National Oceanography Centre

PASS-SWIO

Portagauge and Satellite Sea Level Monitoring System for the Southwest Indian Ocean

Portagauge installation and operation instructions

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1. Overview

The Portagauge is a self-contained portable tide gauge that facilitates rapid deployment and ease of installation.

Traditional tide gauges require a substantial investment in hardware to install a system in one fixed location. A tide gauge installation is designed and constructed to suit the requirements of a specific location; this is then installed and robustly anchored to the land to prevent movement. It is usually not possible, or desirable, to move this installation and reinstate it at a new location. In contrast, the portagauge has been designed to provide the qualities of a permanent tide gauge installation, in a package that permits transportation and relocation around various sites.

This document describes how to install and decommission the Portagauge (for relocation to a new site) and how to access and download the data it collects.

The fully assembled Portagauge is shown below (Figure 1).

Figure 1. Portagauge fully assembled.

Portagauge consists of the following key components (Figure 2):

- Vegapuls 6X radar sensor
- Trimble Zephyr GNSS antenna
- Trimble Alloy GNSS receiver
- Satlink3 data logger
- Vaisala PBT110 Barometer
- Mobile data communication

The equipment is housed inside two glass reinforced plastic (GRP) enclosures which in turn are located inside a steel protective case, this, in conjunction with the angled solar panels, protects the instruments from water ingress from wave overtopping or rainfall. The steel case of Portagauge, which houses the GRP equipment enclosures, has drain holes to allow water to exit the case should ingress occur. Weak points in the GRP are the coaxial connectors which do not have seals fitted (all other connectors use seals for weather protection). For this to become an issue, the outer steel case would need to fill with water until the level of the coaxial connectors is overtopped. This would require the Portagauge to be completely overwhelmed with water, for example during storm surge event.

The design of the portagauge is based on NOCs permanent tide gauge installations, but uses lighter materials to ensure portability. The radar arm has been stiffened using guy wires to reduce windage. Any oscillation effects due to wind will average out over the 5 second measurements of the radar and GNSS. The Portagauge is not designed to withstand cyclones and should be dismantled and removed to a safe place if extreme weather is forecast.

The dimension of the Portagauge are shown in Figure 3. It weighs 180kg when the water tank is empty and 460kg when full.

Figure 2. Key components of the Portagauge.

1. Trimble Zephyr GNSS antenna 2. GPS and 4G antennas for data logger time and communications 3. Vegapuls 6X radar sensor shown with protective cover 4. Solar panels 5. Water ballast tank 6. Turnbuckle anchoring point 7. GNSS mast / radar arm 8. Levelling feet 9. Instrument box

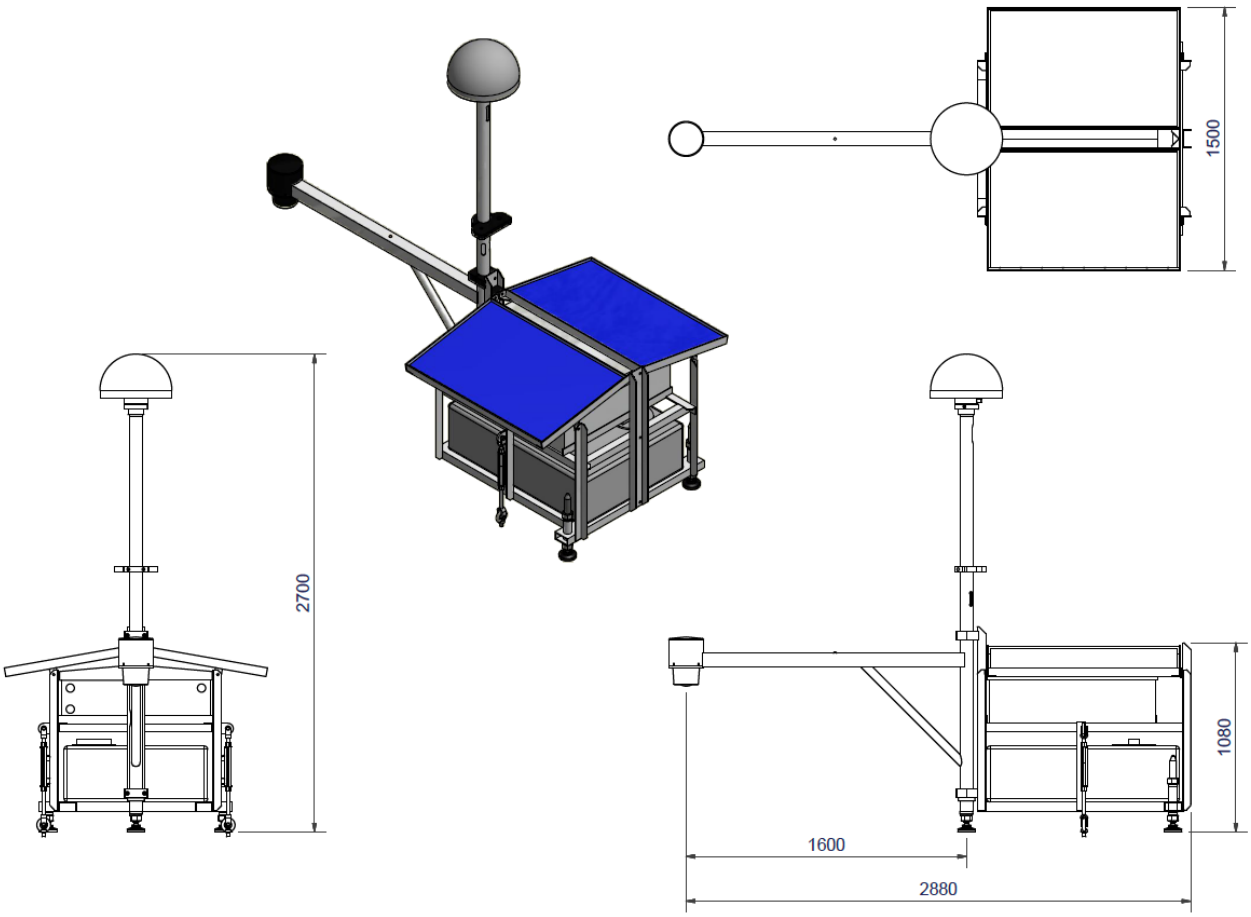


Figure 3. Design drawing for portagauge, dimensions in millimetres

2. Basic Operation

Portagauge should be positioned close to the quay edge so that the radar arm can extend out over the water, with a clear view of the sea surface. There should be no obstructions from boats, pontoons, or fenders below the radar sensor. The chosen location must have water below the radar sensor at all states of the tide and not dry out at low water, especially during spring tides.

The Vegapuls 6X radar sensor accurately measures the distance to the sea surface. As the sea level varies due to the tide, the radar sensor measures the distance to the sea surface continuously. These data are recorded by the Satlink3 data logger, which generates an average sea level value every minute. This value is sent to a Raspberry Pi minicomputer and stored for onward transmission via mobile data networks.

The GNSS antenna continually receives signals from satellites overhead, which are logged by the Trimble Alloy GNSS receiver. These data provide information on the location of the Portagauge and provide an indication of any vertical land movement experienced by the gauge. If the Portagauge is connected to a mobile data network, the GNSS data is automatically transmitted to NOC for processing and analysis. In the absence of an internet connection, the data is stored on the GNSS receiver and can be downloaded periodically by a local operator.

The GNSS also receives reflected signals from the sea surface, which through an innovative analysis technique called Interferometric Reflectometry (GNSS-IR) can be used to infer sea-level. For GNSS-IR to work well, the system must be positioned where the GNSS antenna is overlooking unobstructed open water, and there are no tall structures nearby that will block the low elevation GNSS signals from reaching the antenna.

3. Assembly Instructions

3.1. Frame

The Portagauge frame arrives partially disassembled (Figure 4) to reduce the size of the shipping crate. To deploy the gauge, reassembly is required.

Figure 4. Portagauge partially dismantled for shipping.

1. GNSS mast / radar arm 2. Batteries 3. Portagauge main frame 4. GNSS antenna 5. GNSS radome 6. Installation tools 7. Wooden supports for solar panels 8. Securing bolts

To unpack the Portagauge, loosen the restraining straps securing the equipment inside the shipping crate and carefully remove everything from the crate. Take care when removing the main frame assembly; it is heavy. Remove the packing material covering the solar panels and the wooden support pieces (keep these in case they are needed when transporting the Portagauge in the future). Carefully lower the solar panels and secure in place, by passing a bolt (item number 8 in Figure 4) through the holes (where the wooden supports were attached) in the main frame and solar panel frame (indicated by green arrows in Figure 16)

The GNSS mast / radar arm (item number 1 in Figure 4) needs to be attached to the main frame. The mast is pre-fitted with GPS and 4G antennas (Figure 5), along with the cables for all antennas and sensors. Care should be taken to ensure these are not damaged during unpacking and assembly.

Figure 5. GPS and 4G antennas.

3.2. GNSS Antenna

Prior to attaching the GNSS mast / radar arm to the frame, the GNSS antenna must be fitted to the mast using the threaded rod (this has been removed from the mast during shipping). Unpack the GNSS antenna from the carboard box it is shipped in.

Locate the threaded rod and fully insert into the base of the GNSS antenna. Support the mast so that the top end is accessible. Install the antenna onto the top of the mast by aligning the threaded rod with the hole and rotating the antenna clockwise. **DO NOT insert the threaded rod into the mast prior to attaching the GNSS antenna as it is possible to lose the rod inside the mast.**

Once fully assembled, the connector on the GNSS antenna should align with the pre-fitted GNSS cable in the mast (Figure *6*). Connect the antenna cable to the antenna.

Figure 6. *GNSS antenna and cable fitted onto the mast.*

Install the antenna radome (Figure 7) on top of the antenna and secure in place using the supplied fixings.

Figure 7. GNSS antenna radome.

3.3. GNSS Mast / radar arm stanchion

The GNSS mast / radar arm (indicated by the yellow arrow in Figure 8) must be securely attached to the main frame with the preinstalled black plastic clamps (indicated by red arrows in Figure 8). Orientate the radar arm to protrude perpendicular from the main frame. Ensure the GNSS antenna is protected from accidental damage whilst attaching the mast to the frame.

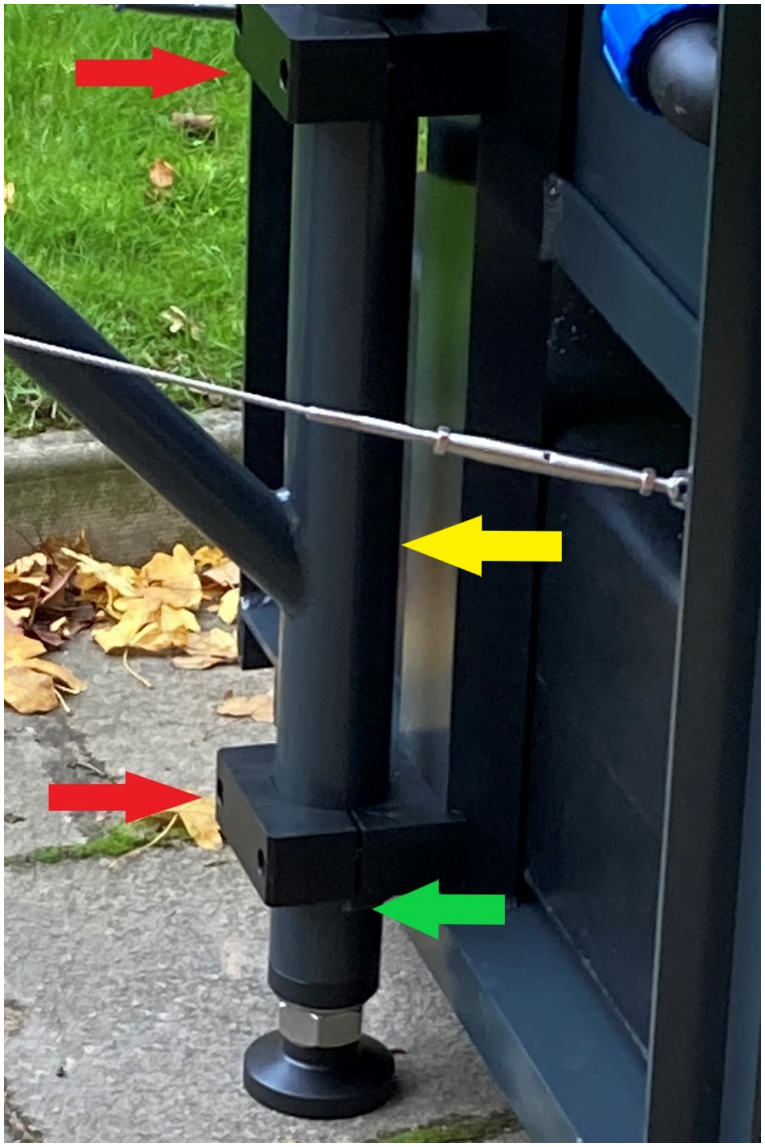


Figure 8. GNSS mast / radar arm mounting clamps.

The GNSS mast / radar arm is fitted with a stop ring (indicated by green arrow in Figure 8) which the lower clamp must sit on once correctly installed. The foot at the base of the mast can be adjusted by unscrewing it and this may help to align the stop ring, so that it supports the bottom clamp. The clamps are tightened using the supplied allen/hex keys. Once the GNSS mast / radar arm is fitted, adjust the foot so that the frame is fairly level. This foot, plus two others at the back of

the frame (Figure 9), will be used to precisely level the Portagauge once it is moved into its final position.

Figure 9. Adjustable feet for levelling.

Stainless-steel guy wires are attached to the GNSS mast / radar arm (Figure 10 and Figure 11) and secured to the fixing points on the main frame. These are tensioned using the turnbuckle adjustment until the arm is rigid (Figure 12).

Figure 10. *Radar arm tensioning (guy) wires.*

Figure 11. *Guy wires attached to radar arm.*

Figure 12. Guy wire attached to main frame with turnbuckle adjustment.

3.4. Radar

Locate the radar sensor and remove it from the packaging. The radar mounting bracket is already fitted to the radar. Locate the radar sensor connector inside the GNSS mast / radar arm and pull it out for easier access (Figure 14). Attach the radar mounting bracket to the GNSS mast / radar arm, by inserting it into the open end (Figure 13). Secure the radar mounting bracket in place using the supplied bolts. The bolts pass through holes underneath the GNSS mast / radar arm and screw into the radar mounting bracket.

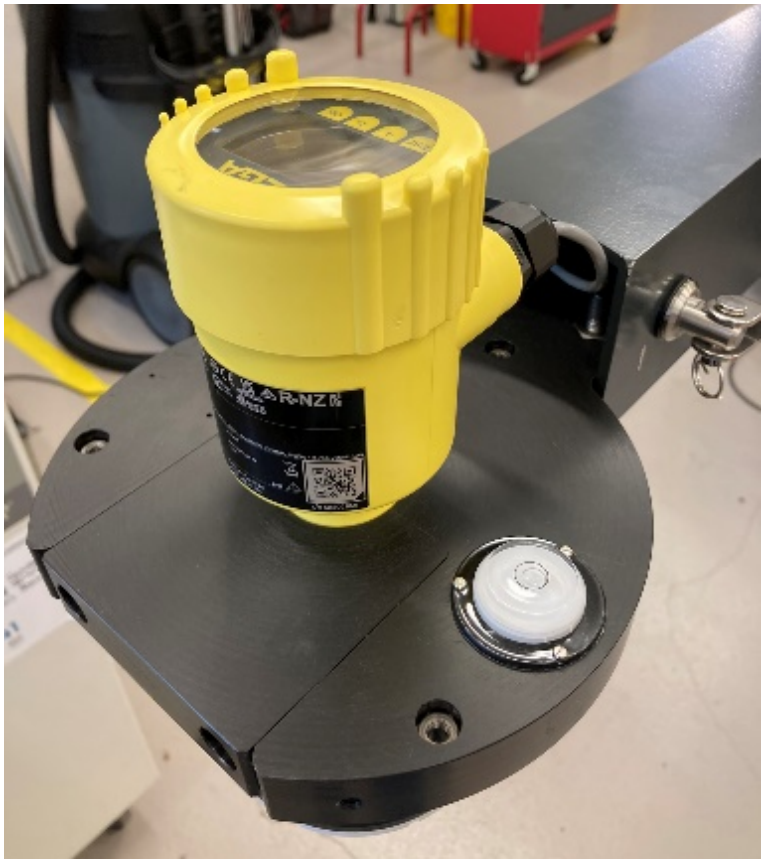


Figure 13. Radar sensor fitted onto radar arm.

Connect the radar sensor to the pre-installed cable, ensuring the connector is fastened tightly to prevent water ingress (Figure 14). Push any excess cable inside the GNSS mast / radar arm open end and place the connector inside for protection.

Figure 14. Waterproof connector for radar sensor

3.5. Cables

All cables are pre-routed through the GNSS mast / radar arm structure and emerge via flexible conduit (Figure 15). Remove the blue locking nut from the right-angled conduit connector (red arrow, Figure 15), pass these cables through the opening and reconnect the rigid conduit right-angle connector. To secure the connector in place with the locking nut, the solar panels will first need to be raised (see Section 3.6) and the metal enclosure lid removed.

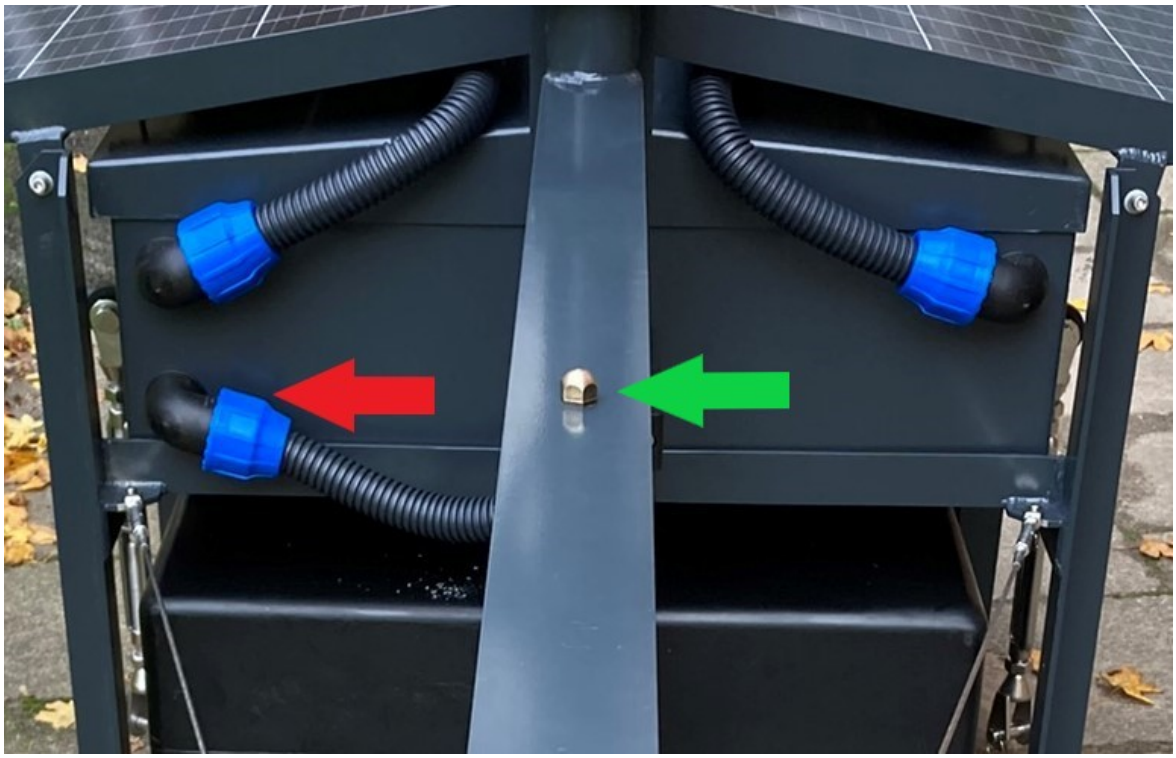


Figure 15. Conduit for cable access

3.6. Solar panels

The solar panels are pre-installed on the metal frame. They operate on a hinge system and are secured to the main frame using stainless-steel bolts (Figure 16). In the packing crate the solar panels are propped in a raised position using wooden supports. These supports must be removed as described in Section 3.1.

Figure 16. Solar panel mounting bolt locations. Green arrows indicate bolts removed for accessing equipment enclosures.

The bolts, indicated by red arrows (Figure 16), act as the hinge mechanism for the solar panel and **must not be removed**. The bolts indicated by green arrows are removed to allow the solar panel to rotate upright, there are two more bolts on the other end of the solar panel (not shown in the figure) that must also be removed to allow the panel to rotate.

Removing the four bolts (two at either end of the frame) identified by the green arrows in Figure 16 and lifting the solar panel frame upwards, will allow access to the metal enclosure beneath. The solar panel frame will rotate until it is vertical and in line with the mast. To prevent the solar panel from dropping, insert one of the stainless-steel bolts into the appropriate hole on the plastic antenna bracket, located on the mast (Figure 17).

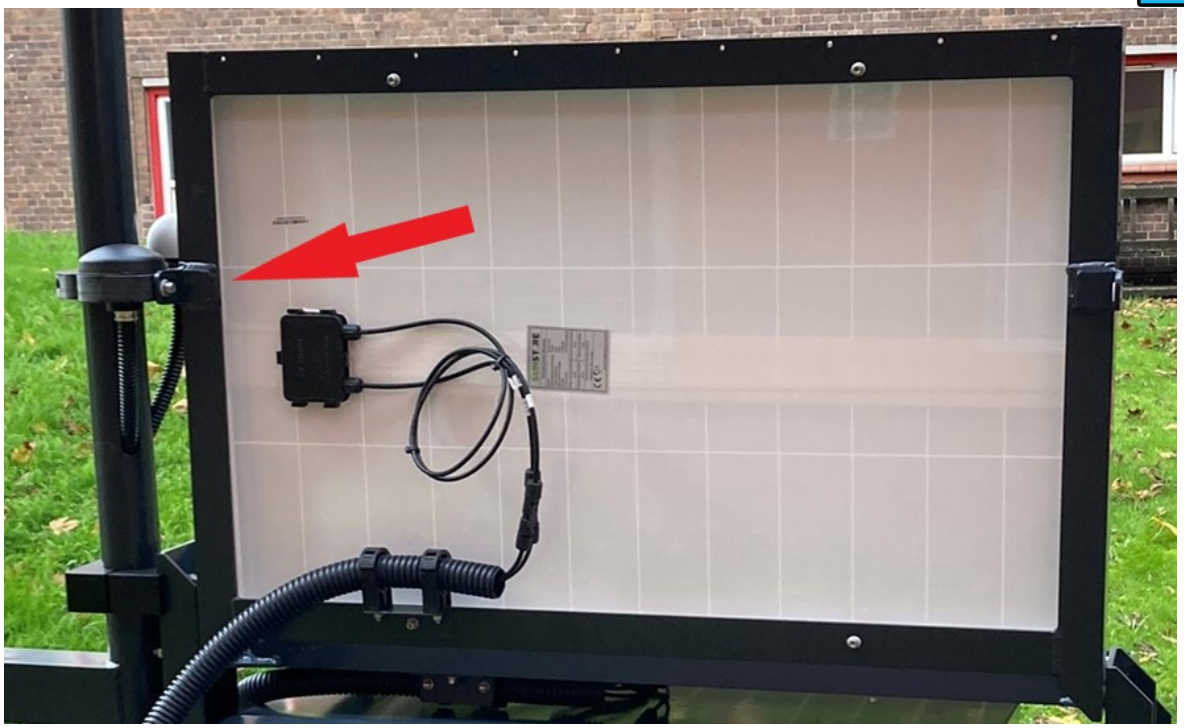


Figure 17. Solar panels locked in place.

With the solar panels raised (Figure 17), remove the lid, secured by four clasps (Figure 18) of the metal enclosure.

Figure 18. Metal enclosure clasps

Figure 19. Standard solar panel connectors.

During transport, the solar panels are disconnected from the main system via standard solar panel connectors (Figure 19), located behind the solar panel. **DO NOT connect the solar panels to the system at this stage.** Follow the final assembly procedure (Section 3.8) for information on connecting the solar panels, once assembly is completed.

3.7. Batteries

The tide gauge is powered by 2 x 70Ah lead crystal batteries. Locate the batteries and check for damage before use. **If they are damaged, do not use.** Seek replacement batteries of a similar type, size, and capacity.

Remove the plastic battery terminal cover (Figure 20) and aluminium retaining bar. Install the batteries, with the terminals nearest to the equipment cabinets (Figure 21). Refit the retaining bar, ensuring that the fixings are not overtightened as this could cause damage to the batteries. Figure 21 shows the wiring connected, **DO NOT install the wiring or connect the batteries to the system at this stage**. Follow the final assembly procedure (Section 3.8) for information on connecting the batteries, once all other assembly work is completed.

Figure 20. Battery terminal cover.

Figure 21. Batteries installed in parallel configuration. Mini blade fuse holders are indicated by the red arrow.

3.8. Final Assembly

Check that all the cables are connected to the appropriate connectors.

Cables that require connection to the equipment panels include:

- GNSS antenna cable
- GPS antenna cable
- Radar cable
- 4G antenna cables consisting of:
    - 4G
    - GPS
    - 4G
    - Wi-Fi

The logger enclosure has five SMA coaxial connectors for the Teltonika RUT955 4G mobile phone network router, however the 4G antenna only has four cables (one connector, bottom left in Figure 22, will not be used). Ensure the SMA connectors are fitted to the appropriate sockets, which are labelled accordingly (Figure 22). The Wi-Fi cable uses a reverse polarity connector and will not fit into the 4G or GPS socket. There is just one Wi-Fi cable from the antenna.

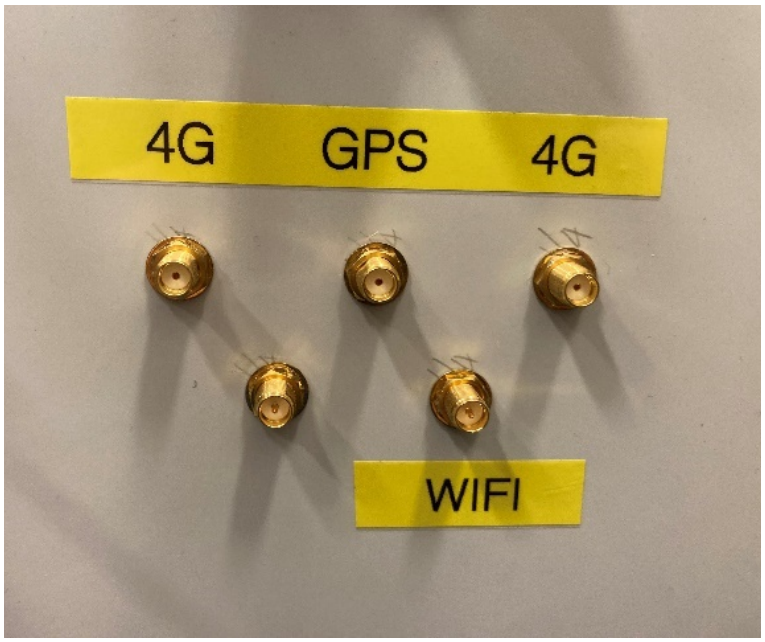


Figure 22. 4G communication SMA connectors.

The large silver N type connector on the logger enclosure, adjacent to the small brass GPS SMA connector, is not used. This is fitted with a blue boot cover to protect it from dust (Figure 23).

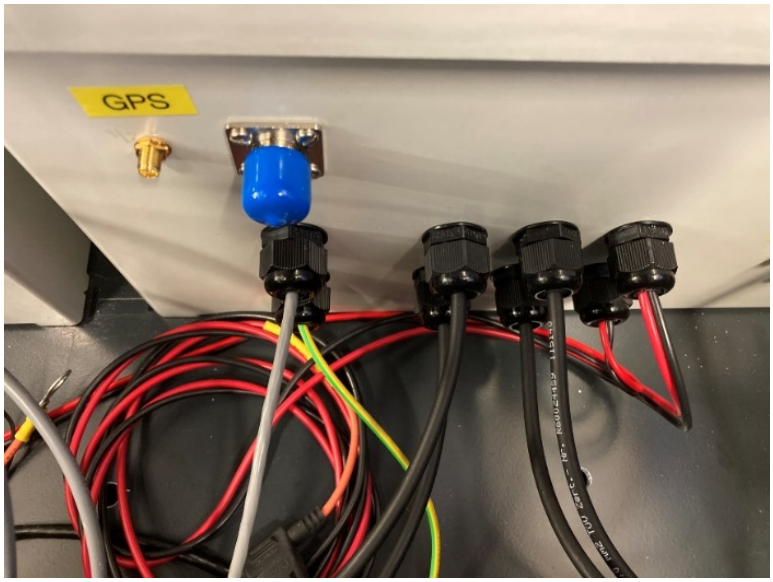


Figure 23. Logger enclosure connectors. N type connector (blue) is not used.

The GNSS antenna cable is connected to the N type connector on the GNSS enclosure (Figure 24).

Figure 24. GNSS antenna N type connector.

The battery interconnection leads, and cabinet key are taped to the outside of the equipment cabinets, Figure 25 and Figure 26.

Figure 25. Battery interconnection leads and spares.

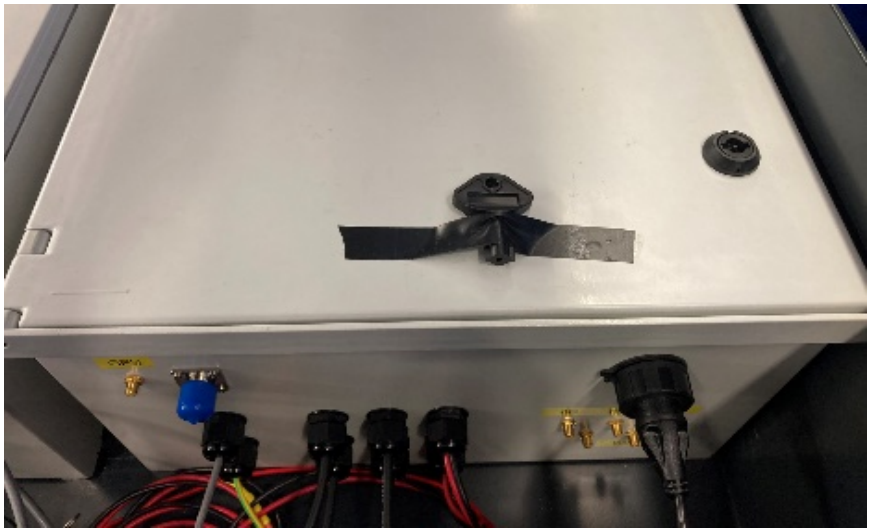


Figure 26. Cabinet key.

Open both equipment cabinets and open all the fused breakers (Figure 27 and Figure 28).

Figure 27. Logger switched fuses in the open position.

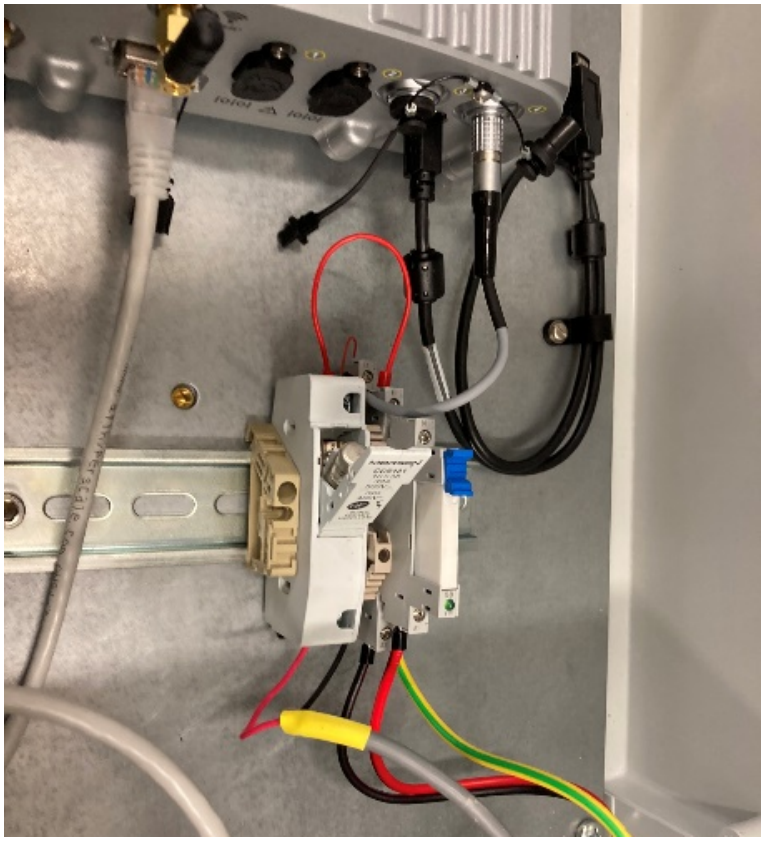


Figure 28. GNSS switched fuse in the open position.

Locate both power cables for the equipment cabinets. Remove the mini blade fuses (indicated by the red arrow in Figure 21) and together with the battery interconnection leads, connect the batteries in parallel as shown in Figure 21 and Figure 29.

Taking care to prevent accidentally shorting the battery terminals, connect the equipment battery leads; red to positive and black to negative, with the batteries wired positive to positive and negative to negative using the supplied interconnection leads. See Figure 29 for wiring details.

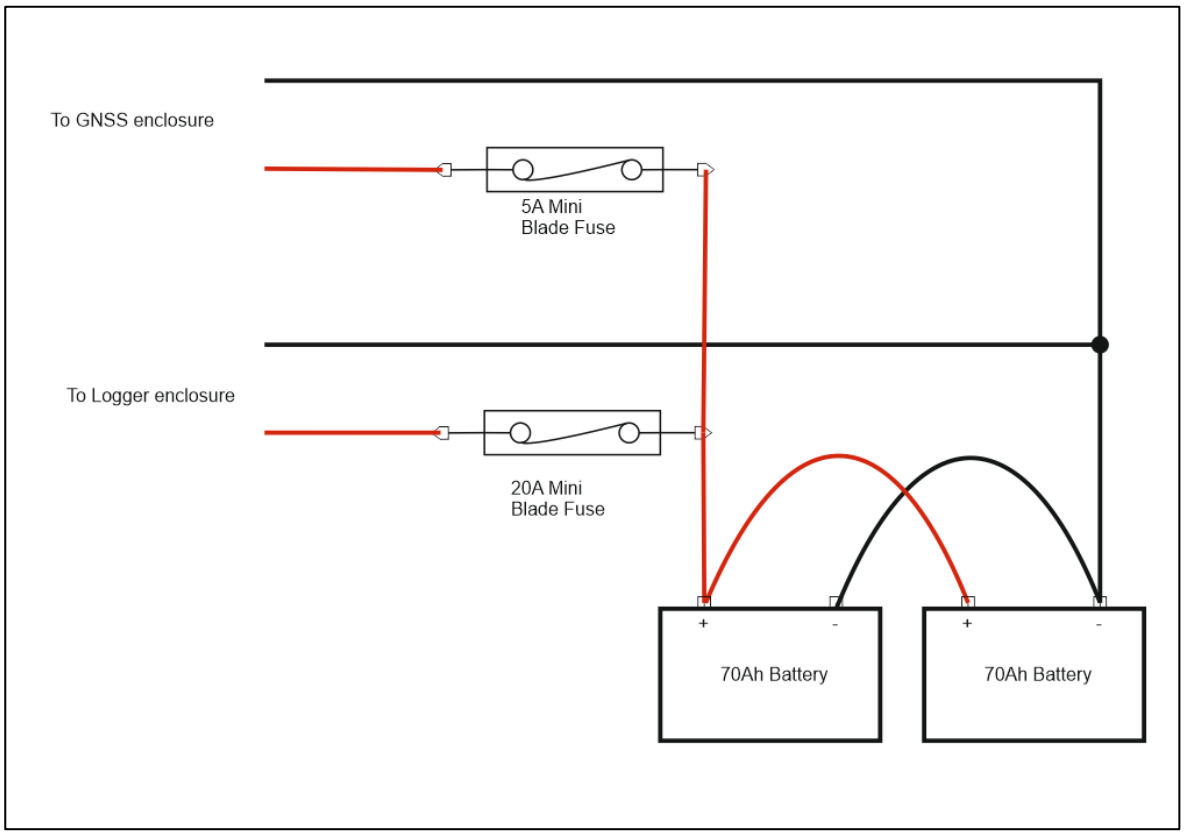


Figure 29. Batteries connected in parallel configuration.

Connect the positive and negative terminals of the equipment power leads to different batteries (see Figure 21 and Figure 29). This ensures that the solar charge controller will charge both batteries equally. **Do not install the mini blade fuses at this stage.**

Connect the solar panels to the system via the quick detach connectors (Figure 19) located behind the solar panels. **Do not close the fused breakers S1 and S2**. This will be covered in Powering Up, Section 4.1.

If the system will use a mobile data connection, insert the SIM card into the holder of the RUT955 4G router (Figure 30 and Figure 31). Connect the serial lead to the serial port connector on the Satlink3 logger (Figure 32 and Figure 33). **Do not connect the serial lead to the logger if a mobile data connection is not being used.** This will cause the Raspberry Pi minicomputer's filesystem to fill up (with datafiles) and stop it from operating.

Figure 30. Teltonika RUT955 router.

Figure 31. SIM card slot and access pin.

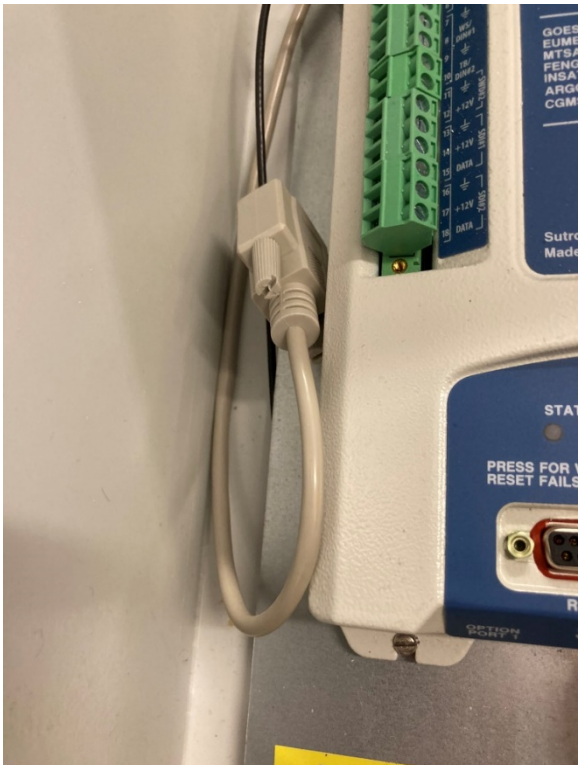


Figure 32. Serial lead for data transmission.

Figure 33. Connect the serial data lead to the Satlink3 logger if a mobile data connection is available.

If required, use the SIM card adapters or access pin to facilitate with fitting the SIM card (Figure 34).

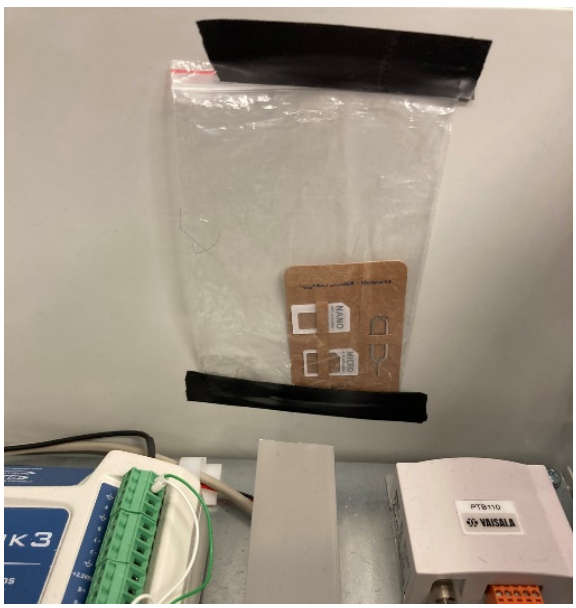


Figure 34. SIM card adapters and access pin.

4. Operation

4.1. Powering Up

Before applying power to the Portagauge, please ensure the assembly procedure (Section 3) has been followed correctly.

The power system for the Portagauge consists of rechargeable lead crystal batteries and solar panels. The batteries are charged by the solar panels through a Morningstar SS-20L-12V solar charge controller.

When completing the following steps, ensure both solar panels are in the upright position (Figure 17). This will limit the amount of power being generated by the panels and allow easy access to the equipment enclosures.

Powering up the charge controller **must be done in the following order**:

1. Connect the load to the charge controller by closing the fused breaker labelled PWR inside the logger enclosure (Figure 27).
2. Connect the batteries to the charge controller by inserting the mini blade fuses into their respective holders (Figure 21 and Figure 29). Ensure the 20A fuse is fitted to the logger enclosure power lead and the 5A fuse is fitted to the GNSS enclosure power lead. A battery status LED should illuminate on the solar charge controller (See Appendix 2, Figure 53). If there is no LED illuminated, check the mini blade fuse is inserted correctly. After connecting the battery leads, the logger will begin to power up.
3. Connect the solar panels to the charge controller by closing the fused breakers S1 and S2, Figure 27.
4. Close the fused breaker inside the GNSS enclosure (Figure 28). The Trimble Alloy receiver (Figure 47) should automatically power on and the display will light up. If the Trimble Alloy does not power up, check the mini blade fuse is inserted correctly.

4.2. Starting the Portagauge

Portagauge has been designed to be simple to start. The main system including the radar and data logger will start automatically once the PWR fuse breaker is closed, and power is provided from the battery or solar panels.

In the GNSS enclosure, closing the fuse breaker (Figure 28) enabling power supply from either the batteries or solar panels) will power up the Trimble Alloy GNSS receiver. This will be confirmed on the receiver display (Figure 47).

After closing the PWR fused switch, the system will power up and begin logging data. This will be shown by LEDs illuminated on the Satlink3 data logger (Figure 33). The LCD display on the Vegapuls 6X radar will power up and start displaying a number (Figure 38). If the Portagauge is awaiting positioning overlooking the sea, the radar will measure the distance between itself and the ground (or any object that may be between the radar sensor and the ground). The reading on the radar can be checked against this distance using a tape measure.

4.3. Time switch settings

The Teltonika RUT955 4G router is operated via a time switch that is pre-set to operate for three hours during the daytime (Figure 35). The time displayed on the switch is set to Coordinated Universal Time (UTC). The switch should be set to operate during the middle of the day when the solar panels will generate most power, activating at 08:00 UTC (11:00 EAT) and deactivating at 11:00 UTC (14:00 EAT). **These times must be setting during installation (the pre-programmed times are incorrect).**

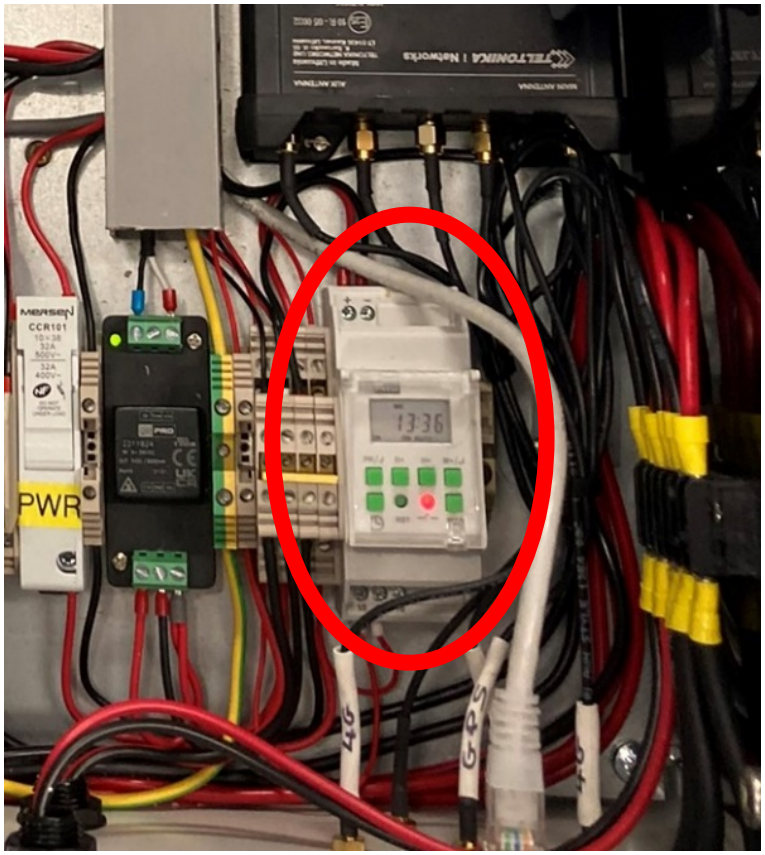


Figure 35. Time switch for 4G communications.

The time is set by pressing the clock key plus H+ (for hours) or M+ (for minutes), Figure 36.

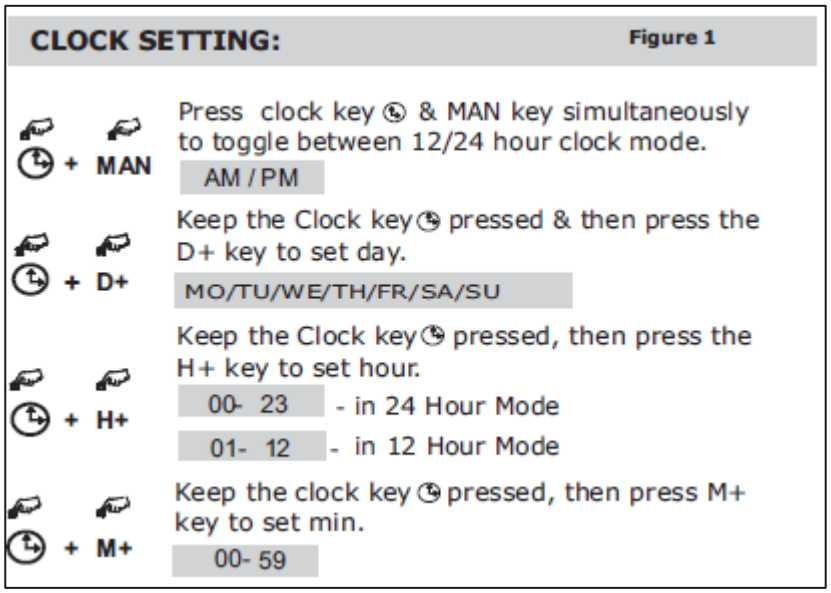


Figure 36. Clock setting instructions.

As described in Figure 37 the On/Off times can be set by pressing PR to go to the appropriate “On” time and then pressing H+ to set the hours and M+ to set the minutes. MAN (-) can be used to decrement.

Press the PR button to move to the “Off” time and use H+ and M+ buttons to set it.

The clock operates in UTC, so for the 4G router to power up during the middle of the day East Africa Time, the **“On” time must be set to 08:00 UTC and the “Off” time must be set to 11:00 UTC.**

Refer to the Time Switch manual (Appendix 1) for full operating instructions.

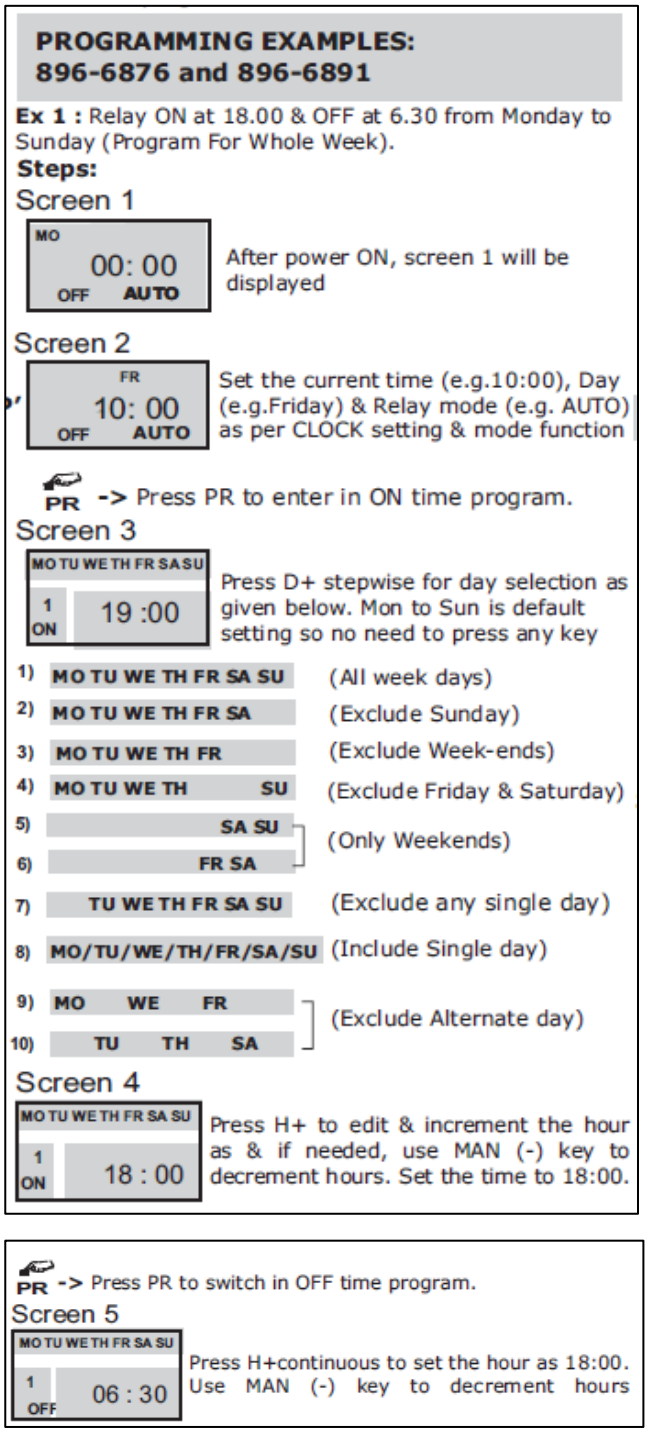


Figure 37. Programming the clock.

Once the system is operational, close the doors of the data logger and GNSS receiver enclosures, and lock them using the supplied cabinet key (Figure 26).

Replace the metal enclosure lid and secure using the metal clasps (Figure 18). Secure the metal clasps with the four padlocks. Each padlock has the same code: 135.

4.4. Installing the Portagauge

Ensure the Portagauge has been fully assembled (Section 3) before installing it into the final measuring location.

1. Test the operation of the system and the radar sensor prior to deployment by following ‘Starting the Portagauge’, Section 4.2.
2. At a location close to the final deployment position, but where access to the radar sensor is maintained adjust the feet to level the Portagauge. Place the supplied spirit level on the radar arm, to obtain an accurate level across the length and the width. Check this against the bubble spirit level on the radar sensor bracket (Figure 38)
3. Place the spirit level on top of the brass benchmark on the radar arm (green arrow in Figure 15) and ensuring that it is level, extend towards the radar sensor. Measure the vertical distance between the radar sensor face (reference plane, indicated by 1 in Figure 39) and the base of the spirit level. Note this value.
4. Fit the radar protective cover (Figure 40)
5. Position the Portagauge close to the final position and adjust the feet, using the supplied spanner, to get the Portagauge ‘almost’ level. This will aid with the final levelling adjustment once Portagauge is moved into the final position.
6. Move the Portagauge into the final measuring position. The Portagauge is very heavy, follow manual handling procedures when moving it into position.
7. Re-check and adjust the level of the radar arm across the length and the width, by adjusting the feet.
8. Check the vertical alignment of the GNSS mast / radar arm using the spirit level and adjust the feet as necessary.
9. Remove the bolts holding the solar panels upright and gently lower them and secure in place using the supplied bolts (Figure 16). Check the level of the Portagauge again.
10. Once the Portagauge is perfectly levelled, use lock the nuts on the adjustable feet to prevent further movement.

Figure 38. Radar sensor and bubble level.

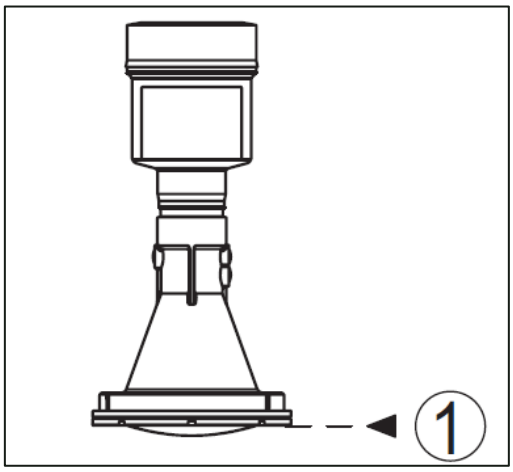


Figure 39. Radar reference plane.

Figure 40. Radar sensor with protective cover.

4.5. Securing the Portagauge

The Portagauge must be secured to prevent unwanted movement. The Portagauge is heavy once fully assembled, but must be anchored to the quayside to prevent movement. Any movement in the Portagauge will be reflected in the radar and GNSS measurements and will degrade the data quality.

There are two ways to increase the stability of the Portagauge:

1. A water fillable ballast tank (Figure 41)
2. Turnbuckle anchoring points (Figure 42)

The ballast tank can be filled with water to increase the mass of the installation. An aluminium filling funnel has been supplied to aid filling the tank with water.

Figure 41. Plastic water ballast tank.

Figure 42. Water tank filling point and turnbuckle anchoring point.

Two turnbuckle anchoring mechanisms are fitted to the Portagauge (Figure 2 and Figure 42) to facilitate hard anchoring to the quayside. These require holes to be drilled in the quayside and anchor eye bolts fitting. The turnbuckles can then be attached to the eyebolts and tensioned to secure the Portagauge to the quayside. An electric drill and drill bits have been supplied facilitate anchoring of the Portagauge. For best results, the water tank should be filled and the Portagauge anchored to the ground using the turnbuckles. Fill the water tank before anchoring the turnbuckles to the ground.

After filling the water tank and installing the eyebolts for the turnbuckle tensioning system, the level of the Portagauge must be checked again. Any movement induced in the radar arm or GNSS mast / radar arm due to filling the water tank or tensioning the turnbuckles, must be corrected by slackening the turnbuckles, adjusting the levelling feet, and re-tensioning the turnbuckles. Repeat this process until the Portagauge is completely level and secured with the turnbuckles under tension.

Use the lock nuts on the turnbuckle to prevent them from slackening.

5. Data recovery

If manual download of the data collected by the portagauge is required, the enclosure can be accessed with the portagauge in situ. The solar panels must be raised to the upright position and locked in place (Figure 17), the enclosure clasps (Figure 18) can then be opened and the lid removed.

5.1. Satlink3

The easiest way to download the data from the Satlink3 data logger is by using the included USB flash drive (Figure 43). This is shipped plugged into the USB host port. The data are not stored on the USB flash drive automatically.

To transfer data to the USB flash drive, remove the drive from the USB port, wait a few seconds and then reinsert the drive back into the USB port. The amber LED will flicker rapidly to show that data transfer is underway and once the data transfer is completed, if everything went well the green LED will illuminate continuously, otherwise the red LED illuminates continuously. If the red LED illuminates, try the procedure again and if necessary, use a different USB flash drive.

It is now safe to remove the USB drive and view the stored data on a PC. The LED remains lit until the USB drive is removed from the USB port.

Figure 43. USB flash drive data download (red arrow), Wi-Fi connection button (red circle).

Data can also be downloaded from the Satlink3 by using the communication software LinkComm. LinkComm can be downloaded from the OTT HydroMet website, https://www.otthydromet.com/en/p-sutron-linkcomm-software/LINKCOMM, the Apple App Store® or Google Play™. The language can be changed to French by accessing the options menu.

Communication with the Satlink3 can be achieved by using a USB-A to micro-USB cable plugged into a laptop USB port, or via a Wi-Fi connection. To make a Wi-Fi connection to the Satlink3, press the silver button marked 'Press for Wi-Fi' (Figure 43). The button will illuminate. Search for the Wi-Fi network created by the Satlink3 and connect. Once connected to the Wi-Fi network, open the LinkComm software and connect to the Satlink3 by selecting the Station Wi-Fi option (or the USB option if using a USB cable).

Once connected, it should display the dashboard which will give information about the system including the latest values from the sensors.

Select the Data tab from the bottom of the LinkComm screen (Figure 44) and select Download.

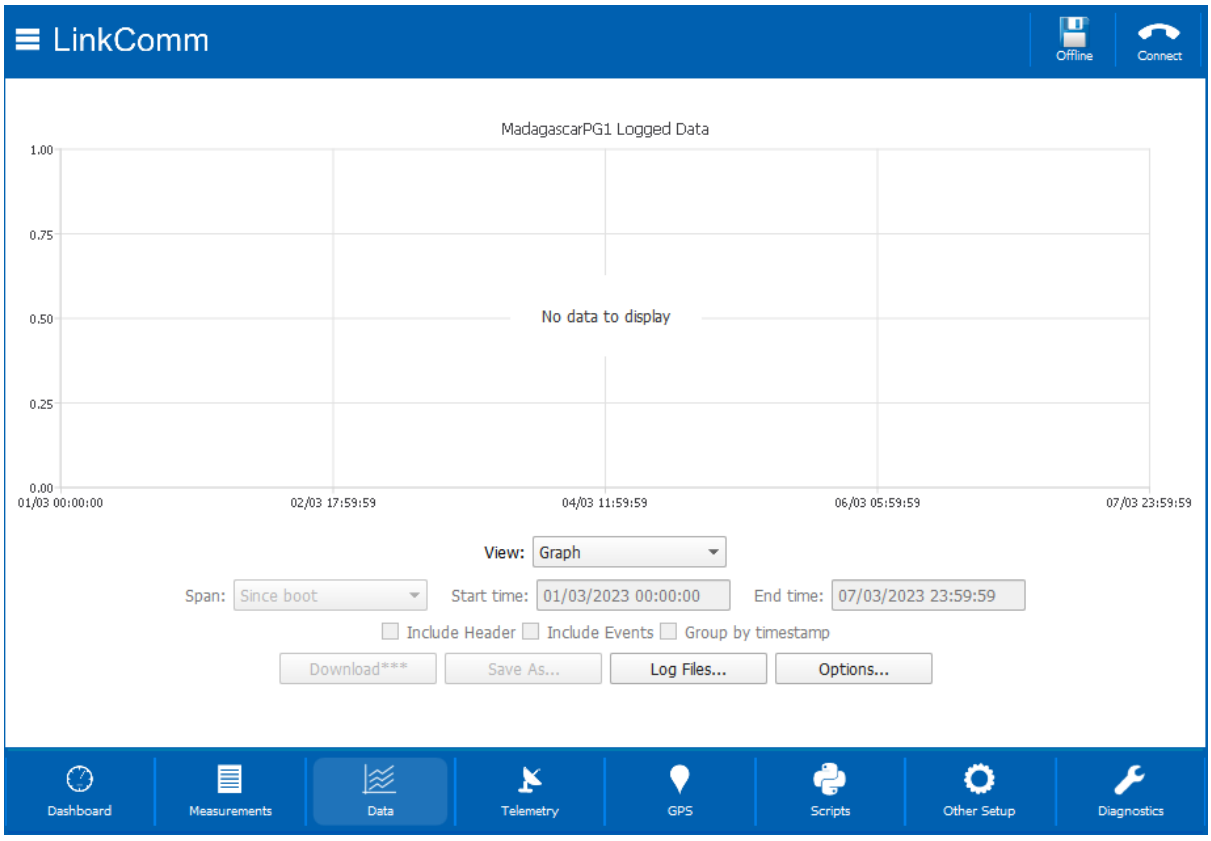


Figure 44. LinkComm screen.

There are also versions of the LinkComm software that run on Apple and Android phones. Using these is similar to using the PC software via the Station Wi-Fi connection.

5.2. Trimble Alloy GNSS

The Trimble Alloy GNSS receiver has a built-in web server, so no special software is required to communicate with it.

To connect with the Alloy, there are two options: Ethernet or Wi-Fi.

To use an ethernet connection, connect your laptop PC to the RUT955 router using an ethernet cable. Power up the RUT955 router (if not already powered up) by pressing the MAN key on the time switch (Figure 35), see Time Switch instruction sheet (Appendix 1). The laptop should automatically be assigned an IP address.

To use a Wi-Fi connection, there are two options:

1. Connect to the RUT955 Wi-Fi network:
2. Connect to the Trimble Alloy Wi-Fi access point

5.2.1. Using the RUT955 Wi-Fi Access Point

To connect to the RUT955 Wi-Fi access point, ensure the RUT955 is powered up and search for the Wi-Fi network below. The RUT955 is powered from the time switch. Manual override of the time switch may be necessary to access the Wi-Fi.

Wi-Fi SSID: RUT955_81DF

Wi-Fi Password: Qz70Rsy2

Using a web browser, enter http://192.168.1.70 into the URL bar on the web browser. The browser should display the login screen for the Trimble alloy receiver (Figure 45). The language can be changed using the menu on the left of the screen by selecting **Receiver Configuration/default language.** The login details are:

User Name: admin

Password: 6221r40032!

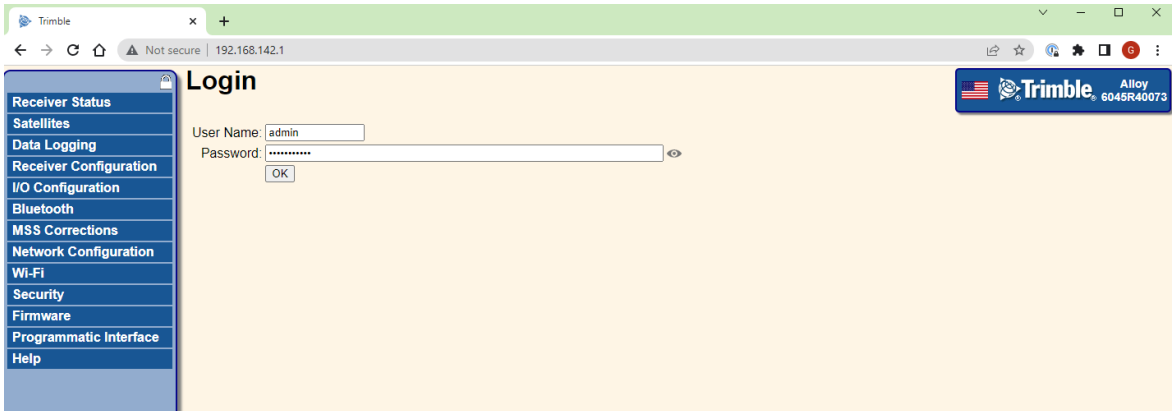


Figure 45. Trimble Alloy login screen.

To download the stored data, click on Data Logging -> Data Files. This will then list all the data files that are stored (Figure 46), which can then be selected and downloaded.

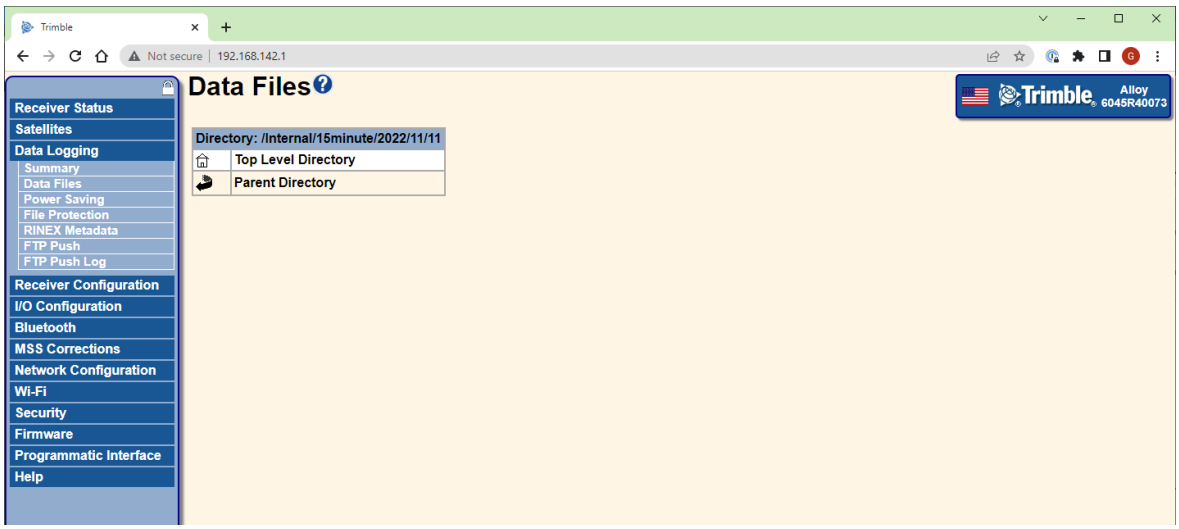


Figure 46. Trimble Alloy data files.

5.2.2. Using the Trimble Alloy Wi-Fi Access Point

The Trimble Alloy also has Wi-Fi access point functionality, which is disabled by default. To enable this, from the default display screen on the Trimble (Figure 47), press the enter key and using the keypad, scroll down to the Wi-Fi Access Point option and press enter (Figure 48).

Select enable by pressing enter and toggling between Disable and Enable using the Up/Down keys (Figure 49). Press enter when done and press Esc a couple of times to return to the main screen.

Once enabled, connect to the Trimble Alloy Wi-Fi network

Wi-Fi Access Point SSID: 6221R40032

Wi-Fi Password: 6221r40032!

Open a web browser and enter http://192.168.142.1 into the web browser URL bar. The login screen (Figure 45) should appear, and the instructions above can be followed for downloading the data.

Once the data is downloaded using the Trimble Alloy Wi-Fi network, follow the steps above to disable the Wi-Fi Access Point on the Trimble Alloy GNSS receiver.

Figure 47. Default display screen.

Figure 48. Wi-Fi Access Point.

Figure 49. Configure Wi-Fi Access Point.

6. Moving the Portagauge

To move the Portagauge to a new location, the system will need to be decommissioned from its current location and disassembled for transport to the new location.

6.1. Decommissioning

Slacken the tension on the turnbuckles, but do not remove them yet. Drain the water from the ballast tank. There is a drain plug on the end of the tank for this purpose (Figure 50). Unscrew the plug and fully remove it to drain the water from the tank. Once fully drained of water, refit and tighten the drain plug.

Figure 50. Ballast tank drain plug.

Remove the turnbuckles from the quayside and using safe manual handling procedures, move the Portagauge away from the quay edge. Remove any eye bolts from the quayside that may cause a trip hazard.

Raise the solar panels and secure in the upright position (Figure 17). **Do not transport the solar panels in this position, since the bolts holding the solar panels upright are not fixed in place**. Remove the metal enclosure lid and open both equipment enclosures. Download the data from the system (see Data recovery, Section 5). Once data download is completed, power down the system.

To power down the system, complete the following steps:

1. Disconnect the solar panels from the charge controller by opening the fuse breakers S1 and S2 (Figure 27). Disconnect the solar panel connectors behind the solar panels (Figure 19).
2. Open fused circuit breaker inside the GNSS enclosure (Figure 28). Switch off Trimble Alloy GNSS receiver by pressing and holding the power button (shown in green in Figure 49) if it is still operating due to the internal battery.
3. Remove the battery plastic cover and disconnect the batteries from the solar charge controller by removing the mini blade fuses from the power cables (Figure 21) and storing them in a safe place.
4. Disconnect the load from the solar charge controller by opening the fused breaker PWR (Figure 27).
5. Disconnect the power and interconnection leads from the batteries. Remove the aluminium retaining bar and remove the batteries. Refit the aluminium bar and plastic battery cover.
6. Close all the fused circuit breakers in the logger and GNSS enclosures, close the enclosure doors and lock them with the supplied key.

Refit the metal enclosure lid and secure with the metal clasps.

Lower the solar panels and secure in place for transport. Place protective material over the solar panels to prevent damage occurring during transport.

If the Portagauge cannot be transported with the solar panels secured in the lower position, use the timber supports shipped with the Portagauge (Figure 4) to secure the solar panels in a more upright position. Ensure the timber supports are securely fastened in place using the bolts supplied, before transporting. Place protective material over the solar panels to prevent damage occurring during transport.

Disconnect the radar sensor cable from the radar (Figure 14) and remove the sensor from the radar arm. Place in a safe location to prevent damage during transport.

The GNSS antenna should be removed before transporting the Portagauge, to prevent damage occurring. The antenna can be removed without removing the GNSS mast / radar arm. To remove the antenna, a ladder is required to access the antenna. Remove the antenna cable from the antenna. Remove the radome cover and carefully remove the antenna. Remove the threaded rod and safely store all items to prevent loss or damage during transport.

If the GNSS mast / radar arm needs to be removed for transport, disconnect the cable connectors from the equipment enclosures, remove the right-angled conduit connector (Figure 15) and remove the cables from inside the metal enclosure. Lower the adjustable feet and support the main metal frame while removing the plastic clamps that mount the mast onto the frame. Make sure any exposed cabling is protected from exposure to water ingress and damage during transport.

APPENDIX 1. Digital Time Switch Instructions

DIGITAL TIME SWITCH

RS Stock No's:

896-6876, 896-6891 (24Hr/7 Day)
896-6885 (Pulse function)

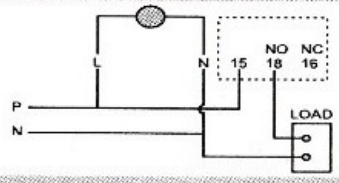
⚠ CAUTION :

- Installation should be done by skilled electrician only.
- Heavy Inductive loads should be equipped with interference suppressors like varistors, RC snubbers.
- Use of contactors is recommended if load exceeds the contact rating. Please see Inductive load category.
- Non- Rechargable Battery Disposal: As per the applicable regulations in country and state, by authorized, professional disposal firms knowledgeable in Federal, State or Local requirements of hazardous waste treatment & transportation.

NOTE :

- **IMPORTANT:** IF Daylight Saving Time (DST) applicable, First Set Date, then Set DST & then set the Real Time Clock.
- **IMPORTANT:** When user presses ◷ key in program edit mode, it returns to Run mode.
- **Battery Mode:** Key sensing may be slower so please make sure that any key is pressed for at least 1 sec.
- Product innovation being a continuous process, we reserve the right to alter specifications without any prior notice.
- User is recommended to ensure the suitability of the product for the intended application

CONNECTION DIAGRAM:



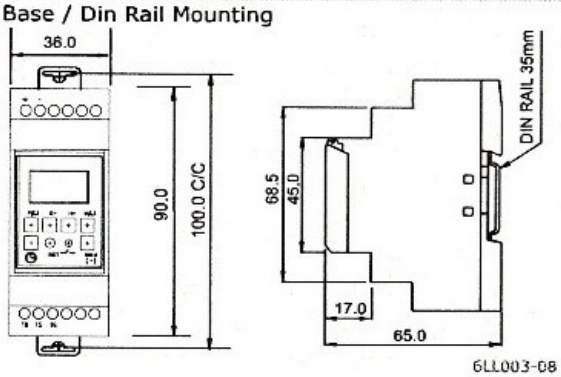
TERMINAL DETAILS :

Ø3.5 mm	0.54 N.m (5 Lb.in) Terminal screw - M2.5
	1 x 0.2...3.3 mm² Solid Wire
AWG	1 x 24 to 12

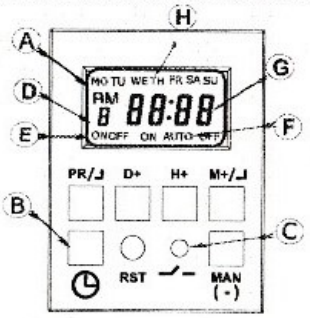
Use Copper Conductors Only, 60/75°C.

OVERALL DIMENSIONS :

Base / Din Rail Mounting



FRONT VIEW:



A - LCD
B - Keypad
C - Relay 'ON/OFF' LED Indication.
D - Program Number
E - Relay Status
F - Mode
G - HR : MIN
H - Day

KEY FUNCTIONS :

PR /⌟ - Program key to view & edit programs & As ESC Key
D+ - Day selection & Also as an Date/DST Increment key
H+ - Hour Increment & Also as an Date/DST Decrement key
M+/⌟ - For Crono: To increment Minute
For Pulse : To set Pulse duration
Also as an ENTER key
(H+) + (M+) - To enter in DATE / DST mode
RST - Reset programs & settings in the device.
MAN (-) - Manual key for overriding.
Also to decrement D/H/M in program mode
◷ - Clock Key, to set the clock
CLK + MAN - To set 12 / 24h clock mode
CLK + PR - To Lock / Un-lock keypad

CLOCK SETTING: Figure 1

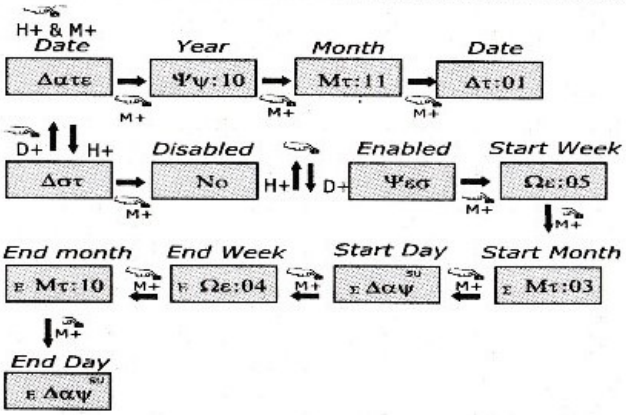
◷ + MAN — Press clock key ◷ & MAN key simultaneously to toggle between 12/24 hour clock mode.
AM / PM

◷ + D+ — Keep the Clock key ◷ pressed & then press the D+ key to set day.
MO/TU/WE/TH/FR/SA/SU

◷ + H+ — Keep the Clock key ◷ pressed, then press the H+ key to set hour.
00- 23 - in 24 Hour Mode
01- 12 - in 12 Hour Mode

◷ + M+ — Keep the clock key ◷ pressed, then press M+ key to set min.
00- 59

DST & DATE SETTINGS : Figure 2



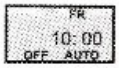
- During Run mode, press H+ with M+ to enter 'δΑτΕ' menu. Press M+/↵ to enter this menu. Edit ΨΨ, MT & ΔT using D+ or H+.
- 'δΑτΕ' menu is being displayed, press H+ or D+ to select ΔΣΤ & press M+/↵ to enter its menu.
- User can enter ΑΣΤ & Δατε as shown in the figure 2 above.
  For this, D+ key is used to increment the parameter value
  H+ key is used to decrement the parameter value
  M+ key is used to save the current parameter value
  PR key is used to escape to previous parameter screen
- During ΑΣΤ period 'd' will appear at bottom left corner of the screen & day will be updated according to current date. No need to set day manually by pressing CLK & D+ key.

Note:

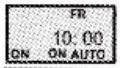
1. ΑΑΤΕ & ΔΣΤ must be set in regions where ΔΣΤ is observed. When ΔΣΤ is enabled LCD shows 'd' at the left corner.
2. ΔΣΤ Start / End: Clock is rolled over from '02:00' to '03:00' at start and is rolled over from '03:00' to '02:00' at end.
3. When ΔΣΤ period starts, clock gets incremented by 1 hour. If the user has set the Clock prior to setting the ΔΣΤ and accounted for this additional hour that would get incremented, then the user might have to readjust the clock.

MANUAL OVERRIDE & MODE DESCRIPTION:

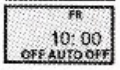
Press MAN key to toggle between-



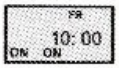
1. AUTO: As per set program.



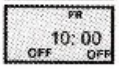
2. ON AUTO: Manual ON up to next ON event. (Not Applicable for Pulse)



3. AUTO OFF : Manual OFF up to next OFF event. (Not Applicable for Pulse)



4. ON: Manual ON (Continuous).



5. OFF: Manual OFF (Continuous).

PROGRAMMING DETAILS :

Program Description(896-6876 & 896-6891)

25 ON/OFF Programs																								
1	2	3	4	5	6	7	8	9	A	B	C	D	e	f	G	H	J	L	n	P	q	T	u	Y

Program Description(896-6855)With Common Pulse 'P'

Pulse	16 ON Programs															
PL	0	1	2	3	4	5	6	7	8	9	A	b	C	d	E	F

Program Description(896-6855)With Individual Pulse

16 ON Programs (As 'Prg/Pulse)' with very 1st common pulse P																			
PL	0	PL	1	PL	2	PL	3	PL	4	PL	5	PL	6	PL	7	PL	8	PL	9

16 ON Programs (As 'Prg/Pulse)' with very 1st common pulse																			
PL	A	PL	b	PL	C	PL	d	PL	E	PL	F	PL							

How to Delete the Program?

1. To delete single program, go to respective program, press H+ until '--' hr comes & press M+ until '--' min comes on LCD. '--:--' displayed on LCD indicates empty program.
2. To delete/reset all the programs & settings, press RST key.

KEYPAD LOCK(🔒):

To lock the keypad, press the '🕒' and the 'PR' key simultaneously for 3 seconds or more.
'bLoC' will appear on the screen indicating that the keypad has been locked.
When the keypad is locked none of the parameters can be edited, only the mode can be changed from 'Auto' to 'ON Auto' and 'Auto OFF' by pressing the 'MAN' key.
To unlock the keypad press '🕒' and PR key simultaneously for 3 or more sec. 'ULoC' will appear on screen.
The keypad can be locked only in Run mode and not in program Edit mode.

FREQUENTLY ASKED QUESTIONS :

Q.1: In event of power failure, do I lose all my programs?
A.1:No, because battery has a reserve of approx 6 yr at operating temperature. In absence of power, we can program the device as per requirement. However, during power fail, relay or LED will not operate but the relay status can be observed on LCD screen.

Q.2: How to use Manual override? When is it applicable?
A.2:Press MAN key to toggle to ON Auto, Auto OFF, ON or OFF mode. (Refer Mode Description). It is used if user requires an immediate ON or OFF of the relay.

Q.3: Can I select any day in the week as my weekly OFF?
A.3: Yes, when in PR mode, toggle by pressing D+ & MAN (-) or D+ key respectively to select individual holiday selection.

Q.4: What should I do to remove all programs & reset RTC?
A.4: Press RST key. All programs will get deleted, RTC will be reset to 00:00 & Default day as Monday.

Q.5: How do I change clock format from 12 h to 24 h?
A.5: Press 🕒 & MAN key simultaneously to switch clock format from 12h to 24 h & vice-versa.

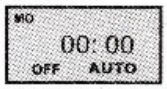
Q.6: How does ON AUTO & AUTO OFF feature help?
A.6:ON AUTO / AUTO OFF feature bypass the current program & continues with the next program. ON AUTO mode returns back to AUTO mode at next programmed ON Time. AUTO OFF mode returns back to AUTO mode at next programmed OFF Time. In this way, one can override the relay to switch ON/OFF without affecting the further programs.

PROGRAMMING EXAMPLES: 896-6876 and 896-6891

Ex 1 : Relay ON at 18.00 & OFF at 6.30 from Monday to Sunday (Program For Whole Week).

Steps:

Screen 1



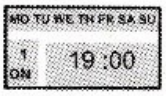
After power ON, screen 1 will be displayed

Screen 2

Set the current time (e.g.10:00), Day (e.g.Friday) & Relay mode (e.g. AUTO) as per CLOCK setting & mode function

PR -> Press PR to enter in ON time program.

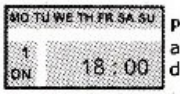
Screen 3



Press D+ stepwise for day selection as given below. Mon to Sun is default setting so no need to press any key

1) MO TU WE TH FR SA SU (All week days)
2) MO TU WE TH FR SA (Exclude Sunday)
3) MO TU WE TH FR (Exclude Week-ends)
4) MO TU WE TH SU (Exclude Friday & Saturday)
5) SA SU (Only Weekends)
6) FR SA
7) TU WE TH FR SA SU (Exclude any single day)
8) MO/TU/WE/TH/FR/SA/SU (Include Single day)
9) MO WE FR (Exclude Alternate day)
10) TU TH SA

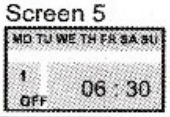
Screen 4



Press H+ to edit & increment the hour as & if needed, use MAN (-) key to decrement hours. Set the time to 18:00.

PR -> Press PR to switch in OFF time program.

Screen 5

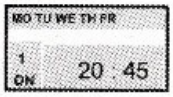


Press H+continuous to set the hour as 18:00. Use MAN (-) key to decrement hours

Example 2: 3 Different programs for whole week

	RELAY ON	RELAY OFF	
Program 1:	20:45 (MO-FR)	06:30 (SA)	**Steps:** Set the clock
Program 2:	19:00 (SA)	06:30 (SU)	as explained in
Program 3:	18:15 (SU)	06:30 (MO)	screen 1 & 2 above

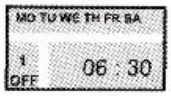
Screen 6



Press D+ 3 times to select MO-FR. Set ON time as 20:45 by using H+ & M+ key.

PR -> Press PR to switch in OFF time.

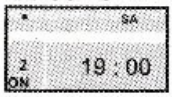
Screen 7



Press D+ once to select MO-SA. Set OFF time as 06:30 by using H+ & M+ key.

PR -> Press PR to enter in 2nd program.

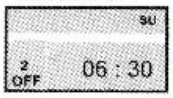
Screen 8



Press D+ continuous to select SA. Set ON time as 19:00 by using H+ & M+ key.

PR -> Press PR to switch in OFF time.

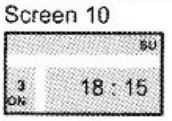
Screen 9



Press D+ continuous to select SU. Set OFF time as 06:30 by using H+ & M+ key.

PR -> Press PR to enter in 3rd program.

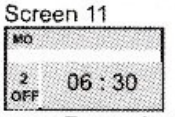
Screen 10



Press D+ continuous to select SU. Set ON time as 18:15 by using H+ & M+ key.

PR -> Press PR to switch in OFF time.

Screen 11



Press D+ continuous to select MO. Set OFF time as 06:30 by using H+ & M+ key.

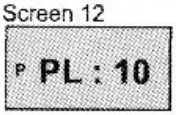
PR -> Press PRG once.

To save & exit the program, press key

PROGRAMMING EXAMPLES 896-6855

Ex. 1: Programming For Fixed Pulse Time

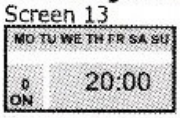
Screen 12



PR -> Press PR once to enter pulse duration. Press M+ continuous to set any pulse duration from 1 to 59 s. E.g. 10s. This fixed pulse duration will be applicable to all 16 programs

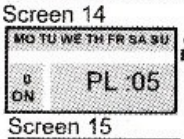
Ex. 2: Programming For Individual Pulse Times

Screen 13



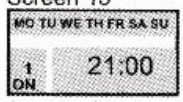
In this case, user has to first set the ON time & then pulse duration for the same Press PRG two times to enter in ON time for program '0'. Set the ON time (20:00) & day with the help of H+/M+/D+ keys

Screen 14



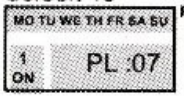
PR -> Press PR once to enter pulse duration. Set the pulse 0 (for program 0) for duration of 05 by pressing M+ key.

Screen 15



PR -> Press PR once to enter in program 1 Set the ON time (21:00) & day with the help of H+/M+/D+ keys

Screen 16



PR -> Press PR once to enter pulse duration Set pulse 1 (for program 1) for duration of 07 by pressing M+ key.

6LL003-08

APPENDIX 2. Morningstar SS-20L-12V Solar Charge Controller Status LEDs

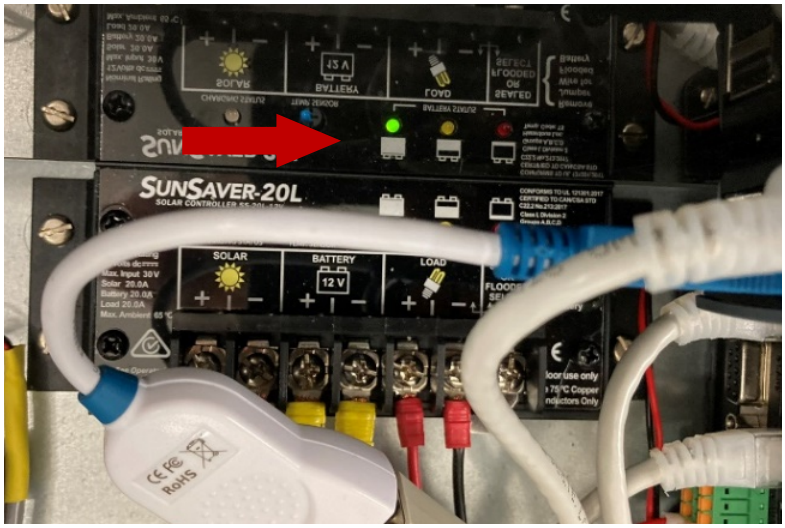


Figure 51. Sunsaver LEDs showing battery status on the solar charge controller.

There are three state-of-charge (SOC) LEDs on the solar charge controller (Figure 51), together with a battery charge state pictogram: Green (nearly full), Yellow (half full) and Red (empty). Depending upon which LED is illuminated and whether it is flashing or solid determines the state of charge (Figure 52).

SOC LED	Indication	Battery Status	Load Status
Green	Fast Flashing (2 Flash / sec)	Full Battery: Equalize Charge	Load On
Green	Med. Flashing (1 Flash / sec)	Full Battery: Absorption Charge	Load On
Green	Slow Flashing (1 Flash / 2 sec)	Full Battery: Float Charge	Load On
Green	On solid	Battery Nearly Full	Load On
Yellow	On solid	Battery Half Full	Load On
Red	Flashing (1 Flash / sec)	Battery Low	LVD Warning (Load On)
Red	On solid	Battery Empty	LVD (Load Off)
None	No LEDS On	Battery Missing	Load Off

Figure 52. Battery state of charge indicator.

When there is sufficient solar power generation, the status LED will illuminate (indicated by the red arrow, Figure 53 and Figure 54).

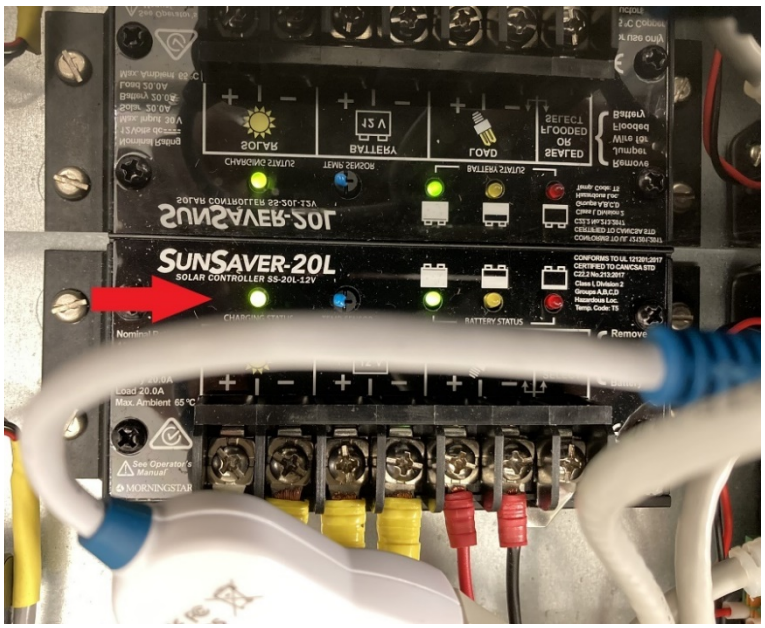


Figure 53. Solar charge controller status LED.

STATUS LED

The Status LED indicates charging status and any existing solar input error conditions. The Status LED is on when charging during the day and off at night. The Status LED will flash red whenever an error condition(s) exists. Table 2 lists the Status LED indications.

Color	Indication	Operating State
None	Off (with heartbeat[1])	Night
Green	On Solid (with heartbeat[2])	Charging
Red	Flashing	Error
Red	On Solid (with heartbeat[2])	Critical Error

[1] Status LED heartbeat indication flickers ON briefly every 5 seconds
[2] Status LED heartbeat indication flickers OFF briefly every 5 seconds

Table 2. Status LED definitions

Figure 54. Solar charge status LED meaning.

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