Base Station MK5 Installation

Introducing the MK5 Base Station (model MK5-F1)

MK5-F1 is an electronic device that is part of the wider category of Internet-of-Things (IoT) devices. As the name suggests, it is part of a network of devices that are accessible through the internet. That means that if an authenticated user is connected to the internet, he or she can access the device from almost anywhere in the world.

MK5-F1 is part of an ecosystem of electronic devices that aims to provide users remote control of resources, as well as assistance in conserving those resources, specifically electrical power and water. When it comes to water, the MK4-SV (Smart Valve) is specifically used to detect and measure the flow of water as well as open and close a motorized valve to either allow or restrict flow. The MK4-SV is used in conjunction with a wireless Base Station (BS), and the combination of Smart Valve and Base Station is collectively referred to as MK5-F1. This is shown in Figure 1.



Figure 1: MK5-F1 Base Station (left) and Smart Valve (right)

When the Smart Valve is installed in a water line (hot or cold), MK5-F1 can be set up to operate in a variety of modes. Most basic is *Park Open*, where the valve is permanently open, or *Park Closed*, where the valve is closed. Then there are dispense modes, where the valve is opened remotely to dispense either a specified volume, or dispense for a particular duration. These modes are referred to as the *Dispense-by-Volume* or *Dispense-by-Duration* modes. Finally, the *Active Control* mode is open by default and waits for water to start flowing. Once it detects flow, the unit will allow only a specified amount of flow time. At approximately the 75% mark, a warning is issued and then the valve is closed when 100% is reached. At this point the valve remains closed for a specified “on-hold” time after which it opens again. This is

intended, for example, to curb unrestricted use of hot water in either residential, rental or commercial scenarios. In the case of hot water, both electricity and water conservation are achieved.

The purpose of this document is to provide guidance for the physical installation of MK5-F1.

Safety Considerations

The following are important for safe installation of the product:

1. MK5-F1 operates from 230VAC, 50Hz power which presents a shock hazard that can be lethal. Installation must be carried out by a qualified electrician.
2. Always ensure power is switched off and disconnected from mains power before opening the MK5-F1 controller unit for whatever task.
3. The MK4-SV valve may be installed in line with water under high pressure. Ensure that the main water supply is turned off and pressure relieved in the line before working on the installation or maintenance of the system.
4. The MK4-SV valve may be installed in line with hot water systems, and as such there is risk of scalding due to high water temperature and possibly steam that may be present in the pipes. Extreme caution is advised and for this reason, installation and maintenance must be done by a qualified plumber.

Abbreviations and Acronyms

The following abbreviations and acronyms are used throughout the document and its drawings:

AC	:	Alternating Current
BS	:	Base Station
DC	:	Direct Current
ID	:	Identification
LED	:	Light Emitting Diode
PCB	:	Printed Circuit Board
SV	:	Smart Valve

Environmental Considerations

MK5-F1 is designed to operate in ambient temperatures of -20degC up to 50degC.
As such, the following should be observed for installation.

Base Station

1) Never install the unit where it will be exposed to direct sunlight. If necessary, artificial shading needs to be installed to protect the unit from direct sunlight.
2) Always install the unit in an upright orientation (e.g. against a vertical wall), level with the ground, and with the cable glands at the bottom to prevent rain from entering the Base Station. This is shown in Figure 2.

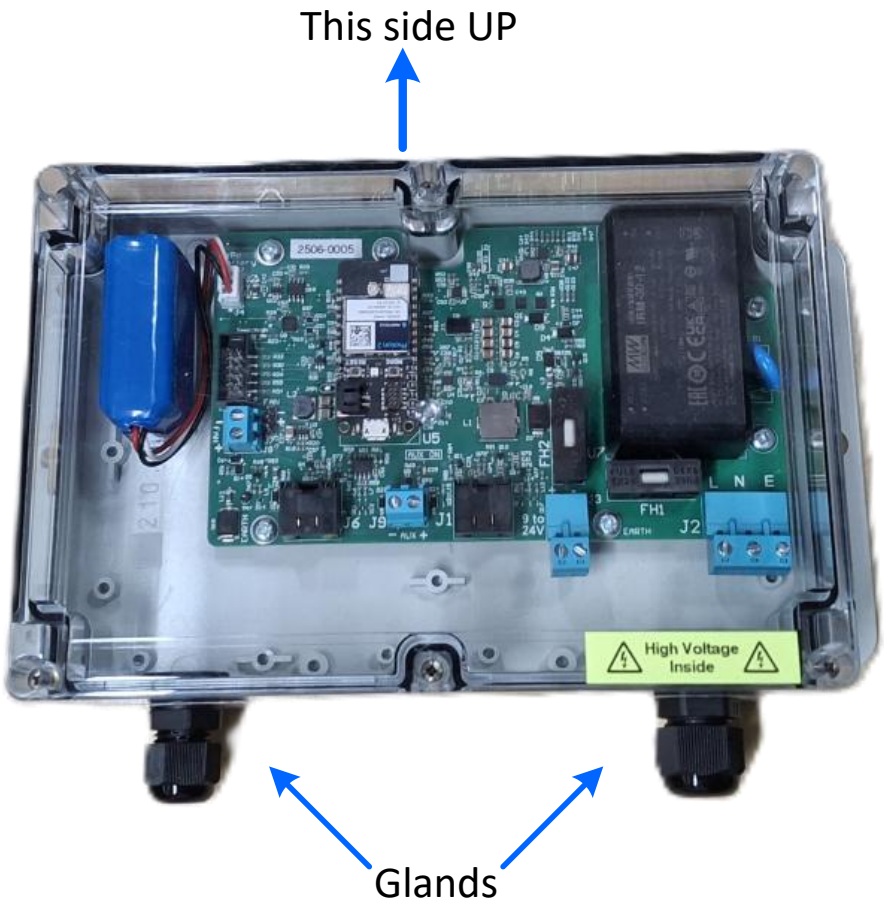


Figure 2: Required orientation for installation of the Base Station

3) Always install the unit at the appropriate height from ground level to prevent exposure to flooding due to rising water levels.
4) It is recommended not to install the unit in attics or roof spaces due to the high temperatures reached in such areas. If a longer distance than 1 meter between the Base Station and the Smart Valve is required for installation, contact Smart Technology SA for other cable length options.

Smart Valve

The main requirement for the Smart Valve is to shield it from direct sunlight. This is to prevent premature deterioration of it cabling, enclosure and other non-metallic parts.

Installation Location

There are three main considerations when it comes to the location of the unit.

The Distance from the Base Station to Smart Valve

The standard length of cable provided with the Smart Valve is approximately 1 meter (older units) and 2 meters on more recent units. If a longer distance between the Base Station and the Smart Valve is required for installation, contact Smart Technology SA for other cable length options.

Availability of Mains Power

MK5-F1 requires 230VAC, 50Hz for operation. It typically uses less than 15W of power. The MK5-F1 unit has a built-in backup battery for short durations of operation when mains power becomes temporarily unavailable. The battery can typically provide 4 hours of operation, although that depends on the number of discharge cycles that the battery has seen, its age as well as how actively the unit is being used.

Wi-Fi Access

The MK5-F1 Base Station requires access to a Wi-Fi network. The Wi-Fi radio of the unit has a capability similar to that of a typical mobile phone. This means that when there is line-of-sight between the unit and the Wi-Fi router a longer range can be achieved, and the more walls between the router and the Base Station the shorter the operating range is. An external antenna can increase operational range. These options can be discussed with Smart Technology SA.

Initial Setup of the Unit

The following steps should be followed prior to installation of the unit in its final location:

1) Make sure the unit is unpowered and its power cord is unplugged from the wall socket.
2) Unscrew the six lid screws and open the enclosure.
3) Remove the antenna which is wrapped in bubble plastic and install it on the side of the unit by screwing it hand tight onto its connector. Be sure not to over tighten it or use any tools to fasten it. Carefully swivel the antenna, without forcing it, until it is positioned as shown in the picture below:



Figure 3: Antenna mounting on the side of the unit.

4) Locate the battery connector and jumper shown in Figure 4 below. Remove the jumper. Take note of the keys on the one side of the battery connector and match them to the slots on the mating connector on the PCB of the unit. Insert the connector without forcing it. Notice the orientation with the red wire on the left. Do not force the connector in! It should easily engage.

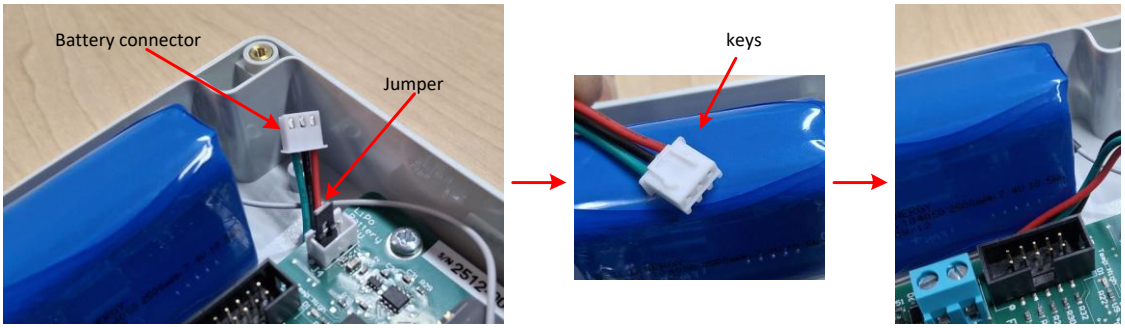


Figure 4: Battery connector and jumper

5) **Close the lid and fasten down at least two of the screws to ensure the unit is safe.**
6) Make sure you have the SSID and password of your Wi-Fi router available because that will be required to connect the Base Station to your Wi-Fi network.
7) Create a profile on Smart Technology SA's website so that you can register the unit and access it through STSA's server. Open up a browser on your computer or cell phone and go to the STSA website: www.stsa.app or www.smartvalvetech.co.za
8) Set up a Wi-Fi hot spot so that the unit can be set up for internet access. You need a cell phone that has a data connection other than Wi-Fi. This means the cell phone must be connected to the cell phone network and be able to access the internet without Wi-Fi. Set up a hot spot on your cell phone with the following SSID and password:
   a) SSID: AQS_SETUP
   b) Password: pwAqsSetup

9) Make sure the unit has its lid in place, plug the unit into a wall plug and switch it on. The LEDs of the unit should light up as shown below:

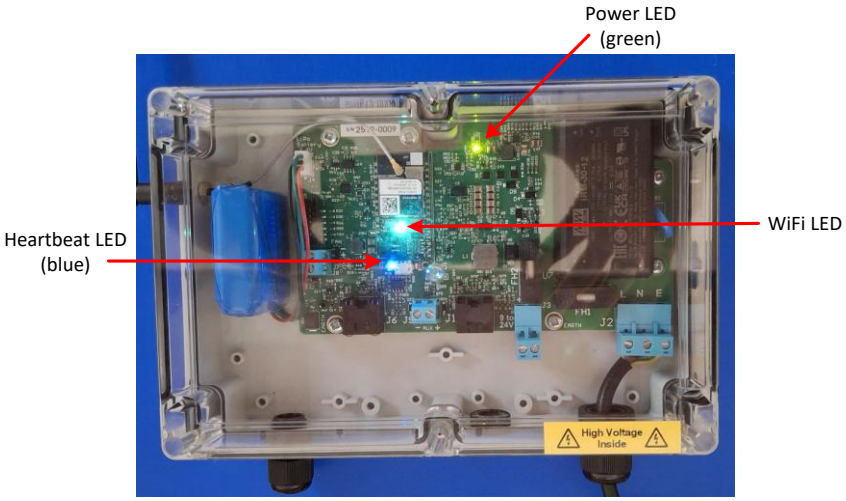
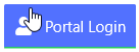


Figure 5: Power the unit

10) Make sure that the green power LED is on, and the blue Heart Beat LED is blinking.
11) Connect to the STSA server by clicking 

on the STSA website. Log in to the website (or create an account if you have not yet), click on ***Base Station Groups*** in the side bar, and click Manage in the Base Station Groups box.

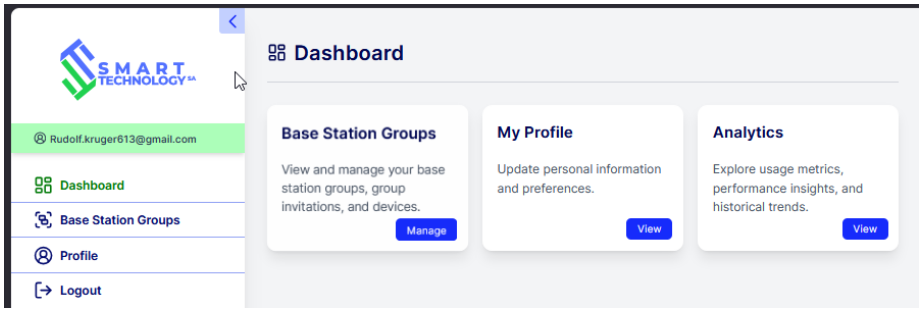


Figure 6: Click Manage on the Base Station Groups box.

12) Click the Add Base Station button and then type in a name for your Base Station, select the Base Station group (usually just the default one), and then type in the serial number printed on the label of your Base Station. The serial number always has the format NNNN-YYYY, where N and Y are always numbers or capital letters between "A" and "F". Also type in any useful information for your own reference in the Location Description text box. Finally click Submit to register your unit.

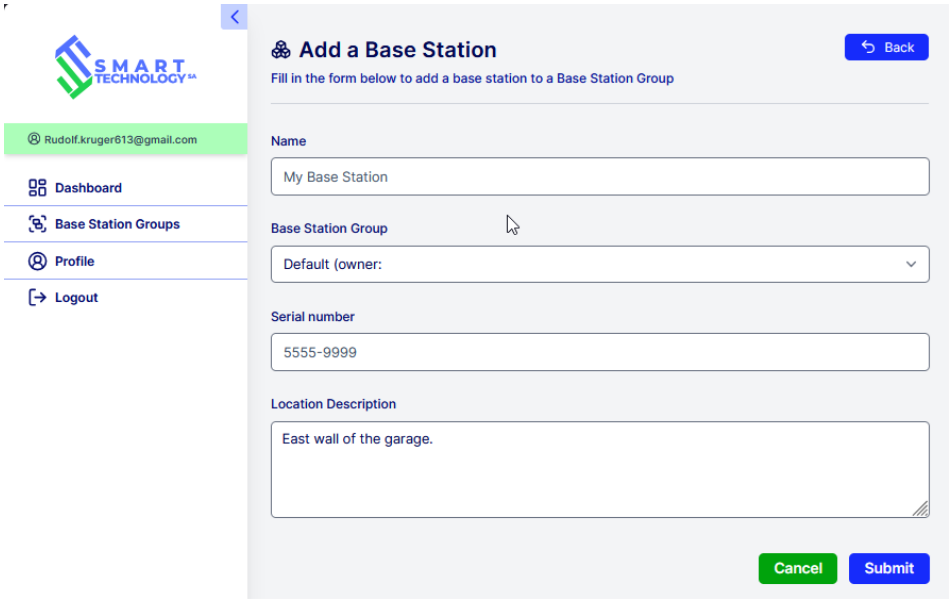
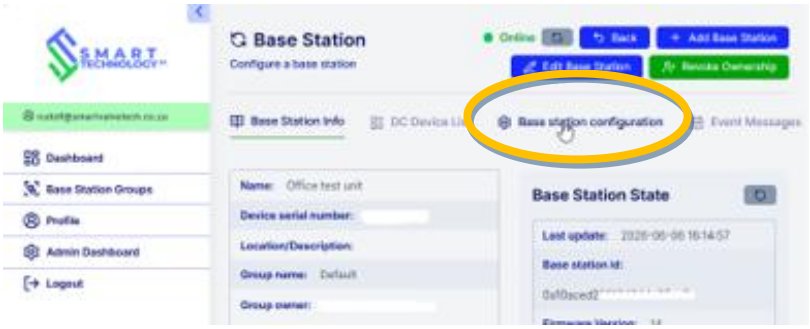
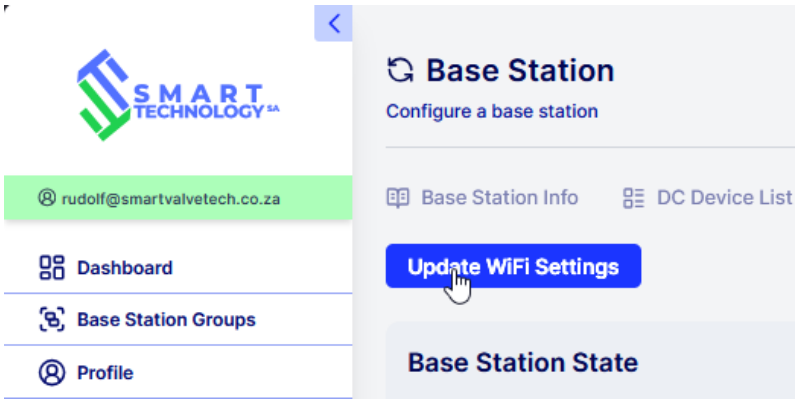


Figure 7: Register the unit

13) The Base Station is now added to your profile. What remains is to set up the Base Station with your Wi-Fi router's credentials. Click on ***Base Station Groups*** in the side bar, click on the View icon (eye icon) of your Base Station Group and then again next to your added Base Station. At the top, click on ***Base Station Configuration*** next to the gear icon, and then ***Update Wi-Fi Settings***





14) Fill in your Router's credentials (SSID and password) and click Update Wi-Fi Settings. You can add up to four sets of credentials to allow your Base Station to connect to various Routers.

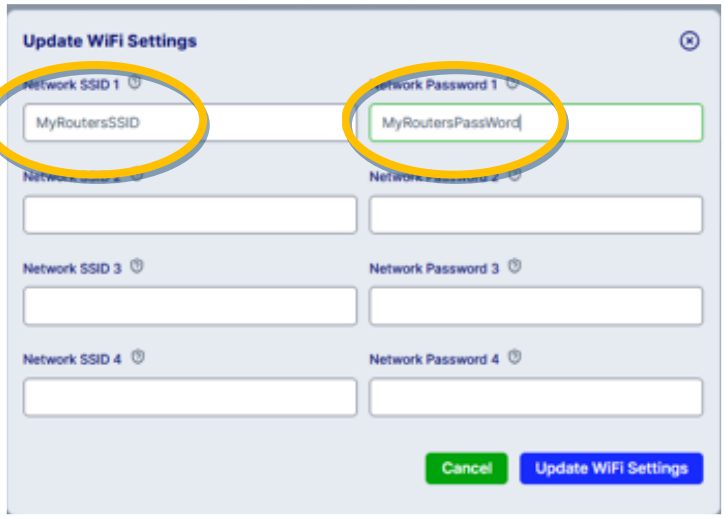


Figure 8: Add your Router's credentials to your Base Station setup.

15) Disconnect you cell phone's hotspot. The Base Station will take approximately 5 minutes to re-establish a connection to the internet through the Wi-Fi Router. A successful connection to the internet is indicated by the Wi-Fi LED on the unit "breathing" a cyan colour.

Mounting the Base Station

The enclosure of the Base Station needs to be in an upright orientation, level with the ground, and with the cable glands at the bottom.

The enclosure has wings on its side that have mounting holes through which the unit can be fixed to walls or other structures. Under no circumstances may holes be drilled inside the unit's enclosure for whatever purpose. Drilling holes inside the enclosure will void the unit's warranty. Be careful not to damage the unit's label during installation because the Serial Number printed on it is required to connect the unit to the Wi-Fi network.

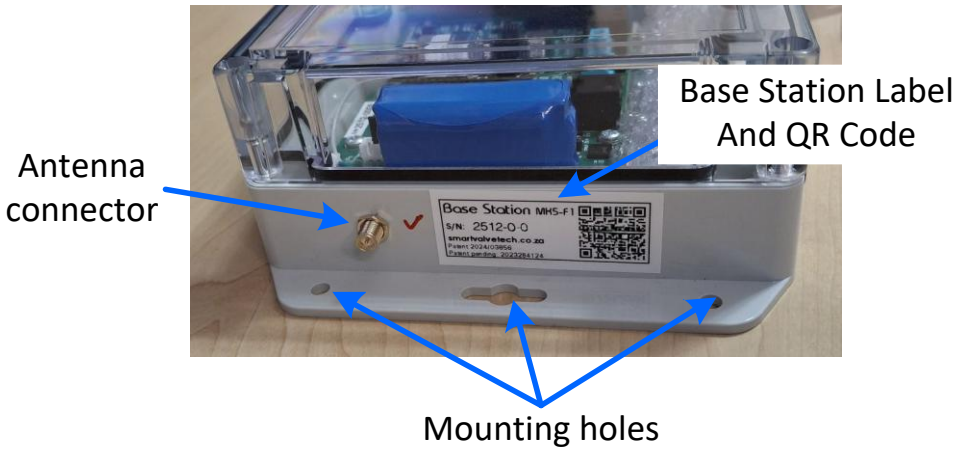


Figure 9: Base Station mounting holes and label.

Connecting the Smart Valve

At the bottom side of the Base Station provision is made for two cable entries. In the centre is a hole without a gland through which the Smart valve cable is installed. This is shown in Figure 10.

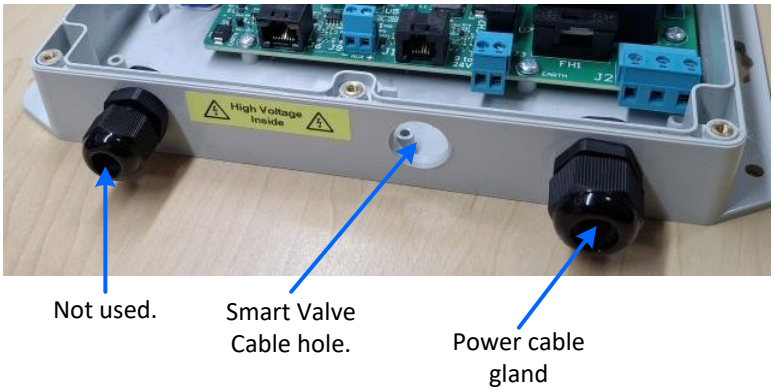


Figure 10: Cable entries for the Smart Valve and power cables.

The Smart valve cable is already fitted with a gland. To install it follow these steps:

1) Locate the loose gland on the Smart Valve cable and remove the nut from the gland as shown in Figure 11.



Figure 11: Remove the nut from the Smart Valve cable gland.

2) Pass the end of the cable through the hole in the Base Station, fit the gland through the hole and fasten it with the nut on the other side - hand tight only.

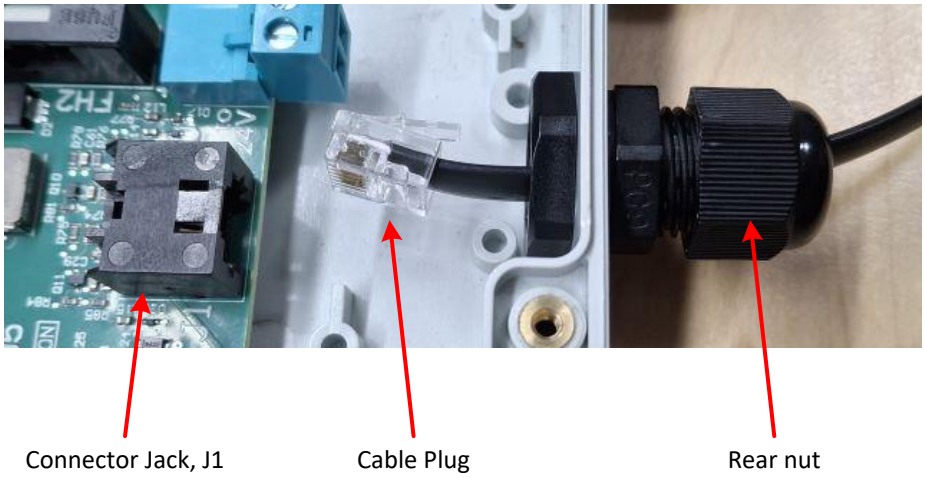


Figure 12: Smart Valve cable installation.

3) Now insert the cable plug into the jack (J1) on the PCB (see Figure 12). Push the cable slightly through the gland so that a short extra bit of cable is present in the enclosure and fasten the rear nut (Figure 12) – only hand tight! Figure 13 shows the completed installation of the Smart Valve cable.

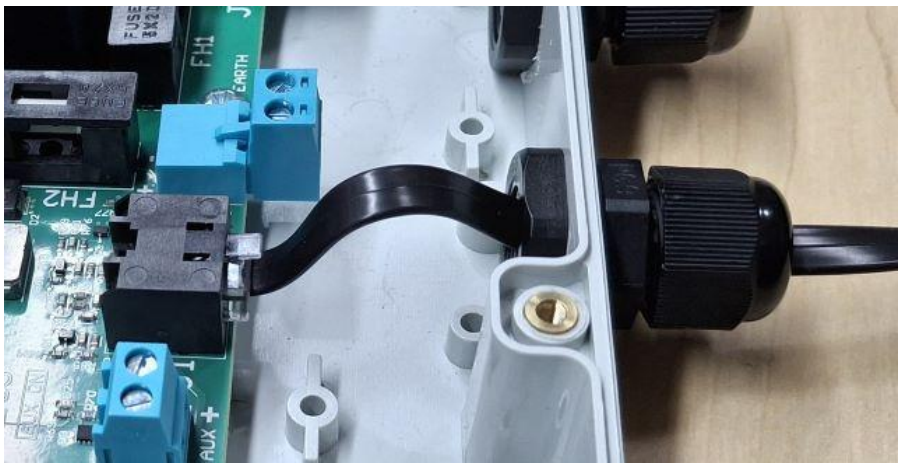


Figure 13: Smart Valve cable installation complete.

Connecting mains power

Mains power is connected to the Base Station PCB through a connector as indicated in Figure 14. The connector can be unplugged from the jack on the PCB to make it easier to fit it to the power cable. The power cable is connected to the connector with its screw terminals. The mains connector is then plugged back into the jack (J2) on the PCB.

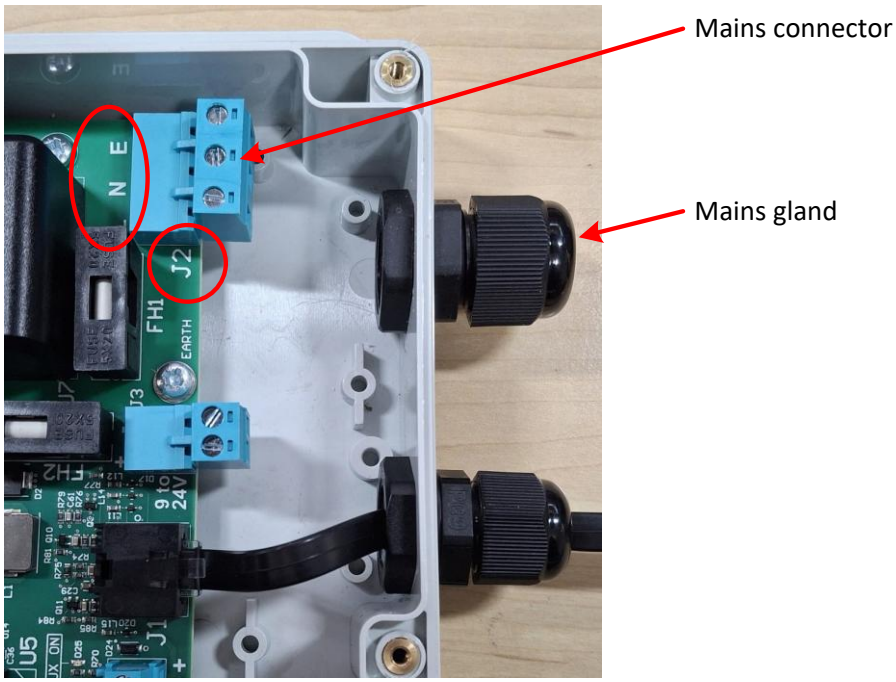


Figure 14: Mains connector to the Base Station PCB.

1) The first step is to unplug the mains connector from the PCB, pass the cable through the gland and connect the cable correctly to the connector as shown in Figure 15.

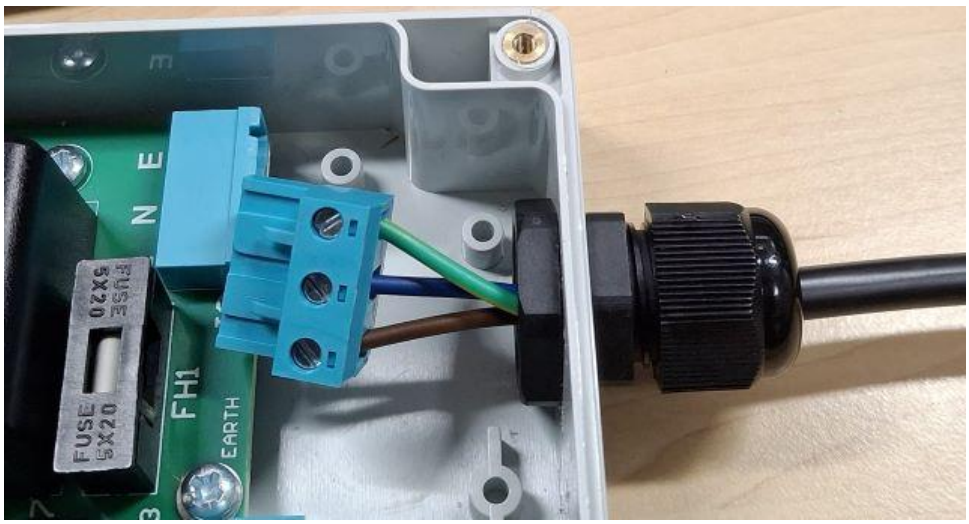


Figure 15: Mains connector with mains cable connected.

2) The connector is then plugged into jack J2 as shown in Figure 16. Note that the correct connections (Live, Neutral & Earth) to the connector is shown on the PCB.

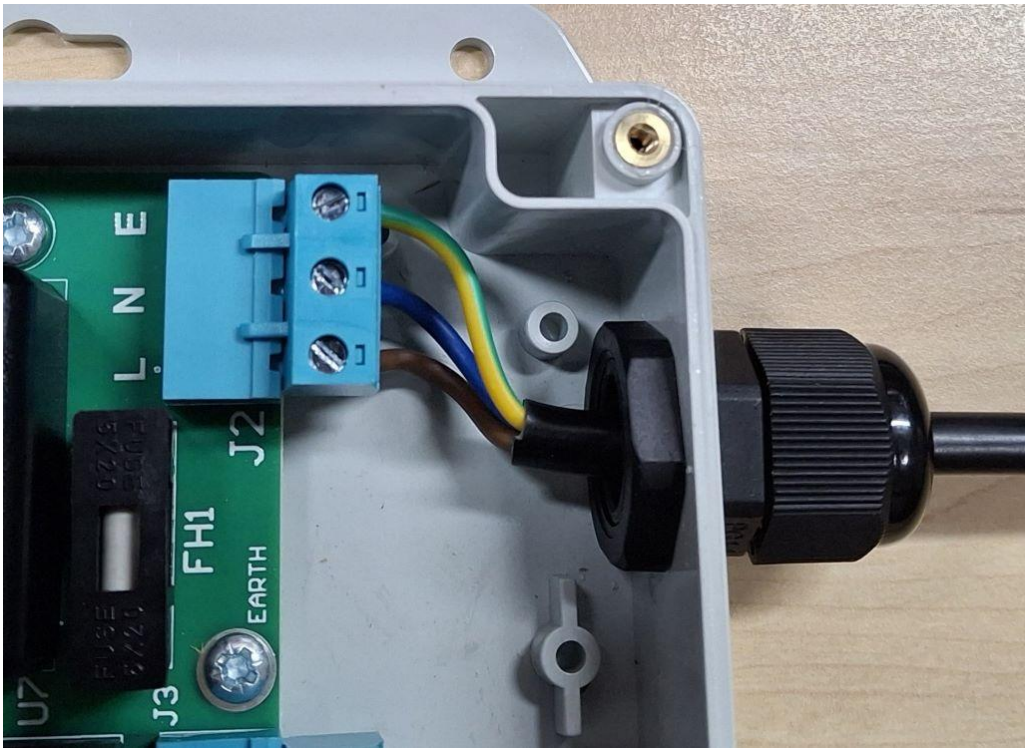


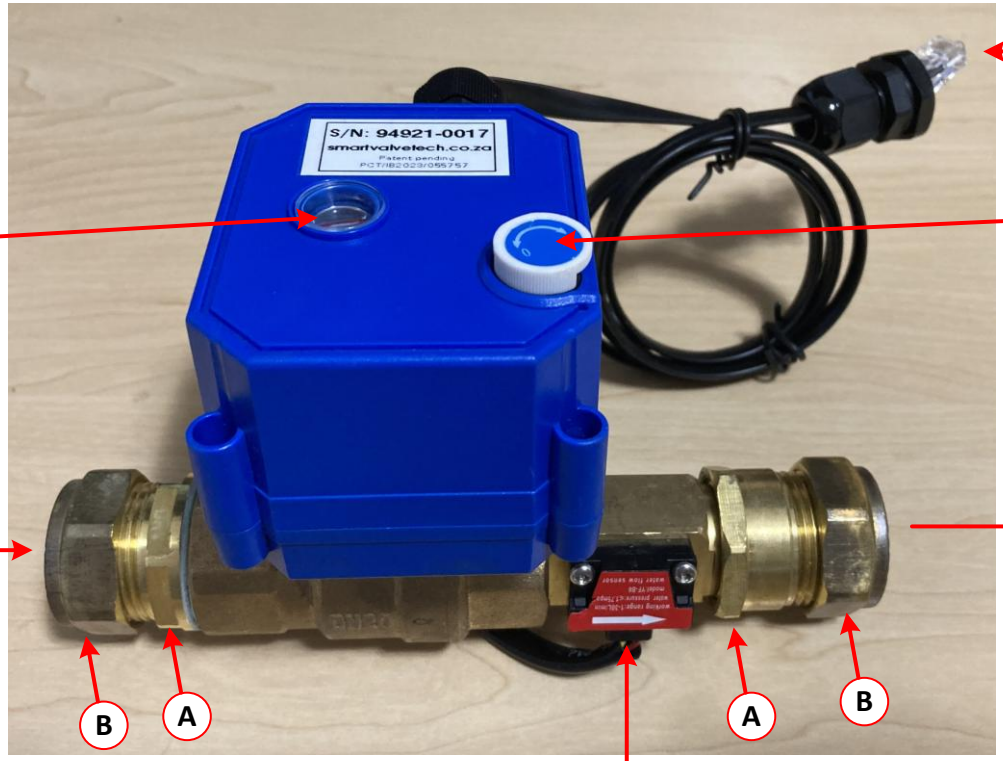
Figure 16: Mains connector plugged into jack J2.

3) Finally ensure that there is no tension on the wires by pushing the cable through the gland and then fastening the rear nut of the gland. For thinner wires a cable tie can be fastened around the cable sleeve at the gland to prevent the cable from pulling out.

Smart Valve Installation

The following are important to keep in mind for the installation of the Smart Valve, depicted in Figure 17 (next page):

1) The flow meter is direction sensitive. Install the valve so that water will flow in the direction indicated by the arrow on the flow meter.
2) The valve is intended for connection to 22 mm and 15 mm copper pipe **only** with the compression fittings that are already installed with it. Under **no** circumstances are pipes to be soldered to the unit because the excessive heat will damage the flow sensor and internal components of the valve.
3) For installation with 15 mm copper pipe, use a 22 x 15 reducing fitting to convert the 22 mm compression fittings for 15 mm pipe.
4) Always install the valve in the upright position (i.e. blue enclosure at the top).
5) Always install the valve on a pipe that is level with the ground.
6) Always use two wrenches to tighten the compression fittings. There are internal seals in the assembly that may be overstressed if the torque applied to the compression fitting is transferred to the internal couplings. This means a special thin wrench may need to be used on the input side of the valve.
7) Only use the manual override of the valve when it is disconnected from the controller, or if the controller is completely unpowered (the battery in the controller is unplugged and mains power is off).
8) To use the manual override (with the unit unpowered as discussed above), pull out the wheel until the internal gear properly engages and then rotate. Look through the window on the valve enclosure to see the position of the valve.



Connection to the controller. Keep safe from humidity and water if not connected.

Manual override to open or close the valve when it is not connected to a controller. Lift and rotate until the valve is open or closed. Press down again when done.

Window showing the valve position (open or closed)

22mm compression fitting. Connect to the geyser

22mm compression fitting. Connect to the hot water pipes.

22 x 15 Brass reducing fitting



Water flow direction: make sure this is the direction the water will flow, otherwise the flow meter will not measure correctly.

Important installation notes:

1. Install horizontal(i.e. level) and upright (i.e blue enclosure at the top) as shown in the picture.

2. Ensure correct water flow direction, see picture.

3. When tightening the compression fittings, use 2 wrenches on the fitting (see A and B) to prevent over-tightening and damaging the internal seals of the assembly.

3. To connect to 15mm pipe, use a reducing compression fitting (see picture).

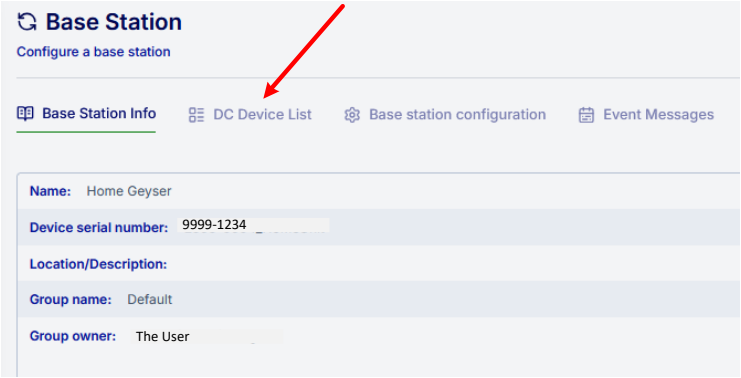
4. Do not solder on attached pipe because the heat will destroy the flow sensor and internal seals.

Figure 17: Installation of the Smart Valve

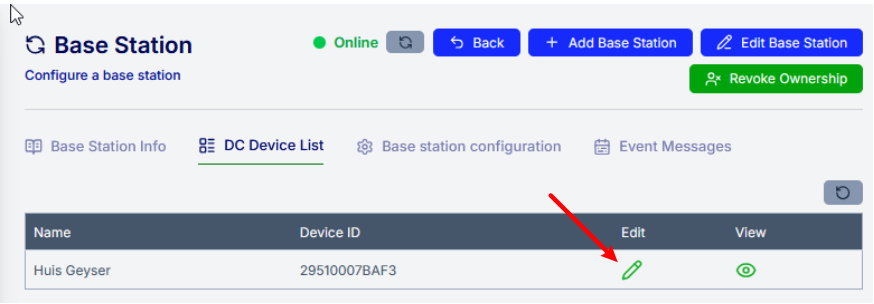
Setting up the Valve's Operating mode

Log into the STSA portal from the website (www.stsa.app or www.smartvalvetech.co.za), and navigate as follows:

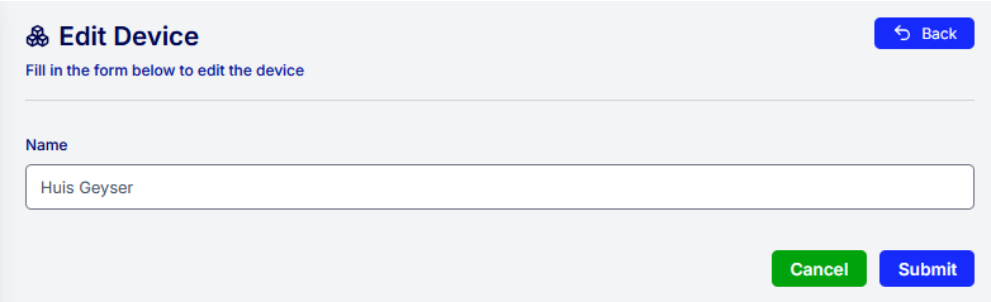
1) In the side bar, click Base Station Groups,
2) Click the View (eye) icon to view the contents of your Base Station group.
3) Click the View icon of your Base Station, to see a list of the Daisy Chain devices connected to the Base Station.
4) Select the DC Device List Base Station. Your Daisy Chain device should be listed



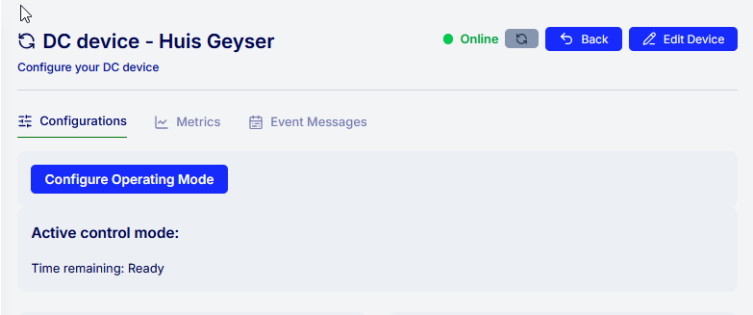
5) Click on the Edit (pencil) icon:



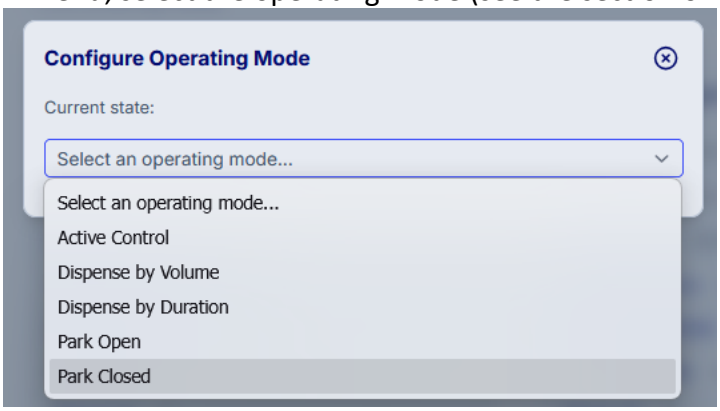
6) In the Edit Device screen, click Submit.



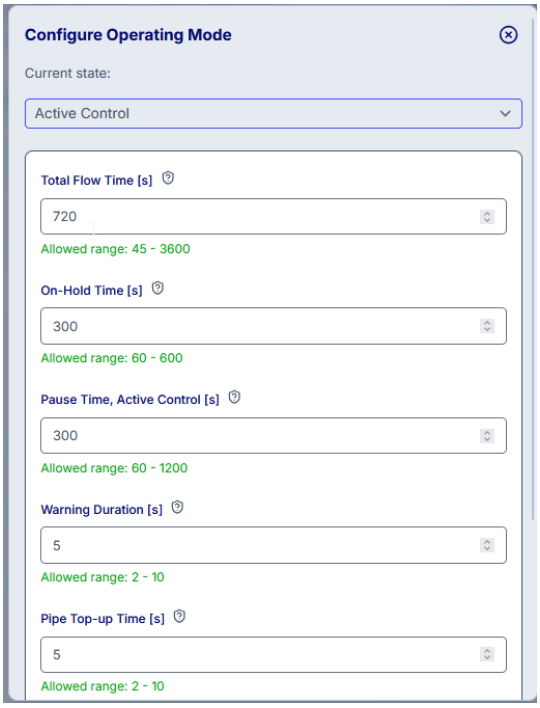
7) In the DC Device view, click Configure Operating Mode:



8) From the Dropdown menu, select the operating mode (see the section on *Valve Operating Modes*):



9) Where required set operating parameters. As an example the Active Control mode is shown below:



10) Depending on the operating mode selected, the valve may react by opening or closing.

Valve Operating Modes

The following operating modes are available:

Park Open

The valve is permanently open

Park Closed

The valve is permanently closed

Active Control

The valve is open by default but when it detects water flow it starts a flow timer. The user sets a “Total Flow Time” parameter which is the total duration of continuous flow allowed at a time. When the 75% mark of that time is reached, the valve closes temporarily to indicate to the user of the water that there is a limited time of use remaining. When the timer flow reaches the “Total Flow Time” mark, the valve closes for an “On-Hold Time” duration, before opening again, allowing another cycle to start.

Dispense by volume

The valve is closed by default. The user sets a target volume (in Liters) that can be dispensed. Start Dispense and Stop Dispense buttons appear on the web interface by which the user can Start and Stop dispensing water. When the allowed volume is reached the valve will close.

Dispense by duration

The valve is closed by default. The user sets a target duration for dispensing of water. Start Dispense and Stop Dispense buttons appear on the web interface by which the user can Start and Stop dispensing water. When the allowed duration is reached, the valve will close.