



# Final report

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## AxisTech Device Deployment - Windy Station

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## Abstract

AxisTech is an Australian based Agtech solution provider with a focus on IoT devices and whole-of-business data.

Our philosophy is to provide an end-to-end solution that is as robust at each point as possible. Where there aren't existing solutions available we develop our own, where there are solutions available, we look for best of breed or best fit for purpose. We love collaborations and partnerships and think this is the best way to solve real problems with real solutions.

We are playing our part in digitising agriculture.

AxisTech is proud to have been part of the MLA Digital Livestock 4.0 pilot hosted by Romani Pastoral Company (RPC) providing connectivity and digital solutions at Windy Station. The project was undertaken to demonstrate existing and available AgTech devices to help drive uptake and adoption by producers.

A number of solutions installed at Windy Station require Sigfox IoT RF network connectivity and so two Sigfox mini base stations were installed as part of the AxisTech demonstration.

In addition to these base stations, the following devices and sensors were installed:

- 2 x AxisTech weather stations
- 2 x AxisTech rain gauges
- 3 x AxisTech soil probes
- 2 x AxisTech water trough cameras
- 5 x Waterwatch water trough sensors
- 4 x Waterwatch water tank sensors
- 2 x AxisTech Water Trough cameras (cellular)

Some of the key results we have identified that arose from the project include:

- Project planning required for IoT outcomes – what knowledge, benefits and outcomes is the host looking to gain from the data generated by devices?
- Time required by project host to understand devices and to incorporate data into decision making activities as well as device maintenance.
- Relationship between the AgTech provider and the farm manager and the support provided is essential to the success of the project.

## **Executive summary**

### **Background**

The purpose of the project was to demonstrate hardware devices available in the market as requested by producers, industry groups, solution providers, researchers and universities.

RPC developed an IoT 'shopping list' of devices for installation and demonstration and AxisTech was successful in their application for RFQ to install devices and connectivity.

The results of the demonstration will be used to help recognise the key steps producers need to take when undertaking their own IoT projects and to prove the performance and use case for the devices installed by AxisTech.

### **Objectives**

The main objectives of the project were for AxisTech to install a range of devices and solutions as listed in the above Abstract. This was successfully achieved in two installations, the first in December 2019 and the second in October 2020. Due to state border closures caused by Covid-19, there was significant delay in completing the second installation which included the deployment of 2 x AxisTech water trough cameras.

### **Methodology**

As part of the methodology of the project, AxisTech provided:

- On Farm Connectivity (Sigfox)
- On Farm Devices
- Apps and Dashboards

### **Results/key findings**

The results of the project were determined during a handover on 23 December with AxisTech, RPC Management team and MLA where feedback on the devices, their performance and use case was provided. It was determined that at this point, the Waterwatch tank and trough sensors had demonstrated significant value and the rest of the devices were still to prove their value and use case. AxisTech will continue to work with the RPC General Manager to potentially modify install locations of some devices and to assist with future use cases for the other devices.

### **Benefits to industry**

The benefits to industry of this project are that it enables producers, industry groups, researchers and universities to obtain knowledge and use cases for IoT devices available in the market so that they may complete their own IoT projects and improve their own farming operations. It also enables providers to test the robustness and reliability of their devices and to develop use cases based on the outcomes achieved.

### **Future research and recommendations**

For future research and project development, AxisTech has the following recommendations:

- It is important to address use cases and outcomes as part of the device or solution selection process to ensure the Farm Manager obtains real value from the devices and the project.
- Adequate time is required for project planning, manufacturing and installation to ensure a successful project.
- After installation, the solution provider should work closely with the Farm Manager to ensure there is full understanding of solutions including the importance of installation location, how the device works and the information it can provide and, how the device data can be used as part of daily operations and within the on-farm decision making process.

## 1. Background

The purpose of the project was to further demonstrate hardware devices available in the market as requested by producers, industry groups, solution providers, researchers and universities following the success of the demonstration at Carwoola Station in 2018/ 2019.

RPC developed an IoT 'shopping list' of devices for installation and demonstration and AxisTech was successful in their application for RFQ to install devices and connectivity.

There is a growing appetite for IoT on-farm devices within the industry and the MLA Digital Livestock 4.0 was an excellent opportunity to provide an updated demonstration of digital solutions ready and available in the market. The outcome of the demonstration is to not only deliver value to the host farm (RPC) but to also showcase device performance and to develop use cases. This in turn will help to increase producer confidence, knowledge and to drive adoption of on farm devices.

## 2. Objectives

Digital farms are important for the longevity of Australian red meat supply chains, whether that be to inform consumers of our credentials such as the CN30 program or Beef Sustainability initiative or to improve production businesses. Romani Digital Farm has demonstrated technology that was not available previously or willing to be provided at the time, during Carwoola phase 1.

In November 2018, Meat and Livestock Australia (MLA) hosted the inaugural Digital Forum, as a commercial testing ground for Agtech innovation. The Digital Forum was designed to push industry innovation providers to work together within networks and visualisation tools and also to commercially test the robustness of their devices and services.

Sensors are becoming more relevant to modern farming systems as agriculture, as an industry, becomes more data centric. The data from a collection of sensors can enhance the efficiency, safety and quality of a farming enterprise. This is achieved by gaining greater control and insight into the assets a herd or flock interacts with, allowing producers to make better management decisions in a shorter amount of time.

AxisTech develops devices in order to power and control a variety of environmental multiuse sensors including weather monitoring, soil monitoring and water sensors. These devices generate data which is packaged and compressed by the device for delivery via LPWAN to back-end cloud servers. Users can apply the analysed data to make better informed decisions, improve efficiencies and

productivity, create cost savings and maximise profitability.

As part of this project, AxisTech successfully deployed a range of devices:

- 2 x Sigfox mini base stations
- 2 x AxisTech weather stations
- 2 x AxisTech rain gauges
- 3 x AxisTech soil probes
- 2 x AxisTech water trough cameras
- 5 x Waterwatch water trough sensors
- 4 x Waterwatch water tank sensors
- 2 x AxisTech Water Trough cameras (cellular)

In addition to this, AxisTech has provided ongoing updates and a final handover and training to RPC Management team and to MLA as required. Following the handover, it was evident that additional training on devices and how the relevant data can be used was required throughout the project to ensure maximum value was achieved from the device demonstration.

### 3. Methodology

#### 3.1 On Farm Connectivity

A number of solutions provided by AxisTech as part of the project require the global Sigfox IoT RF network. Sigfox in Australia operates on RCZ4 922MHZ.

Thinextra is the exclusive Sigfox network operator for Australia, New Zealand and Hong Kong and the first global specialised IoT network, products and solutions provider.

Two Sigfox Mini Base Stations were installed at Windy Station. Throughout the project, these base stations required maintenance and adjustments to ensure they were working as required and it is expected that these will require ongoing maintenance to ensure their performance.

AxisTech will continue to provide this support.

Sigfox Mini Base Stations	Date Installed	Latitude	Longitude
Base Station A: Dodds	16/11/2019	-31.5979705	150.4101766
Base Station B: Brown's Ridge	16/11/2019	-31.6119033	150.4505854



The AxisTech S95-A21 Weather Station is solar powered with data sensors that capture wind speed, wind direction, rainfall, temperature, barometric pressure and relative humidity. Please refer to Appendix 7.1.1 for detailed specifications.

S95 Weather Station	Date Installed	Latitude	Longitude
Claremont South Weather Station (ATWS1)	16/11/2019	-31.5734879	150.4530916
Paddock 35 Weather Station (ATWS2)	15/11/2019, Relocated 8/10/2020	-31.6310967	150.4561798



Claremont South Weather Station (ATWS1)



Paddock 35 Weather Station (ATWS2)

### 3.2.2 AxisTech Rain Gauge

The AxisTech S95-A26 Tipping Rain Gauge is a standalone device with independent solar power. Please refer to Appendix 7.1.2 for detailed specifications.

S95 Rain Gauge	Date Installed	Latitude	Longitude
Windy Ridge Rain Gauge (ATRG2)	15/11/2019	-31.6300636	150.3704983
Windy Homestead Rain Gauge (ATRG1)	18/11/2019	-31.6310967	150.3810914





Windy Ridge Rain Gauge (ATRG2)



Windy Homestead Rain Gauge (ATRG2)

### 3.2.3 AxisTech Soil Moisture Probes

During the second installation, the soil probes originally installed were upgraded with new EnviroPro probes due to the inconsistent performance of the original AquaCheck probes in that location. The AxisTech Soil S95-EP600 soil probe provides capacitance-based soil moisture and soil temperature. Please refer to Appendix 7.1.3 for detailed specifications.

It is understood from the handover meeting that the soil probes have so far not provided the value that they should to the RPC Farm Manager and this is mainly due to the location of installation. AxisTech is keen to work with RPC to understand what learnings they would like to gain from the soil moisture probes and can assist and advise on where they should be moved to.

S95 Soil Probe	Date Installed	Latitude	Longitude
Dodds Soil Probe 600mm (ATSP1)	14/11/2019 Probe upgraded 08/10/2020	-31.5953087	150.4028052
Windy Ridge Soil Probe 600mm (ATSP2)	15/11/2019 Probe upgraded 08/10/2020	-31.6300636	150.3704983
Claremont South Soil Probe 600mm (ATSP3)	13/11/2019 Probe upgraded 08/10/2020	-31.5734879	150.4530916



Dodds Soil Probe (ATSP1)



Windy Ridge Soil Probe (ATSP2)



Claremont South Soil Probe (ATSP3)

### 3.2.4 Waterwatch Tank & Trough Sensors

The Waterwatch Tank & Trough Sensors have a high accuracy radar sensor designed specifically to measure liquid levels in water tanks and troughs. During the second install, the trough sensors were replaced as described in the table below as they were not performing due to animal damage, flat batteries or requiring firmware or hardware updates.

During the final handover, the RPC Farm Manager confirmed that the Waterwatch tank and trough sensors were the most used devices and had provided significant time savings with staff at Windy Station no longer having to drive around to check water levels on those tanks and troughs with the sensors installed.

Please refer to Appendix 7.1.4 for detailed specifications.

T35 Level Sensors	Date Installed	Latitude	Longitude
Sth Windy Ridge Trough (ATTr1)	14/11/2019 Replaced 07/10/2020	-31.639333519046	150.372535043943

Mid Windy Ridge Trough (ATTr2)	14/11/2019 Replaced 07/10/2020	-31.6314498049077	150.373263044526
Nth Windy Ridge Long Trough (ATTr3)	14/11/2019 Replaced 07/10/2020	-31.6266464540281	150.373160453794
Nth Windy Ridge Round Trough (ATTr4)	14/11/2019 Replaced 07/10/2020	-31.6217539928235	150.367702590727
Top East Trough (ATTr5)	15/11/2019 Replaced 07/10/2020	-31.6164659098683	150.371041626391
Waterway Water Tank (ATWT1)	15/11/2019	-31.6285948866884	150.358809757608
Halls Water Tank (ATWT2)	15/11/2019	-31.6275950694788	150.435685097872
Block 4 Creek Water Tank (ATWT3)	16/11/2019	-31.6202966699847	150.404288749372
Plumbers Junction Water Tank (ATWT4)	16/11/2019	-31.6109645694962	150.403991505849



Nth Windy Ridge Round Trough (ATTr4)



Nth Windy Ridge Long Trough (ATTr3)



Top East Trough (ATTr5)

### 3.2.5 AxisTech Trough Cameras

The AxisTech Solar 4G Camera has an 8.0-megapixel camera, enables live video on a smart phone from anywhere, shows recorded footage and events that have occurred and can send notifications of motion, a pre-set crossed line, object removal and an area that has been entered or exited.

At time of writing the installed cameras are currently not functioning as they should be and require adjusting. AxisTech has been in touch with the RPC Farm Manager to arrange a date to assist with troubleshooting and will follow up to arrange a suitable time for a video call to rectify the issues.

Please refer to Appendix 7.1.5 for detailed specifications.

Trough Camera	Date Installed	Latitude	Longitude
South Windy Ridge Trough Cam (Trough1)	08/10/2020	-31.5953087	150.4028052
Middle Windy Ridge Trough Cam (Trough2)	08/10/2020	-31.6300636	150.3704983



South Windy Ridge Trough Cam (Trough1)



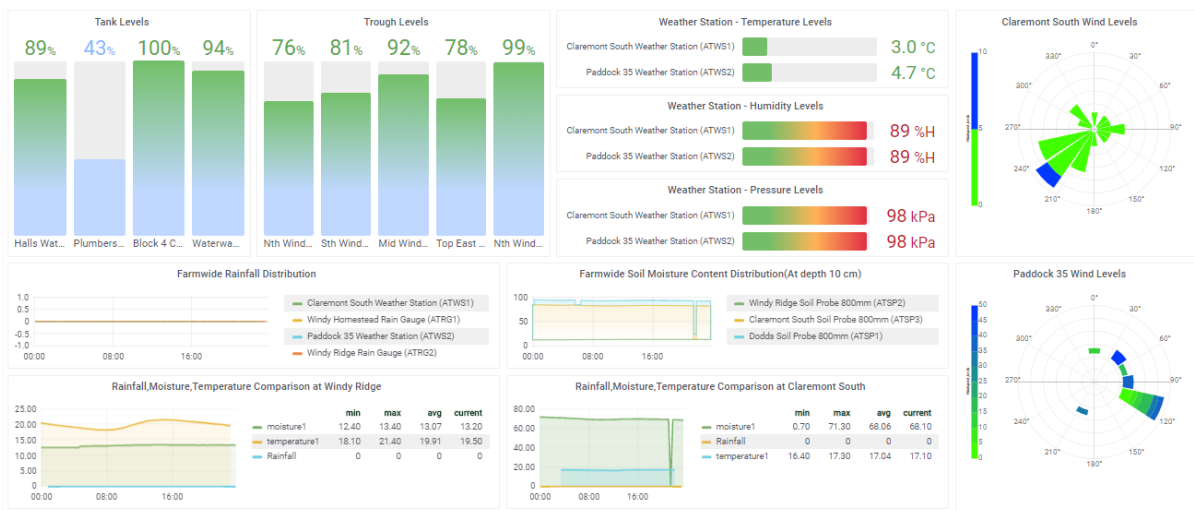
Middle Windy Ridge Trough Cam (Trough2)

### 3.3 Apps and Dashboards

#### 3.3.1 AxisTech Dashboard

AxisTech has provided the RPC Management team with a customised Dashboard which can be used as a decision making tool with live data feeds and alerts. This Dashboard includes data of all devices supplied by AxisTech for the project, not including the trough cameras.

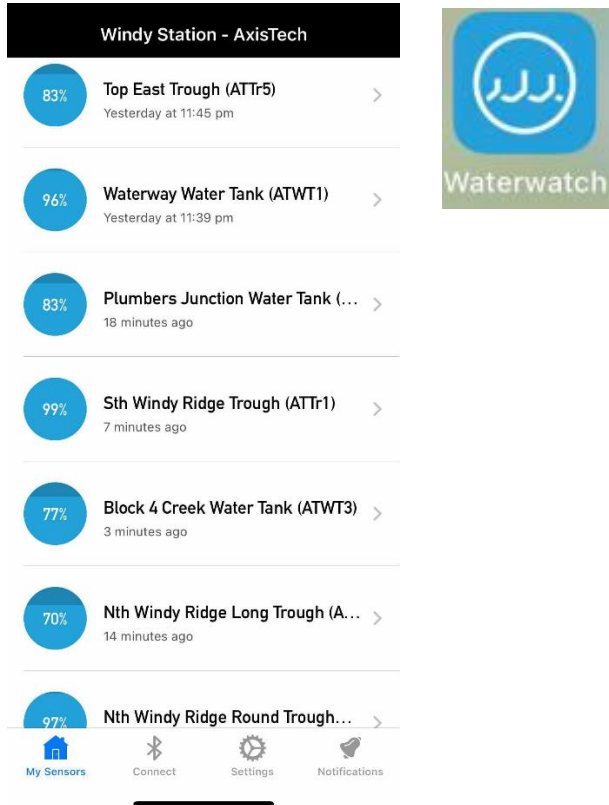
It is understood that this device display has not been used by the RPC Farm Manager as part of their day to day operations. AxisTech has been in discussions with the RPC Farm Manager on an upgraded option for the AxisTech Dashboard – our AxisStream Data Management System where all data from the MLA Digital Livestock 4.0 2019/2020 Pilot can be ingested into a farmer owned data store and used by a variety of consumption tools to provide insight and analysis.



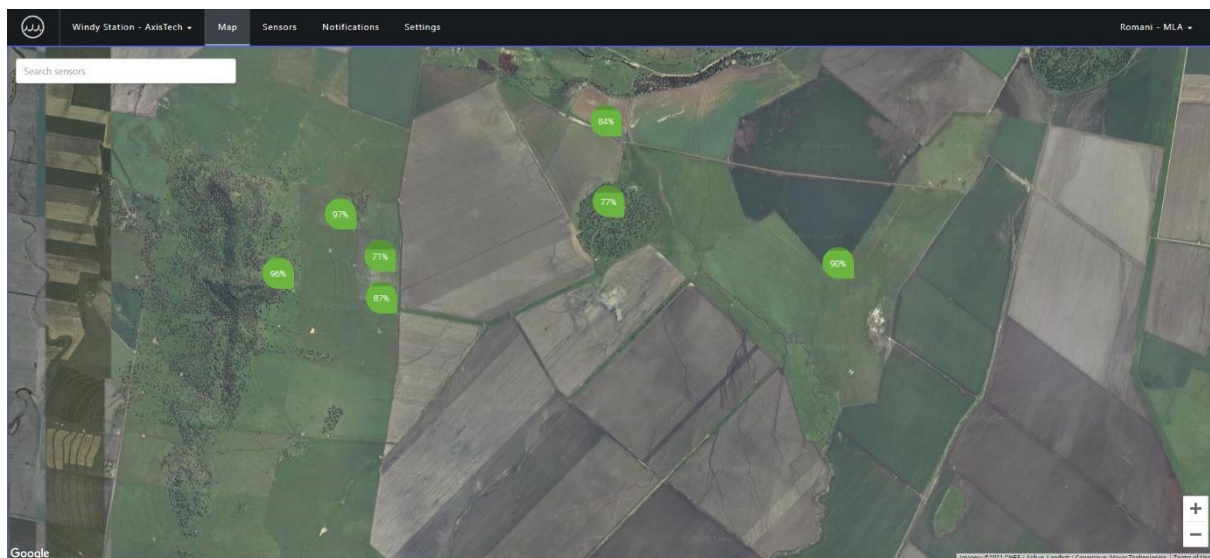
AxisTech device data displayed on Dashboard

### 3.3.2 Waterwatch App and Dashboard

The Waterwatch App provides insights on a mobile phone into those troughs and tanks at Windy Station that have a Waterwatch device installed. The online dashboard provides additional details and insights on tanks and troughs including a map view and detailed tank information.



#### Waterwatch App view



#### Waterwatch Dashboard Tank and Trough map view



Waterwatch Dashboard Tank insights

**3.3.3 AxisTech Camera App**

The iDMSS Plus App (for iOS) or aDMSS (for Android) enables the ability to view and manage cameras from anywhere at any time. Notifications and alerts can also be set. As mentioned in section 3.2.5 AxisTech Trough Cameras, some trouble shooting is required to adjust the cameras and AxisTech will also provide some refresher training to ensure that the RPC Farm Manager and staff can access and use the Camera App.



## 4. Results

A handover was held on 23 December 2020 with AxisTech, RPC Management team and MLA. During this meeting AxisTech went through the devices, dashboards and Apps and asked for feedback on how the devices were going and how they were being used. It has been acknowledged by the RPC Farm Manager that, among other things, there has been significant value demonstrated with the Waterwatch tank and trough sensors in terms of time saved not having to drive around checking tanks and troughs on Windy Station.

There appears to be some knowledge gaps by RPC in regard to some of the other AxisTech devices installed at Windy Station. AxisTech will continue to provide support and training to ensure some value is obtained from the devices installed at Windy Station.

## 5. Key findings

The main key findings from the MLA Device Deployment Project at Windy Station are:

- As a device provider, AxisTech has a production cycle of approximately 4-6 weeks for device production, testing and provisioning prior to installation. It is important these times are included in project timings to ensure that devices are complete and ready for install.
- The time required for installation is dependant on the number and types of devices, their locations and if any other equipment or resources are required to complete the install such as poles or brackets etc.
- Time and input is required by the Farm Manager and/or Farm Staff for installation planning, sensor and device selection, connectivity requirements, understanding and utilising the device data and for ongoing device maintenance as required.
- Communication between the Farm Manager and Device Provider is important and should be regular and ongoing to ensure there aren't any knowledge gaps and that the Farm Manager receives the support that they need for a successful project.

## 6. Conclusion and recommendations

The AgTech industry has been on a journey from the very first pilots and trials which introduced devices and solutions to farmers, through to solutions that are helping farmers and agribusinesses reach a level of digital maturity that delivers tangible improvements to operations, productivity and profitability. The development and evolution of AgTech though has not been as simple as first thought.

AxisTech has been on its own journey with this too. Through our own learnings and collaborations, we have evolved our company to not only develop and produce devices that deliver data, but to play a more comprehensive role in the bigger picture of digitising agriculture. Our founder, in collaboration with Belinda Lay of Coolindown Farms have arrived at a framework which deconstructs solutions into their fundamental elements.



This framework is based around 8 Pillars that were formulated out of the lived experience in implementing end-to-end solutions on farm and the learning journey that has taken place from projects including the MLA AgTech Trial at Carwoola Pastoral Company and the MLA Digital Livestock 4.0 Trial at Windy Station.

1. Installation
2. Sensors
3. Devices
4. Connectivity
5. Data Ingestion
6. Data Storage
7. On Farm Data Consumption
8. Aggregated Data Consumption

We believe the red meat industry can achieve greater success from their digital projects by following this framework which can help to achieve full value from the project findings. Further information on the 8 Pillars can be found here: <https://axistech.co/agtech-deconstructed-and-the-8-pillars/>

Going forward, AxisTech will continue to provide support to the RPC Management team with further training on how to use the deployed devices and associated software. This will include use cases for devices and insights on how the data from these devices can be used.

AxisTech will continue discussions with MLA and RPC Management team on providing additional value to the MLA Digital Livestock 4.0 Pilot around management of device data and other on-farm data using AxisTech's data management solution, AxisStream which has been designed to ingest data into a farmer or business owned data store where it can be consumed using a range of tools that provide knowledge and insights for the business.

We look forward to continuing our collaboration with both MLA And Romani Pastoral Company beyond this pilot, continuing to add value and continuing our vision of digitising agriculture.

## 7. Appendix

### 7.1 Device specifications

#### 7.1.1 AxisTech S95-A21 Weather Station

Specifications	
Model	S95-A21 Weather Station
Product Code / Barcode	S7937827 / 0601557937827
GPS	High sensitivity GPS & GLONASS (-146 to -165 dBm)
Wind speed sensor	Test range: 0~45m/s
Wind direction sensor	Test range: 0~360° Resolution: 1°

Ultrasonic wind sensors (optional)	Range: 0-60m/s, 0-360° Resolution: 0.01m/s, 1°
Atmospheric temperature	Temperature Range: -40~60°C, resolution: 0.01°C, Accuracy: ±0.5°C
Humidity	Humidity Range: 0-100%RH, Resolution: 0.05%RH, Accuracy: ±3%RH
Barometric pressure	Pressure range: 0-1100mBar. Resolution : 0.1mbar Accuracy: ±1mBar
Rain gauge	Range: ≤4mm/min. Resolution: 0.2mm Accuracy: ±4%
Solar radiation (optional extra)	Measure Spectral Range: 300-3000nm Range: 0-1500w/m2 Sensitivity: 7-14uV/W/M-2
UV sensor (optional extra)	Spectral range 240~400nm Range: 0-200W/m2, 0-200uW/cm2, 0-15UV index

### 7.1.2 AxisTech S95-A26 Rain Gauge

Specifications	
Model	S95-A26 Rain Gauge
Product Code	S793758
GPS	High sensitivity GPS & GLONASS (-146 to -165 dBm)
Rain gauge	Range: ≤4mm/min. Resolution: 0.2mm Accuracy: ±4%

### 7.1.3 AxisTech S95-EP Soil Probes

Specifications	
Model	AxisTech Soil-S95-EP
Sensors	Moisture sensor spacing: 10cm Diameter: 33.5mm +/-0.2mm Moisture resolution: 0.01% Accuracy: +/- 2% @ 0% VWC to 50% VWC Temperature resolution: 0.01°C Accuracy: +/- 1° @ 25°C Salinity resolution: 0.001dS/m Accuracy: +/- 5% @ 0-4dS/m at 10%-30% VWC pH specifications: Range: 0-14 pH Accuracy: ±0.1 pH Resolution: 0.01pH
Power	Solar with Li battery backup

### 7.1.4 Waterwatch Tank & Trough Sensors

Specifications		
Model	Waterwatch T35 Tank Sensor	Waterwatch LS1-R1Trough Sensor
Housing	Polycarbonate + PBT Waterproof and UV resistant Dimensions 130x110x90mm	Polycarbonate + PBT Waterproof and UV resistant Dimensions: 185x105x80mm
Sensor	60GHz Radar sensor Measurement accuracy 0.2% Measurement range 0.15m to 3.5m Operating temperature: -20°C to +60°C	42kHz Ulstrasonic Measurement accuracy 1% Measurement range 0.3m to 5m Operating temperature: -40°C to +85°C
Power	Inbuilt Li battery 3 – 10 year battery life depending on connectivity and reporting rate	Inbuilt Li battery 3 – 10 year battery life depending on connectivity and reporting rate

### 7.1.5 AxisTech Solar 4G Cameras

Specifications	
Model	AXCAM-1B8-S120-105-S4G
Configuration	Solar Static Camera Unit
Camera	Single 8.0MP static
Power	120W Solar
Battery Backup	105AH (>4 days)
Connectivity	3G/4G/LTE Single SIM modem
Onboard Storage	128GB (approx. 60days)
Housing	Pre-assembled in IP66 powder coated steel enclosure
Installation	Units supplied with bolts and u-bolts required for pole or shed installation. For pole install recommended 100x100x3mm square galvanized tube. Poles and installation can be provided if required
Optional upgrades (not included)	Motion triggered flood LED lighting Motion triggered pre-recorded notification/warning Motion triggered combined flood LED lighting and pre-recorded notification/warning Full 360 degree Pan Tilt Zoom camera controls (PTZ) Dual SIM modem and high gain antennae

	Thermal imaging camera Optional upgrade to lighter weight lithium batteries
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