

D20[®] RG1 Product Manual

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1. GETTING STARTED

1.1 THE ZEPIRO D2O RG1

The Zepiro® D2O® (Direct-To-Orbit) RG1 is a satellite telemetry solution for digital, pulse type, tipping bucket rain gauges. It is ideally suited to use in remote or difficult to access areas and can transmit from virtually any surface location globally within satellite service areas.

It is a low-powered device designed for endurance, maintenance-free monitoring applications with the included battery capable of providing power for up to three years.

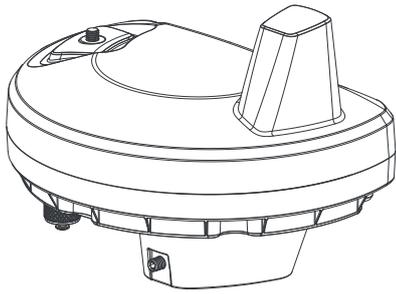
The D2O RG1 records hourly rainfall totals and data messages are created and queued for satellite transmission periodically throughout the day, each containing up to 7 hourly measurements. Messages are sent via a low-earth orbit satellite network back to a terrestrial ground station. From there Zepiro's servers securely recompile the data packets to readable formats and forwards the data to the end user for analysis.

1.2 KEY FEATURES

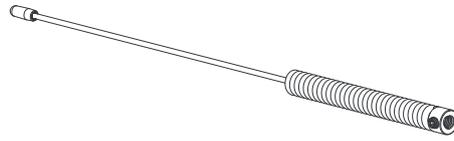
- Integrated satellite transceiver
- Integrated GPS receiver
- Low power micro processor for data acquisition
- Pulse Input, 30uA Bias, Normally Open Contact
- Range up to 819mm/h Rainfall
- Recording Capacity of 52428.8mm before counter roll-over
- Tamper detection and reporting
- Internal non-rechargeable battery pack (serviceable)
- Single protected M12 8-Pin Interface connector to device
- Separate USB interface to allow for "as installed" commissioning and validation via Serial Terminal software
- Self-contained in rugged housing to suit harsh environments (Pending IP67 testing)

1.3 IN THE BOX

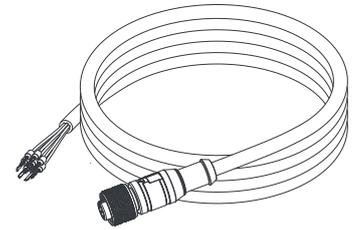
The D20 RG1 is provided with the following items:



Zepiro D20 RG1 Unit



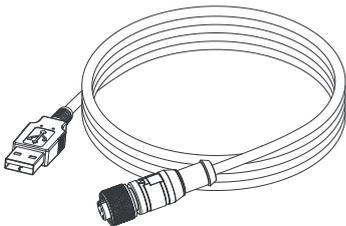
D20 Antenna with securing M4 Grub Screw



8-Pin M12 Interface Cable

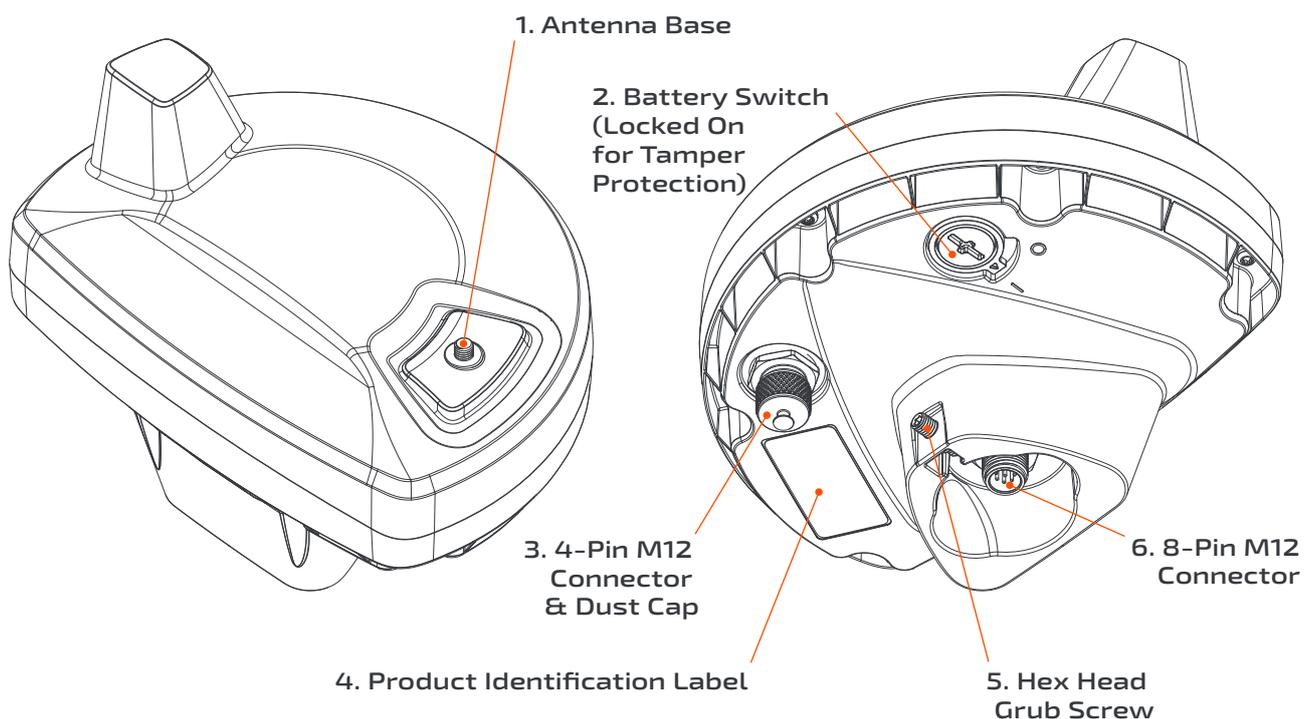
1.4 ACCESSORY ITEMS

The following item is available separately:



4-Pin M12 To USB-A Cable

1.5 D20 UNIT FEATURE IDENTIFICATION



1.6 OTHER TOOLS REQUIRED

Computer

A Computer capable of running a Serial Terminal software application, with a USB-A port, capable of supplying at least 500mA of current.

Serial Terminal Software Application

The Computer must have a Serial Terminal software application installed on the operating system. The D20, once connected to the computer by the **4-Pin M12 To USB-A Cable**, is programmed by a Command Line Interface (CLI) using the Terminal Software application. A recommended terminal application for the Windows® operating system is:

Tera Term

<https://osdn.net/projects/ttssh2/releases/>

2.5mm Allen Key, or Other 2.5mm Hex Drive

A 2.5mm Allen Key or other Hex Drive is needed to fasten the D20's **Hex Head Grub Screw**, which is used to secure the device to its mount.

2.0mm Allen Key, or Other 2.0mm Hex Drive

A 2.0mm Allen Key or other Hex Drive is needed to fasten the Antenna's Hex Head Grub Screw, which is used to secure the **Antenna** to the **Antenna Base**.

2. DATA GUIDE

2.1 INTRODUCTION

The D2O will transmit a range of data during its normal operation. In addition to the regularly transmitted core rain gauge data, the D2O will also periodically transmit system and notification data relating the ongoing operation and health of the device.

Data is optimised for transmission through the satellite network, and is then uncompressed and formatted for analysis by the Zepiro servers before being presented for end use.

The following tables indicate the data that will be transmitted at various times during the D2O deployment.

2.2 RAIN GAUGE DATA

This data includes the readings and parameters associated with the rain gauge input, as well as indicates the data integrity. This data is typically transmitted 4 times a day.

DATA	DESCRIPTION
Total mm	The total rainfall that has been recorded in millimetres since the D2O's initial deployment
Data Points	Up to 7 hourly measurements of rainfall in mm, to 0.1mm precision, individually timestamped. The number of measurements included in an individual message will vary within a 24hr period based on synchronisation time settings
Battery Charge	The remaining battery charge of the D2O as a percentage, at 1% resolution
Device Integrity Info	Basic information to indicate that the system is performing as intended without alert, tamper or fault

2.3 SYSTEM DATA

System data includes diagnostic information about the D2O and is key to understanding how the unit is performing. This data is continually updated and is usually transmitted twice a week.

DATA	DESCRIPTION
Battery Information	Includes the current battery voltage and remaining charge level as a percentage
Module Temperature	The temperature of the PCB board within the D2O enclosure in Degrees Centigrade
Current GPS Coordinates	The Global Positioning System (GPS) Latitude and Longitude coordinates in 0.001 resolution
RSSI	The Receiver's background noise level or RSSI (Received Signal Strength Indicator) in dBm
Queue	The remaining storage space in the transmission queue in bytes (0 - 320 bytes)
Sample Counter	The total number of samples taken since the D2O's initial deployment

2.4 NOTIFICATIONS DATA

Notification data includes information on any alert, tamper or fault the D20 may be experiencing. This data is only transmitted if there is an active alert, tamper or fault.

DATA	DESCRIPTION
Alert Data	Reports on alerts (New Battery, Tamper, Login, Memory, Other), including the time that the first alert type was recorded, the elapsed time from first alert to most recent alert, the types of alert recorded and the total number of alerts recorded (of any type).
Tamper Data	Reports the time activated when the internal tamper switch opens (activates)
Fault Data	Reports on faults (Wire Fault, Temperature, Sensor, Failure, Other), including the time that the first fault type was recorded, the elapsed time from first fault to most recent fault, the types of fault recorded and the total number of faults recorded (of any type).

3. INSTALLATION

3.1 ANTENNA BASICS

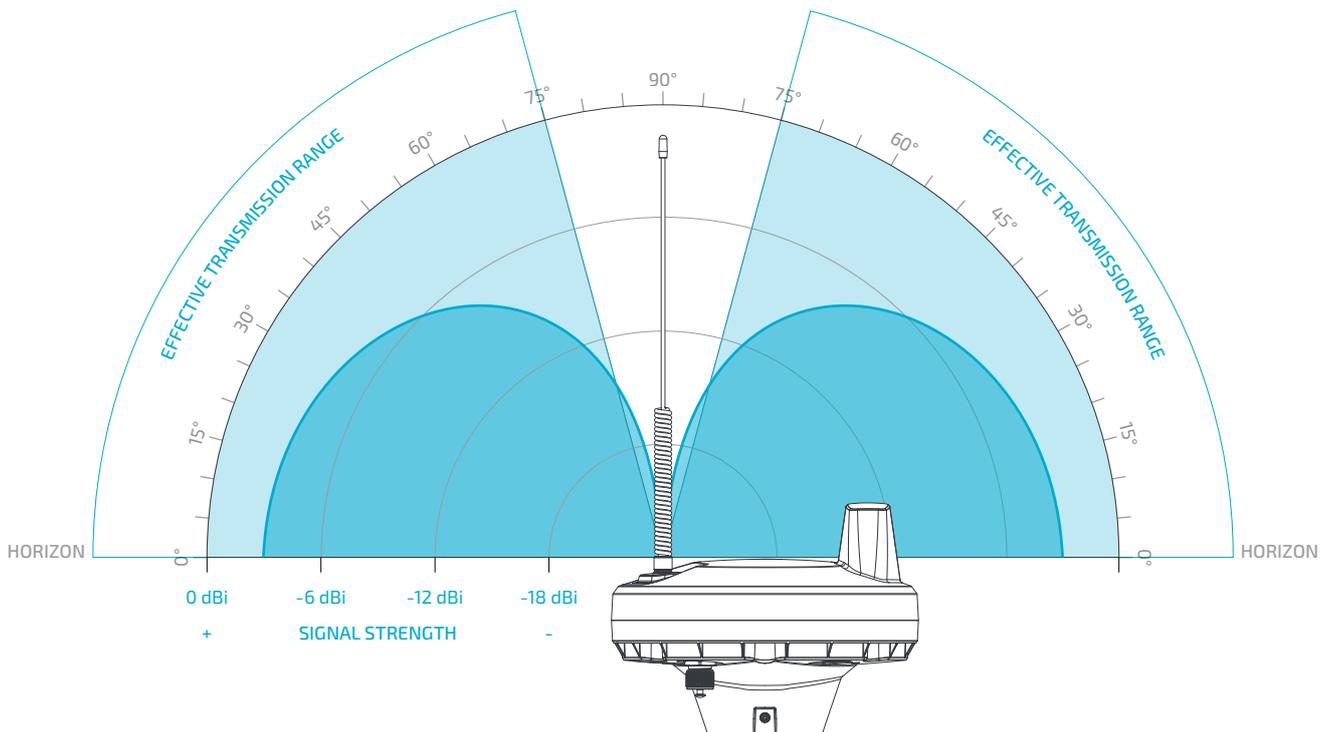
Before deciding on a location to install your D20 unit it is important to understand how the D20 operates.

The D20 uses electromagnetic radio waves to communicate with the individual satellites in a nano-satellite constellation. Transmission and reception of these waves is facilitated by the D20's antennas.

The D20 knows when these orbiting satellites will be transiting through a visible section of sky and transmits messages during this window.

The vertical orientation of the D20's antennas means that it has the strongest transmission and reception abilities in a range perpendicular to the Antenna, emanating in a radial pattern. When a satellite passes through the sky between the horizon, and up to approximately 75° from the horizon the D20 has the greatest opportunity for a successful transmission or reception. Satellite passes below 20° above the horizon have a lower probability of transmission.

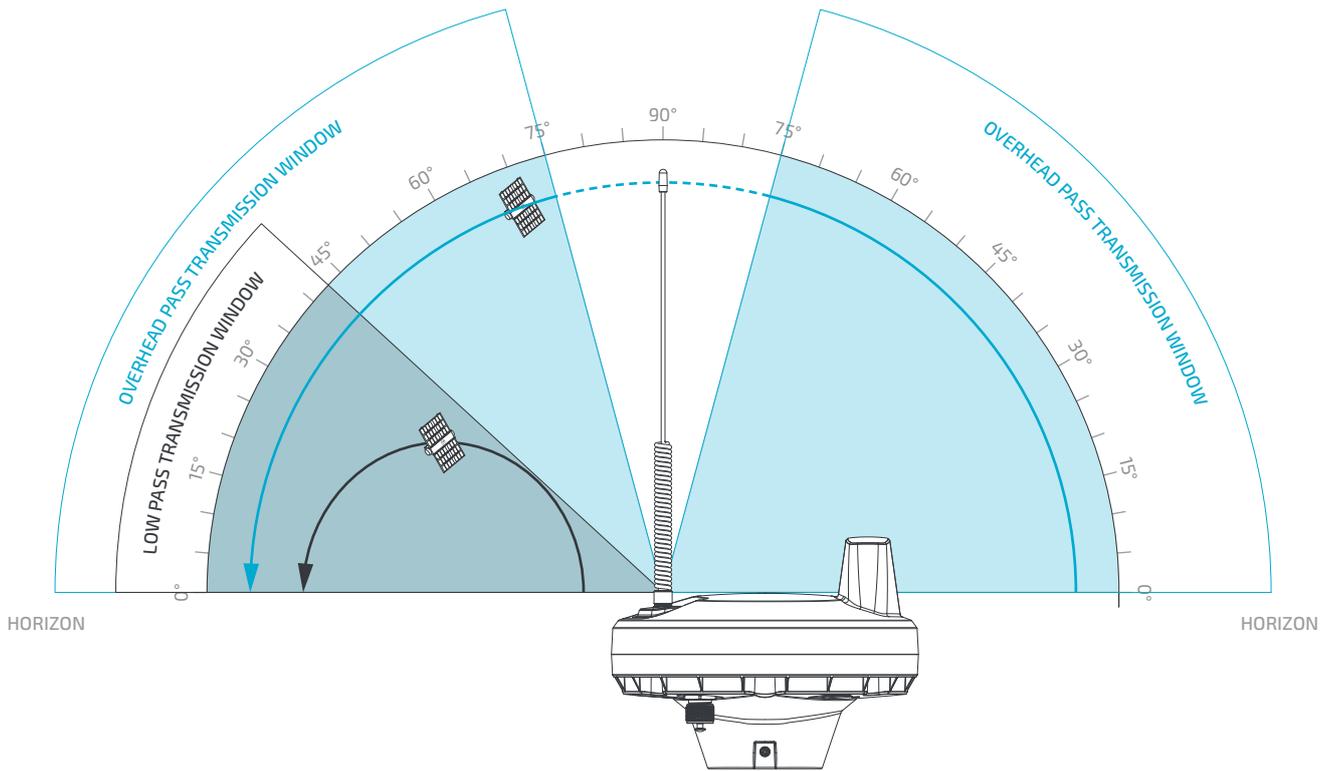
Directly above the Antenna, between 75° and 90° (straight upward), the transmission and reception abilities of the Antenna are poor.



The Antenna gain pattern. The signal strength of the antenna is indicated by the dark arced sections and results in an effective transmission window of approximately 75° from the horizon.

Most satellite passes will occur across a partial section of sky. This is due to the orbital pattern of the satellites and their relationship to the D20's position on earth.

Having a clear line of sight to as much of the sky as possible, and in all directions, will minimise the risk of missed transmission opportunities.



The lighter Blue arrow shows a satellite pass that goes directly overhead, allowing for a long transmission window with a short break while the satellite is directly overhead. The darker Grey arrow indicates a low satellite pass that only appears in the sky briefly, at a few degrees above the horizon. The D20 will experience a mixture of these types of passes.

3.2 SITE SELECTION

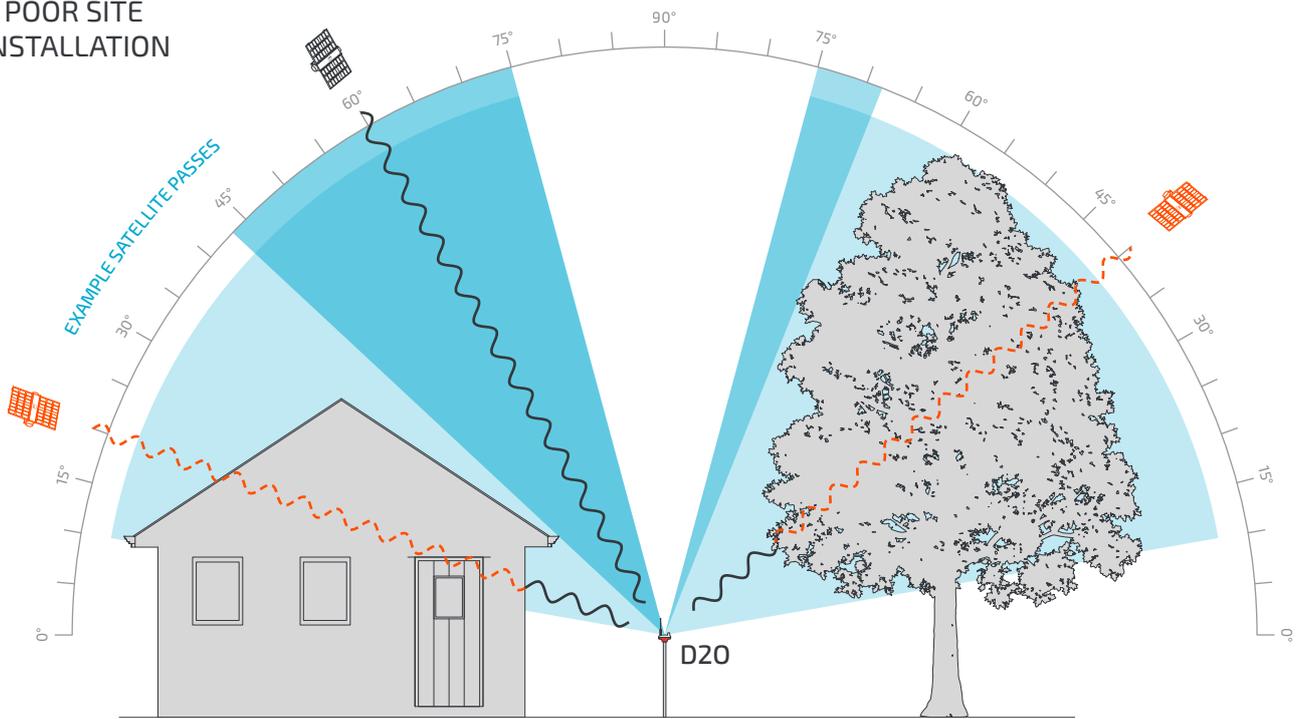
A site should be selected where the D20 unit can see the most sky possible. Where practical the D20 should always be the highest mounted object on top of a mounting post. Avoid placing the D20 in the following locations:

- In close proximity to buildings, fences, poles, or other structures
- Under or near tall trees or dense foliage
- At the bottom of deep canyons or valleys
- Underneath or in close proximity to solar panels, weather stations, or any other type of equipment that may share a mounting post/mast with the D20
- In a mounted position that is at risk of flooding/submersion
- In close proximity to sources of RF interference such as high voltage power lines, mobile phone towers or radio towers

Placing the D20 unit in any of the above situations may restrict, or prohibit, successful transmissions.

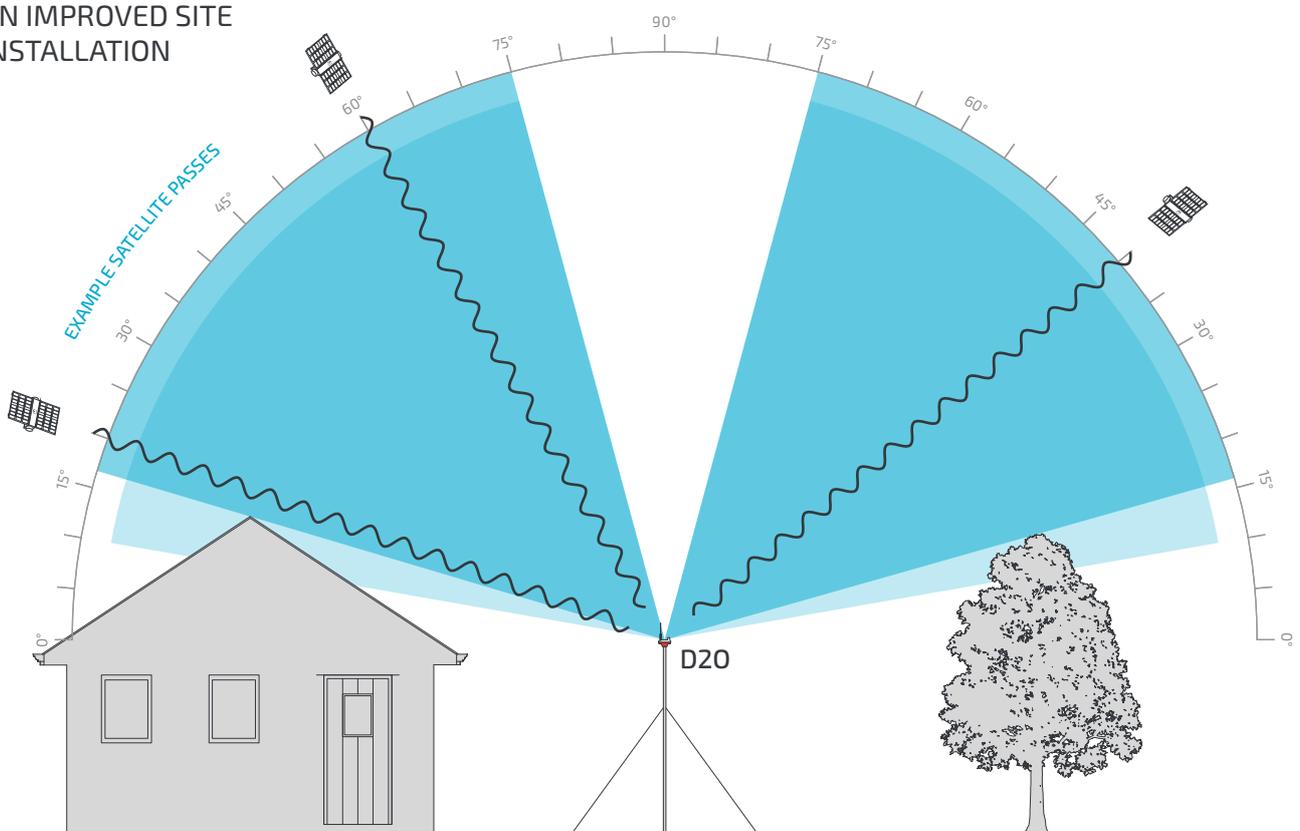
Ideally the D20 should have a clear view of the sky in all directions from 10° above the horizon.

A POOR SITE INSTALLATION



A poor site installation. The proximity to the building and tall trees means that several transmission angles, particularly close to the horizon, may have failed due to an obstruction of the radio waves. The dark segments represent unobstructed transmission angles at this site and the light segments represent the ideal transmission angles.

AN IMPROVED SITE INSTALLATION

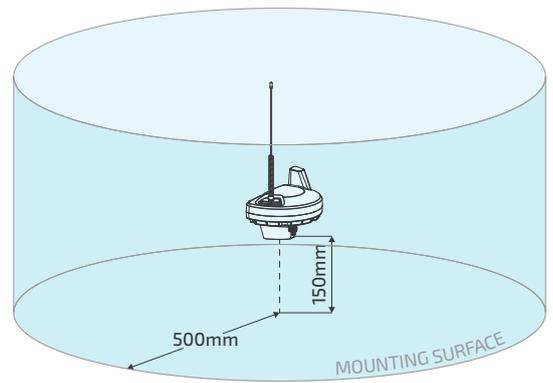


An improved site. The distance to the building has increased and an area with lower surrounding foliage has been selected. To further maximise transmission opportunities the D20 has been placed on a taller mast allowing for a wider view of the sky. Now the overlap of the unobstructed angles (dark segments) has increased to cover almost all of the ideal angles (lighter segments).

3.3 MINIMUM CLEARANCE

Irrespective of the mounting type or scenario, the D20 must have a minimum clearance to the nearest object to avoid Radio Frequency (RF) interference and adverse Antenna influence.

With the exception of the mounting device itself (post, mast etc.), there should be no other surfaces or objects within 150mm below the base of the D20 unit and 500mm radially from the centre of the unit as per the diagram.



3.4 PRE-ASSEMBLY

As a first step the **Antenna** must be installed on the D20 unit before it will function.

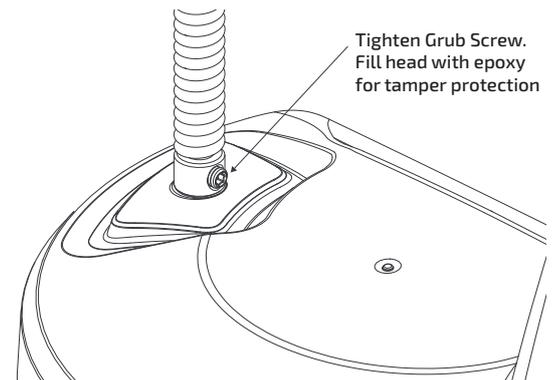
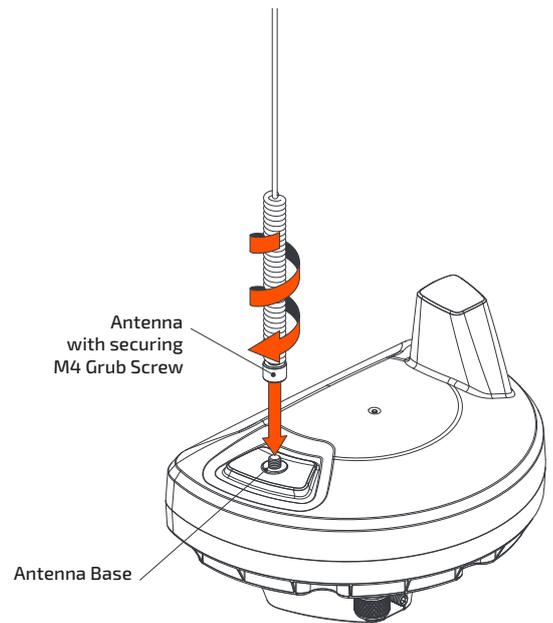


IMPORTANT NOTE:

Extra care should be taken when handling the D20 once the Antenna has been attached. Eye protection is recommended to avoid accidental eye contact with the Antenna tip.

The **Antenna** is then attached by screwing it on the exposed **Antenna Base** thread on the top of the D20 unit. It should be tightened until the **Antenna** contacts the D20 Unit. Do not over-tighten the Antenna as irreparable damage may occur.

Tighten the Antenna's M4 securing Grub Screw until it bites into the Antenna Base thread and prevents the Antenna from being unscrewed by hand. For scenarios where tamper prevention or evidence is require then the Grub Screw head can be epoxy filled.



3.5 D20 INTERFACE CABLE ATTACHMENT

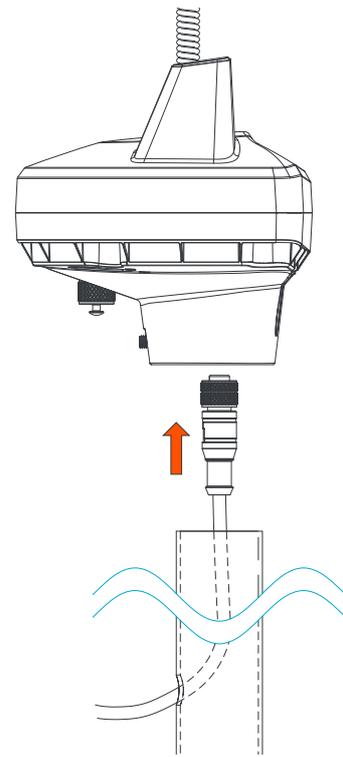
The D20 is capable of being mounted in several ways. In all mounting scenarios it is recommended that the supplied 1.5 meter **8-Pin M12 Interface Cable** is threaded through the mounting device (e.g. a post), emerging only at the point of connection to a device or junction box. This is to decrease the risk of damage to the **8-Pin M12 Interface Cable** from sources such as:

- Bird, livestock or other animal damage or abrasion
- Falling branches or foliage
- Premature cable deterioration from ultraviolet light and weathering
- Snag risks

As such it is important to prepare the mounting device and cable before installing the D20.

If applicable, an appropriately sized hole should be drilled where the cable will exit the mounting device and the cable threaded through the post and hole prior to attaching the D20. Ensure the hole is clean, de-burred and will not damage the cable. Consider the use of a rubber grommet on the hole edge to increase protection.

The **8-Pin M12 Interface Cable** should then be attached and fastened to the D20 unit via the **8-Pin M12 Connector**, ready for final mounting and commissioning.



3.6 POST MOUNTING

The D20 supports direct installation to a cylindrical post. The mounting socket on the D20 can accommodate a post with:

- Outer diameter 32mm - 34.5mm
- Internal diameter >26mm

The preferred solution for direct mounting of the D20 is the use of a Nominal Pipe Size (NPS) steel post with a Diameter Nominal (DN) 25mm or 1 Inch, as specified in the Australian/New Zealand standard AS/NZS1163 or the American Standard ASTM A53M.

25mm (DN) NPS is specified as having an outside diameter of 33.4 - 34mm and is commonly available in hardware stores and from steel suppliers, often sold as fence posts.

Suitably secured galvanised or stainless steel post should be used to ensure weather resistance and durability. Providing a path for any water to drain from within the post will reduce corrosion potential and extend the installation life.

As well as ensuring a suitable height for transmission capabilities, as per the Site Selection section, the height of the post should also correspond to the risk of damage or interference to the D20. For example if used in an area with livestock the device should be higher than the livestock could reach. If prone to vandalism the D20 should be high enough to deter interference and may require additional protection mechanisms.

3.7 MAST MOUNTING

Antenna mounts and masts are commonly available with a 32mm outer diameter post making them an acceptable mounting solution.

Several antenna mast kits, including guyed options, are capable of extending several meters into the air and may be a preferred solution to increase transmission capabilities in areas where the D20 is surrounded by tall objects.

IMPORTANT NOTE:



If installing the D20 at a height that cannot be safely reached once installed, such as a tall mast, ensure the D20 is switched on and commissioned prior to mounting as these steps require physical access to the device.

3.8 SECURING

Ensure the post or mount is engaged all the way to the bottom of the D20 mounting socket. The D20 is supplied with a **Hex Head Grub Screw** to fasten the device to its mount. Use a 2.5mm Allen key or other 2.5mm Hex drive to fasten the grub screw. The screw should only be tightened enough to stop easy rotation or removal of the device.



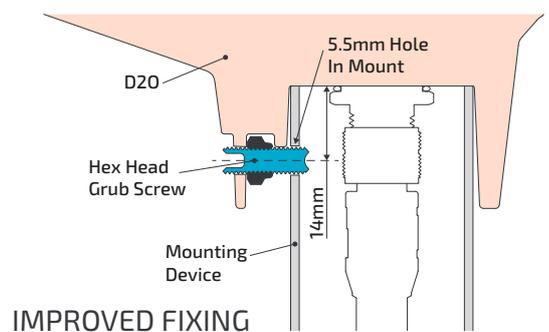
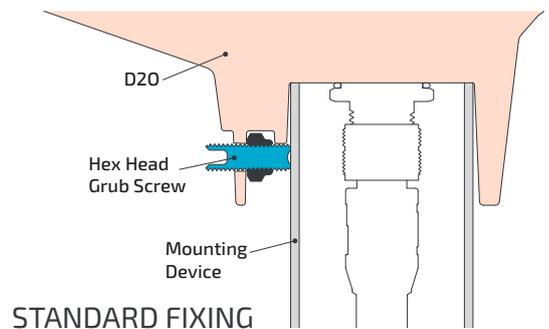
IMPORTANT NOTE:

Do not over-tighten the grub screw. It is possible to permanently damage the D20's plastic enclosure by over-tightening the grub screw to the mount.

For increased mounting strength on a 34-34.5mm post, pre-drill a hole in the post for the grub screw to pass through. The hole centre should be drilled at 14mm from the top of the mount, in the desired direction. The use of a 5.5mm drill is recommended.

If using a post with a diameter <34mm, pre-drill an indentation/recess into the post at the same location. In <34mm diameter pipe a complete hole will not provide the securing force required and the D20 will have a loose fit.

For scenarios where tamper prevention or evidence is required then the **Hex Head Grub Screw's** head can be epoxy filled.



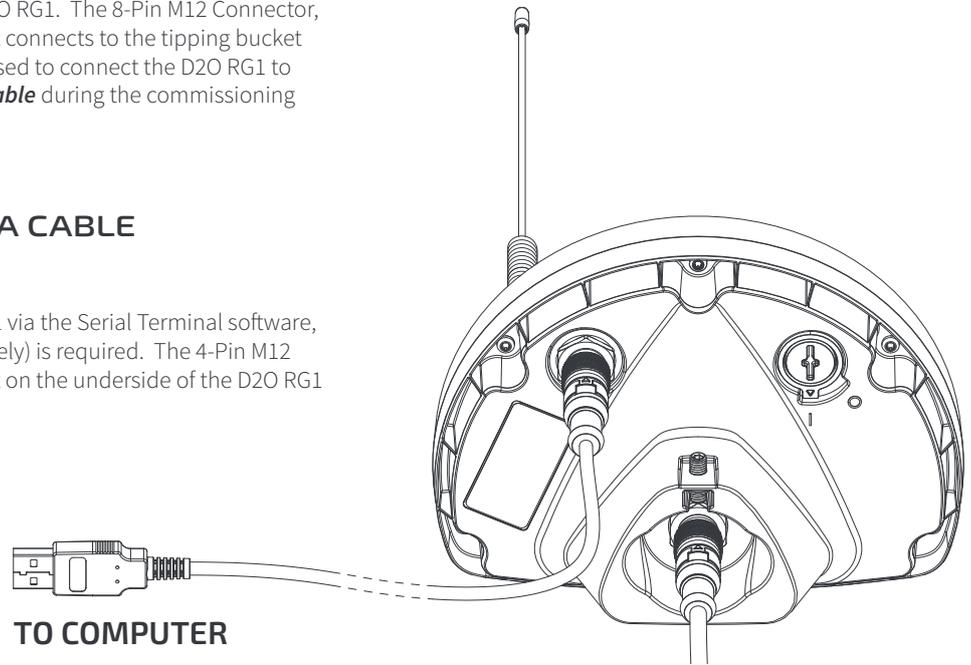
4. WIRING GUIDE

4.1 INTRODUCTION

There are 2 interfaces available on the D20 RG1. The 8-Pin M12 Connector, located centrally, is the interface port that connects to the tipping bucket rain gauge. The 4-Pin M12 Connector is used to connect the D20 RG1 to a computer via the **4-Pin M12 to USB-A Cable** during the commissioning process.

4.2 4-PIN M12 TO USB-A CABLE

To program and commission the D20 RG1 via the Serial Terminal software, a **4-Pin M12 to USB-A Cable** (sold separately) is required. The 4-Pin M12 connector interfaces to the matching port on the underside of the D20 RG1 unit.

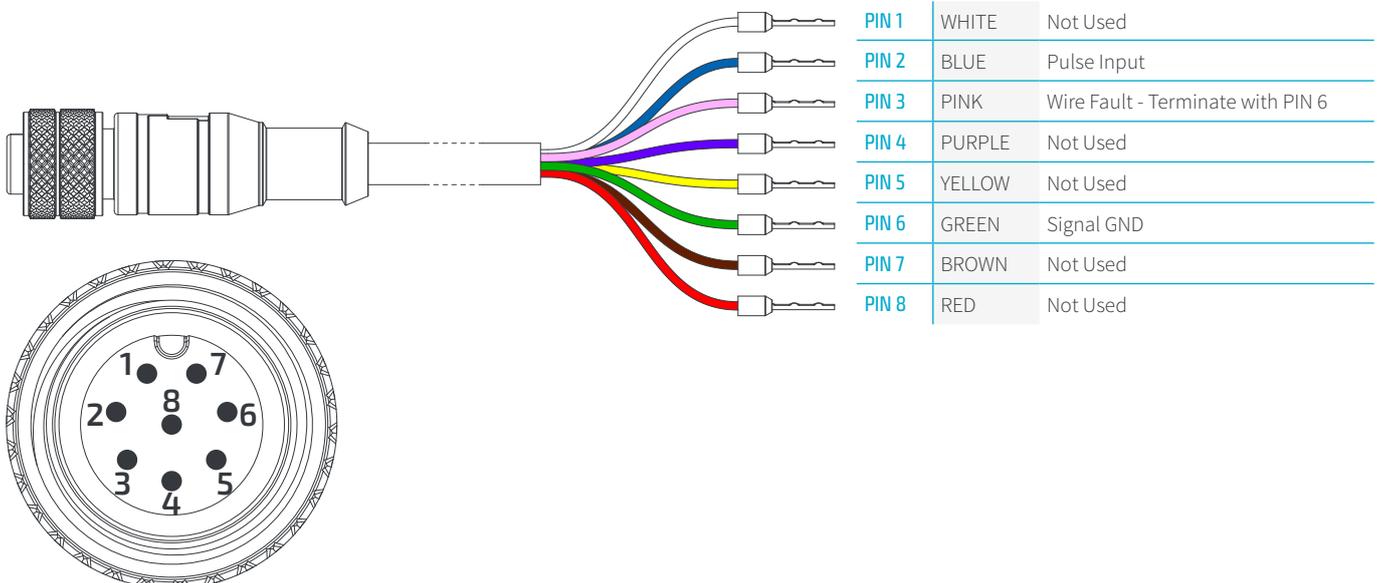


4.3 8-PIN M12 INTERFACE CABLE

The D20 RG1 can be connected to a tipping bucket rain gauge using the **8-Pin M12 Interface Cable**. One end of the cable has the 8-Pin M12 Female Interface and the other has 8 ferruled capped wires to enable custom wiring.

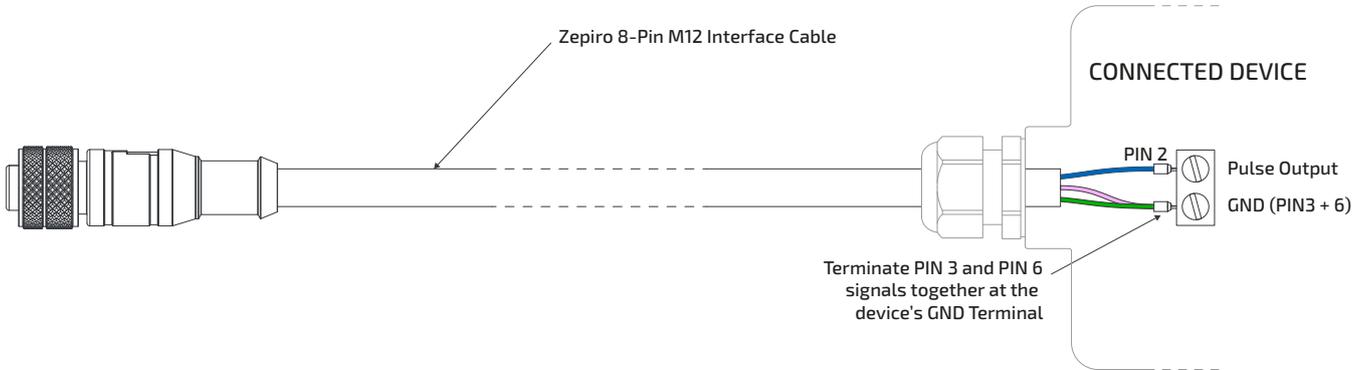
The pin arrangement for the female connector and the corresponding wire colours are shown in the diagram below. Once connected to the D20, their corresponding functions are shown in the table.

Wires that are not used can be cut off.



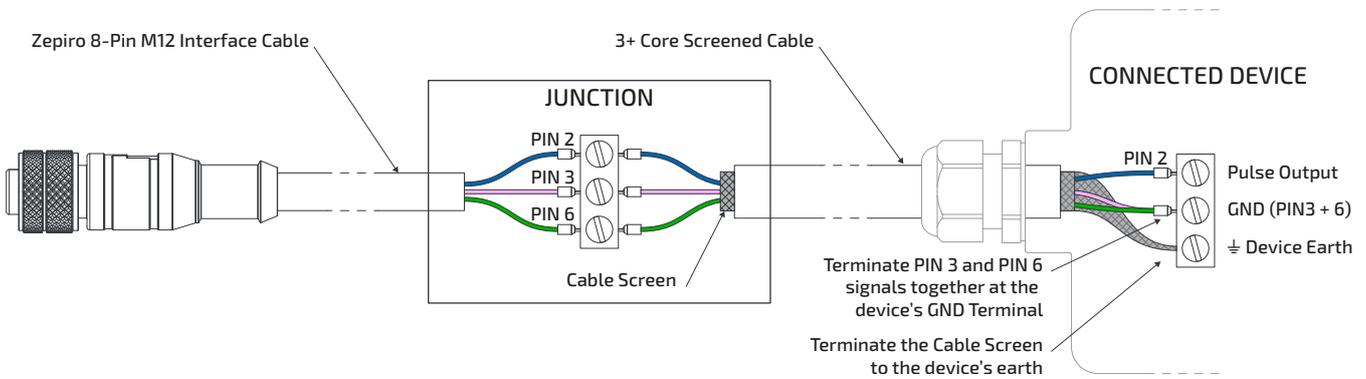
PIN 3 and PIN 6 must be connected together when terminating the connection to the Rain Gauge. This enables the wire fault. Failing to connect PIN 3 and PIN6 will result in continuous daily fault messages being generated.

In instances where the **8-Pin M12 Interface Cable** will be used to connect directly to the Rain Gauge the connection should be as follows (unused pins not shown):



In instances where the **8-Pin M12 Interface Cable** will be terminated into a junction (such as a connector or breakout box), the circuit formed between the connecting of PIN 3 and PIN 6 signals should terminate at the device, not the junction.

Note a screened cable, with 3 or more cores, should be used to complete the connection between the junction and the Rain Gauge. This cable length should be kept as short as possible to minimise the chance of electrical or magnetic interference influencing the pulse input signal. Example below (unused pins not shown):



5. D20 RG1 PROGRAMMING

5.1 INTRODUCTION

Before the D20 can perform its normal operation it must be programmed with the desired operating parameters.

Programming occurs via a serial interface, using a plaintext protocol that can be entered by either human or automated system input. A Serial Terminal software application (such as [Tera Term](#)), running on a Computer, is required in order to send human entered input commands via a Command Line Interface (CLI) to the D20.

Once a connection is established, the CLI provides the following setup features:

- Control of the D20 Digital Power Switch
- Set device acquisition and system parameters
- Generate a Commissioning Report to confirm current settings

When setting up a D20 for the first time the steps shown in the following sections should be sequentially followed to ensure the D20 will be correctly setup and perform its normal operation.

5.2 PRE-PROGRAMMING CHECKLIST

Before commencing any programming or commissioning tasks the following prerequisite tasks must be completed:

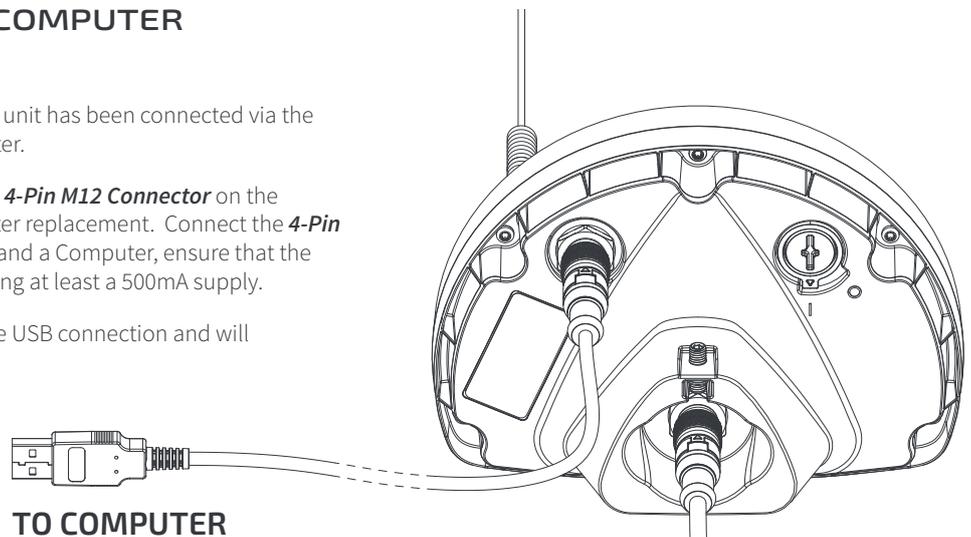
- A **4-Pin M12 to USB-A Cable** must be available for connection between the D20 and a USB port of the Computer, without extension. Ensure the USB Port is capable of providing at least a 500mA supply
- Ensure GPS satellite signals are available by moving outdoors or close to a window (required to obtain date, time and location settings of the D20)
- Serial Terminal software is installed on the Computer

5.3 CONNECTING TO A COMPUTER

Interfacing to the D20 can occur once the unit has been connected via the **4-Pin M12 to USB-A Cable**, to the Computer.

Remove the protective **Dust Cap** from the **4-Pin M12 Connector** on the bottom of the D20, and store safely for later replacement. Connect the **4-Pin M12 to USB-A Cable** in-between the D20 and a Computer, ensure that the Computer's USB Port is capable of providing at least a 500mA supply.

The D20 unit is now being powered by the USB connection and will commence its start-up sequence.



5.4 START-UP SEQUENCE

Once powered by the USB connection, the expected start-up sequence for the D2O is as follows:

- The unit will power up and within 2-5 seconds a light within the **Battery Switch** should flash a green light twice
- The D2O now acquires the GPS location, time and date settings which can take up to 90 seconds
- Next the start-up sampling configuration and system status information is prepared for transmission at the next opportunity, before the unit enters sleep mode
- Without further intervention the D2O will then wake at the next set sampling time
- The unit is now ready to interface via the Serial Terminal software

5.5 SERIAL TERMINAL SETTINGS

To start interfacing to the D2O via the CLI, follow the steps below. For this example the 'Tera Term' software application is used, but equivalent processes should be available in other Serial Terminal Applications.

1. Start Tera Term
2. On the New Connection Window, select a Serial connection type. From the drop-down control, select the Communications **Port** that corresponds to the D2O unit, then click the **OK** Button at the bottom of the window
3. The Terminal window is now shown. Verify the serial connection settings are correctly setup by going to the **Setup > Serial Port...** menu. The following serial interface parameters should be used:

PROPERTY	DESCRIPTION/VALUE
Bit Rate (Speed)	115,200 bits/second
Data bits (Size)	8 bits
Parity	None
Stop Bits	1
Flow Control	None

4. Once confirmed click the **New Open** Button to proceed
5. Double press the **Enter** Key until a Chevron character **>** is displayed. The Chevron **>** indicates the D2O is ready to receive CLI input. If a Chevron does not appear within a few seconds the D2O may be busy performing setup or synchronisation tasks with the satellite network - please wait up to 30 seconds and try again. If no Chevron appears then please refer to the Serial Terminal Troubleshooting Section for help
6. In the event the D2O re-enters sleep mode, indicated by a **GOODBYE** message on the screen, press the **Enter** key repeatedly until the unit wakes and a Chevron **>** is once again displayed

5.6 VT100 TERMINAL EMULATION OPTION

As an option the D20 supports VT100 terminal emulation for a cleaner display.

Key VT100 Notes:

- To wake the D20, and at the end of every command, press the “**Enter**” key
- The terminal shows a prompt with a chevron **>**
- Sleep timeout is 40s after the last “**Enter**” key press. The message **GOODBYE** is sent when entering sleep mode
- Keeping the CLI active for more than 3minutes will reset the D20.
- Entering a wrong or incomplete parameter will display an error message
- Entering **help** will provide a list of commands where parameters in **{ }** are optional
- Entering **help acq** shows help of all commands of the **acq: group**

If your terminal is set to support VT100 emulation, the CLI supports:

- **Cursor Left**, **Cursor right**, **Backspace** and **Delete** keys for corrections.
- **Cursor Up** shows the command history.

5.7 CORE OPERATION PROGRAMMING

The following procedure ensures that the core parameters for the normal operation of the D20 RG1 are set, and that it will enter a normal operating mode once complete. Use the CLI complete the following, pressing the **Enter** key after each line, noting the text entered is case sensitive:

1. Enable the D20's Battery Power by typing:

```
sys -p ON
```

2. Enter admin mode to allow the editing of system settings (requires the admin password; The default is: **password**):

```
admin password
```

Note that if the password has previously been changed from the default, you will need to enter the currently set password.

3. It is recommended to change the default password. This command requires the new password to be entered twice, separated by a single space. The password cannot contain whitespace. Example below using **newpassword** as the new password:

```
sys -P newpassword newpassword
```

4. Set the Rain Gauge's tipping bucket volume in mm (0.1mm precision). The supported range is 0.1 to 5.0mm. Example below using 1.0mm volume:

```
inp -c 1.0
```

5. Apply the changes to the parameters:

```
apply A
```

The D20 RG1 now has the core parameters set to perform its normal operation.

If the unit is being preconfigured prior to its final installation it may be desirable to preserve the battery life until deployment. The D20's Battery Power can be disabled by entering the below command. This is an *Admin Restricted* command and cannot be set until the **admin** command has been executed:

```
sys -p OFF
```

Note: the unit will remain powered by the USB connection until disconnected.

There are many additional CLI commands that can be reviewed by entering **help** into the CLI, or by reviewing the Serial Commands section of this manual.

It may be desirable to generate a Commissioning Report once installed to verify the system settings are as intended. This can be generated using the **report** command. This will generate a list of currently set parameters which can be copied and saved for record keeping purposes.



IMPORTANT NOTE:

Ensure the D20's *Battery Power* has been enabled through the CLI before leaving the D20 for its normal operation. No samples or transmissions will occur if the *Battery Power* is off.

5.8 DISCONNECTING FROM A COMPUTER

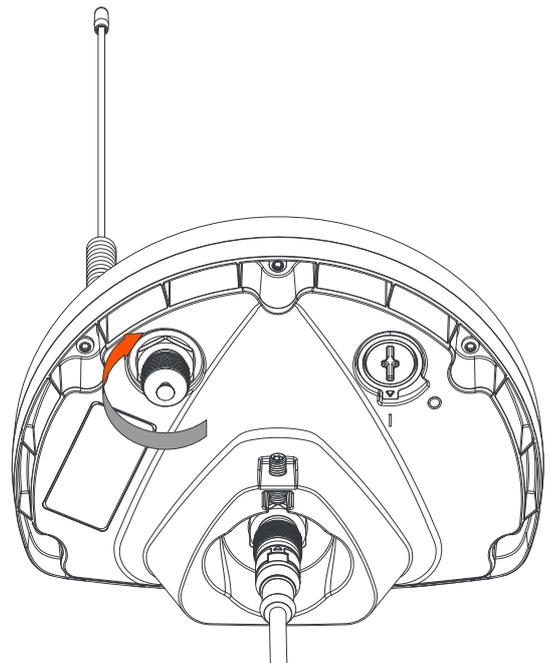
Once all programming and commissioning processes have been completed it is important to disconnect the **4-Pin M12 to USB-A Cable** and replace the **Dust Cap** to improve the environmental durability of the product and protect the connector.

The **4-Pin M12 to USB-A Cable** should be kept and stored safely for future use. The following sections in this document outline some of the other functions that can be accessible when using this connection and the Serial Terminal software.



IMPORTANT NOTE:

Ensure the D20's *Battery Power* has been enabled through the CLI before leaving the D20 for its normal operation. No samples or transmissions will occur if the *Battery Power* is off.



6. SERIAL COMMANDS

6.1 INTRODUCTION

This section provides information on all of the Serial Commands that may be entered into the CLI.

When entering any command (and any relevant parameter) it must be followed by a carriage return control character, which is sent by pressing the **Enter** key on the user's keyboard.

The commands are case sensitive with some characters used in both upper and lower case forms.

Dates and times used for the D20 are all based on Greenwich Mean Time (GMT).

The commands are split into category groups as follows:

GROUP	DETAILS
-	Admin Parameters
sys	D20 Unit System Parameters
time	System Time Parameters
gps	Global Positioning System (GPS) Parameters
acq	Data Acquisition and Configuration Parameters
msg	Satellite Network Coverage and Transmission Parameters
inp	External Device Input Parameters

6.2 COMMAND LIST

The full list of available commands is shown below. The Commands are shown in **Bold** text and available Parameters are shown in Regular text within brackets < >. Detailed information about each command can be found in the "[COMMAND DETAILS](#)" section:

Admin Parameters

COMMAND SYNTAX	DETAILS
help	Displays a list of all available commands
help <cmd>	Provides information about a particular command, where <cmd> is the command of interest.
admin <password>	Allows administrator access to modify the <i>Admin Restricted</i> editable parameters of the device. All <i>Admin Restricted</i> parameters will be unavailable until this command is applied. The default password is <code>password</code>
apply <A or D or F>	Accepts (A) or Discards (D) changes made to <i>Admin Restricted</i> settings of acq and inp commands when administrator access has been enabled. Parameter F restores all modified parameters to their factory defaults.
report	Displays a Commissioning Report of all key parameters currently set on the D20.

D20 Unit System Parameters

COMMAND SYNTAX	DETAILS
<code>sys -c</code>	Displays the Network Module Registration Code
<code>sys -d</code>	Displays the Receiver's background noise level or RSSI (Received Signal Strength Indicator) in dBm
<code>sys -q</code>	Displays the remaining storage space in the transmission queue in bytes
<code>sys -L</code>	Displays an estimate of the remaining power in the battery as a percentage (0% to 100%)
<code>sys -p <ON or OFF></code>	Sets the Battery's Power Switch State to either ON or OFF. Setting to OFF is an <i>Admin Restricted</i> command
<code>sys -P <password> <password></code>	Sets a new administrator password. The new password parameter must be entered twice, separated by a space. Passwords must not contain whitespace. This is an <i>Admin Restricted</i> command
<code>sys SC <1000 to 50000> <pw></code>	Resets the battery capacity after replacement. Requires battery pack capacity to be entered as well as a special password provided by Zepiro. Please contact your dealer for assistance

Time Parameters

COMMAND SYNTAX	DETAILS
<code>time -g</code>	Displays the verbose system time in GMT

Global Positions System (GPS) Parameters

COMMAND SYNTAX	DETAILS
<code>gps -g</code>	Displays the last acquired GPS position as Latitude and Longitude with GMT time acquired
<code>gps -v</code>	Displays if the GPS Fix is Valid

Data Acquisition and Configuration Parameters

COMMAND SYNTAX	DETAILS
<code>acq -t <hh></code>	Sets the Acquisition Synchronisation Time: Hour of Day (0 - 23) GMT. <i>Admin Restricted</i>

Satellite Network Parameters

COMMAND SYNTAX	DETAILS
<code>msg -g</code>	Displays the date and time (GMT) of the next satellite transmission opportunity

Rain Gauge Input Parameters

COMMAND SYNTAX	DETAILS
<code>inp -c <0.1 to 5.0></code>	Sets the Rain Gauge Bucket volume in millimetres (0.1mm precision) in the range of 0.1mm to 5.0mm. <i>Admin Restricted</i>
<code>inp -g</code>	Displays the total rainfall that has been recorded in millimetres since deployment
<code>inp -z <confirm></code>	Resets the pulse counter to zero. Enter CLEAR at <confirm> to avoid accidental use. <i>Admin Restricted</i>

6.3 COMMAND DETAILS

Each of the Commands available is explained in more detail in the following sections.

COMMAND SYNTAX	DETAILS
help <cmd>	Displays a help message associated with the command name at parameter <cmd>.
Example: Using the msg command.	
help msg msg -g	: Get next Tx opp. Verbose

COMMAND SYNTAX	DETAILS
admin <password>	<p>Allows administrator access to modify the <i>Admin Restricted</i> editable parameters of the device. All <i>Admin Restricted</i> parameters will be unavailable until this command is applied.</p> <p>IMPORTANT NOTE: Changes made to <i>Admin Restricted</i> parameters of acq and inp commands will not be applied until the apply command is used.</p> <p>The parameter for <password> should be the currently set administration password for the device. The default password is password</p> <p>The administration access will last for the current session. If the device enters sleep mode and the message GOODBYE appears in the Serial Terminal software, then the command will need to be entered again upon waking the device.</p> <p>Using this command will generate a notification message type, advising of the login, that will be sent via the Zepiro servers.</p>
Example: Using the default password to allow administration access. OK message displayed when successful.	
admin password OK -> Remember to use 'apply' command to save changes	

COMMAND SYNTAX	DETAILS
apply <A or D or F>	<p>Accepts (A) or Discards (D) changes made to <i>Admin Restricted</i> parameters of acq and inp commands when administrator access has been enabled.</p> <p>Entering parameter F restores all modifiable acq and inp command parameters to their factory defaults.</p> <p>This is an <i>Admin Restricted</i> command and cannot be set until the admin command has been executed.</p> <p>IMPORTANT NOTE: Changes made to <i>Admin Restricted</i> parameters of acq and inp commands will not be applied until the apply command is used. Failing to apply the modified parameters can result in the Commissioning Report displaying incorrect values.</p>
Example: Using the A parameter to accept changes. OK message displayed when successful.	
apply A OK	

COMMAND SYNTAX	DETAILS
report	<p>Displays a Commissioning Report of all key parameters currently set on the D2O.</p> <p>IMPORTANT NOTE: The apply command should be used prior to executing this command to ensure that all <i>Admin Restricted</i> parameters of acq and inp commands have been applied, and that the Commission Report is showing correct information. Unapplied changes will still display in the Commission Report but will not execute until the apply command is used.</p> <p>The returned date and time formats are: Day - Month - Year Hour : Minute : Second in Greenwich Mean Time (GMT).</p>

Example: Report with example data for a D2O RG1.

```

report
COMMISSIONING REPORT

SYSTEM
Date/Time:      07-01-2021 04:37:48
Model:          RAIN
Module ID:      00fb81d90a M1-24
FW/HW Build:    FW: TEST___00_09_00 HW: CUSTOM1
TX/RX Build:    1.3.2
Temp:           26.1 DegC
Tamper:         CLEAR
Cable:          CONNECTED

POWER
Batt. Charge:   99 %
Battery Lvl:    2996 mV
Batt. Switch:   ON

GPS
Latitude:       -27.5774187
Longitude:      153.0970311
Acquired:       07-01-2021 04:37:04

ACQUISITIONS
Acq.Mode:       Pulse
Acq.Type:       Rain hourly
Sync Time:      00:00
Data Sets Acq: 48
Next Acq.:      07-01-2021 05:00:00
Bucket Size:    0.200 mm

TRANSMISSION
Message ID:     230

READINGS
Total Rain:     325.2 mm

```

COMMAND SYNTAX	DETAILS
sys -c	Displays the unique Network Module Registration Code. Typically the module is already pre-registered on the network.
Example:	
sys -c tpsez74fgajae334yddtr66my	

COMMAND SYNTAX	DETAILS
sys -d	<p>Displays the Receiver's background noise level or RSSI (Received Signal Strength Indicator) in dBm.</p> <p>This advanced diagnostics command queries the receiver background noise level. The measurement is being performed periodically in the background when the unit is entering sleep mode.</p> <p>The receiver is very sensitive and Laptop connections and other equipment can affect the reading adversely. A good reading should be lower than -95dBm i.e. (-95 to -110dBm).</p> <p>Note: This value is also periodically transmitted as part of the system diagnostics data and the transmitted value will give a more accurate indication.</p>
Example:	
<pre>sys -d RSSI = -96dBm</pre>	

COMMAND SYNTAX	DETAILS
sys -q	<p>This diagnostics command provides insight as to how much data the D2O can transmit.</p> <p>If the message queue is empty, meaning no data has been scheduled for transmission, the size returned is 320 bytes.</p> <p>If too many samples have been recorded and scheduled for transmission, the D2O's queue will become overloaded and the size returned will be 0 bytes. In this scenario scheduled messages will be lost.</p> <p>If the message queue remains low for long periods, but the system is not over committed with acquisitions, it indicates the D2O is keeping older data for re-transmission to achieve the best probability for the data to get through. This is usually caused by the location and current satellite orbits.</p> <p>Note: This value is also periodically transmitted as part of the system diagnostics data.</p>
Example:	
<pre>sys -q Queue Bytes Remaining: 300</pre>	

COMMAND SYNTAX	DETAILS
sys -L	<p>Displays an estimate of the remaining power in the battery as a percentage (0% to 100%).</p> <p>The D2O records the power consumption based on system activity. The D2O is powered by primary cell batteries and an estimation of power left as a percentage is calculated and returned.</p> <p>Note: This value is also periodically transmitted as part of the system diagnostics data.</p>
Example:	
<pre>sys -L 94%</pre>	

COMMAND SYNTAX	DETAILS
<code>sys -p <State></code>	<p>Sets the Battery's Power Switch State. The Available Parameters for <State> are:</p> <p>ON</p> <p>OFF <i>Admin Restricted - Cannot be set until the admin command has been executed</i></p> <p>The device will remain powered by the USB connection, even after the OFF parameter is used. Disconnecting the USB cable after the OFF parameter is set will shut down the D2O.</p> <p>This setting is applied immediately upon carriage return (Enter Key).</p> <hr/> <p>IMPORTANT NOTE:  Ensure the D2O's Battery Power has been enabled through the CLI before leaving the D2O for its normal operation. No samples or transmissions will occur if the Battery Power is off.</p>
<p>Example: Turning the Battery Power Switch State to ON. OK message displayed when successful.</p> <pre>sys -p ON OK</pre>	

COMMAND SYNTAX	DETAILS
<code>sys -P <password> <password></code>	<p>Sets a new administrator password.</p> <p>This is an <i>Admin Restricted</i> command and cannot be set until the admin command has been executed.</p> <p>To minimise the risk of saving a password with a typing mistake, the parameter for <password> must be entered twice, separated by a space. The password cannot contain whitespace.</p> <p>IMPORTANT NOTE: It is critical to remember the password as there is no mechanism for Zepiro to reset the password in the event it is forgotten.</p>
<p>Example: Setting the administrator password to be ab3Rq46. OK message displayed when successful.</p> <pre>sys -P ab3Rq46 ab3Rq46 OK</pre>	

COMMAND SYNTAX	DETAILS
<code>sys SC <1000 to 50000> <code></code>	<p>Resets the battery capacity after replacement to allow for correct ongoing system power estimates to occur.</p> <p>The first parameter Requires battery pack capacity to be entered in milliamp hours (mAh) in a range between 1000 mAh to 50000 mAh.</p> <p>The second parameter is a special permissions code generated on request by Zepiro.</p> <p>This process cannot be completed without a new factory supplied battery kit. Please contact your Zepiro dealer for assistance.</p>
<p>Example: Setting the battery capacity to be 10,000 mAh and an example permissions code of H42st5Pb. OK message displayed when successful.</p> <pre>sys SC 10000 H42st5Pb OK</pre>	

COMMAND SYNTAX	DETAILS
time -g	Displays the verbose system time in Greenwich Mean Time (GMT). This is the same value generate by the gps -t command, but decoded into a human readable format. The returned date and time format is: Day - Month - Year Hour : Minute : Second
Example:	
<pre>time -g Date/Time: 07-01-2021 04:37:48</pre>	

COMMAND SYNTAX	DETAILS
gps -g	Displays the last acquired GPS position as Latitude and Longitude with the time acquired in Greenwich Mean Time (GMT).
Example:	
<pre>gps -g Latitude: -27.5774187 Longitude: 153.0970311 Acquired: 07-01-2021 04:37:04</pre>	

COMMAND SYNTAX	DETAILS
gps -v	Displays if the GPS location and time Fix is deemed to be valid.
Example:	
<pre>gps -v Yes</pre>	

COMMAND SYNTAX	DETAILS
acq -t <hh>	<p>Sets the data acquisition synchronisation time as an Hour of the day (0 - 23) Greenwich Mean Time (GMT).</p> <p>The data synchronisation time is defaulted to 00:00 GMT. The D20 features a fixed hourly sampling interval and data sampled within 24h is synchronised to a "GMT-day".</p> <p>Shifting the synchronisation time parameter <hh> (in hours) provides a means to align the D20's first reading of the day to correspond to that of a desired time zone. The offset must be applied as a positive whole hour value only. For example if the desired time zone is GMT -04:00 the synchronisation time parameter would be 20, making the synchronisation occur at midnight local time.</p> <p>It may also be helpful when the last data acquired needs to be delivered before a certain time. For example a typical application might be to sync the previous day's total reported measurement to 9AM local time. To achieve this for Brisbane, Australia (GMT+10:00) it would make it 11:00PM GMT, therefore 23 would be entered as the parameter.</p> <p>This is an <i>Admin Restricted</i> command and cannot be set until the admin command has been executed.</p>
Example: Scenario where the D20 synchronisation time needs to align with midnight in the local time zone for Brisbane, Australia (GMT +10:00).	
<pre>acq -t 10 OK</pre>	

COMMAND SYNTAX	DETAILS
msg -g	<p>Displays the date and time in Greenwich Mean Time (GMT) of the next satellite transmission opportunity within a 24 hour window from now.</p> <p>The returned date and time format is: Weekday Day - Month - Year Hour : Minute : Second</p> <p>While this is the next opportunity it does not guarantee a successful transmission will occur. Factors such as physical obstructions, interference or inclement weather can prevent a successful transmission from occurring.</p>
Example:	
<pre>msg -g Thursday 07-01-2021 11:54:22</pre>	

COMMAND SYNTAX	DETAILS
inp -c <0.1 to 5.0>	<p>Sets the Rain Gauge Bucket volume in millimetres (0.1mm precision) in the range of 0.1mm to 5.0mm. This volume should be supplied by the Rain Gauge manufacturer.</p> <p>This is an <i>Admin Restricted</i> command and cannot be set until the admin command has been executed.</p> <p>IMPORTANT NOTE: Changes made using this <i>Admin Restricted</i> command will not be applied until the apply command is used.</p>
Example: Using a 1.0mm volume Rain Gauge Bucket.	
<pre>inp -c 1.0 OK</pre>	

COMMAND SYNTAX	DETAILS
inp -g	<p>Displays the D20's total counter reading, translated to rainfall in millimetres. This is a cumulative reading that includes all readings ever recorded by the D20 since initial deployment.</p>
Example:	
<pre>inp -g Total Rain: 2614.2 mm</pre>	

COMMAND SYNTAX	DETAILS
inp -z <confirm>	<p>Resets the total accumulated pulse counter to zero. Enter CLEAR at <confirm> to avoid accidental use.</p> <p>This is an <i>Admin Restricted</i> command and cannot be set until the admin command has been executed.</p>
Example:	
<pre>inp -z CLEAR OK</pre>	

7. SPECIFICATIONS

7.1 TECHNICAL SPECIFICATIONS

ENVIRONMENTAL	Operating Temperature Range	-15 to +60°C (+5 to + 140°F)
	Enclosure Ingress Protection (IP) Rating	IP67 (Pending Testing)
POWER	Nominal Operating Voltage	3.0 to 3.6VDC
	Max System Standby Current	60µA TBC (with Pulse Contact Open)
	Nominal Non-Rechargeable Battery Capacity	10Ah
RADIO FREQUENCY	Transmit Frequency (VHF)	161.45MHz
	Receive Frequency (UHF)	400.575MHz
	GNSS Receive Frequency	1571 to 1606MHz
INPUTS	Pulse Input with 30µA Bias - Normally Open (NO) Contact	1
	Pulse Max Signal Low Level	500mV
	Pulse counter can be externally biased up to	5V
	Pulse Signal Type	Active Low Momentary
	Pulse Length	3 to 100ms
	Burst Pulse Rate	5Hz
	Maximum hourly rainfall rate	819.2mm/h
	Maximum total count before roll-over to zero	52,428.8mm
SYSTEM	Device Internal Temperature Sensor Range	-30 to +70°C (-22 to + 158°F)
	Tamper Detection	Yes
	Wire Fault Detection	Yes
MECHANICAL	Securing Fastener	M5 Hex Head Grub Screw (2.5mm Key)
	Enclosure Materials	ASA, PMMA, TPE

7.2 REGULATORY & RADIATION INFORMATION

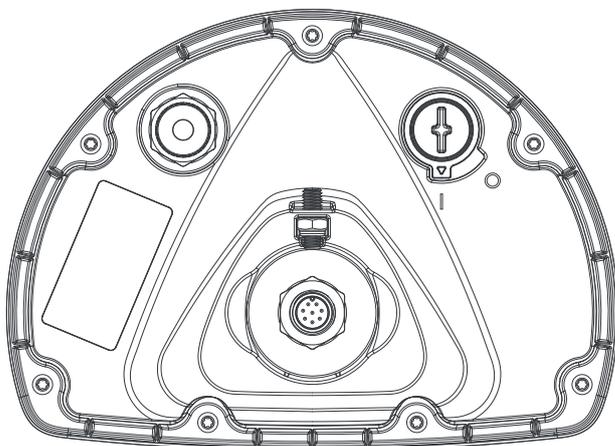
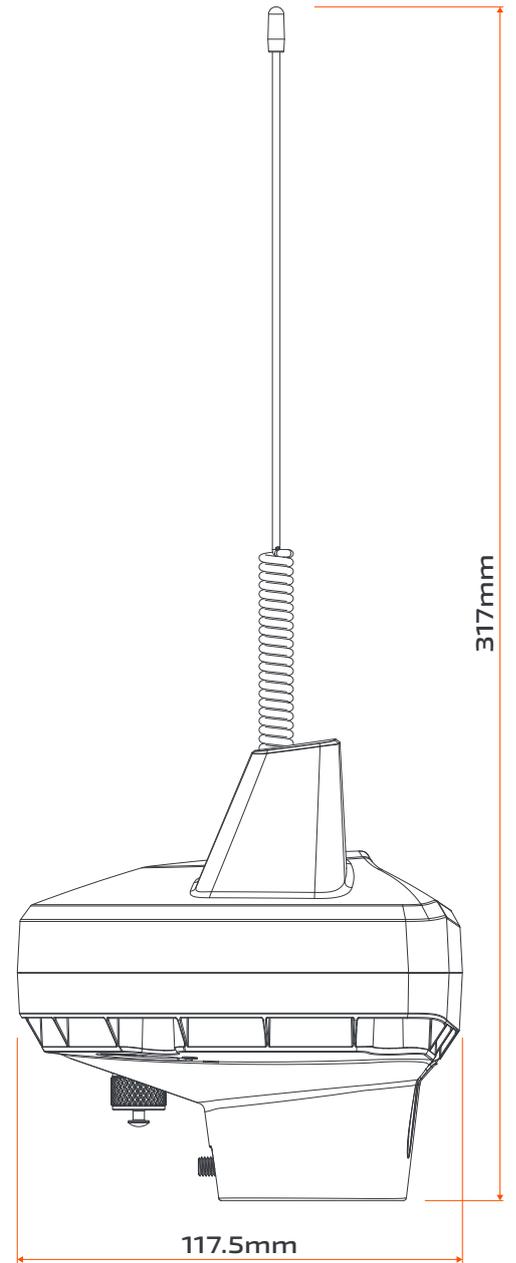
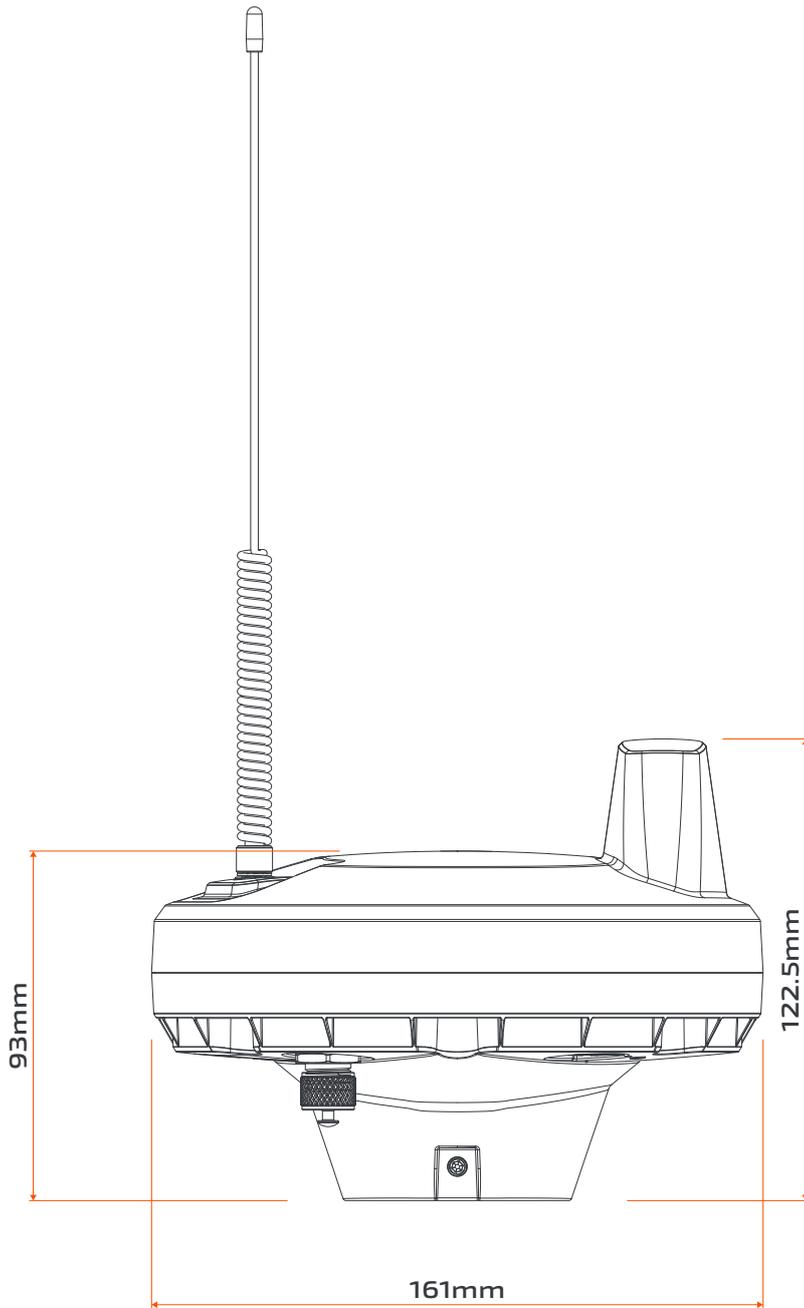
The Zepiro D20 has the following approvals & listings:

- AS/NZS CISPR 32 : 2015 (EN55032) Class B and AS/NZS 2772.2: 2011 for RCM Labelling

NOTICE: This equipment complies with the ACMA Radio-communications (Electromagnetic Radiation - Human Exposure) standard 2014 for General Public Exposure. A minimum of 9 centimetres separation between the device and the user and all other persons should be maintained

WARNING: Changes or modifications to this device not expressly approved by Zepiro could void the user's authority to operate this equipment

7.3 PRODUCT DIMENSIONS



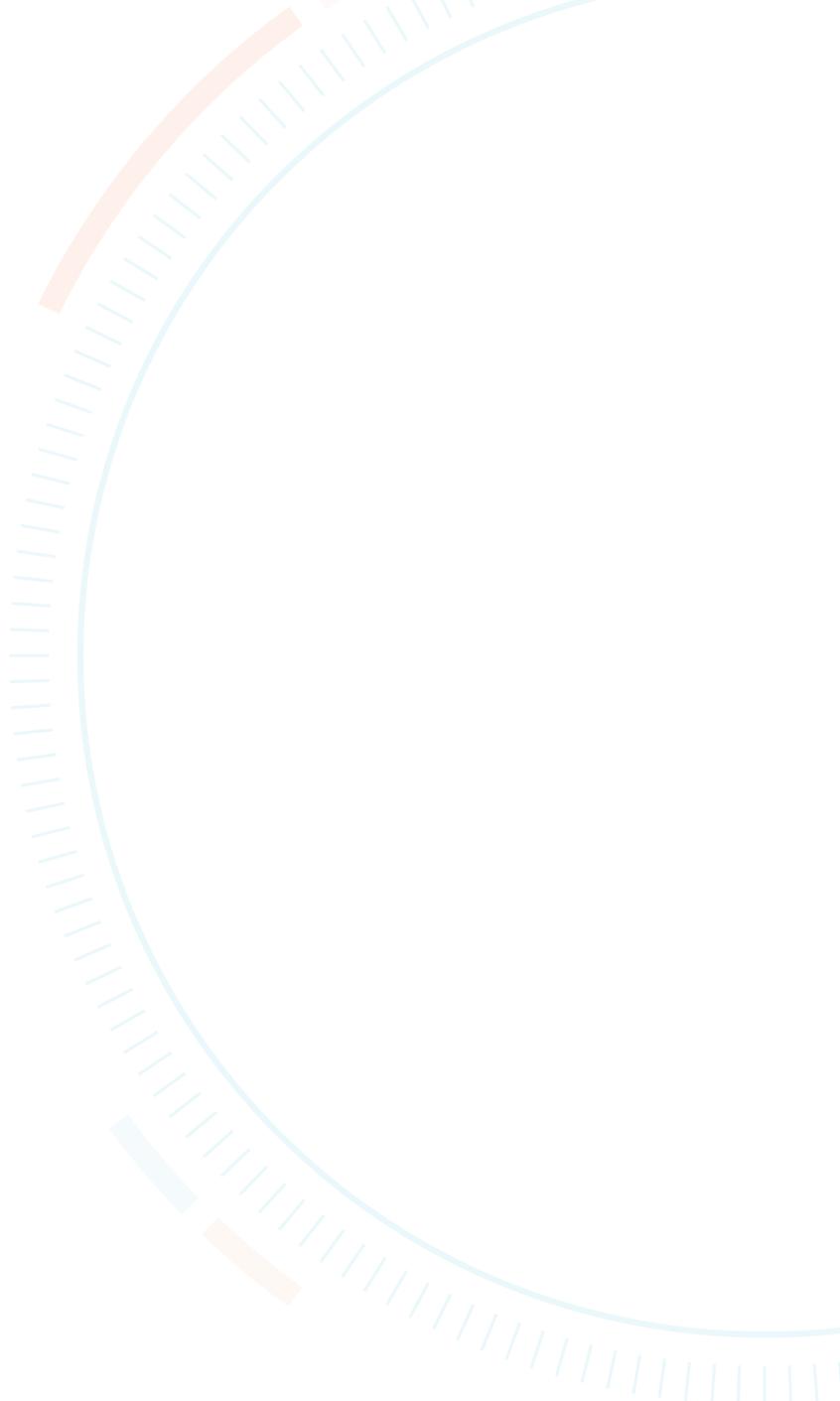
8. TROUBLESHOOTING

8.1 OPERATIONAL TROUBLESHOOTING

SITUATION	ACTION
Unit appears to be inactive once the 4-Pin M12 to USB-A Cable is disconnected, despite the Battery Switch command sys -p being set to ON .	<ul style="list-style-type: none">• Check if the battery is depleted by entering the report command in Serial Terminal software. The battery voltage and charge level is also periodically transmitted as part of the system data messages. If depleted, contact a service agent to organise a replacement• The following process can be used to check if the switch is on:<ul style="list-style-type: none">- Observe the power switch LED, while accessed via serial interface the LED is lit green- After sending the ON command, disconnect the usb cable while the LED is still lit- The LED should remain ON until the time out has expired and the unit returns to sleep
The D20 is still powered despite setting the Battery Switch command sys -p to OFF	<ul style="list-style-type: none">• Verify the Battery Switch state is set to OFF by running the report command in the Serial Terminal software• Disconnect all sources of external power, including the 4-Pin M12 to USB-A Cable and any available external sources attached via the 8-Pin M12 Interface Cable• The D20 should now be shut down
The D20 Antenna becomes loose over time	<ul style="list-style-type: none">• Ensure the Antenna's M4 Securing Grub Screw is firmly tightened against the Antenna Base of the D20 as per the Installation section• Avoid over-tightening the Antenna to the Antenna Base as this may cause irreparable damage to the D20
The D20 is experiencing transmission issues	<ul style="list-style-type: none">• Ensure that the Battery Switch state is set to ON by running the report command in the Serial Terminal software. No samples or satellite transmissions will occur if the D20 has the Battery Switch state set to OFF - the D20 will not be powered• Check if the battery is depleted by entering the report command in the Serial Terminal software. If depleted, contact a service agent to organise a replacement• Review the site selection and installation criteria from the Installation section of this manual to ensure there are no external or proximity factors influencing the D20 transmission capabilities• Check there are no local or regional sources of strong Electromagnetic or Radio Frequency interference that could be affecting operation and transmission• Check the D20 is clean and securely installed, that there are no obvious signs of damage or bending to the Antenna, and that the Antenna has a clean and secure attachment to the Antenna Base• If problems persist please contact your support representative for more detailed assistance

8.2 SERIAL TERMINAL TROUBLESHOOTING

SITUATION	ACTION
Cannot connect the D20 to the Serial Terminal software	<ul style="list-style-type: none"> • Ensure the 4-Pin M12 to USB-A Cable is properly connected to the D20 with the M12 threaded connection fully fastened • Ensure the USB-A connector of the 4-Pin M12 to USB-A Cable is directly connected to an active port on the Computer, avoiding the use of USB hubs or other intermediate connections • Ensure the USB-A port of the Computer is capable of supplying at least 500mA of current • Remove all other USB connections from the Computer (except mouse and keyboard) to remove potential port conflicts • Ensure that the Computer has its USB ports available (not blocked by an administrator or security setting) and that the Serial Terminal software has appropriate permissions to run • Ensure the correct COM Port is selected in the Serial Terminal software. Experiment with different ports if the D20's Port is not obvious • Review the "SERIAL TERMINAL SETTINGS" section to ensure the Serial Terminal software's connection settings are correct. • If problems persist please contact your support representative for more detailed assistance
The D20 is connected to the Serial Terminal software, but is not responding	<ul style="list-style-type: none"> • Repeatedly press the Enter key until a Chevron > appears in the Serial Terminal software as more than one press is required to wake the D20 from sleep mode • If no Chevron appears, continue intermittently pressing the Enter key over the next 30 seconds as the D20 may be busy performing synchronisation tasks with the satellite network • If problems persist please contact your support representative for more detailed assistance
The parameter values shown on the Commissioning Report do not appear to match the data being recorded by the D20	<ul style="list-style-type: none"> • Ensure that changes made to the Admin Restricted parameters of acq and inp commands are applied and executed by running the apply command. The Commissioning Report will show the modified values for acq and inp commands even if they have not been applied, however the D20 system will not incorporate those changes in its normal operation until the apply command has been executed
Require a list of all available CLI commands	<ul style="list-style-type: none"> • Once a Chevron > is shown, type help into the Serial Terminal software to see a full list of available CLI commands



SUPPORT & CONTACT

Technical advice and resources including manuals, user instructions and datasheets are all available from the zepiro.tech website.

For direct product support please contact your local distributor or a Zepiro representative.