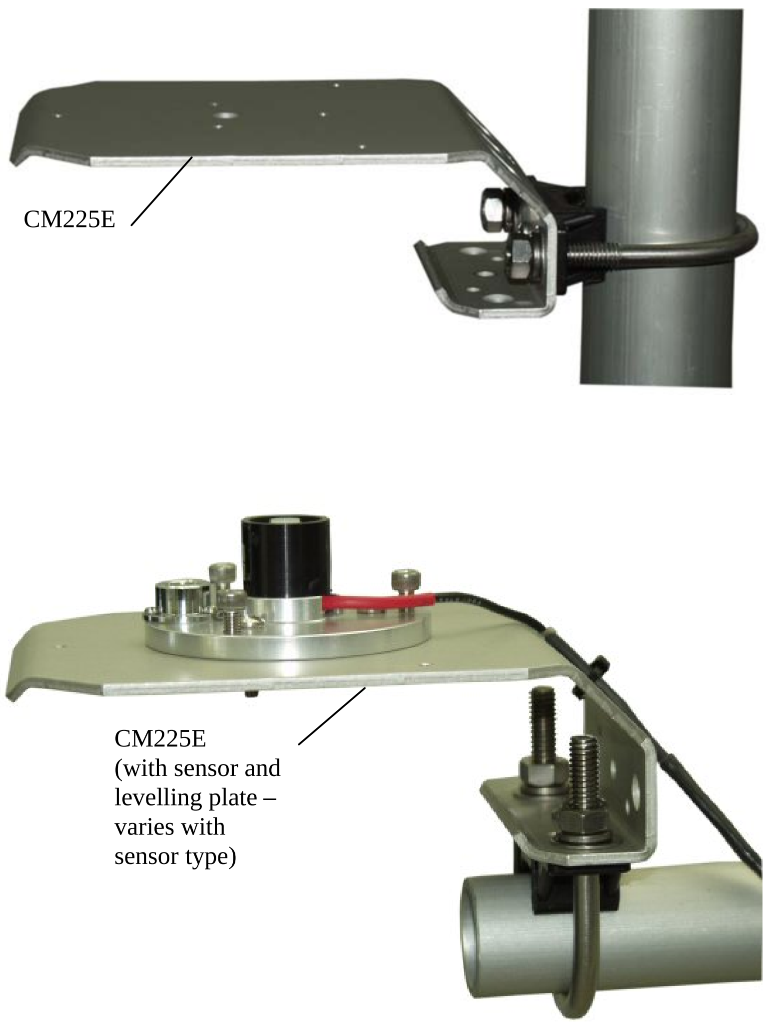

Figure 11. CM225E Pyranometer Mounting Stand

4.2.6 Satellite Antenna using the CM230 Adjustable Angle Mounting Kit

The CM230 mounts an antenna (25-38 mm OD) to a mast or vertical pipe (33-54 mm OD) as shown in Figure 12. The bracket allows the antenna to be adjusted for different angles.

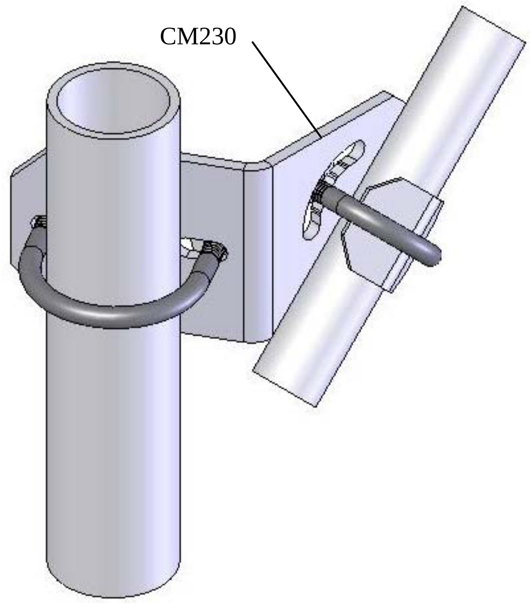

Figure 12. CM230 Adjustable Angle Mounting Kit

4.2.7 Specialist Antenna using the CM235 Magnetic Mounting Stand

The CM235 provides a 8.8 cm square platform for mounting magnetic base antennas. The CM235 attaches to horizontal or vertical pipes (25-54 mm OD) as shown in Figure 13.

Figure 13. CM235 Magnetic Mounting Stand

4.2.8 Temperature/Relative Humidity Probe

The sensor can be inserted into the radiation shield before it is mounted on the tower. This is done by loosening the large hexagonal nut and inserting the sensor into the shield. See the sensor manual for full installation details.

CAUTION The sensor MUST be mounted correctly into the radiation shield both for proper operation and to ensure adequate sealing against water. Please see the sensor manual for detailed instructions.

Secure the radiation shield to the tower with the U-bolt and nuts. For ‘standard’ measurements, the sensor should be secured at a height of 1.2m, although the exact height will depend on the nature of the application.

Figure 14 shows the radiation shield attached to the tower.

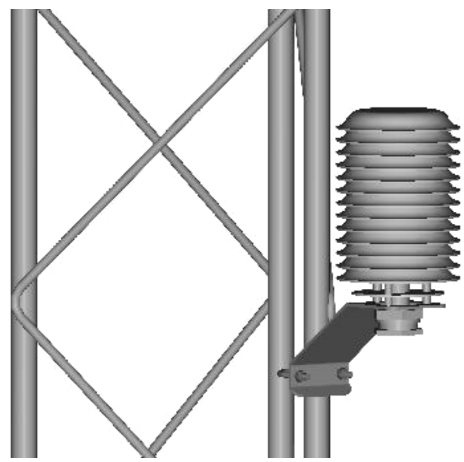

Figure 14 Radiation Shield Mounted on Tower

4.3 Lightning Protection and Grounding

4.3.1 Lightning Protection

For most applications, if the tower has been correctly erected and installed in proper foundations as described in this manual, no further grounding system for the tower should be necessary. An optional grounding system consisting of a lightning spike, two copper-covered steel grounding spikes, grounding wire, clamps and connectors is available for high risk areas (see WARNING below).

Assemble the lightning spike onto the top of the tower using the special clamp as shown in Figure 15, below.

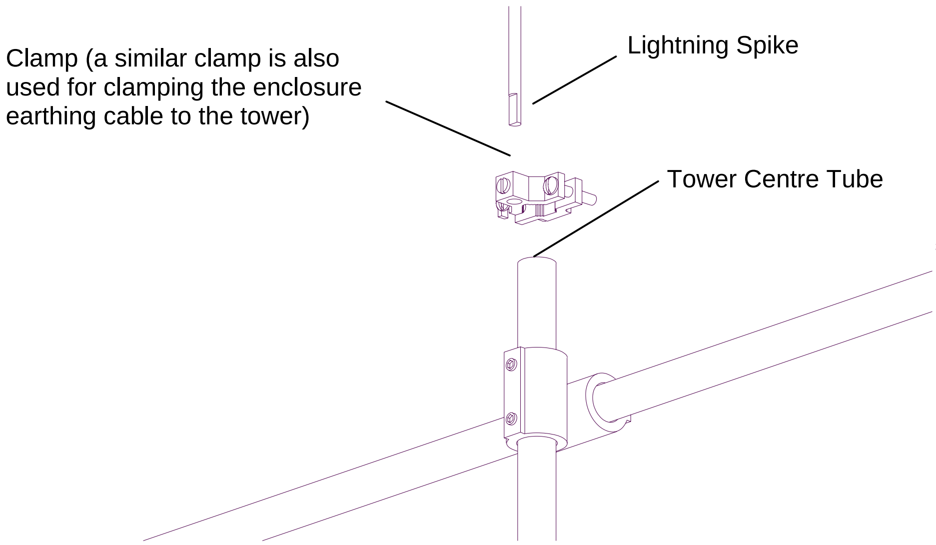

Figure 15 Assembly of Lightning Spike onto Tower

WARNING

A properly assembled and mounted weather station is designed to give the system protection against induced transients and secondary lightning discharges. While the system does offer some protection against lightning damage, if the weather station is installed at a site where frequent direct lightning strikes are likely, Campbell Scientific recommends that you fit the optional grounding kit and, additionally, seek the advice of a specialist lightning protection company.

4.3.2 Grounding the Enclosure

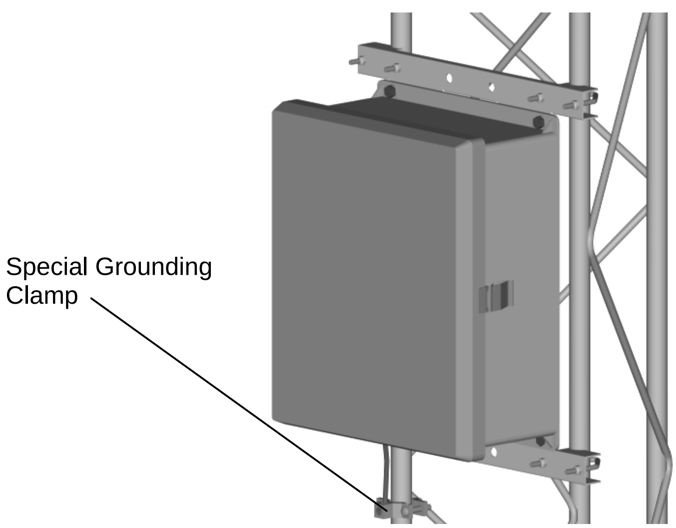

Figure 16 Grounding the Enclosure to the Tower

The enclosure must be electrically grounded to the tower using a length of the yellow/green grounding wire provided. Take the wire from the brass grounding lug on bottom face of the enclosure to the special grounding clamp shown in Figure 16, above.

Fit the grounding clamp to the vertical tower leg on the left hand side of, and about 150 mm below, the enclosure. Insert the grounding wire into the clamp and tighten securely to the tower leg.

4.4 Solar Panel

4.4.1 Mounting

Fix the solar panel to the tower, as shown in Figure 17, in a convenient location and orient it due south (for northern hemisphere applications). For short-term applications the solar panel should be angled to be perpendicular to the solar angle at midday. For longer term unattended applications, such as a 12-month period, the solar panel should be angled to obtain best performance during the winter months. This ‘optimum tilt angle’ is equivalent to the latitude plus 15 degrees facing permanently true south. (Ensure that the solar panel is not cast into shadow by the pyranometer arm at low solar angles.)

NOTE It may be necessary to support the solar panel on a separate mounting pole to avoid other components of the AWS casting shadow onto the panel surface.

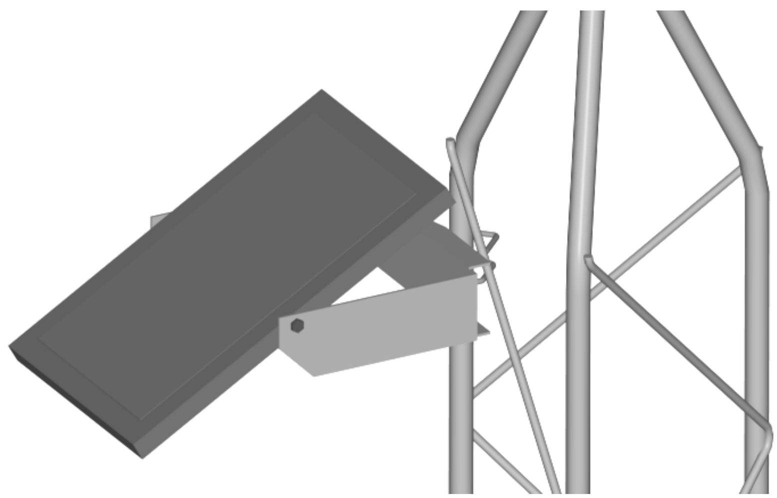

Figure 17 Mounting the Solar Panel

Refer to the solar panel manual for further details.

4.4.2 Connections

With the PS100E Power Supplies

Route the cable from the solar panel into the enclosure via the cable gland or connector (if ordered). Connect it to the charger circuit of the power supply (see power supply manual).

NOTE To connect the solar panel cable to the power supply you may need to cut off the standard connector fitted to it and connect the wires directly to the screw terminals (polarity does not matter).

With External Battery

Please refer to the solar panel manual for full details. Route the power cable from the external battery into the datalogger enclosure and connect it directly to the datalogger.

CAUTION When connecting an SOP18, or a solar panel supplied with a separate regulator, make sure you observe the correct polarity when connecting to the battery. Incorrect connection can destroy the regulator.

4.5 Final Connections

1. Secure all earthing wire and sensor cables to the tower with cable ties.
2. Fit the sensor plugs into the sockets on the base of the enclosure following the connection diagram supplied with each station.
3. Coil up any excess cable and strap it to the tower.

CAUTION It is essential to secure excess cable to the tower as unsecured lengths of cable can blow around in the wind which may cause the wires to break inside, sometimes without any external signs of damage.

4. Make additional connections to and from the datalogger through the large cable gland; any unused plugs or sockets should be sealed off using the sealing caps. Tighten the cable gland and check that it seals properly.

NOTE

1. Cable glands will not seal directly onto most cables, especially when more than one cable enters through a single gland. Please refer to the Maintenance section for details.

2. The small cable gland on ENC series enclosures is for venting purposes but may be used for additional cables *if venting is not needed.* Please refer to the enclosure manual for further details.

5. Communications and Programming

Most new users will probably use Short Cut to program the datalogger. Short Cut is an easy to use program builder, and is part of Campbell Scientific's datalogger support software package, PC200W. Short Cut covers all the standard sensors and produces a wiring diagram which should always be used when wiring up your sensors and peripherals. The use of Short Cut and the PC200W software is fully explained in the PC200W User Guide.

NOTE If your ATW3 is pre-programmed by Campbell Scientific, this is done using Short Cut. In this case you will be provided with a ‘hard copy’ printout of the Short Cut program and wiring diagram, which can be used for re-programming or backup purposes if required.

If you are a more experienced datalogger programmer, and the programs provided by Short Cut do not fully meet your needs (for example if you wish to use a ‘non-standard’ sensor), then you can write or edit your own programs using the Edlog/CRBasic program editor which is part of the optional PC400 or LoggerNet support software packages. The new or edited program can then be downloaded to the datalogger as described below.

5.1 Using Campbell Scientific Support Software

After installing the software as described in the User Guide, use the datalogger program as follows:

1. Set up the link between your PC and the datalogger (refer to the datalogger manual for cabling).

   If you intend to use a different link (such as a telephone or short-haul modem), consult the instruction manuals for the interfaces you are using.

2. Turn on the datalogger. For a CR1000 with PS100E power supply, connect the power using the in-line connector between the power supply and the datalogger and turn on the switch.

   After turning the datalogger on leave it for at least one minute to complete its power-up tests.

3. Use the Connect function in PC200W, PC400 or LoggerNet to communicate with the AWS as described in the appropriate software manual

4. Also use the Connect or Send function of the software to download your own datalogger program (if the datalogger is not already pre-programmed).

5. Use the other functions of the software as needed. For example, you can set the datalogger clock and monitor the sensor readings to verify that the sensors have been installed correctly. See the appropriate software manual for details.

6. If you want to edit the program use Short Cut, Edlog or the CRBasic Editor as appropriate.

6. Maintenance

6.1 Enclosure

1. Referring to the *ENC 10/12, ENC12/14 and AM-ENC Enclosures Installation Manual*, seal the cable gland if it is used for cable entry.

CAUTION Do not use bath or tile sealant, which gives off corrosive fumes that can damage circuit boards. Use proper electronic grade silicone rubber or plumber’s putty.

2. Place desiccant in the enclosure as described in the *Enclosures Installation Manual*.

CAUTION Failure to use or exchange the desiccant may lead to condensation inside the enclosure. Not only will this lead to corrupted data but in the long term can also cause corrosion which is expensive to repair.

6.2 Inspection

After a few days check that the tower is secure and level.

At least every year (and preferably every six months) check the tower and components for damage.

The desiccant packs in the enclosure should be changed or dried out at an interval which depends on how frequently the enclosure door is opened. Drying may be done by placing in an oven at 120°C for 16 hours. In general the desiccant will last as long as a set of alkaline batteries (4-6 months) if the door is opened for a few minutes each week. More frequent inspections of the datalogger or operation in very wet or humid conditions may require more frequent changing of desiccant. A mineral desiccant is recommended and can be supplied on request.

6.3 Sensors

Please refer to individual sensor manuals for maintenance and calibration procedures.

7. Contacting Campbell Scientific

We trust that your ATW3 Weather Station will give you many years of accurate weather data and trouble free use. If you do have any problems, please check out the troubleshooting guide in Appendix B. Further help and advice is available from your local representative or from Campbell Scientific as shown below:

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Appendix A. Setting a Wind Direction Sensor to True North

To get optimum wind direction data from your weather station, it is recommended that you set up your wind direction sensor with reference to true north (rather than magnetic north). This Appendix provides advice on how to achieve this.

A.1 Magnetic Declination

Magnetic declination is sometimes referred to as the magnetic variation or the magnetic compass correction. It is the angle formed between true north and the projection of the magnetic field vector on the horizontal plane. Magnetic declination varies according to geographical location. In the UK, for instance, it changes by over eight degrees from the most Easterly to the most Westerly points. Also, the magnetic pole tends to wander or drift, so its location can change over time, and so it is recommended that wind direction measurements are made with reference to *true* north.

A.2 Determining True North

The difference between true and magnetic north is easily corrected by adding or subtracting the difference between the two readings as explained below.

True North is usually found by firstly reading a magnetic compass to establish magnetic north and then applying the appropriate correction for magnetic declination (where magnetic declination is the number of degrees between True North and Magnetic North as explained above). The magnetic declination is found by reference to an up-to-date ordnance survey map of the geographical location being considered. Maps are made in relation to true north pole, and will normally indicate the magnetic declination angle in degrees.

Declination angles East of True North are considered negative, and are subtracted from 360 degrees to get True North (see Figure A-1). Declination angles West of True North are considered positive, and are added to 0 degrees to get True North (see Figure A-2). The examples shown below are for a declination angle of 15° East and West respectively.

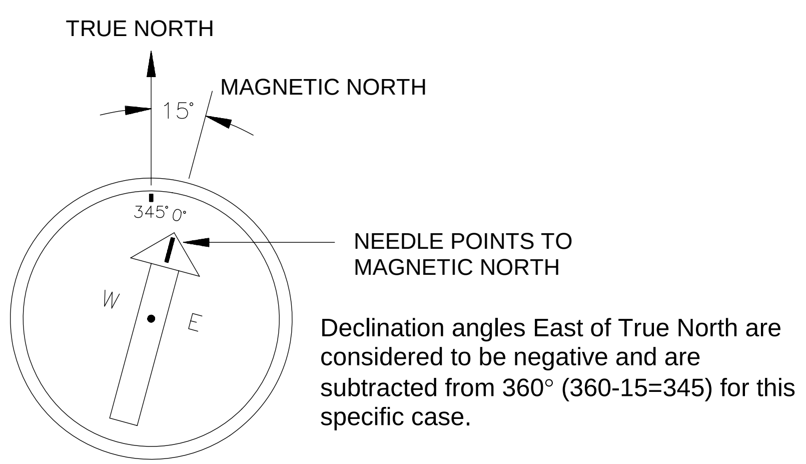

Figure A-1 Declination Angles East of True North

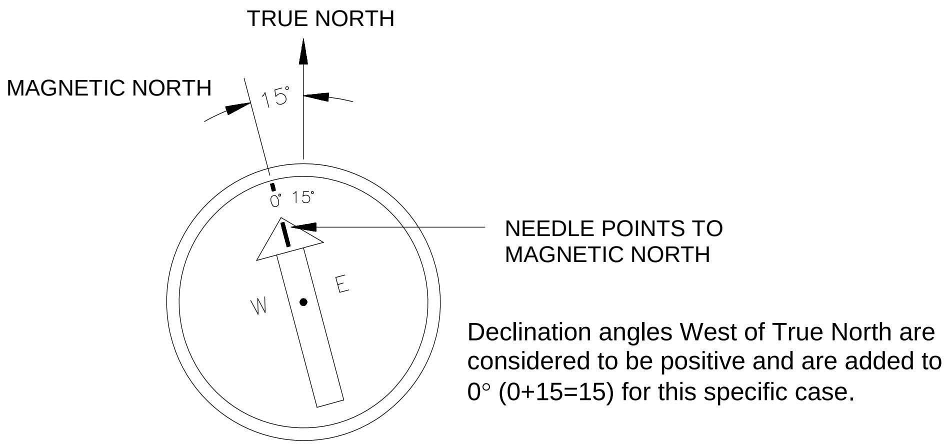

Figure A-2 Declination Angles West of True North

A.3 Setting Up the Wind Direction Sensor on the AWS

Setting up the wind direction sensor for correct orientation is most easily done with two people – one person to aim and adjust the sensor and a second person to observe the wind direction displayed by the datalogger. The procedure is slightly different for the Model 01503 Wind Monitor and the W200P Windvane as indicated in paragraph 4, below. Follow the correct sequence for your sensor:

1. Establish a reference point on the horizon coinciding with True North.

2. Sight down the instrument centre line and aim the nose cone or counterweight at this reference point.

3. Display the input location for wind direction using the *6 Mode on the datalogger, or, if connected to a PC, use the monitoring facility in your datalogger support software (see software manual for details).

4a. *For the 05103 Wind Monitor only:*
Loosen the *lower* ‘orientation’ fitting band clamp (do not loosen the upper clamp).

4b. *For the W200P Potentiometer Windvane only:*
Loosen the setscrew which clamps the windvane body to the mounting plate. Note that the mounting arm for the windvane should normally be oriented in an East–West direction. This will ensure that, when aligning the windvane to true North, body movement will not be restricted by the connecting cable.

5. While holding the vane in position, slowly rotate the sensor base until the datalogger indicates 0 degrees.

6. Re-tighten the band clamp (Wind Monitor) or the setscrew (Windvane). Ensure that the instrument is mounted vertically – check with a spirit level if necessary.

Appendix B. Troubleshooting

If your Automatic Weather Station seems to be operating incorrectly, there are a number of checks you can make to help isolate the problem. These checks may enable you to solve the problem, but, in any case, will give you some basic facts to pass on to an engineer if you need to contact Campbell Scientific.

B.1 No Response from the Datalogger

Do the following steps:

1. Make sure that the main power supply battery has been installed and connected properly. Ensure that the spade connectors are attached to the correct battery terminals and that the green connector is fully inserted into the power connector point on the datalogger **– see Section 5 of the ATW3 Manual**.
2. Use a voltmeter to measure the voltage between the 12V and G terminals on the datalogger. The voltage must be between 9.6V and 16V DC for correct operation.

If there is still no response from the datalogger, follow the appropriate section below.

B.1.1 Using a PC and Interface – SC929, SC32A or RAD-SRM Modems

1. Make sure that the correct interface and cables are used and securely connected to the CS I/O port on the datalogger and to the RS232 port of the computer **– see Section 5 and the appropriate Interface manuals.**

2. Make sure that the software is correctly installed and the station file is configured on the computer. **See the PC200W/PC208W Manual.**

If you still cannot communicate with the datalogger, please contact your local representative or Campbell Scientific. **See Section 7.**

B.1.2 Using a CR10KD Keyboard/Display

1. Check the CR10KD response after each step in Section B.1 above.

2. Disconnect any sensor wires connected to the 5V or 12V terminals on the datalogger.

3. Reset the datalogger by turning the power ‘OFF’ and then ‘ON’.

If you still cannot get a response from the datalogger, please contact your local representative or Campbell Scientific. **See Section 7.**

B.2 -99999 is Displayed in an Input Location

This indicates an incorrect response from one of the sensors. Check the following:

1. Ensure that the battery voltage is between 9.6V and 16V DC.

2. Check that the sensors are wired to the correct datalogger channel as shown in the sensor wiring tables. If programmed using Short Cut, ensure that the wiring diagram is followed precisely.

NOTE If your ATW3 was pre-programmed by Campbell Scientific, you will have received a 'hard copy' printout of this program. After checking basic connections, as above, it is a good idea to check your current program against the printout and revert to the original program (by reprogramming if necessary) to eliminate programming errors before checking further for sensor and/or hardware problems.

B.3 Unreasonable or Unexpected Results are Displayed in an Input Location

Inspect the appropriate sensor for damage and/or contamination. Check that the sensor is correctly wired, and conforms exactly to the wiring diagram if using Short Cut.

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