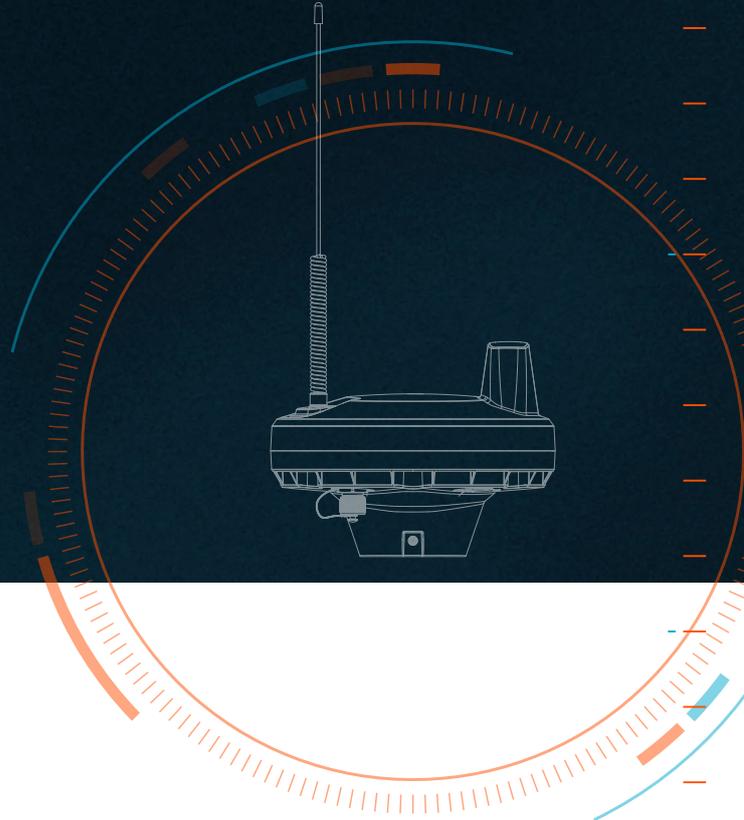


D20[®] SDI Product Manual

Version 1.0
September 2020
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1. GETTING STARTED

1.1 THE ZEPIRO D2O SDI

The Zepiro® D2O® (Direct-To-Orbit) SDI is a satellite telemetry solution for devices that can interface via the SDI-12 protocol. It is ideally suited to use in remote or difficult to access areas and can transmit from virtually any surface location globally.

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

Once setup, the D2O SDI efficiently packages the data messages of SDI-12 readings from the connected device, and sends them 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
- Powered SDI-12 supporting multiple channels
- 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 *D2O Setup Utility* software
- Self-contained in rugged housing to suit harsh environments (Pending IP67 testing)

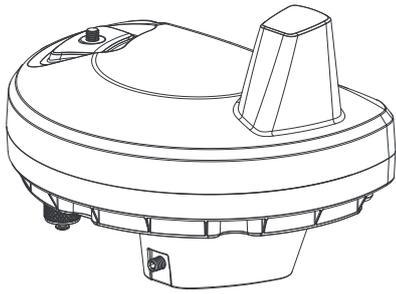
1.3 APPLICATIONS

The Zepiro® D2O® (Direct-To-Orbit) SDI is ideally suited to monitoring applications in many industries including the following examples:

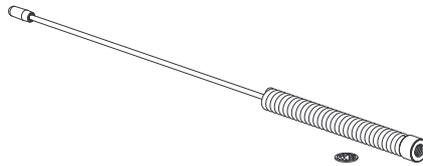
- Water Quality and Management
- Weather and Meteorological
- Bores and Ground Water
- Agriculture & Livestock
- Remote Asset & Infrastructure Monitoring
- Mining
- Scientific Reporting

1.5 IN THE BOX

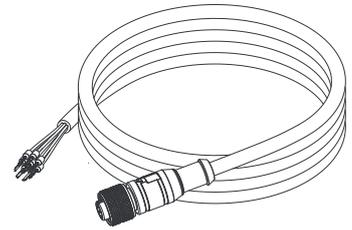
The D20 SDI is provided with the following items:



Zepiro D20 SDI Unit



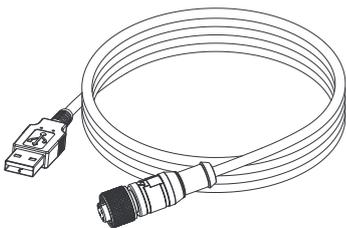
D20 Antenna and Serrated
Tooth Washer



8-Pin M12 Interface Cable

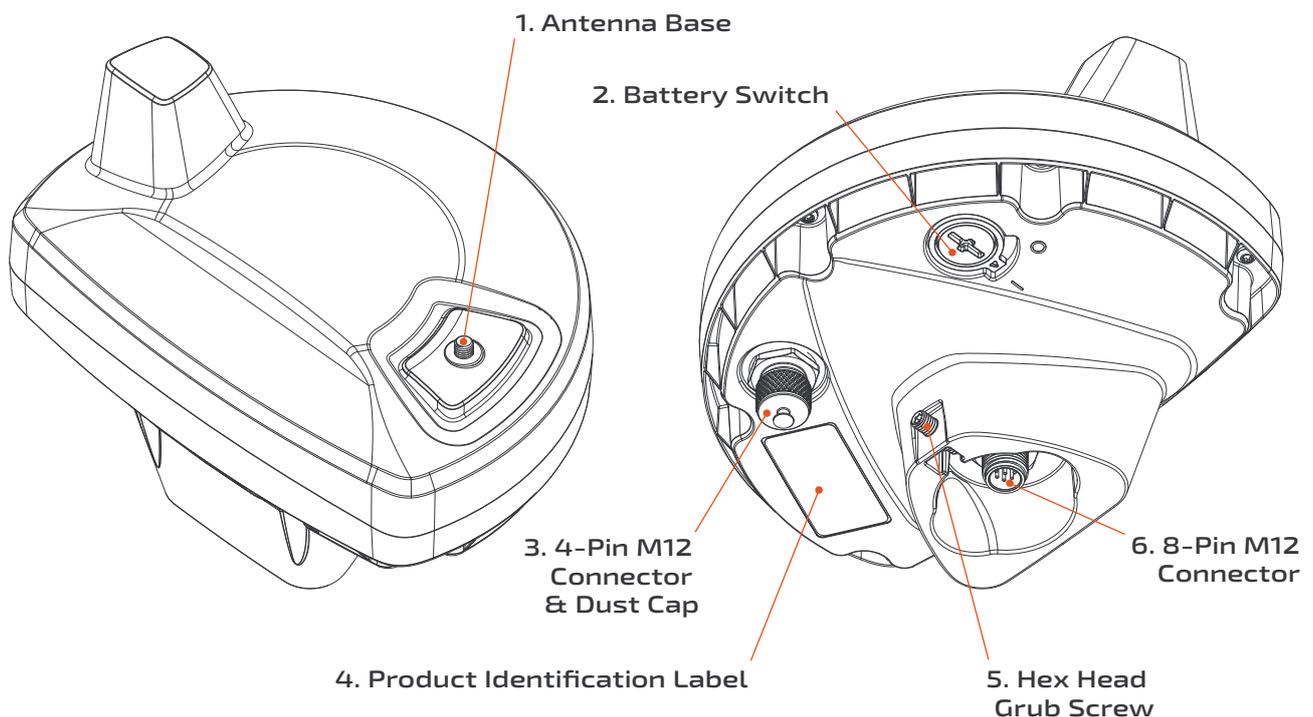
1.6 ACCESSORY ITEMS

The following item is available separately:



4-Pin M12 To USB-A Cable

1.7 D20 UNIT FEATURE IDENTIFICATION



1.8 OTHER TOOLS REQUIRED

Windows® 10 Computer

A Computer with a USB-A port, running a Microsoft® Windows® 10 operating system is required to run the *D20 Setup Utility*. The D20 SDI must be programmed and commissioned, using this software, before use.

Flat Blade Screwdriver or Coin

A wide, flat blade screwdriver or small coin (such as AUD 10 cents, or USD quarter) is required to rotate the *Battery Switch* on the D20 unit.

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. INSTALLATION

2.1 ANTENNA BASICS

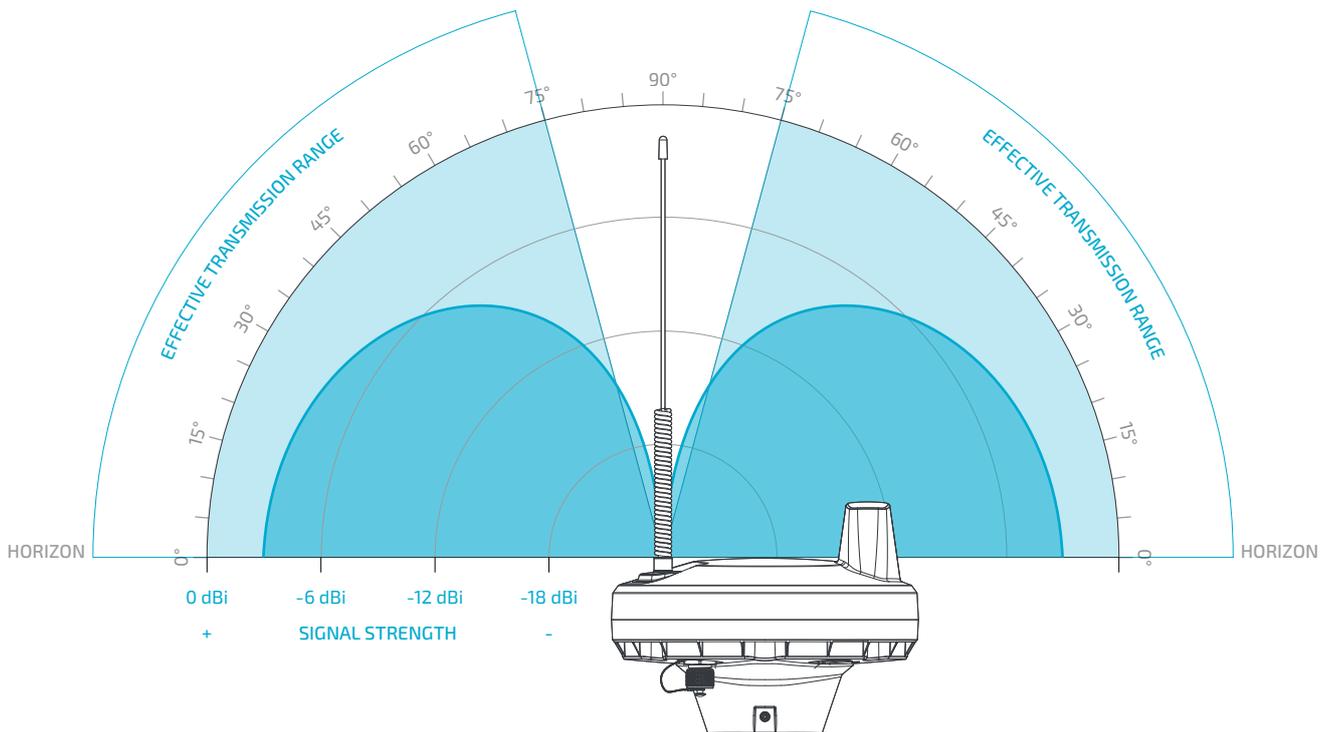
Before deciding on a location to install your D20 unit it is important to understand how the D20 operates.

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.

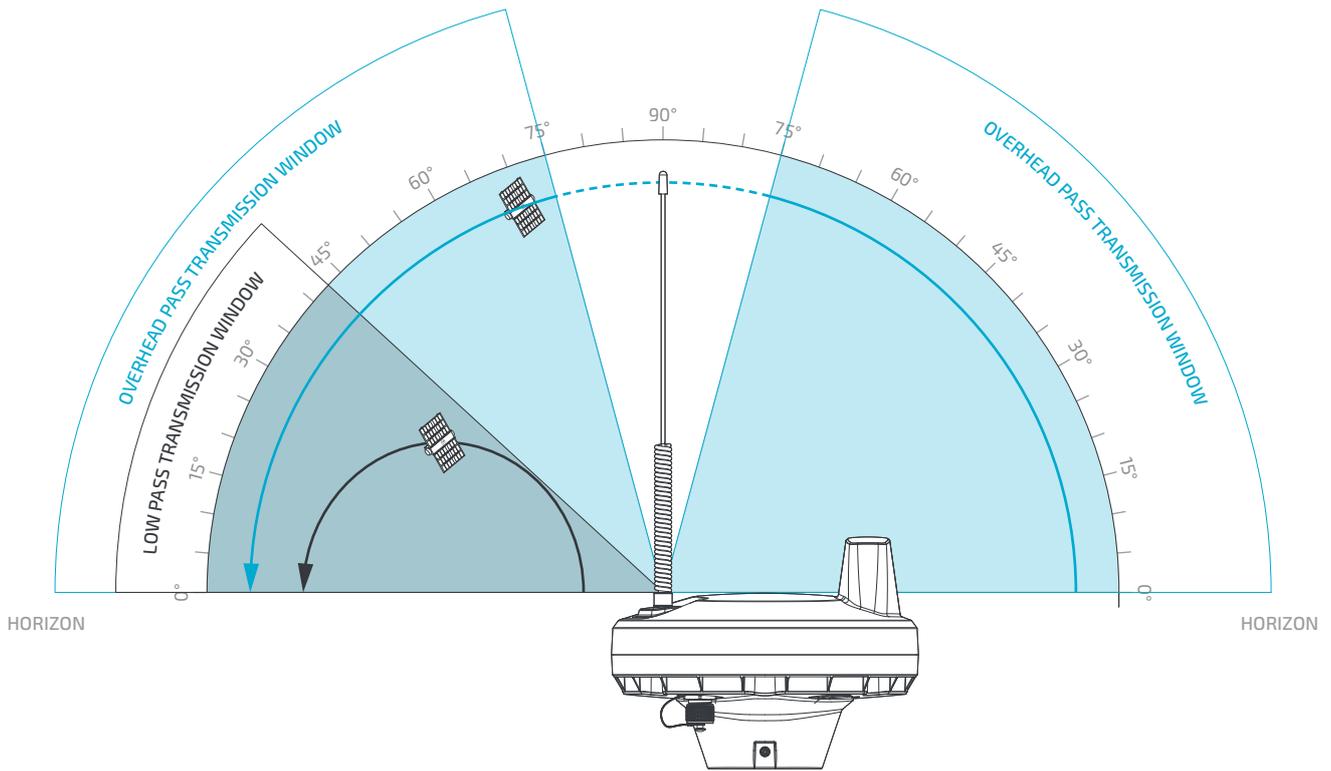
Directly above the Antenna, between 75° and 90° (straight upward), the transmission and reception abilities of the Antenna are poor.



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. The signal strength directly above the Antenna is weak and can't be relied upon for effective transmission.

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.

2.2 SITE SELECTION

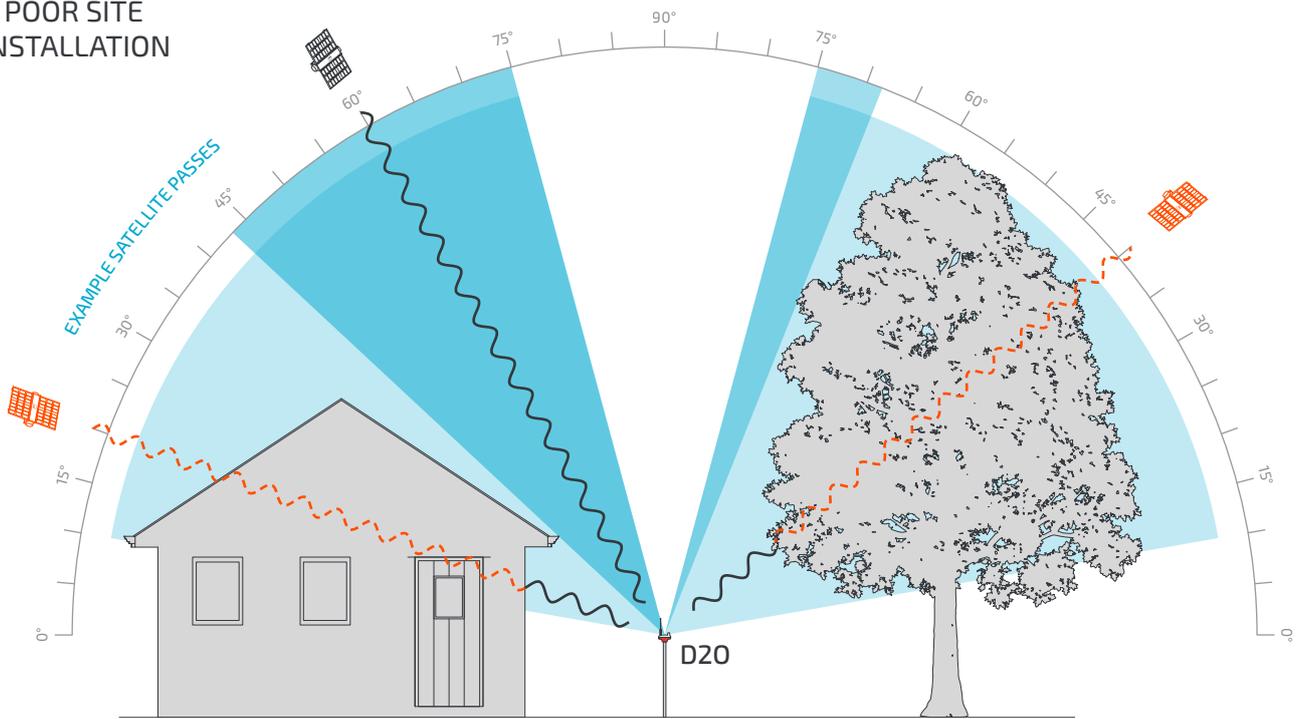
A site should be selected where the D20 unit can see the most sky possible. Where practical the D20 should always be the highest mounted object on top of a mounting post. Avoid placing the D20 in the following locations:

- 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.

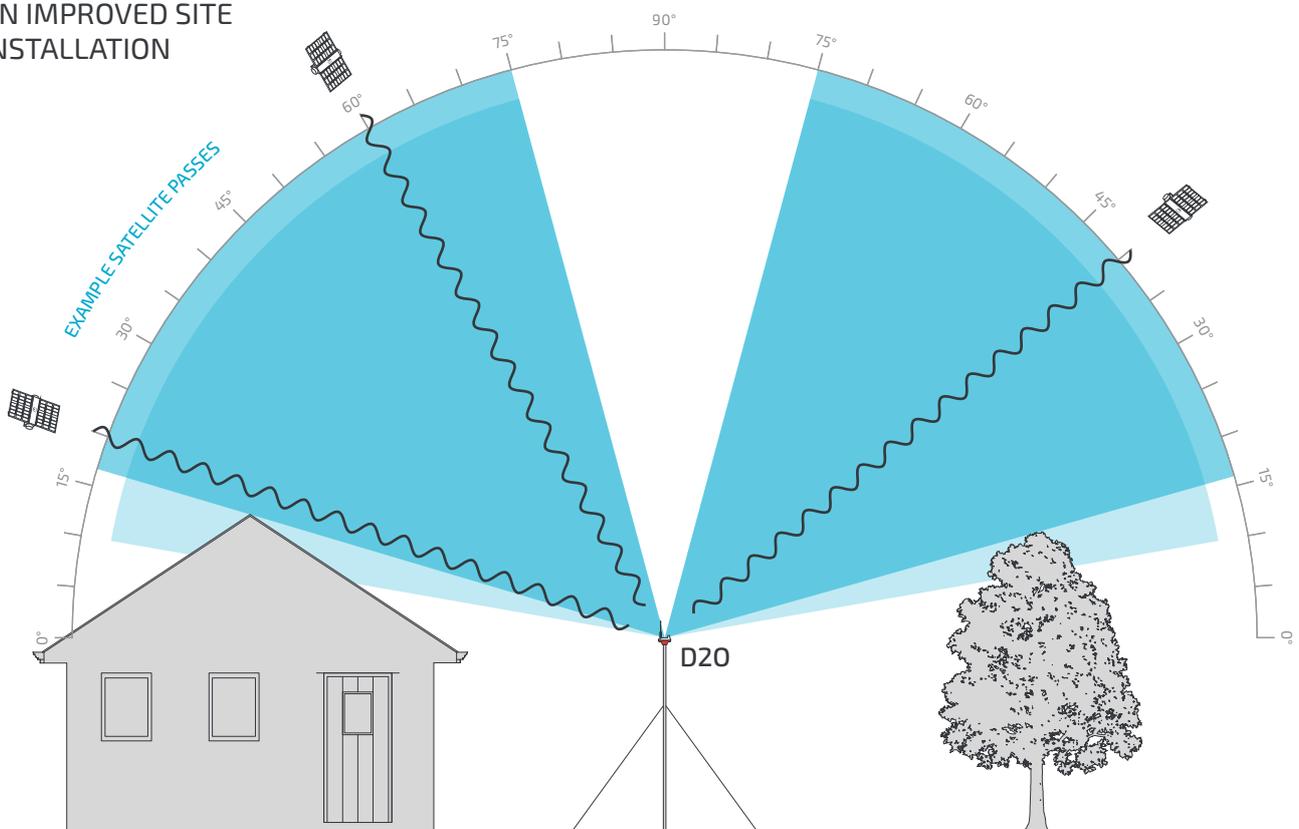
Ideally the D20 should have a clear view of the sky in all directions from 10° above the horizon.

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

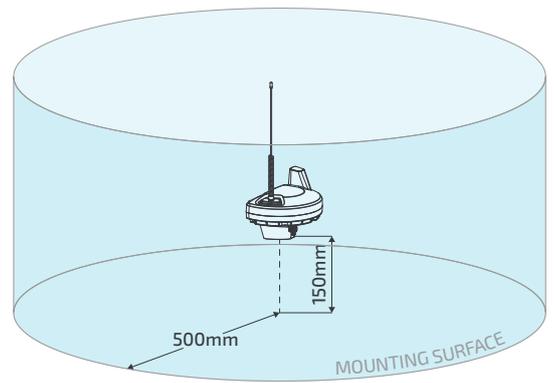


An improved site. The distance to the building has increased and an area with lower surrounding foliage has been selected. To further maximise transmission opportunities the D20 has been placed on a taller mast allowing for a wider view of the sky. Now the overlap of the unobstructed angles (dark segments)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

2.3 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.



2.4 PRE-ASSEMBLY

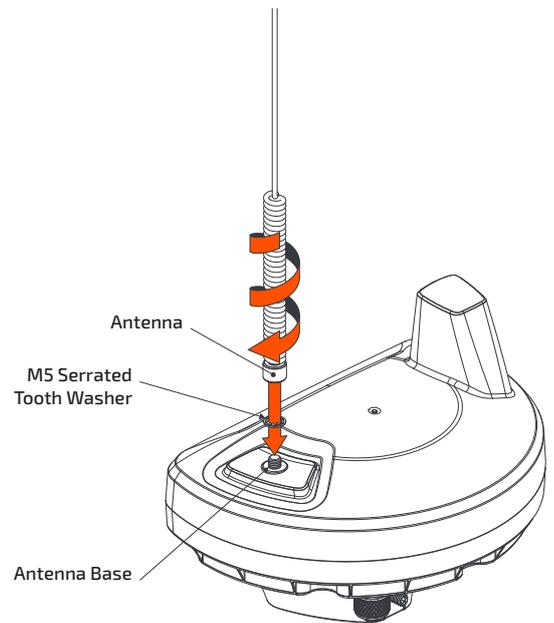
As a first step the *Antenna* must be installed on the D20 unit before it will function.



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.

Before screwing the *Antenna* to the D20 locate the *M5 Serrated Tooth Washer* and slip it over the *Antenna Base*. 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 to an extra one third of a turn after the *Antenna* contacts the *M5 Serrated Tooth Washer*. This ensures the toothed washer sufficiently engages with the plastic of the D20 and the Stainless Steel of the *Antenna* to provide an anti-rotation, locking function. Do not over-tighten the Antenna as irreparable damage may occur.



2.5 D20 INTERFACE CABLE ATTACHMENT

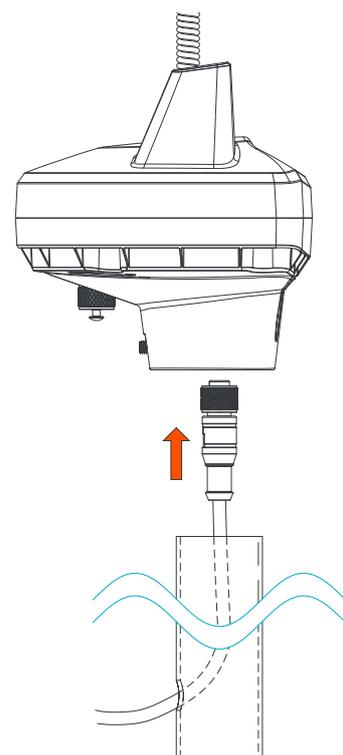
The D20 is capable of being mounted in several ways. In all mounting scenarios it is recommended that the supplied 1.5 meter *8-Pin M12 Interface Cable* is threaded through the mounting device (e.g. a post), emerging only at the point of connection to a device or junction box. This is to decrease the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



2.6 POST MOUNTING

The D2O supports direct installation to a cylindrical post. The mounting socket on the D2O can accommodate a post with:

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

The preferred solution for direct mounting of the D2O 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 section 2.2, the height of the post should also correspond to the risk of damage or interference to the D2O. For example if used in an area with livestock the device should be higher than the livestock could reach. If prone to vandalism the D2O should be high enough to deter interference and may require additional protection mechanisms.

2.7 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 D2O is surrounded by tall objects.

IMPORTANT NOTE:



If installing the D2O at a height that cannot be safely reached once installed, such as a tall mast, ensure the D2O is switched on and commissioned prior to mounting as these steps require physical access to the device.

2.8 SECURING

Ensure the post or mount is engaged all the way to the bottom of the D20 mounting socket. The D20 is supplied with an **Hex Head Grub Screw** to fasten the device to its mount. Use a 2.5mm Allen key or other 2.Hex drive to fasten the grub screw. The screw should only be tightened enough to stop easy rotation or removal of the device.

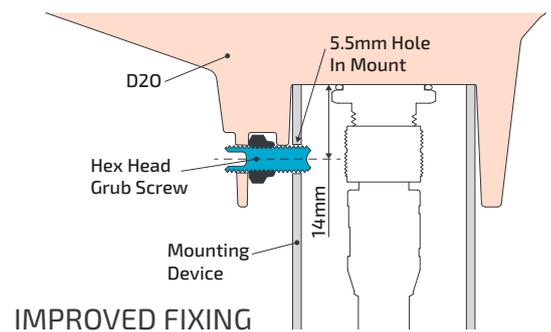
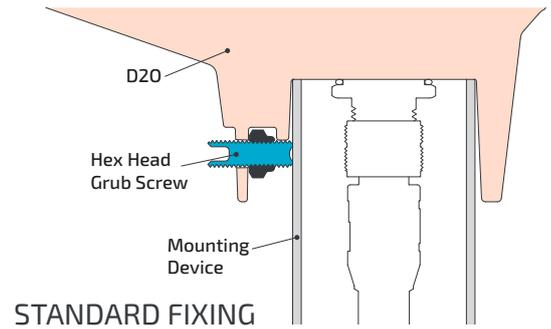


IMPORTANT NOTE:

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.



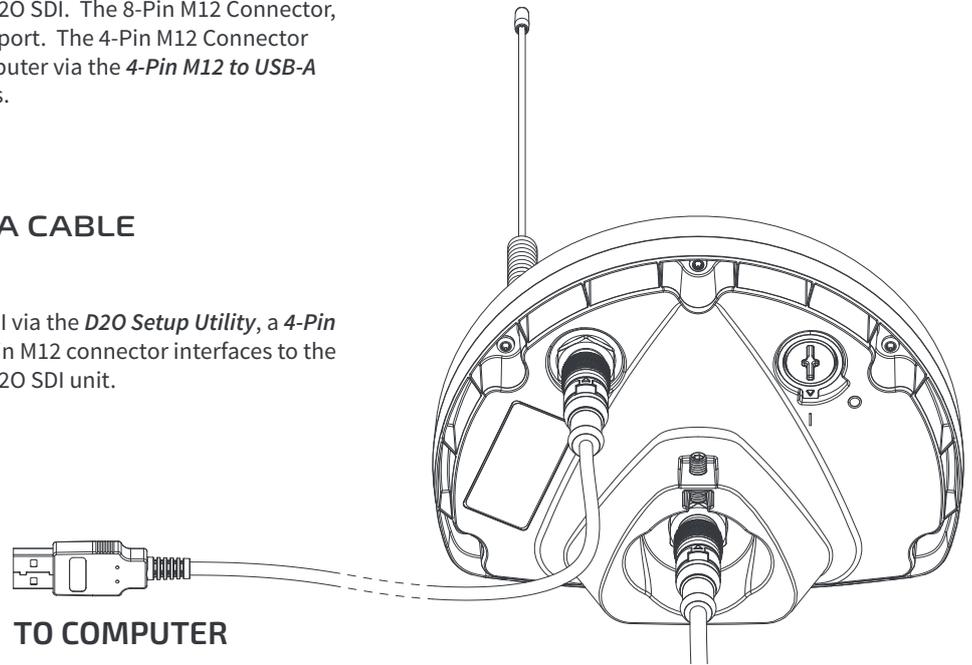
3. WIRING GUIDE

3.1 INTRODUCTION

There are 2 interfaces available on the D20 SDI. The 8-Pin M12 Connector, located centrally, is the SDI-12 interface port. The 4-Pin M12 Connector is used to connect the D20 SDI to a computer via the *4-Pin M12 to USB-A Cable* during the commissioning process.

3.2 4-PIN M12 TO USB-A CABLE

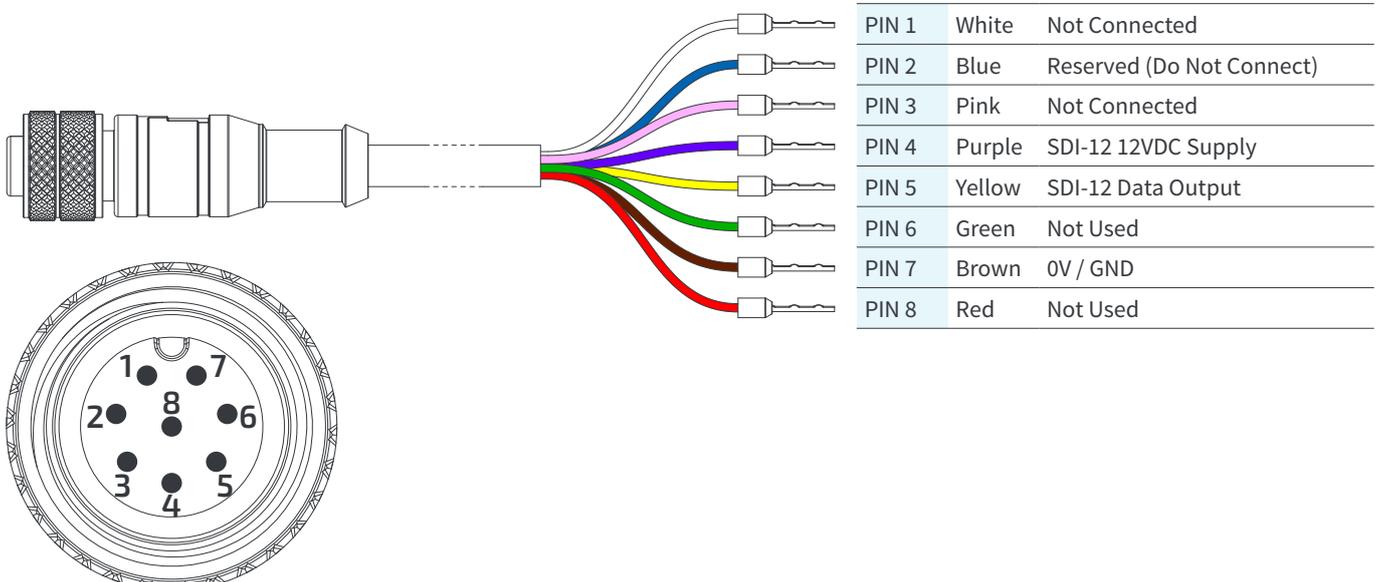
To program and commission the D20 SDI via the *D20 Setup Utility*, a *4-Pin M12 to USB-A Cable* is required. The 4-Pin M12 connector interfaces to the matching port on the underside of the D20 SDI unit.



3.3 8-PIN M12 INTERFACE CABLE

The D20 SDI can be connected to an SDI-12 Device using an *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 SDI, their corresponding functions are shown in the table:



4. OPERATION GUIDE

4.1 BEFORE STARTING

Before the D20 SDI unit can perform its normal operation it must be programmed to establish the desired operating parameters. Without a valid program, the D20 will not know how to communicate to the attached SDI-12 Device.

The D20 SDI can be programmed either prior to installation or during the installation process. In either scenario the SDI-12 Device must be connected to the D20 SDI at the time of commissioning in order to correctly setup and test the system. See the Wiring Guide section of this product manual for more information on connecting devices.

When performing the commissioning process on an installed unit, it is recommended to ensure the cables between the SDI-12 Device and the D20 SDI are correctly connected in their final installed position to ensure the system is a known state once commissioning is complete.

4.2 STARTING THE D20

Using a wide flat blade screw driver or coin, rotate the **Battery Switch** through 45° to the **ON** position. The **ON** position is indicated by the “I” character on the enclosure.

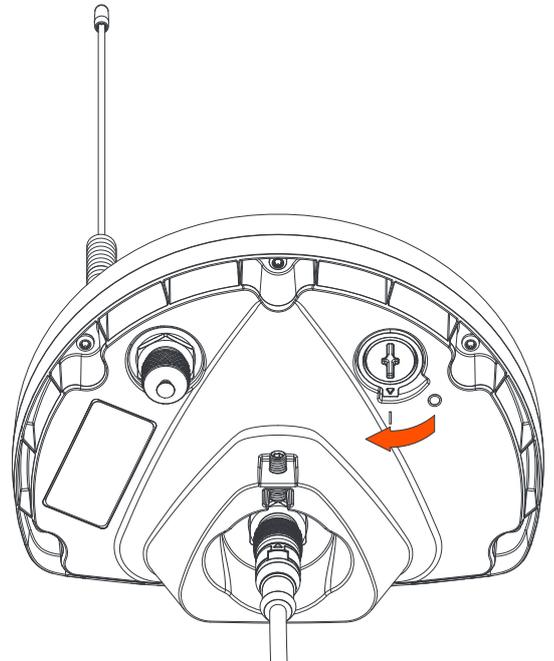
The translucent **Battery Switch** will then flash a green signal light 3 times to indicate it is powered on. If the light does not flash green please refer to the troubleshooting section.

After the unit is powered it will attempt to obtain a Global Positioning System (GPS) fix to update its location and internal time clock.

IMPORTANT NOTE:



If programming indoors the unit may not achieve a GPS fix and the D20 will not receive updated location and time clock data. programming can still proceed.



4.3 SHUTTING DOWN THE D20

Before the D20 can be shut down, ensure there is no active USB connection via the 4-Pin M12 to USB-A cable.

The D20 can be shut down by rotating the **Battery Switch** through 45°, using a wide flat blade screw driver or coin, to the **OFF** position. The **OFF** position is indicated by the “O” character on the enclosure.

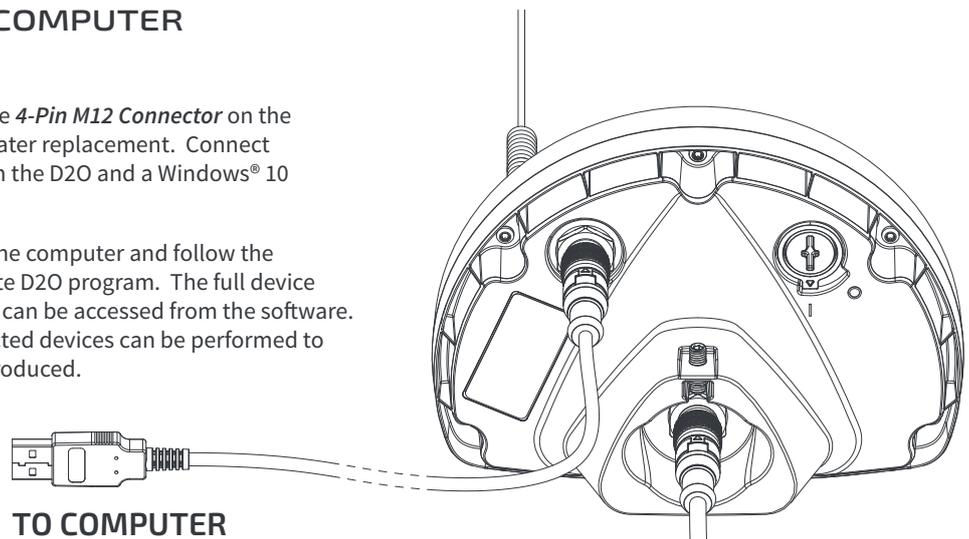
The translucent **Battery Switch** will then flash a red signal light 3 or more times. The unit will be shut down when the light is no longer flashing. If the light does not flash red please refer to the troubleshooting section.

No data will be collected, transmitted or received while the D20 is shut down and the **Battery Switch** is in the **OFF** position.

4.4 CONNECTING TO A 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 Windows® 10 Computer.

Start the *D20 Setup Utility* software on the computer and follow the prompts to load or create the appropriate D20 program. The full device status information and current program can be accessed from the software. Additionally a test reading of the connected devices can be performed to ensure the desired readings are being produced.



4.5 SDI-12 COMMISSIONING PROCESS

The commissioning process is a special function that can only be triggered using the *D20 Setup Utility*. The purpose is to perform a quick test of a complete system with the SDI-12 Device attached and the final program loaded.

During the commissioning process, the SDI-12 Device that has been programmed and connected will perform one sample measurement (data is not logged). This data will be available through the *D20 Setup Utility* to verify the SDI-12 Device data precision is as intended.

Once the system is performing as required, a Commissioning Report can be generated from within the *D20 Setup Utility* for record keeping purposes. Please see the *D20 Setup Utility* section of this product manual for more information about this process.

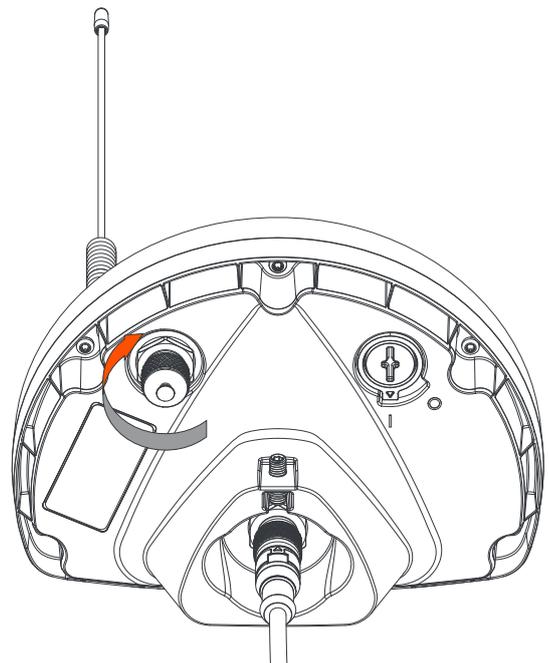
4.6 POST COMMISSIONING

Once the commissioning process has 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 follow sections in this document outline some of the other functions that can be accessed when using this connection and the *D20 Setup Utility*.



IMPORTANT NOTE:
Ensure the D20 SDI's *Battery Switch* is in the *ON* position before leaving the D20 SDI for its normal operation. No samples or transmissions will occur if the *Battery Switch* is in the *OFF* position.



4.7 NORMAL OPERATION

Once the D20 SDI unit is programmed with SDI-12 Device attached, the unit will enter its normal operating mode.

The device will begin by receiving GPS coordinates and the current time in GMT. Once this is complete, the task scheduling will calculate when to next sample the SDI-12 Device and when to generate a data message to send via the satellite link. While the D20 is waiting for a scheduled task time, it will enter low power mode to consume as little power as possible.

When sampling the SDI-12 Device, the D20 SDI unit will enable the 12VDC SDI-12 Supply two (2) seconds before initiating SDI-12 communication to the attached device. All devices defined within the program will be requested to perform a concurrent measurement of their sensors. Once all devices have completed their measurements, the D20 SDI will record the measurement results and disable the 12VDC SDI-12 Supply before returning to low power mode. All SDI-12 Device measurement values are logged. If a SDI-12 Device is programmed but does not respond, it will be marked as faulty and the time of the fault will also be logged. Each SDI-12 Device sampling cycle will attempt to communicate to all programmed devices. If a faulted SDI-12 Device correctly responds to subsequent commands, the device is returned to service and the device state change is logged.

The satellite data message is constructed as defined by the program. There are multiple options as to when and how the message is constructed and will be defined in the *D20 Setup Utility*. Once a message is constructed, it is queued to be sent via the satellite link. The time of the actual transmission is dependent on the satellite trajectory, therefore the data transmission may be delayed. The satellite message will be timestamped at the time of message generation so the data values will remain traceable regardless of the actual transmission time.

Due to functional requirements of the satellite communications system implemented on the D20 SDI unit, if there are any tasks scheduled to occur while the satellite communication is active, the task will be delayed until the satellite communication is complete.

IMPORTANT NOTE:



Ensure the D20 SDI's *Battery Switch* is in the *ON* position before leaving the D20 SDI for its normal operation. No samples or transmissions will occur if the *Battery Switch* is in the *OFF* position.

5. D2O SETUP UTILITY

5.1 INTRODUCTION

Before the D2O SDI can perform its normal operation it must be programmed using the *D2O Setup Utility* software to establish the desired operating parameters. Without a valid program, the D2O SDI will not know how to communicate to the attached SDI-12 Device.

The *D2O Setup Utility* is a Windows® 10 based software tool that interfaces to the D2O SDI when connected via the *4-Pin M12 to USB-A Cable*.

Once a connection is established, the *D2O Setup Utility* provides the following setup features:

- Review of the live D2O SDI status and key unit information
- Programming of the D2O SDI to interface with the connected SDI-12 Device to sample and transmit as required
- Save or open a D2O SDI Program File to enable quick setup
- Set SDI-12 Device transmission and sampling parameters
- Set SDI-12 Device address, precision and channel settings
- Generate a Commission Report of the “as-installed” state of the D2O SDI and a momentary snapshot of the SDI-12 readings

5.2 CONNECTING TO THE D2O SDI

The D2O SDI does not need the *Battery Switch* to be in the *ON* position during this process. Power is supplied to the D2O SDI via the USB connection, once established.

The top right corner of the *D2O Setup Utility* window contains a Connection Panel for selecting the serial port connected to the D2O SDI.

By default the Comms Port selection is set to *Auto*. While in this state the *D2O Setup Utility* will continually search for a D2O SDI unit on an available serial communications port. Plugging an attached *4-Pin M12 to USB-A Cable* into the computer’s USB-A port should result in the D2O SDI being detected.

In the event it is not automatically detected the appropriate Comms Port can be selected manually using the drop down list.

Once connected the Connection Panel should display the following message:

A D2O device has been detected on COM1!

Where COM1 represents the comms channel being used.



IMPORTANT NOTE:

Ensure the D2O SDI's *Battery Switch* is in the *ON* position before leaving the D2O SDI for its normal operation. No samples or transmissions will occur if the *Battery Switch* is in the *OFF* position.

5.3 STATUS MODE

The Status Mode provides an overview of the key hardware and system parameters of the connected D2O SDI unit.

The following fields can be viewed from this screen:

| FIELD | DESCRIPTION |
|------------------------------|--|
| Modem Version | Version of firmware currently installed onto the D2O SDI Modem board |
| SDI Version | Version of firmware currently installed onto the SDI-12 Interface board |
| Device ID | This product's unique identifier, used during the registration process and for dealing with service and support issues. This identifier also appears on the Product Identification Label on the underside of the physical device |
| Module Type | A variant identifier that denotes which satellite network provider, region and frequencies are utilised by this D2O SDI unit |
| SDI-12 Device X Status | The status of each of the connected SDI-12 Devices (where X denotes Devices 1-4): <ul style="list-style-type: none"> OK or Fault - Indicates whether the probe in the program was successfully communicated to by the device None - Indicates the probe is not present in the program NOTE: until a SDI-12 Sample Communication sequence has successfully completed the SDI-12 Device Status will show as Fault . Once completed the status will update accordingly, this process may take several seconds to complete. More than one device will be supported in a future release |
| Comms Status | Indicates if there is a problem with the SDI-12 bus which is inhibiting the device from transmitting or receiving data on the wire |
| Power Switch State | ON or OFF reflects the physical switch status |
| Battery Voltage (V) | The Voltage (V) of the internal battery pack |
| Battery Charge (%) | The remaining capacity of the battery as a percentage from full |
| Battery Type | Indicates if the battery is of a Non-Rechargeable or Rechargeable type |
| Peak Discharge Current (mA) | The peak discharge of current measured in milliamperes (mA) between the battery, and the main system consisting of the SDI-12 processor, SDI-12 bus and modem board |
| GPS Lock | Yes or No to indicate if the D2O SDI currently has a GPS time and location lock |
| GPS Latitude | The last received Latitude coordinate from the GPS Lock |
| GPS Longitude | The last received Longitude coordinate from the GPS Lock |
| System Status | <ul style="list-style-type: none"> Running - All system parameters are OK and the system is ready to run Initialising - System is starting up and waiting for information from the modem with relation to GPS time and serial number etc. No Program - Indicates that the system does not have a valid program and requires a program to be transferred before being able to perform tasks Comms Busy - Indicates that the modem module is busy (TX or RX satellite messages) which could affect other functionality of the D2O SDI unit (may affect user experience while modem comms is busy) Power Off - Indicates that the power switch is in the off position. Disconnection of the USB or external power source in this state will crash the device and the system will not be running |
| Modem Initialised | Indicates whether the modem was successfully initialised. Requires the modem to have achieved GPS lock to provide the time and location of the device |
| Sample Counter | A record of the number of SDI-12 Device sample cycles that have been completed over the life of the device |
| RSSI | The Receive Signal Strength Indication as reported by the internal satellite network provider module. A typical value would be between -80 and -105. If this number is too high, the reception of data from the satellite may be compromised and system updates relating to the satellite system may not be successful. Note this is an indicative value only, and the reading is highly susceptible to local sources of interference including electronic devices and any other object in close proximity |
| Is Programmed | Indicates if a program has been written to this D2O SDI |
| Next Sample Time (UTC) | The Epoch time (UTC) when the next SDI-12 Device sample cycle will be performed as defined by the program loaded |
| Next Satellite Tx Time (UTC) | The Epoch time (UTC) when the D2O SDI will next attempt to send data to a satellite. This is calculated by the internal satellite network provider module and is dependent on location |
| Current Time (UTC) | The current Epoch time (UTC), periodically updated when viewing in Status Mode |

5.4 PROGRAM MODE

The Program Mode allows the key operational parameters of the D20 SDI to be setup. This includes parameters relating to the transmission and sampling of data as well as specific settings for the interfacing to the connected SDI-12 Device. At any stage during the programming process the fields can be reset by clicking the Reset Button in the toolbar.

The following process should be followed when programming a new D20 SDI unit:

Step 1 - Define the parameters of the SDI-12 Device

The left hand section of the Program Mode panel contains settings for the SDI-12 Device, which has the following parameters:

| FIELD | DESCRIPTION |
|--------------------------------------|---|
| SDI-12 Device Name | A user entered name for this SDI-12 Device. Note that this name is not written or stored on the D20 SDI and only exists in the Program Mode of the <i>D20 Setup Utility</i> , for Commission Report identification purposes |
| Address | The address filed is the ASCII address character assigned to the SDI-12 Device configuration. Only values 0 (zero) to 9 are allowed |
| No. of Channels | The number of data Channels (or readings/values) that this SDI-12 Device produces. Up to 13 channels are possible subject to Range / Precision settings |
| Averaging | <p>The number of times to consecutively, and immediately, sample each Channel during a single sampling cycle. A single, averaged reading will be produced from these sequential samples. This may be useful for SDI-12 Devices that do not perform their own internal measurement filtering. It may also be useful in producing a more indicative reading for situations where the measuring device may be highly sensitive or in a dynamic environment</p> <p>When set to None, only a single measurement sample occurs for each Channel and the data returned is used directly to generate the associated satellite message</p> |
| Range / Precision | <p>The Range / Precision of the value of each Channel's SDI-12 sample readings, as sent through to the satellite message. Modifying this parameter will affect the number of Channels that can be added to a Device with higher Range / Precision selections resulting in fewer available Channels. For each setting the data values will be encoded within the defined range and with the decimal precision as indicated by the selection. Data readings outside of this range will produce satellite message reading of the applicable limit</p> <ul style="list-style-type: none"> • <i>SDI-12 Full Range</i>: Encodes with the full possible precision of the data values returned from the probe (Max 4 Channels) • <i>0 to 262144; -131072 to 131071; -13107.2 to 13107.1; -1310.72 to 1310.71</i>: (Max 6 Channels) • <i>0 to 4095; 0 to 409.5; -2048 to 2047; -204.8 to 204.7</i>: (Max 9 Channels) • <i>0 to 255; -128 to 127</i>: (Max 13 Channels) |
| Channel Name (Per Device Channel) | A Name can be set for each Channel of a Device for ease of identification in the Commission Report. Note that this Name is not written or stored on the D20 SDI and only exists in the Program Mode of the <i>D20 Setup Utility</i> . Names will be saved with a program when saving a file. |

Step 2 - Set messaging, sampling and transmission parameters

The Messaging, Sampling and Transmission panel, on the right hand side of the Program Mode panel, can set the following parameters:

| FIELD | DESCRIPTION |
|---------------------|---|
| Sampling Interval | This is the amount of time that will elapse from the previous sample reading until the next sample reading, starting from the Sampling Time (UTC). Limits are applied to other program settings depending on Interval frequency selected |
| Sampling Time (UTC) | The time (UTC) when the first SDI-12 samples will be taken after program has been written to the D20 SDI. Subsequent sampling will be based on the selected Sampling Interval time periods after the initial sample |
| Transmission Mode | Immediate - In this mode of operation the D20 SDI will take a sample reading from the programmed SDI-12 Device and will immediately queue a message for transmission during the next available satellite pass. An initial sample reading will occur at the Sampling Time (UTC) and will repeat at every interval thereafter, within the bounds of the maximum number of allowed messages per day (as validated) Buffer - This mode of operation is best suited to programs where only a single SDI-12 Device with a single Channel is connected to the D20 SDI. The SDI-12 Device is sampled at the rate defined by the Sampling Interval setting. A single satellite message is constructed after enough samples have been taken to fill all of the available data slots in the selected message type. The transmitted message will return each individual sample reading as an offset in time from the value before it, equivalent to the Sampling Interval time |

Step 3 - Validating and writing the program

Once the SDI-12 Device parameters and the messaging, sampling and transmission parameters have been setup as desired, the program can be validated to ensure the selected settings are compliant with the D20 SDI's capabilities and with the user's Maximum Messages / Day setting.

Clicking the Validate Button will perform a series of checks and a summary of the results will be provided in the message box below, advising of the outcome.

Once a program has been successfully validated it can be written to the D20 SDI by clicking the Write Button. The message box below will advise the outcome of the writing operation. Note a validation is also performed during a write operation.

5.5 COMMISSION MODE

The purpose of the Commission Mode is to perform a quick test of a complete system with the SDI-12 Device connected to the D20 SDI and the final program loaded.

It is important that commissioning be performed immediately after writing the program to the D20 SDI, and while the currently transferred program is still loaded in the *D20 Setup Utility* software.

The commissioning process must be followed carefully to avoid accidental generation of incorrect data in the Commission Report:

Step 1

Ensure the D20 SDI is connected via USB. Follow the programming procedure as outlined in the Program Mode section of this product manual to create a program and write it to the D20 SDI. Once the program has been written, click the Commission Button from the top left section of the *D20 Setup Utility*.

Step 2

On the Commission Report page displayed, the following editable fields may be populated by the user as required:

- Business Name
- Site Name
- Site Address
- Commissioning Technician

Note that the above fields are not transferred to the D20 SDI and are intended to be populated during the Commission Report process only.

Step 3

Click the Read Values Button, located to the top left of the Commission Report window. This will perform one sample measurement of all programmed and connected SDI-12 Devices and their Channels. The sampled measurements will be shown at the bottom of the Commission Report, next to their relevant Channels.

Note the data precision of the measurements, as shown in this Commission Report, is representative of the data that will be transmitted once the D20 SDI is in its normal operation. If the precision needs to be adjusted then the Range / Precision may be adjusted from the Program Mode, requiring a re-write of the program before results will take effect.

Step 4

Once the commissioning process has been completed, the Commission Report can be printed using the Print Button, located to the top left of the Commission Mode window.

A PDF document can be created by using the Windows® 10 *Microsoft Print to PDF* printer, or other similar PDF printer, to save the Commission Report for future reference and distribution.

5.6 SAVING AND OPENING A PROGRAM

The *D20 Setup Utility* has the capability to save and open D20 SDI programs.

All editable fields of the Program Mode panel will be saved, including the user entered Names for each Device and its Channels.

To save a program file, click the Save As Button from the toolbar and follow the prompts.

To open a program file, click the Open File Button from the toolbar, and follow the prompts to locate the desired file.

Once a program has been opened, the standard process for verifying and writing the program to the D20 SDI must be followed before the program will execute on the D20 SDI unit.

6. TROUBLESHOOTING

6.1 OPERATIONAL TROUBLESHOOTING

| SITUATION | ACTION |
|--|---|
| Turning the Battery Switch to “ ON ” does not power the D20 and no Green flashes are visible from the Battery Switch | <ul style="list-style-type: none">• 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• Switch the Battery Switch to the “OFF” Position and wait for any Red light flashes to finish• Switch the Battery Switch to the “ON” Position and watch for the Green light flashes• Reconnected sources of external power and continue normal operation• If the problem persists, or no external power is connected, the battery may be depleted (can be reviewed in the D20 Setup Utility software) and needs to be sent to a service agent for replacement |
| Turning the Battery Switch to “ OFF ” does not shut down the D20, or the Red light flashes, visible from the Battery Switch , will not finish | <ul style="list-style-type: none">• Return the Battery Switch to the “ON” Position. 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• Switch the Battery Switch to the “OFF” Position and wait for any Red light flashes to finish• The D20 is now shut down |
| The D20 Antenna becomes loose over time | <ul style="list-style-type: none">• Ensure the supplied M5 Serrated Tooth Washer is installed between the Antenna and the Antenna Base of the D20 as per the Installation section• Ensure adequate securing torque has been applied when threading on the Antenna in order for the M5 Serrated Tooth Washer to have engaged with the plastic of the D20 and the Stainless Steel of the underside of the Antenna• Avoid over-tightening the Antenna to the Antenna Base as this may cause irreparable damage to the D20 |
| The D20 is not reliably transmitting messages | <ul style="list-style-type: none">• Ensure that the Battery Switch is in the ON position. No samples or satellite transmissions will occur if the D20 SDI has the Battery Switch in the OFF position in normal operation - the D20 SDI will not be powered• Check if the battery is depleted (can be reviewed in the D20 Setup Utility 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 regional sources of strong Radio Frequency interference that could be affecting transmissions• 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 |

6.2 D2O SETUP UTILITY TROUBLESHOOTING

| SITUATION | ACTION |
|---|--|
| Cannot connect the D2O SDI to the <i>D2O Setup Utility</i> software | <ul style="list-style-type: none">• Ensure the <i>4-Pin M12 to USB-A Cable</i> is properly connected to the D2O with the M12 threaded connection fully fastened• Ensure the USB-A connector of the <i>4-Pin M12 to USB-A Cable</i> is directly connected to an active port on the Windows® 10 Computer, avoiding the use of USB hubs or other intermediate connections• Remove all other USB connections from the Computer (except mouse and keyboard) to remove potential conflicts• Ensure that the Window 10 Computer has its USB ports available (not blocked by an administrator or security setting) and that the <i>D2O Setup Utility</i> software has appropriate permissions to run• Ensure the latest version of the <i>D2O Setup Utility</i> software is installed• Try using both the auto-detect and manual selection methods from the Comms Port panel of <i>D2O Setup Utility</i> software• If problems persist please contact your support representative for more detailed assistance |
| The Commission Report is displaying data that is inconsistent with the known state of the D2O SDI | <ul style="list-style-type: none">• Carefully follow the process outlined in the Commission Mode area of the <i>D2O Setup Utility</i> section of this product manual. If this process is not followed and fields in the Program Mode panel are modified without re-Writing the program to the D2O SDI, then it is possible to have data that is inconsistent with the actual state of the device shown on the Commission Report |
| Program validation is failing | <ul style="list-style-type: none">• Review the Program Mode area of the <i>D2O Setup Utility</i> section of this product manual to understand the influences each parameter can have on the validity of the program• Ensure the number of messages the program is trying to generate does not exceed 4 messages per day |

7. SPECIFICATIONS

7.1 TECHNICAL SPECIFICATIONS

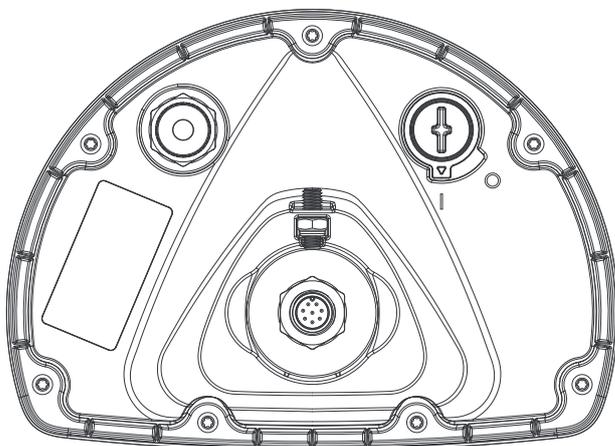
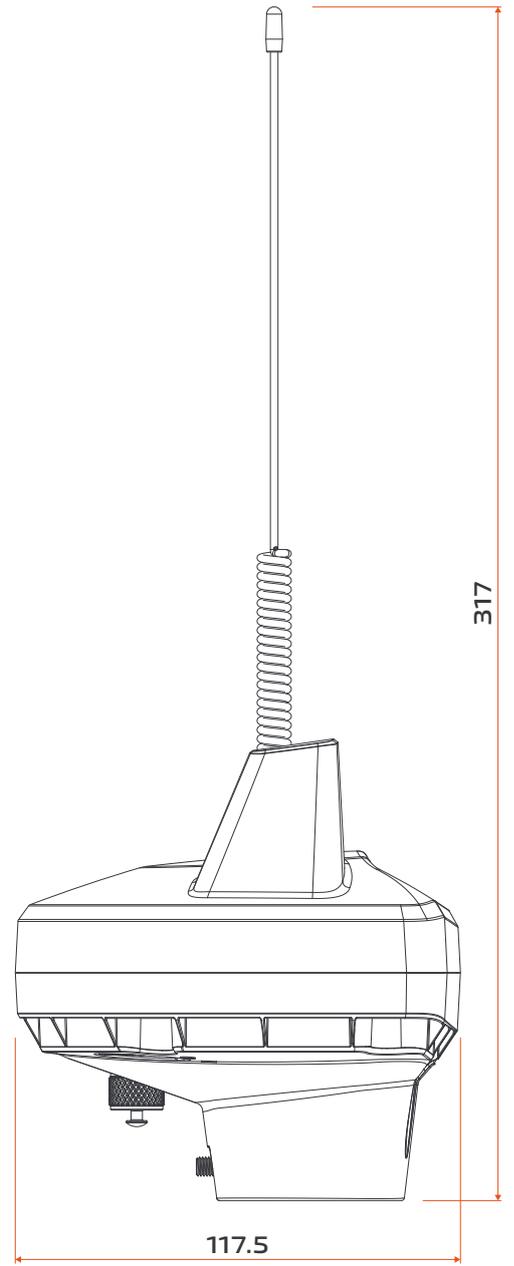
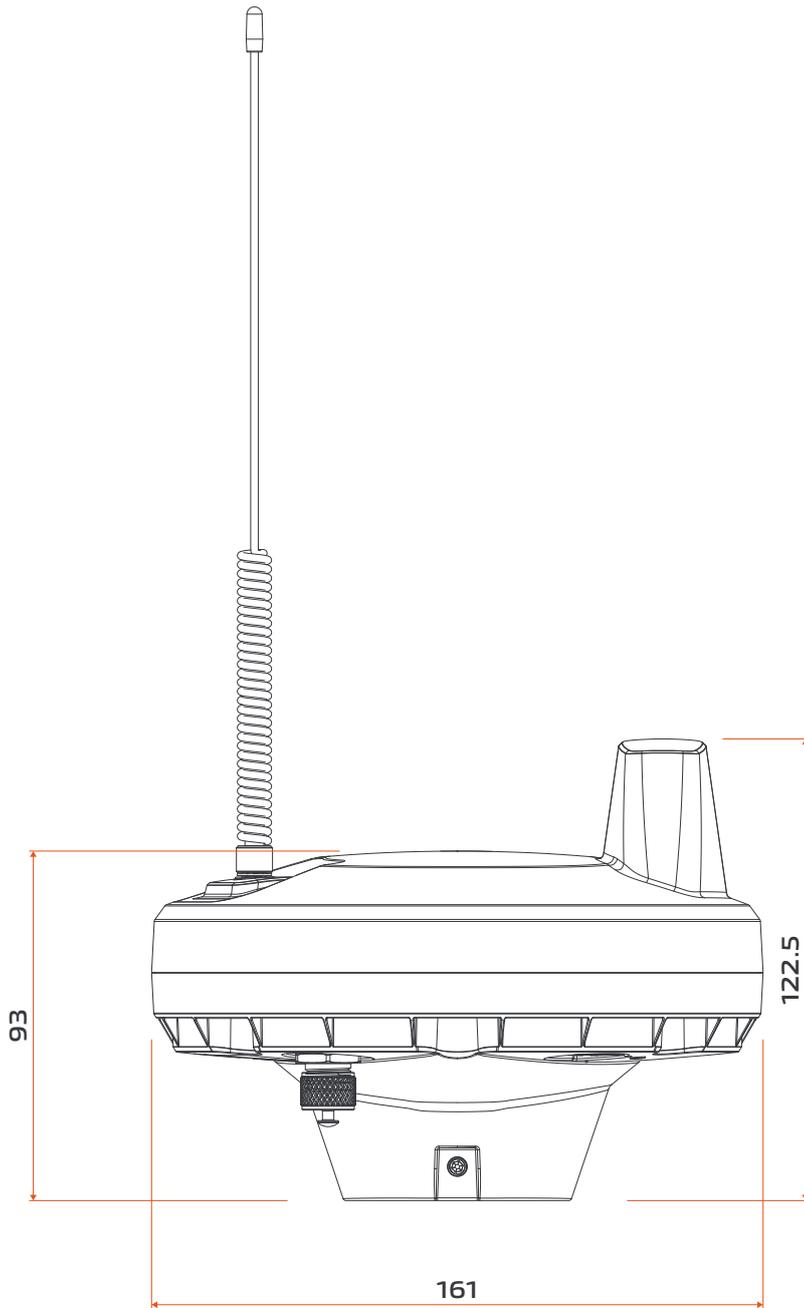
| | | |
|---------------------------------------|---|---------------------------------------|
| ENVIRONMENTAL | Operating Temperature Range | -15 to +60°C (+5 to + 140°F) |
| | Enclosure Ingress Protection (IP) Rating | IP67 |
| POWER | Nominal Operating Voltage | 3.0 to 3.6VDC |
| | Nominal System Standby Current | 25µA |
| | Nominal Non-Rechargeable Battery Capacity | 10Ah |
| RADIO FREQUENCY | Transmit Frequency (VHF) | 161.45MHz |
| | Receive Frequency (UHF) | 400.575MHz |
| | GNSS Receive Frequency | 1571 to 1606MHz |
| SDI-12 | Nominal SDI-12 12V Supply Voltage | 12VDC |
| | Max Continuous SDI-12 12V Supply Current (Reverse Feed Protected) | 40mA |
| | SDI-12 Data Input Logic Low Level | < 0.8VDC |
| | SDI-12 Data Input Logic High Level | > 1.5VDC |
| | SDI-12 Data Output Logic Low Level | < 0.5VDC |
| | SDI-12 Data Output Logic High Level | > 4.0VDC |
| | Maximum Number Of Connected SDI-12 Devices | 1 |
| Maximum Data Points per SDI-12 Device | 13 (Value Precision Dependent) | |
| SYSTEM | Device Internal Temperature Sensor Range | -30 to +70°C (-22 to + 158°F) |
| MECHANICAL | Securing Fastener | M5 Hex Head Grub Screw (2.5mm Key) |
| | Enclosure Materials | ASA, PMMA, TPE |

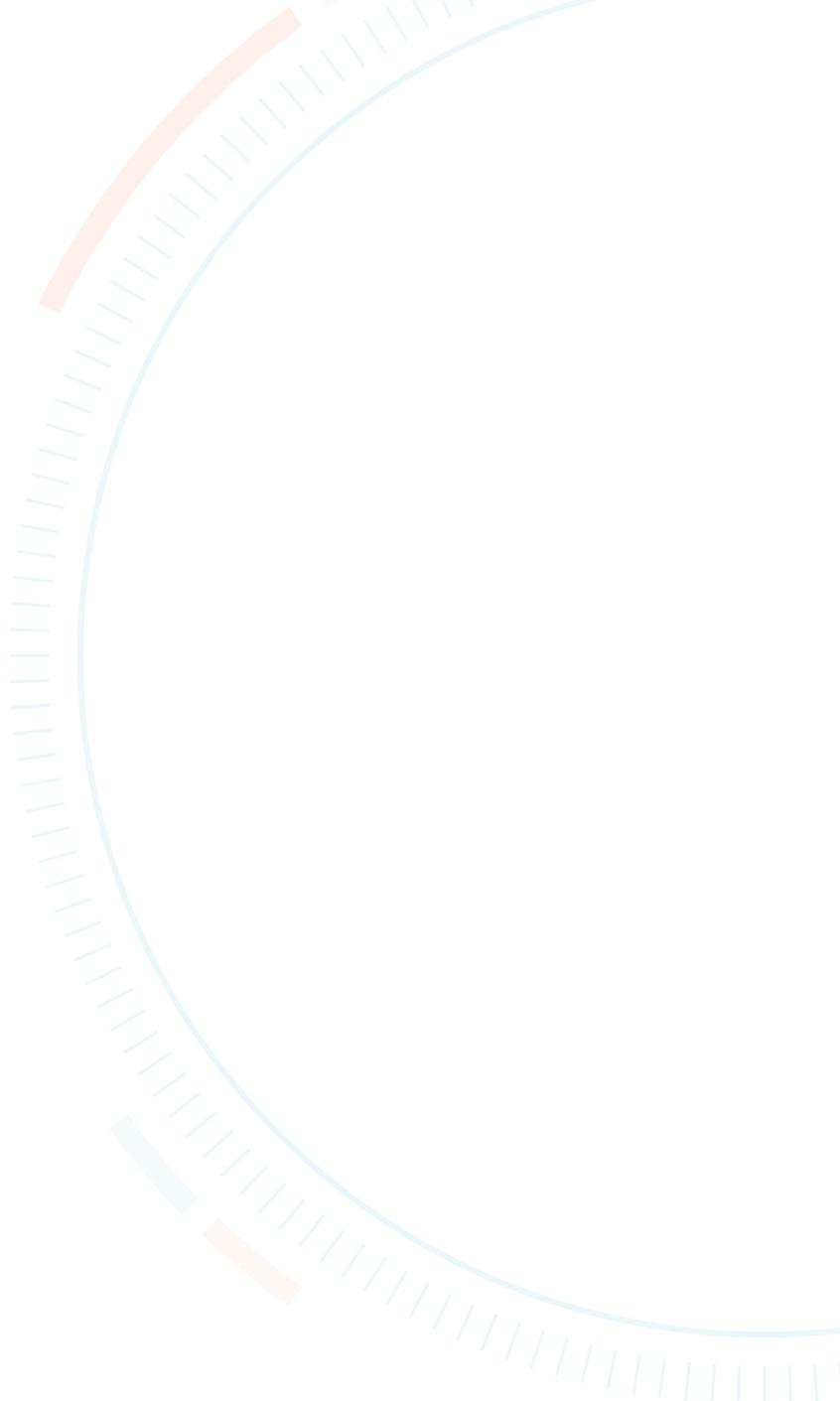
7.2 REGULATORY INFORMATION

The Zepiro D20 SDI has the following approvals & listings:

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

7.3 PRODUCT DIMENSIONS





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.