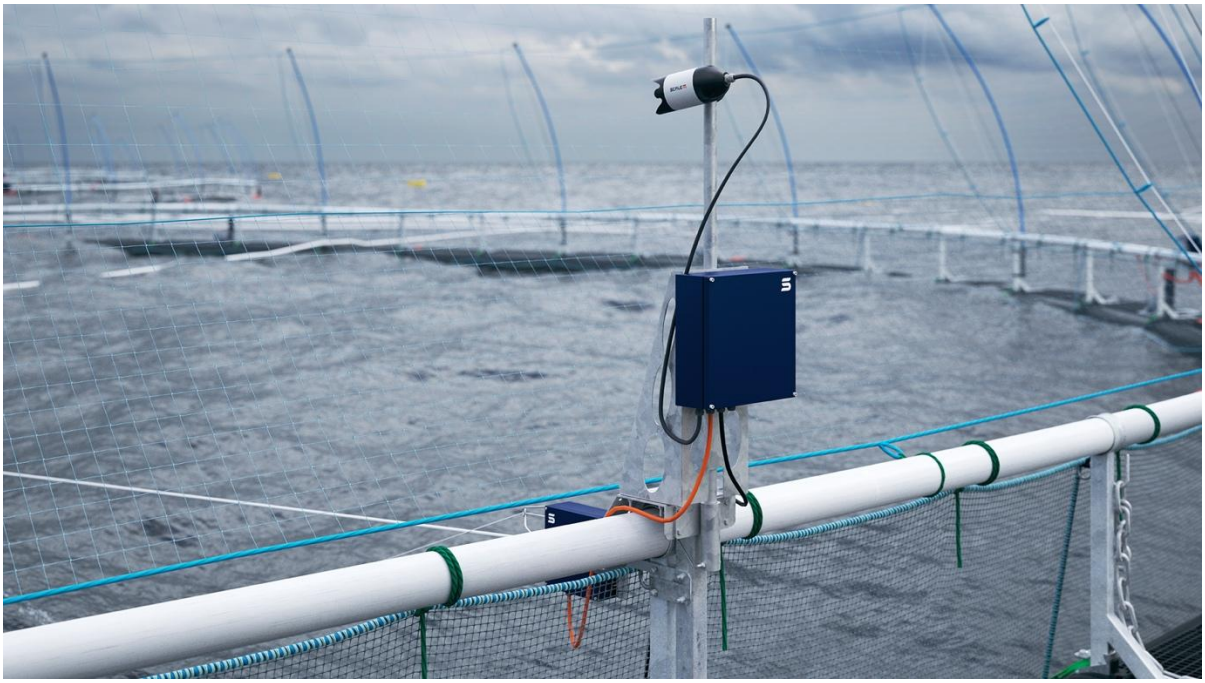
User Manual

Camera System



User Manual

Camera System

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8	06.06.2025	VBL	Add CIU-2000S and Smart Winch. Add guidelines for submerged systems. Add guidelines for camera strain relief knot.
		BUO	Updated Antennas

CONTENTS

1 INTRODUCTION

This user manual describes the installation, use and maintenance of the complete camera system and its associated components.

A separate user manual is available for our camera software, Vision.

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1.2 Symbols

The symbols used in this user manual and what they mean are explained below.

Information

Please refer to the page/chapter or appendix for more information

Exercise caution – risk of damage to equipment and minor personal injuries

Warning – can result in personal injuries

1.3 Disclaimer of liability

Every precaution has been taken, and verified by ScaleAQ AS, in compiling and publishing this document. The contents of this document may be changed without notice due to factors outside the control of ScaleAQ AS. The contents of this user manual should therefore be considered advisory only. The products referred to in this publication are constantly being improved through further research and development, which may result in the information in this manual being updated without notice.

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1.4 Recommendations and reservations

When equipment is installed for the first time by authorised personnel from ScaleAQ AS, the equipment is checked before and after installation to eliminate and minimise any risk to people, fish and other equipment. Site personnel will receive a basic introduction into the elements that must be included in inspection routines.

When reconnecting the equipment, it is important to ensure that the installation and equipment comply with the specifications provided by ScaleAQ and, where possible, have them inspected by authorised personnel from ScaleAQ to remedy any deviations from requirements and specifications that have not been caught.

Using or removing the equipment from pens will not cause any pollution for fish.

A thin layer of Molykote 44 or 111 must applied to the contact surfaces on cables (winch, antenna and camera) to prevent moisture penetration. The external contact surfaces on the camera housing are made of POM, with some stainless steel parts, and hardened Sikaflex to prevent fouling of the assembly screw.

2 SAFETY

2.1 Warranty limitations

Warranty according to contract.

2.2 Waste information

CIUs/PSUs, winches, cameras and cables will be classified as waste electronic and electrical equipment (WEEE) when scrapped.

The camera housing is mainly made of POM, with a small amount of stainless steel.

The mounting bracket, mast and winch bracket are made of aluminium

The bolts, screws, washers and nuts are stainless steel

The underwater camera and depth sensor may contain a small amount of silicone oil or glycol.

When the camera system is not installed and is in storage, there is no risk of environmental contamination. All of its components can be recycled.

2.3 Assessment of escape risk

Under normal operating conditions, a ScaleAQ camera system represents no risk of escape when used on pens in aquaculture facilities. No parts used in the camera system can damage pen bags/netting, ropes or other plastic or steel parts of the pen structure under normal operating conditions.

Factors:

1. Broken camera suspension rope: The cameras have been designed with no sharp edges meaning that they cannot cause tears or holes in pen bags/netting, even if they sink to the bottom of a pen. However, if a camera is left lying on the bottom of a pen for a longer period of time, it may still cause wear and tear on the pen bag/netting.
2. Installation on pen side: The combo mount designed to be installed on the side of a pen is made of heavy duty aluminium and is secured with stainless steel bolts and screws. These do not normally come into contact with pen bags/netting. However, if these parts become loose or are not installed properly, there may be a risk of wear and tear on the pen bag/netting (50-80 cm above the surface of the water).
3. Multiwinch strength: The multiwinch has built-in load protection and is calibrated to lift 10 kg in the sea. Any loads in excess of this will deactivate the motor to prevent any rope/cable/winch being moved by the winch becoming snagged and wearing a hole in the pen bag/netting when the winch is manoeuvred.
4. Surface cameras: The cameras have no sharp edges and, under normal conditions, if one ends up in the water it will not cause tears/holes in the net. However, if it is not retrieved, it may cause problems for the lift-up system.

2.4 Risk assessment

All of the equipment supplied by ScaleAQ undergoes a risk assessment. These cover the most common situations that can arise.

The document ScaleAQ Equipment Risk Assessments contains a matrix of risk assessments and some scenarios for equipment supplied by ScaleAQ. It can be provided upon request.

3 TECHNICAL DESCRIPTION

ScaleAQ's camera system is an advanced monitoring system for controlling the feeding and behaviour of fish in aquaculture and for general inspections of fish in pens. This includes the net walls (limited to the net wall on each side of the winch rope) and the bottom of the net and associated dead fish collector.

The camera system consists of:

- Underwater camera
- Surface camera
- CIU
- Multiwinch
- Mounting bracket for pen
- Antenna
- Aluminium tube/mast
- Strain relief system for fibre cable (for fibre installation only)
- Surface camera
- Camera cable
- Plastic rings and pulley for camera rope
- Pulley for 18 mm rope
- Strain relief system with counterweight
- Rope

Camera installation:

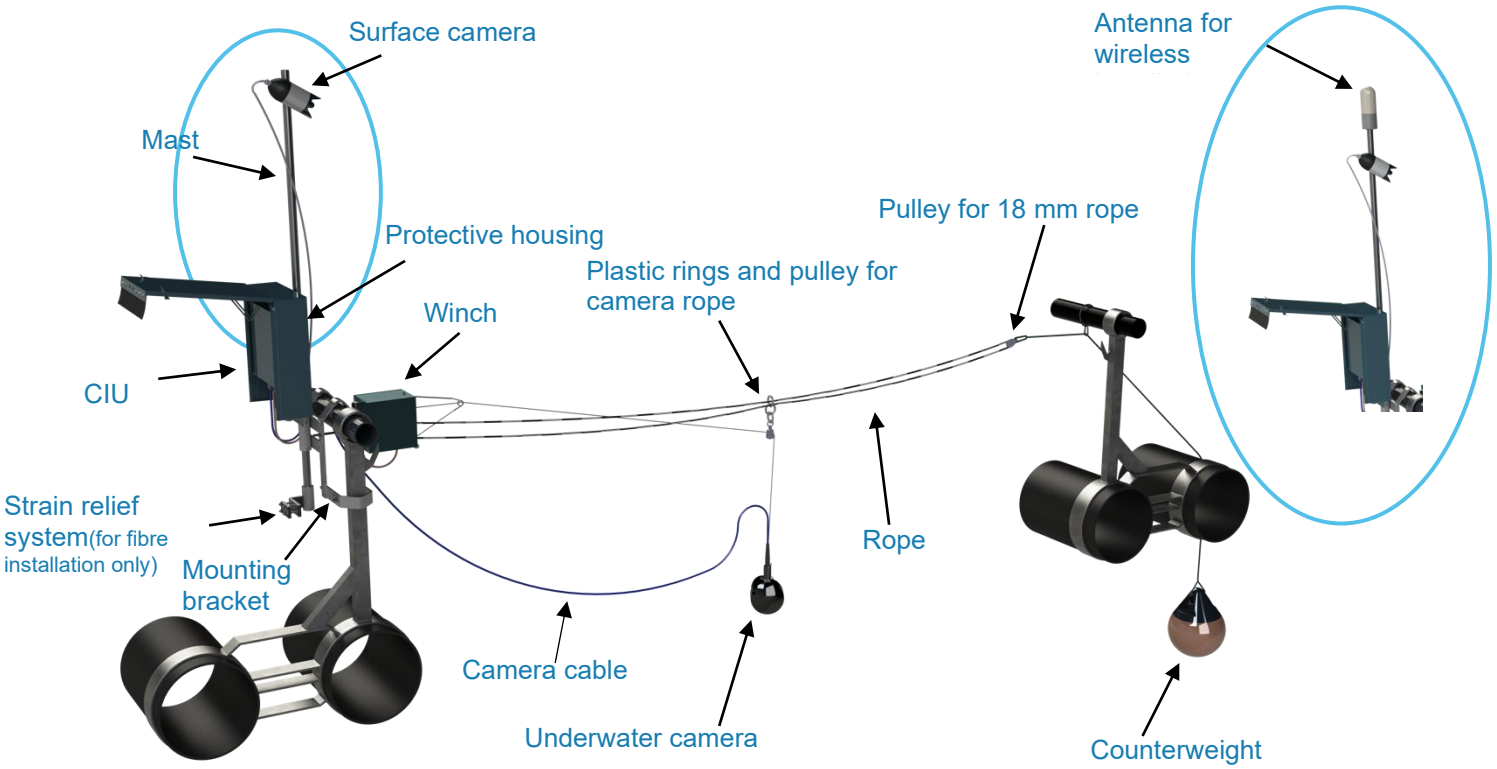


Figure 1 Complete camera system

3.1 Underwater camera

ScaleAQ supplies several underwater camera models (the Orbit series), both with and without pan and tilt. All of the current models come with temperature, depth and compass sensors. Oxygen is an optional extra though and can be selected during the purchase process or be installed later by sending the camera in for service.

Some of the camera models we offer are shown in the figure below.

Figure 2 Orbit underwater cameras

	Orbit-3450 HD	Orbit-3650 HD O_2	Orbit-3700 Fixed HD	Orbit-3700 Fixed HD O_2
Materials	POM, stainless steel, PEEK and glass		POM, PEEK and glass	
Weight in air	6.4 kg		5.6 kg	
Size (W x H x D)	187 x 304 x 198 mm			
Power	24V DC		PoE	
Communication	Coaxial + serial		Network	
Image sensor	CMOS colour		Colour	
Resolution	HD 1280 x 960p60		FHD 1920 x 1080p30	
Light sensitivity	0.00025 Lux		0.0001 Lux	
IP Class	IP69, down to 100m		IP68, down to 80m	
Sensors				
Temperature	✓	✓	✓	
Depth +/- 0.5 m	✓	✓	✓	
Compass +/- 5°	✓	✓	✓	
Oxygen +/- 1.5%		✓		✓
Angle of view	80° in water		120° in water	
Pan/tilt	Yes/Yes		No/No	

Table 1 Specifications – Orbit-3000 series

Figure 3 Orbit-39x0 series underwater camera

	Orbit-3900 **FullHD**	**Orbit-3910 FullHD O_2**	**Orbit-3920 FullHD Wide**	**Orbit-3930 FullHD Wide O_2**
Materials	POM, PEEK, glass and AISI316 (stainless steel)			
Weight in air	7.96 kg			
Power	PoE+ 802.3at max 30W (Power over Ethernet)			
Communication	Network			
Image sensor	CMOS colour			
Resolution	FHD 1920 x 1080p30			
Light sensitivity	0.0001 Lux			
IP Class	IP68, down to 80m			
Sensors				
Temperature	✓			
Depth +/- 0.5 m	✓			
Compass +/- 5°	✓			
Oxygen +/- 1.5%		✓		✓
Angle of view	80° in water		120° in water	
Pan/tilt	Yes/Yes			

Table 2 Specifications – Orbit-39x0 series

3.2 Surface cameras

ScaleAQ currently offers two surface camera models for installation on pens. The first is a bullet camera without pan and tilt. This offers very good images and makes it easy to monitor the spreader and some activities on the surface in the pen. The second is a dome camera, which was chosen because it can be used on pens and provides good images in spite of difficult lighting conditions and reflections in pens. The dome camera has pan and tilt, which means it can be used to look around pens, keep track of personnel who have to work on facilities alone in less favourable conditions and so on.

Both cameras shall be mounted at the top of the pole, beneath the antenna, to minimize effects of waves over time. Please note that the Orbit HD PTZ Basic (360) camera is only recommended to be mounted at locations with HS below 2.

Figure 4 Orbit-210 and Orbit-360

	Orbit HD Surface (210)	Orbit HD PTZ Basic (360)
Materials	Aluminium and POM	Steel
Weight	2.5 kg	2.0 kg
Dimensions	186 x 303 x 198 mm	Ø183 x 174 mm
IP rating	IP68	IP66
Operating voltage	11-13V DC, 3.9W	10-14V DC, 20W, PoE+
Temperature range	-20 °C – +50 °C (approved for Nordic region)	-40 °C – +60 °C
Video signal	Digital	
Resolution	1920x1080p (FullHD)	
Sensor type	CMOS colour	
Zoom	30x optical, 12x digital	20x optical
Aperture	F1.6	
Light sensitivity	0.01 Lux	0.002 Lux
Angle of view	63.7°	60°

Table 3 Specifications – Orbit surface camera series

3.3 Surveillance cameras

ScaleAQ supplies two surveillance camera models, the Orbit-360 and the Orbit-311, whose use depends to some extent on what you want to monitor. In general, the Orbit-360 is used to monitor barge equipment (silo decks, selectors, generators, blowers, etc.) while the Orbit-311 is used for monitoring facilities.

Figure 5 Orbit HD Dome PTZ Extreme and Orbit HD Dome PTZ Basic

	Orbit HD Dome PTZ Extreme (Orbit-311)	Orbit HD Dome PTZ (Orbit-360)
Materials	Aluminium, PC and POM	Steel
Weight	2.0 kg	
Dimensions	Ø183 x 174 mm	
IP rating	IP67	IP66
Operating voltage	24V AC, 35W with heater	10-14V DC, 20W, PoE+
Temperature range	-10 °C – +50 °C	-40 °C – +60 °C
Video signal	Digital	
Resolution	1920x1080p (FullHD)	
Sensor type	CMOS colour	
Zoom	35x optical, 12x digital	23x optical
Aperture	F1.6	
Light sensitivity	0.0006 Lux	0.005 Lux
Angle of view		60°

Table 4 Specifications – surveillance cameras

3.4 CIU

A CIU is used to connect a pen with a barge and creates a network between the screens on the barge or in the control room to the side of the pen. Can be delivered as a fibre or wireless solution.

Figure 6 CIU mounted in protective housing

	CIU-1000	CIU-2000	CIU-2000S	CIU-6000	Protective housing
Materials	Aluminium				
Weight	11 kg				13.7 kg
Dimensions	400 x 400 x 200 mm (without protective housing)				495 x 656 x 241 mm
IP rating	IP67				
Operating voltage	90-264V AC, 47-63 Hz				
Temperature range	-10 °C – +65 °C				
Connections					
Power in	1	1	1	1	
Optical fibre	0 (2)	0 (2)	0 (2)	0 (2)	
Underwater camera (12-pin)	1	0	0	0	
Multiwinch (digital)	1	2	0	0	
Smart Winch	0	0	1	0	
Ethernet (PoE)	3	4	4	6	
Multi socket base plate	4	3	3	2	
Sensors	1	1 (3)	1 (3)	0 (2)	

Table 5 Specifications – CIU and protective housing

The figures in brackets indicate the upgraded capabilities available by purchasing upgrade packages. Contact a ScaleAQ consultant for help on expanding the capabilities of your CIU unit.

3.5 Barge Interface Unit (BIU)

The Barge Interface Unit (BIU) is the barge unit that connects a camera system to the barge's network. This unit is designed for both wireless and fibre connections to pens. The unit contains a switch, which comes preset and has a number of ports ready and available at the bottom of the unit.

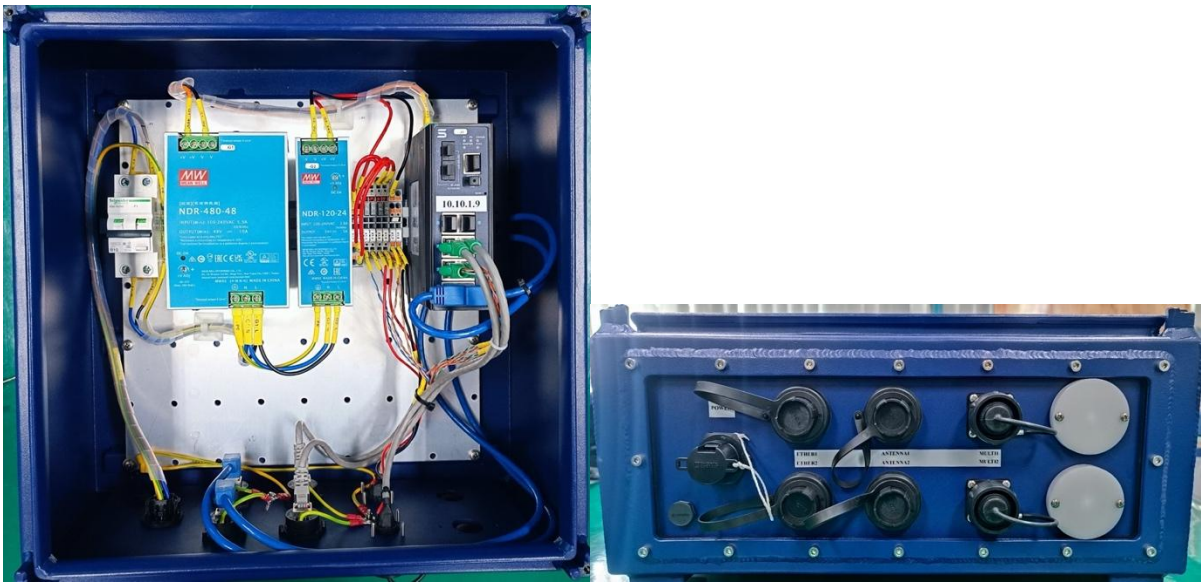


Figure 7 The BIU-1000 and BIU base plate

	BIU-1000	Protective housing
Materials	Aluminium	
Weight	10 kg (without protective housing)	13.7 kg
Dimensions	400 x 400 x 200 mm	495 x 656 x 241 mm
IP rating	IP67	
Operating voltage	90-264V AC, 47-63 Hz	
Temperature range	-10 °C – +65 °C	
Connections		
Power in	1	
Optical fibre	0 (2)	
Ethernet (PoE)	4	
Multi socket base plate	4	

Table 6 Specifications – the BIU-1000

3.6 CIU & BIU Connectivity

The table below shows what the different CIU and BIU models support as standard.

	Model	CIU-1000	CIU-2000	CIU-2000S	CIU-6000	BIU-1000
Infrastucture	Series connection of power	O[1]	O[1]	O[1]	O[1]	O[1]
	Series connection optical fiber	✓	✓	✓	✓	✓
	Power over Ethernet (PoE) 802.3at	✓	✓	✓	✓	✓
	Antenna for pen	✓	✓	✓	✓	X
	Antenna for barge (base station)	X	X	X	X	✓
Connectivity	Power	1	1	1	1	1
	Optical fiber	O[2]	O[2]	O[2]	O[2]	O[2]
	Camera HD 12-pin	1	X	X	X	X
	Winch (digital)	1	2	X	X	X
	Smart Winch	X	X	1	X	X
	Gigabit Ethernet RJ45 (w/PoE)	3	4	4	6	4[6]
	Multicontact	3[3]	3[4]	3[4]	2[5]	2[7]
Software	Vision	✓	✓	✓	✓	✓
Camera support	Orbit-39X0	✓	✓	✓	✓	✓
	Orbit-37X0	✓	✓	✓	✓	✓
	Orbit-36X0	✓	X	X	X	X
	Orbit-34X0	✓	X	X	X	X
	Orbit-360	✓	✓	✓	✓	✓
	Orbit-311/B	✓	✓	✓	✓	✓
	Orbit-210/B	✓	✓	✓	✓	X
Miscellaneous	Third-party cameras and equipment	✓	✓	✓	✓	✓
Sensor support	Orbit-863	✓	✓	✓	O[5]	X
	Orbit-880	✓	✓	✓	O[5]	X
	Orbit-881	✓	✓	✓	O[5]	X
	Orbit-890	✓	✓	✓	O[5]	X
	Orbit-891	✓	✓	✓	O[5]	X
	Orbit-892	✓	✓	✓	O[5]	X
	Orbit-893	✓	✓	✓	O[5]	X

Table 7 CIU & BIU Connectivity

1. Series connection of power using T-splitter accessory.
2. Hole for two fiber connections. Blind plug as standard.
3. 4-port serial module included, standard connection for 34x0/36x0 camera, winch, and two sensors.
4. 2-port serial module included, standard connection for winch and one sensor. Upgradeable to a 4-port module.
5. Serial module not included. Upgradeable with a 2-port module.
6. Two of the Ethernet ports, labeled ‘ANTENNA1’ and ‘ANTENNA2’, support 24VDC passive PoE in addition to PoE 802.3at.
7. Supports only 24VDC and Fast Ethernet.

3.7 Multiwinch – analogue and digital

The multiwinch is mounted on the pen using a combo mount and is controlled by a CIU via camera software. The multiwinch is connected to the CIU via a dedicated cable. The multiwinch controls the camera's vertical and horizontal movement in the pen. It has a built-in function that prevents the rope being fed out without tension.

Never open the winch while the power is connected as this may damage the winch and circuit board.

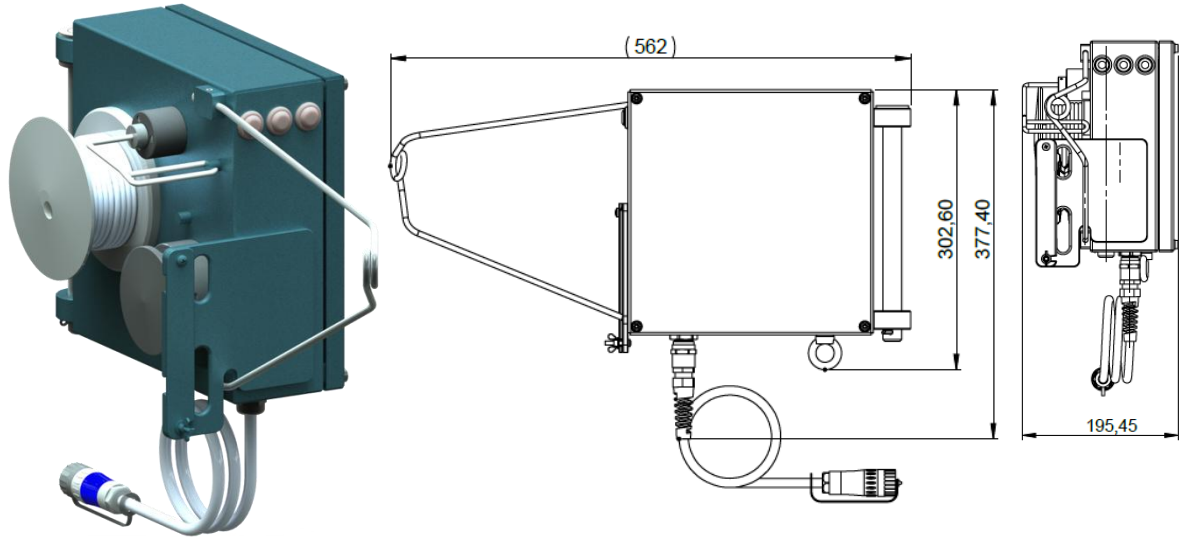


Figure 8 Multiwinch

Materials	Stainless steel, POM and aluminium
Weight	11 kg
Dimensions	See Figure 7
IP rating	IP67
Temperature range	-20 °C – +50 °C
Operating voltage	50V DC nominal
Voltage tolerance	-25% & +50% (37.5V DC/75V DC)
Permanently attached cable	5m
Communication	Analogue (Orbit-PSU versions) or digital (CIU-1000, CIU-2000)

Table 8 Specifications – Multiwinch

3.8 Smart Winch

The Smart Winch is mounted on the pen using a combo mount and is controlled by a CIU via camera software or through its built-in web interface. The Smart Winch is connected to the CIU via a dedicated cable. The Smart Winch controls the camera's vertical and horizontal movement in the pen. This can be done by manually using the web interface or the buttons on the winch, or by setting up events and presets and let the winch move automatically to set positions.

The winch can be remotely controlled and may perform scheduled automatic operations without warning. Always exercise extreme caution when the winch is powered on or in operation. Never stay close to moving parts during operation. Disconnect power supply or disable remote control during maintenance, inspection, or when the winch is not in use.

Never open the winch while the power is connected as this may damage the winch and circuit board.

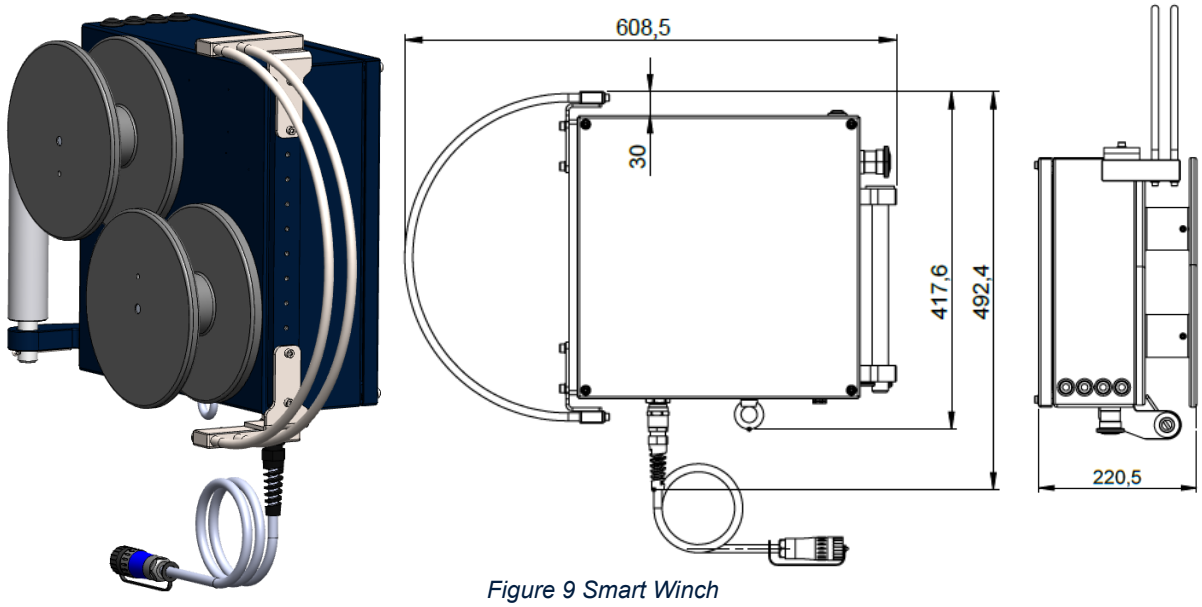


Figure 9 Smart Winch

Materials	Stainless steel, POM and aluminium
Weight	15 kg
Dimensions	See Figure 8
IP rating	IP67
Temperature range	-20 °C – +50 °C
Operating voltage	48V DC nominal
Voltage tolerance	-50% & +20% (24V DC/58V DC)
Permanently attached cable	5m
Communication	Ethernet

Table 9 Specifications – Smart Winch

Refer to the Smart Winch user manual, DOC100511, for more information.

3.9 Orbit mounting bracket for the top ring of a pen

The mounting bracket is used to mount equipment on the top ring of the pen. It can be used for a CIU, mast/antenna, cable strain relief system, multiwinch and surface camera. The assembly process is described in section 4.1.

The mounting bracket comes with a clamp that locks onto one of the top ring's support legs. This ensures that the equipment can be installed securely without too much movement.

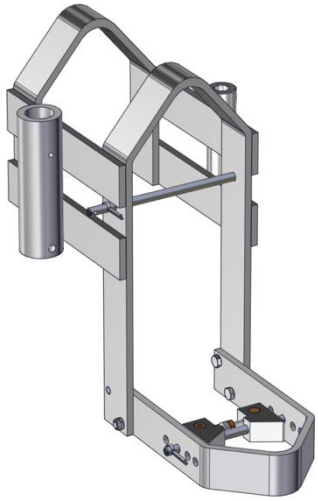


Figure 10 Orbit mounting bracket for the top ring of a pen

Specifications	
Materials	Aluminium and stainless steel
Weight	7.8 kg
Dimensions	315 x 502 x 553 mm
Mast	Ø40 mm

Table 10 Specifications – combo mount

3.10 Mounting attachments designed for the mounting bracket for ScaleAQ's pens

We have specialised mounting attachments for pens supplied by ScaleAQ, which are recommended in preference to the universal bracket shown above. The assembly process is described in section 4.2.

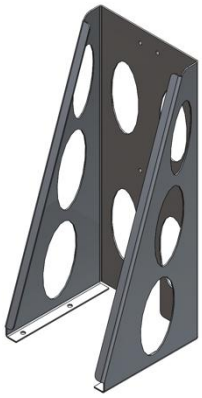
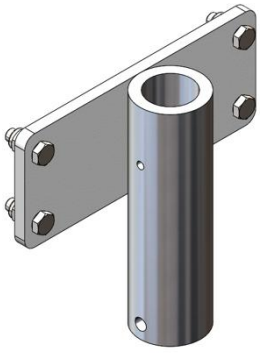
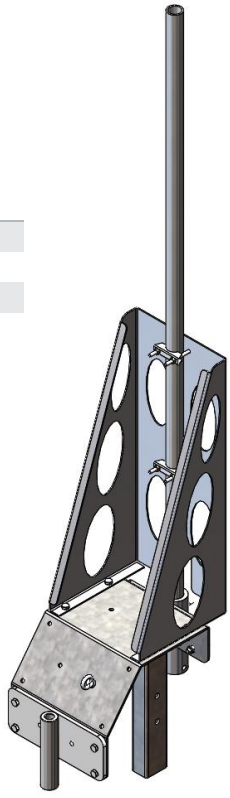
		
Bracket for PSU	Bracket for winch	Bracket for antenna

Figure 11 Mounting attachments ScaleAQ pens

Specifications	
Materials	Aluminium
Weight	TBD
Dimensions	230 x 98 x 10 mm
Mast	Ø40 mm

Table 11 Bracket designed for attachments from pen supplier



3.11 Masts

The masts are an aluminium tube with an outer diameter of Ø40 mm and a length of 1500 mm. They can be used for mounting a CIU, surface camera, sensors, a strain relief system for fibre cable, and an antenna in those cases where one will be used with the mounting bracket.

Masts are supplied with some pre-drilled holes in their lower section.

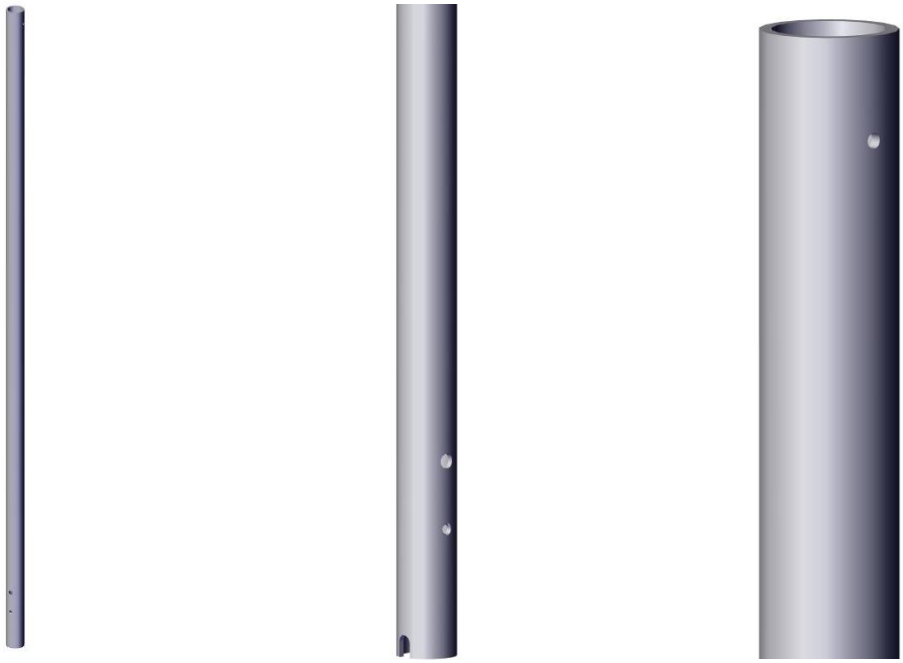


Figure 12 Mast tube with pre-drilled holes in its lower section and prepared for a set screw at the top.

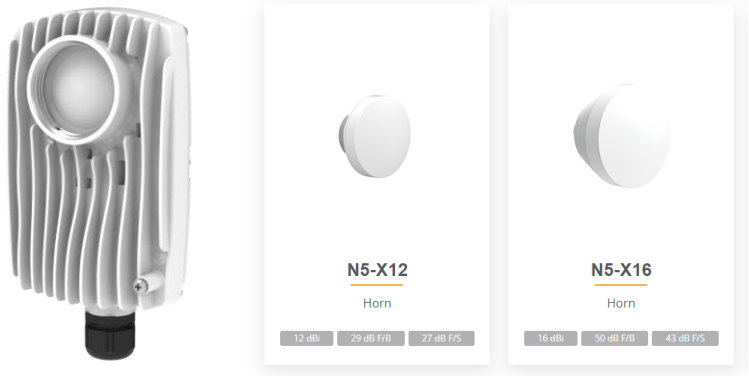
Specifications	Mast
Materials	Aluminium
Weight	1.6 kg
Dimensions	Ø40 x 1500 mm
Set screw dimension	DIN 913 – M5 x 6 mm

Table 12 Specifications – mast

3.12 Antennas

If a system is designed to be wireless, there will be an antenna for each pen, that is meant to be installed on each pole. The cable need to properly and securely fastened to the pole between antenna and CIU.

Antennas are directional and can have different opening depending on the configuration of the antenna you have. If it is only the antenna, without any twist-on antenna, it looks like the antenna below. This have a 58º opening for the signal, meaning it will withstand alot of movement without loosing to much signal.



X12 has a 38º, and the X16 22º opening. The benefit of the more narrow beamwidth is that the signal is more concentrated, and makes it better if the distance between pen and barge is to long.

Make sure the antenna is directed toward the barge, both horizontally and vertically. The antenna is fastened to the pole with a clamp, and is easy to loosen and fastened for adjusting.

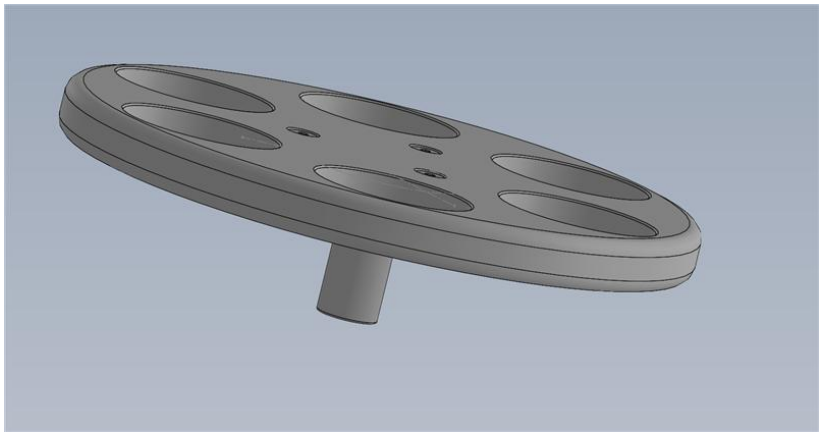


Figure 13 Antenna bird net hat

Specifications	Antenna
Materials	Die-cast aluminum, UV stabilized paint
Weight	0.7 kg
Dimensions	113 x 178 x 67mm
Operating voltage	24V, 0.8A, 20W
Wireless frequency	5150 – 6425 MHz
Wireless bandwidth	20, **40**, 80, 160
Antenna gain	8 dBi (N5-X12 = 12 dBi, N5-X16 = 16 dBi)
Antenna sector	58º (N5-X12 = 38º, N5-X16 = 22º)

Table 13 Specifications – antenna and mast

3.13 Barge antenna

Figure 14 High Capacity Barge Antenna

The new High Capacity Barge Antenna is easy to mount and has many options for connectivity. Including 2x SFP+, 1 Gigabit Ethernet with PoE and 1 power input (48V).

Each antenna has a 90° beamwidth and can handle up to 8 pens, depending on bandwidth requirements it can be less or more, but 8 pens have been tested for good and stable performance.

Specifications	High Capacity Barge Antenna
Materials	Outdoor UV-stabilized polymer with integrated metal mounting back
Weight	3.95 kg
Dimensions	295 x 490 x 75 mm
Operating voltage	48-56 VDC, 0.8A, 40W, PoE
Wireless frequency	5150 – 6425 GHz (varies for each country)
Wireless bandwidth	20, **40,** 80, 160 MHz
Antenna gain	16 dBi
Antenna sector	90°

Table 14 Specifications – Orbit-DUO

3.14 Strain relief system for fibre cables

The strain relief system is included with all fibre installations and is used for fibre cables. It consists of a padded angled bracket mounted on the mast under the CIU housing.

Figure 15 strain relief system with padding

Specifications	Strain relief systems
Materials	Aluminium, stainless steel and rubber
Weight	1.5 kg

Table 15 Specifications – strain relief system

3.15 Plastic rings for camera rope

A number of pulleys are used to manoeuvre the camera horizontally and vertically in the pen. A pair of rings are used where one of the rings is joined to a small pulley. When they are shipped, the pulleys are joined by a plastic tie. This is for transport only and they must not be used in the sea with the plastic tie still on.

Figure 16 Plastic rings for camera ropes

Specifications	Plastic rings
Materials	Nylon and stainless steel

Table 16 Specifications – pulley for camera rope

3.16 Pulley for 18mm winch rope

At the other end of the camera rope there are one or two pulleys that enable the camera to be manoeuvred across the pen. On one ring, there are two, which allows the ring to change shape, while on a steel pen there will only be one.

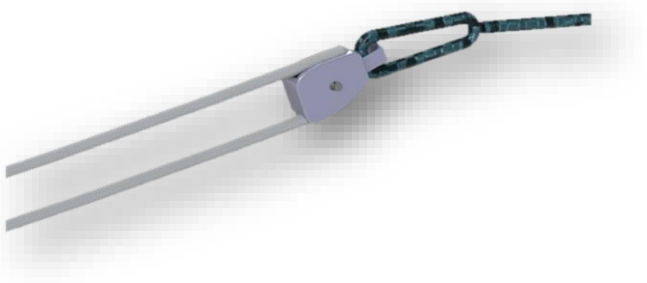


Figure 17 Pulley for 18mm rope

Specifications	Pulley for 18mm rope
Materials	Nylon and stainless steel

Table 17 Specifications – pulley block

3.17 Camera cable

ScaleAQ's camera cable transmits all of the signals between the CIU and camera. Three types of camera cables are currently offered, where the blue cable is the most common and is used to connect cameras in the 3000-3650 series. The black cable can be a good option for inspection systems due to the reinforcement of the cable and outer sheath. The final type is the ethernet variant, which is our latest cable and is designed to support the latest camera platforms (the Orbit-3700, Orbit-3900 and newer cameras).

The cables come in various standard lengths that work well. Ask a ScaleAQ consultant about the length recommended for your pens.

A grey cable called flex is also available and is used for Dome cameras and surface cameras (the Orbit-210).

The maximum length an ethernet cable can be is 95 m.

Specifications	Blue cable	Black cable	Gray flex	Ethernet
Outer sheath	TPU	TPU	TPU	PUR
Outer diameter	10.8 +/- 1 mm	12.1 +/- 1 mm	12.6 mm	7.8 +/- 2 mm
Outer sheath colour	Blue	Black	Grey	Green
Bend radius	100 mm	100 mm	55 mm	78 mm
Temperature range	-15 °C – +85 °C	-15 °C – +90 °C	-30 °C – +70 °C	-30 °C – +80 °C
Coaxial core	RG59	RG59		
Ethernet category			CAT5e	CAT5e
Weight	1.7 kg per 10 m	2.0 kg per 10 m	1.8 kg per 10 m	0.5 kg per 10 m

Table 18 Specifications – camera cables

3.18 Blue rope – Orbit xxx m

The blue rope used comes in a range of lengths designed for the most common standard size pens. It is used to move the camera across the pen, extending from and retracting into the winch. It is strong and easy to maintain with regular cleaning.

The standard lengths for pens are:

- 120 m ring: 80 m
- 160 m ring: 100 m
- 200 m ring: 120 m

In the case of steel pens, the standard delivery is two times the length of the pen (ex. 24 m pen = 50 m rope).

NB!
Use of the winch demonstrates the importance of correct assembly. Users may experience very slow operation using the winch controls if it has not been properly installed. The rope is fed out such that all of the white and blue lines lie parallel. While this might take some time to get right, users will recoup this time through the time saved by proper assembly.

Further information on installation is provided below, see section 5.6.

4 PREPARATION AND INSTALLATION

Conduct visual inspections before and after installation to eliminate any risk of harm to people, fish and equipment.

When reconnecting equipment (new generation), it is important to ensure that the installation and equipment are in good condition and that the necessary maintenance is carried out on equipment that does not comply with ScaleAQ's specifications. Its use will not cause any pollution for fish.

Find a suitable place to install the mounting bracket:

- This must be positioned such that the winch rope runs with/against the direction of the main sea current. If you do not do this, the sea current will exert a lateral force on the camera that cannot be compensated for by the winch.
- Position it such that it is not on a support up which the chains of the bottom ring run.
- Make sure it does not come into conflict with the ropes for the dead fish collector/lift-up.
- Position it such that it will not get in the way of fish carriers and other vessels that could damage the equipment.
- Wrasse hides, lights and other objects in the sea be oriented in parallel with the camera rope to avoid it getting snagged on other equipment since this can damage the camera, winch and other equipment.

4.1 Universal mounting bracket for the top ring of a pen

Place the bracket over the top ring and insert the longest bolt. The washer and split pin must be on the outside of the pen so that they cannot damage the netting.

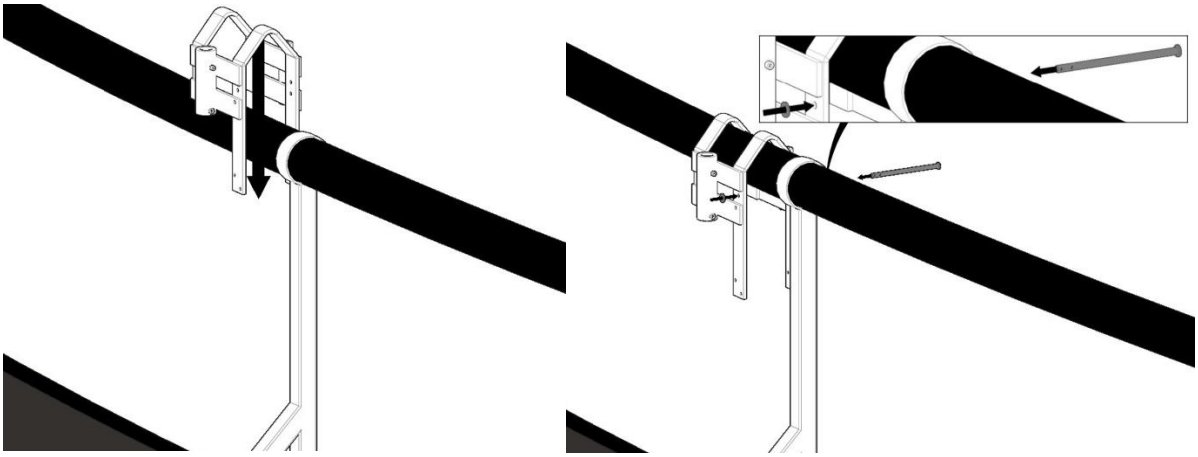


Figure 18 Place the bracket over the top ring and insert the bolt from inside the pen such that it points outwards

Once the locking bolt and split pin are in place, place the lower section of the bracket around the support.

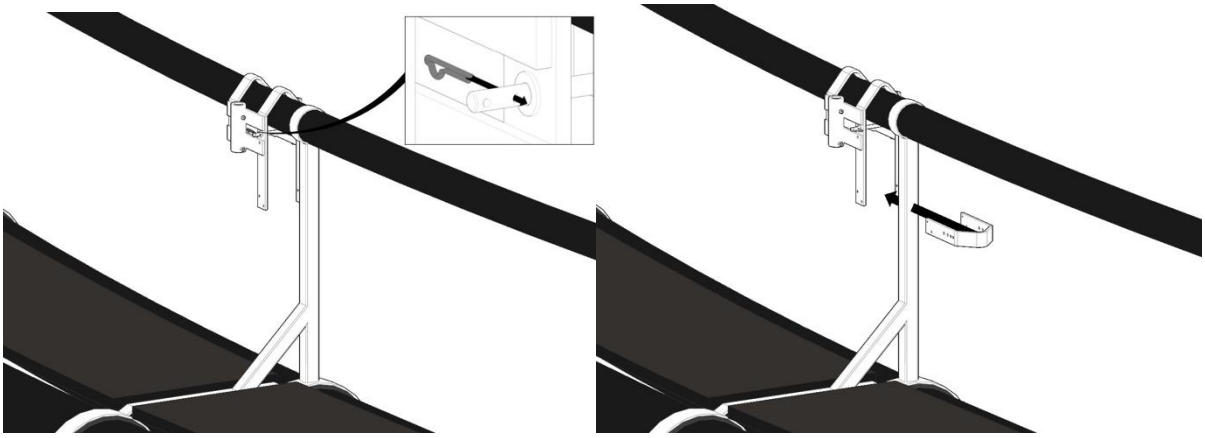


Figure 19 The pin must be inserted on the outside and the lower section goes around the supporting leg

Use the supplied bolts and nuts to secure the two parts together. M10 x 20 mm bolts in the top holes (on both sides). In the lower holes (on both sides) use M10 x 30 mm bolts and M10 locking nuts.

NB: The bolts should be screwed in from the inside such that they point away from the pen bag/netting.

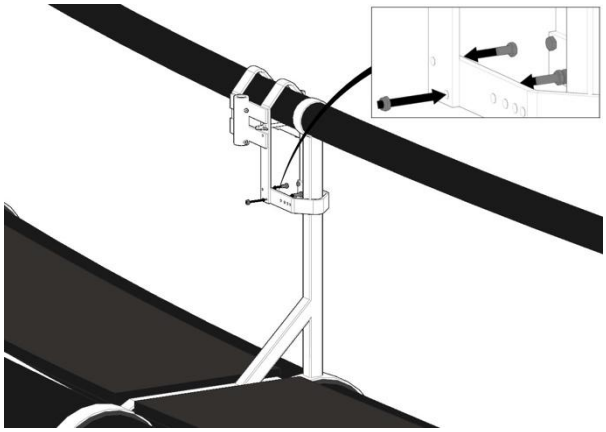


Figure 20 Secure the two sections of the mounting bracket with the supplied bolts and nuts

Push the clamp right up against the support leg, then insert the supplied locking bolt through the clamp and all the way through before attaching the washer and locking splint.

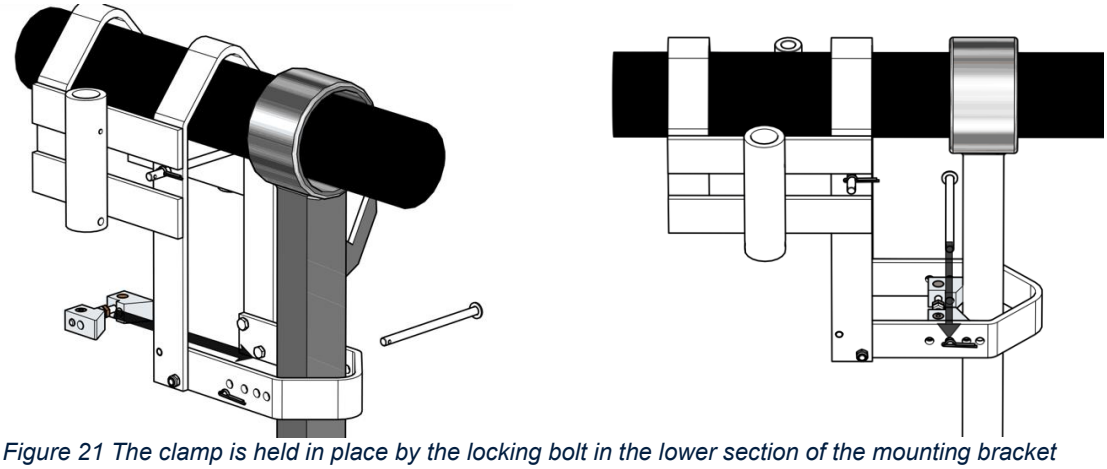


Figure 21 The clamp is held in place by the locking bolt in the lower section of the mounting bracket

Adjusting the nuts in the clamp will tighten it up against the support rack. Tighten it well so that the mounting bracket cannot move. Doing this avoids unnecessary wear and tear on the mounting bracket and ensures that nothing can move very much.

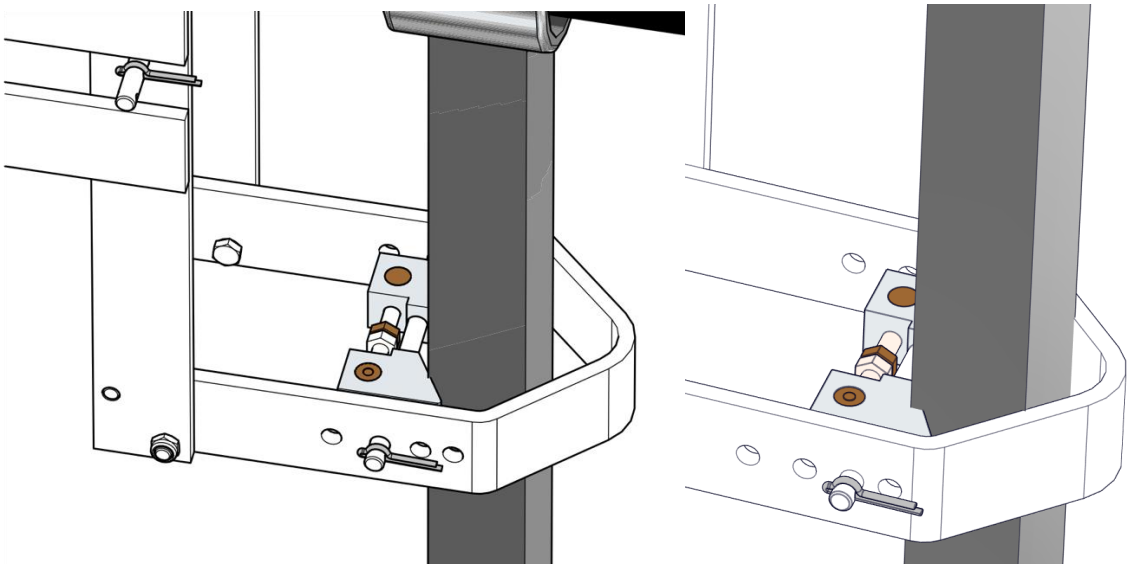


Figure 22 The clamp is tightened using the nuts on the inside

4.1.1 Mast/aluminium tube

Depending on the communication method, wireless or fibre, there are some slight differences in the mounting of the mast.

4.1.1.1 Wireless installations

Mount the aluminium tube with the antenna in the mast holder on the mounting bracket. This should be on the outside of the pen.

The mast must be secured via the mast holder's bottom bolt. Secure the mast with a DIN 912 M8 x 16 mm set screw. Please ensure that the antenna is correctly oriented in relation to the barge.

Masts for wireless solutions come with a pre-numbered antenna. Wherever possible, use the antenna number that matches the pen number to make installation easier.

Figure 23 Mount the mast in the mounting bracket and secure it with a set screw.

ScaleAQ will already have mounted the antenna on the mast when it is shipped from the warehouse. However, an antenna can also be retrofitted if you change from a fibre installation to a wireless one.

4.1.1.2 Fibre installations

When a fibre optic communication solution is installed, the mast must be positioned such that the bottom of the mast is approximately 300 mm below the mast holder in the mounting bracket. If there are no holes in the aluminium tube for the through bolt, these must be drilled. It is fixed in place with the set screw, DIN 912 M8 x 16 mm. Also insert the M10 x 80 mm through bolt through the mast and mast holder.

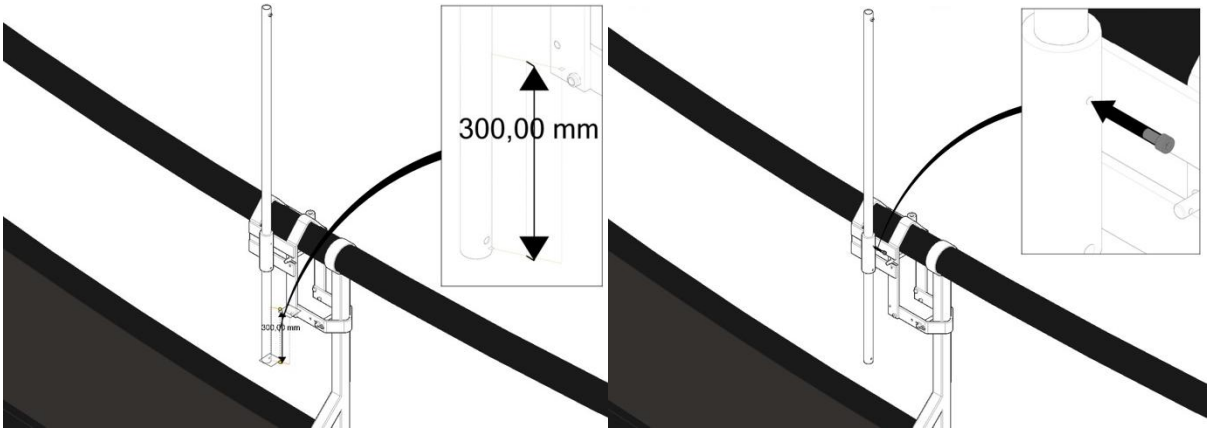


Figure 24 Mount the mast in the mounting bracket and secure it with a set screw.

Install the strain relief system on the underside of the mast holder and secure it in place with the bolt and screw provided. The M10 x 80 mm through bolt and the DIN 912 M8 x 16 mm set screw.

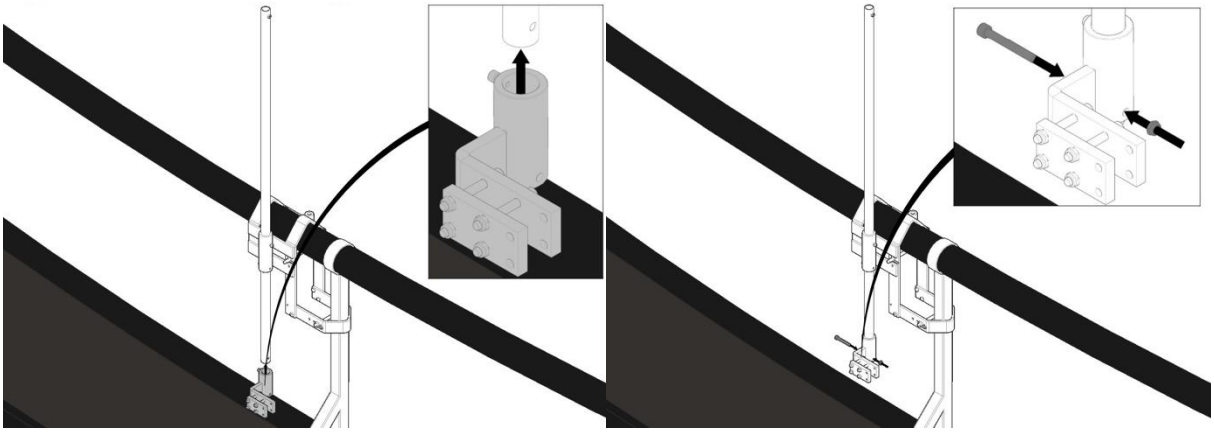


Figure 25 Mount the strain relief system for the fibre cable on the underside of the mounting bracket

4.1.2 CIU/protective housing

We strongly recommend using protective housing for the CIU and usually ship the CIU pre-assembled in protective housing. The mast is installed in the same way for both options, although when installing protective housing we recommend that this be performed by two people due to its size and weight.

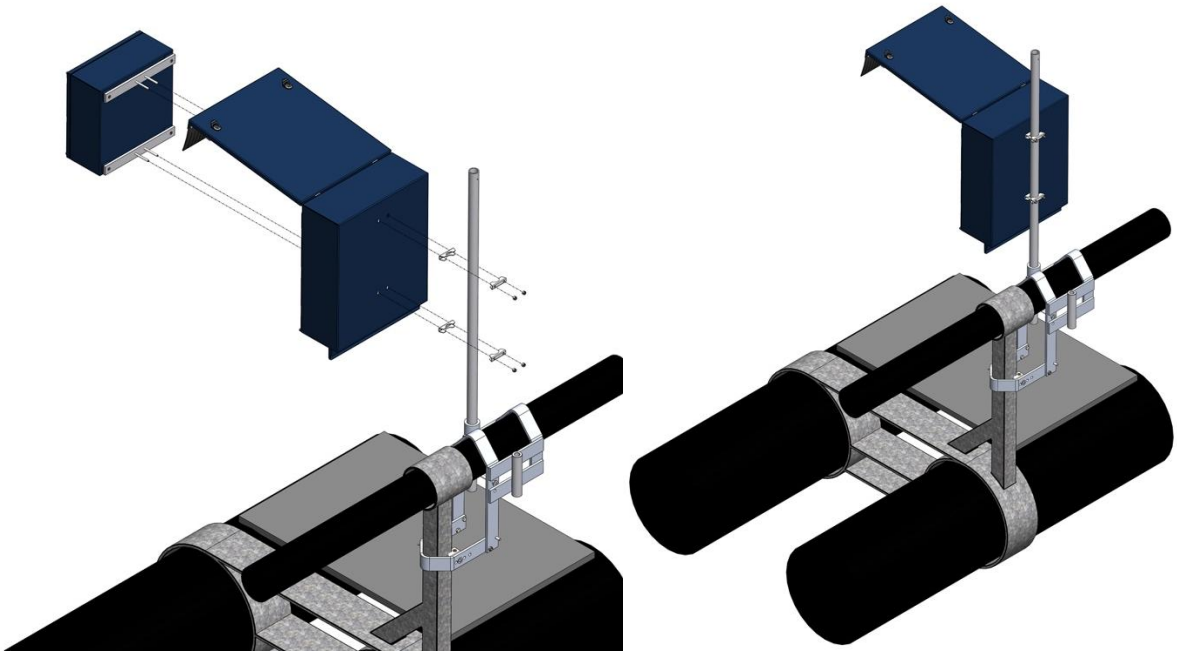


Figure 26 The CIU is installed in protective housing before it is mounted on the mast

4.1.3 Winch and winch cable

The winch must be mounted on the winch holder on the inside of the top ring. We recommend this be done by two people if the user has not already installed the winch because holding the winch in place while inserting the bolt is difficult. Secure the bolt with a split pin. Using an additional securing method is a good idea because it minimises the risk of losing the winch in the netting.

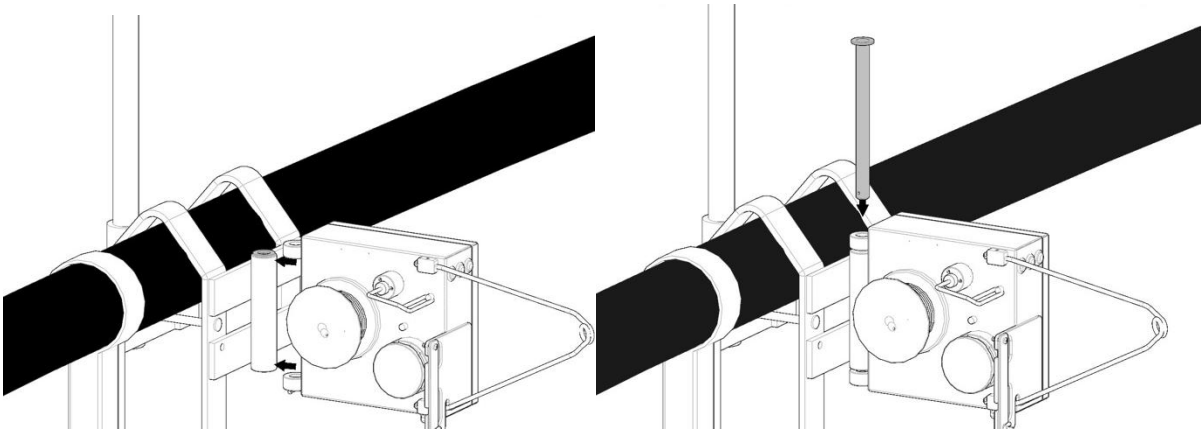


Figure 27 Position the winch on the winch holder on the mounting bracket and secure it in place with a locking bolt

Insert the split pin at the bottom of the bolt to prevent the winch coming loose from the mounting bracket.

The winch cable comes permanently attached to the winch and must be plugged into the CIU via one of the sockets marked “Winch”. Make sure that the netting is not positioned such that the winch cable could get snagged. Any surplus cable must be secured in a proper and suitable manner that prevents damage to the cable or other equipment.

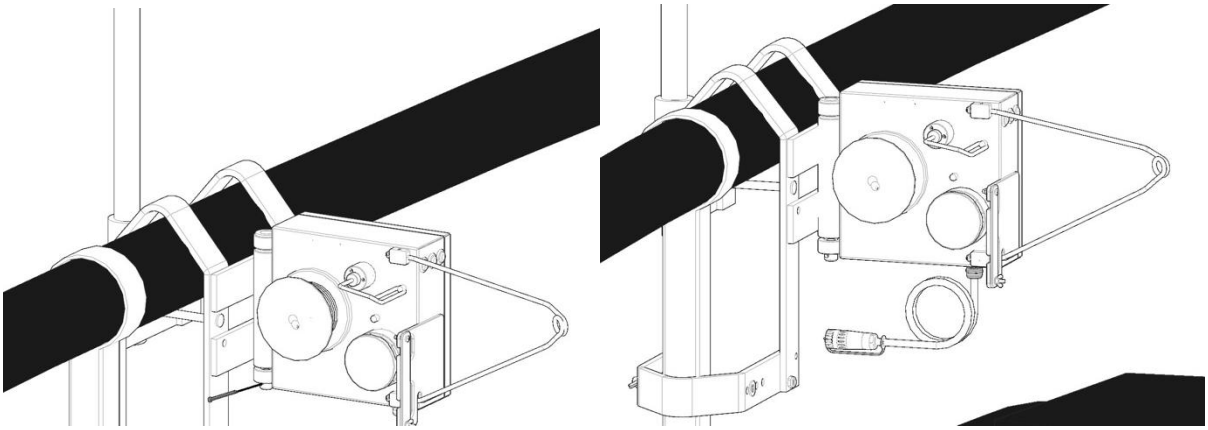


Figure 28 Secure the locking bolt for the winch with the split pin and lead the cable back to the CIU

Apply Molykote 44 or 111 to the winch cable’s contact surface to prevent moisture penetration.

Do not connect the 230V until everything else has been fully connected.

4.2 Mounting bracket designed for pens supplied by ScaleAQ

Mount the bracket for the mast using the four M10 bolts and nuts supplied.

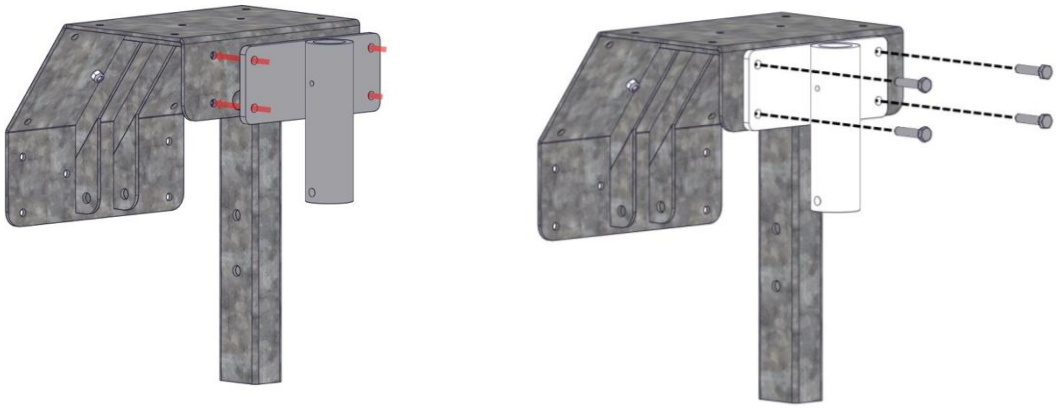


Figure 29 Mount the mast holder on the mounting bracket

Mount the winch bracket to the mounting bracket using the bolts, washers and nuts supplied.

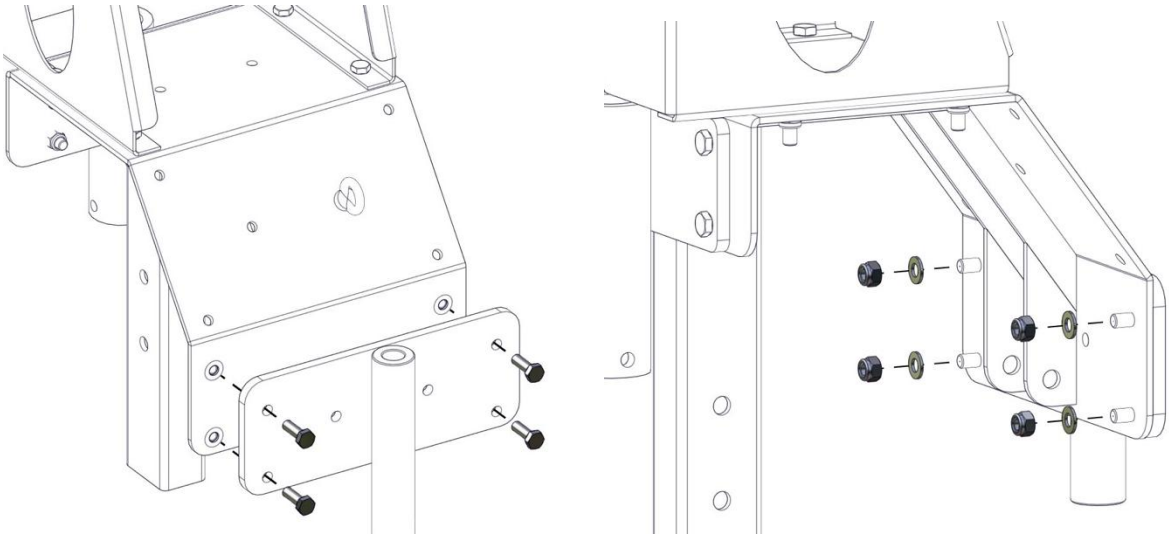


Figure 30 Mount the winch holder on the mounting bracket

Position the bracket for the housing on the mounting bracket and secure it in place with M10 bolts, washers and nuts.

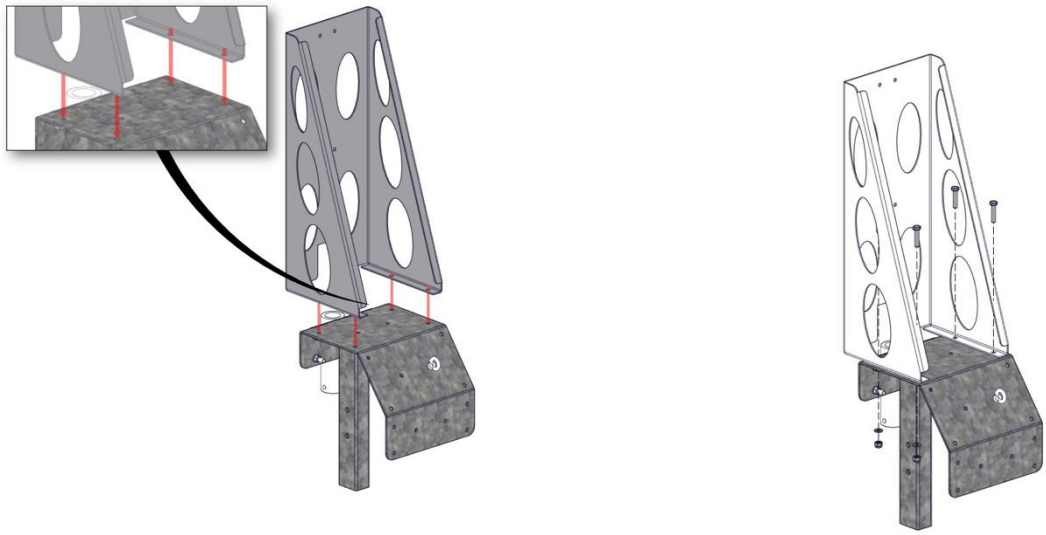


Figure 31 Mount the bracket for the housing on the mounting bracket

Next prepare the support so the mounting bracket can be installed on the top ring. Find a suitable support leg. Avoid support legs with chains running up them from the bottom ring. Use the mounting equipment and bolts supplied to secure it in place. See the drawing below.

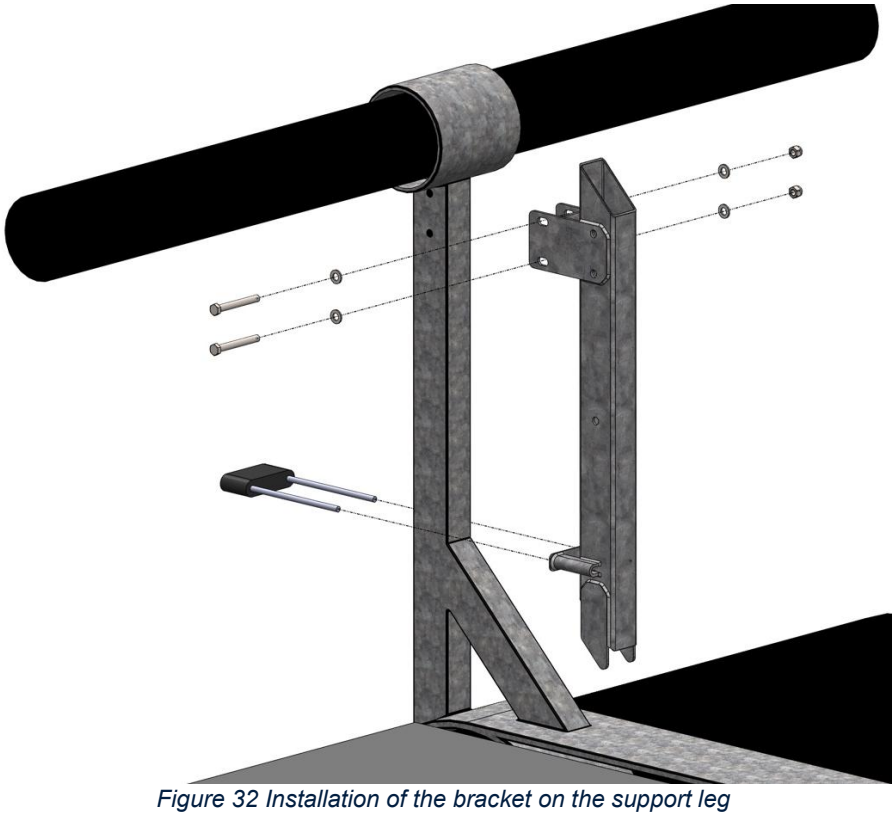


Figure 32 Installation of the bracket on the support leg

Install the assembled bracket for the housing on the support leg. Mount the housing's mast as shown in the figure below, but along the back of the bracket for the housing and through the mast holder. The mast must be secured by the M10 bolt at the bottom of the mast holder via a hole drilled in the aluminium tube.

In the case of a fibre-based installation, a strain relief system must also be mounted at the very bottom of the mast.

Masts for wireless solutions come with a pre-numbered antenna. Wherever possible, use the antenna number that matches the pen number to make installation easier.

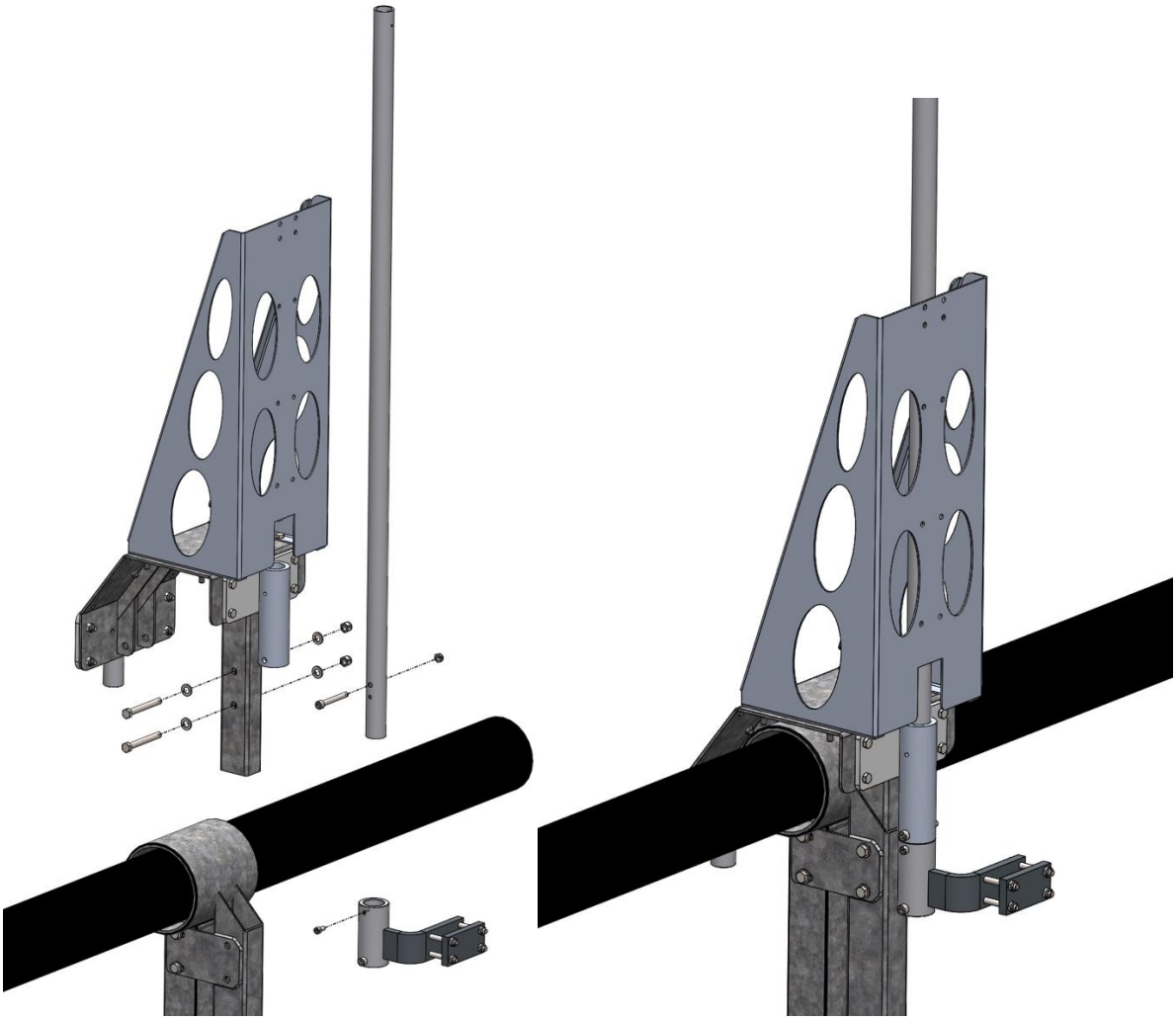


Figure 33 Fully assembled mounting bracket for pens supplied from ScaleAQ

4.2.1 Winches

The winch must be mounted on the inner side of the mounting bracket on a suitable holder. Using an additional securing method during installation is a good idea.

Use the bolt supplied and insert it through the winch holder.

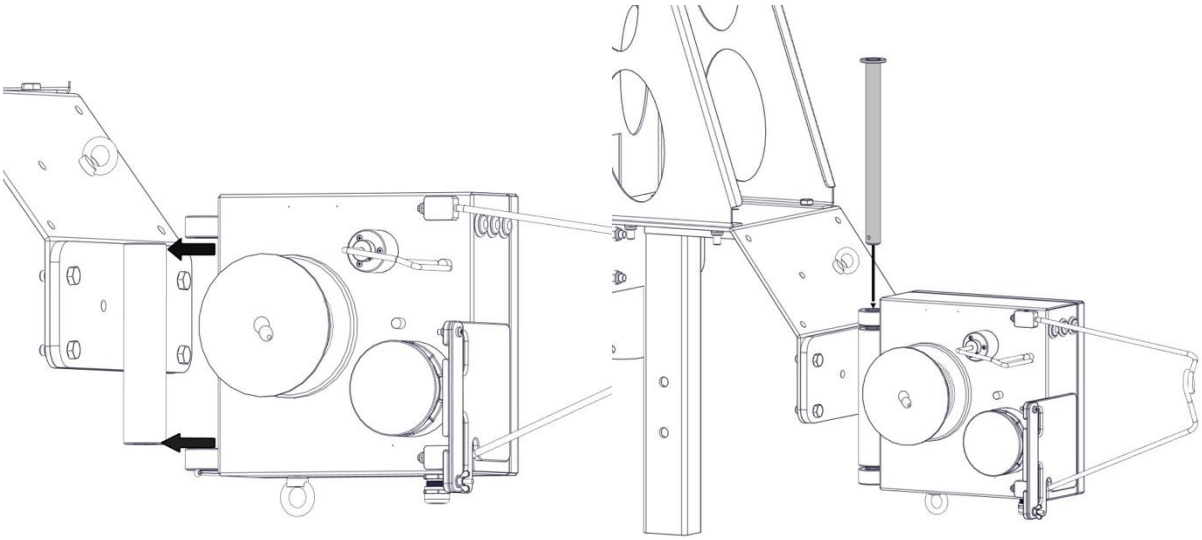


Figure 34 The winch is mounted on the mounting bracket

Secure the bolt for the winch with a split pin. This is designed to prevent the locking bolt working its way up and eventually allowing the winch to drop into the netting.

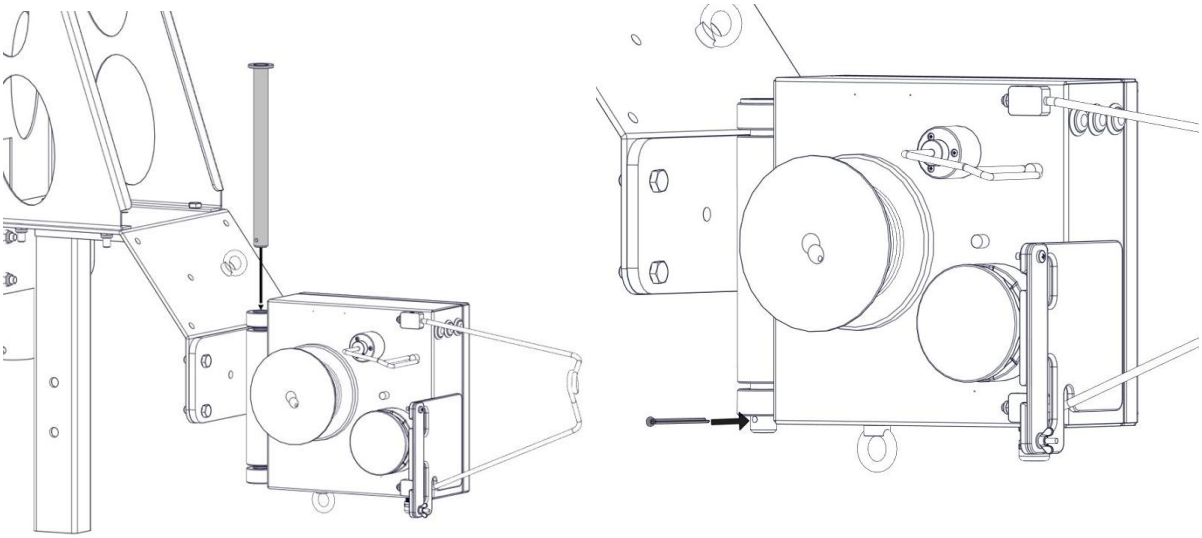


Figure 35 The winch is mounted on the mounting bracket

The winch cable comes permanently attached to the winch and must be plugged into the CIU via one of the sockets marked “Winch”. Make sure that the netting is not positioned such that the winch cable could get snagged. Any surplus cable must be secured in a proper and suitable manner that prevents damage to the cable or other equipment.

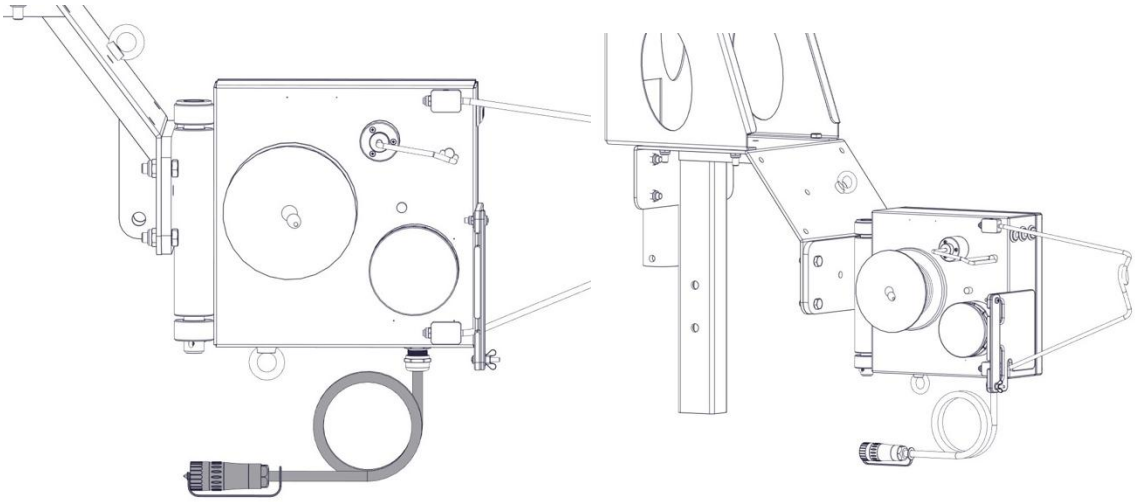


Figure 36 Multiwinch mounted on mounting bracket

Apply Molykote 44 or 111 to the winch cable’s contact surface to prevent moisture penetration.

Do not connect the 230V until everything else has been fully connected.

4.3 Rope and strain relief system

The strain relief system consists of an approximately 25 kg ball counterweight, rope and various pulleys. It is designed to keep the winch rope taut even if the ring becomes deformed due to the wind, currents or other factors.
Warning: it is not recommended to use rubber bands as an alternative to proposed counterweight as this could potentially give more forces to the winch mounting bracket when the pen is deformed than what it is designed for.

Coil the winch rope up before pulling it over the pen.
All of the white and blue lines in the rope must be in parallel throughout the length of the rope to avoid knots/twists in the rope.
The multiwinch rope must be below all the ropes that float, e.g. for the spreader, and above everything that is underwater, e.g. lights and wrasse hides.

1. Open the strain relief holding the counterweight and thread the inner end of the coil of rope through the pulley hanging from the end of the strain relief.

2. Temporarily secure the end to the top ring. Next secure the end from the outside of the coil as well so that you do not lose an end in the sea when you start pulling out the rope.

3. You can now either carry the strain relief and walk around the pen pulling it above/below the ropes that enter the pen, or you can play out the rope first before you start moving.
4. Once you have reached the opposite side and have found a suitable place from which to hang the counterweight, temporarily secure the stain relief to the top ring while you fetch the counterweight and some 8-10 mm rope. This is used to secure a pulley to the top ring that makes it easier for the counterweight to keep the winch rope taut.

5. The pulley below the top ring must be tightened as much as possible such that it has no slack to move. This will prevent it wearing through the rope too quickly. **This must be included as a checklist item when inspecting pens.**

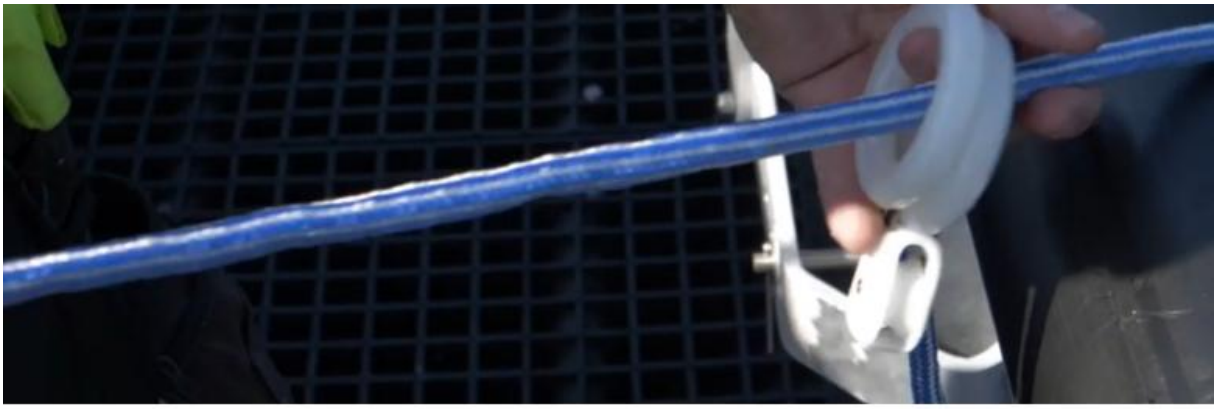
6. Next thread the open end of the strain relief system through this pulley and secure it to the counterweight.

7. If you want to finish the work with the counterweight and make it easier to adjust the length of the winch rope, release the counterweight into the pen. If you want to use an additional means of securing it, you can tie an extra rope to the counterweight and tie it to the support on the ring.

8. If you now look at the winch rope spanning the pen it will probably have numerous twists in it and generally be difficult to pull through.

9. Take the white plastic rings and open the winch's rope holder, such that the winch rope can be threaded through when it is ready. Loosen one end of the winch rope from the top ring and start untwisting it. If it is a 160 m or 200 m pen, you may even overdo the untwisting since it is not easy to untwist it perfectly. When the blue and white lines on the rope are as straight as possible, you can stop. Next tie the end of the rope to the plastic rings.

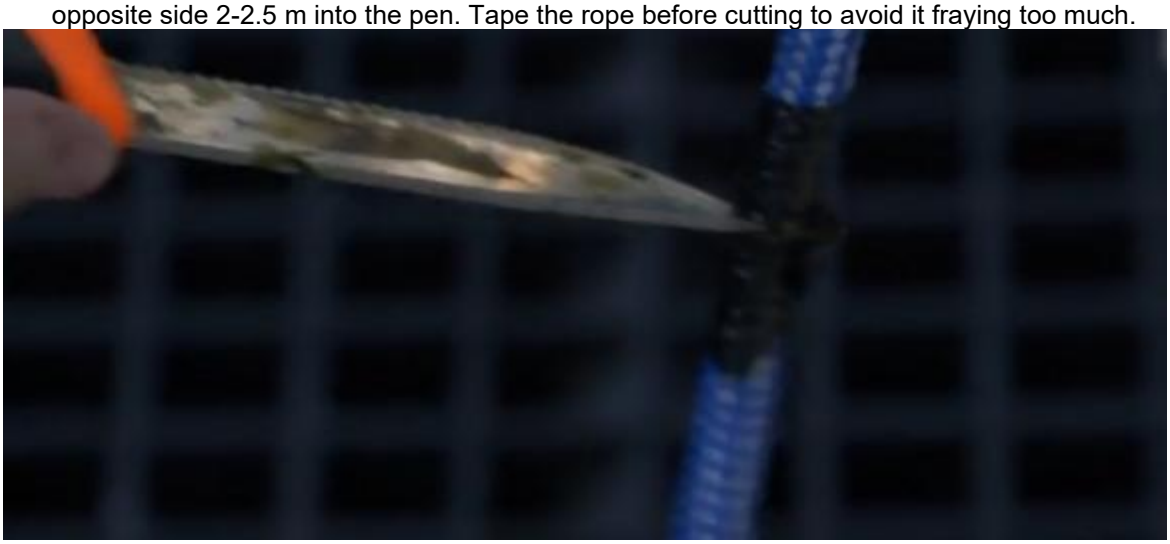
10. The plastic ring with the small pulley is inserted first, followed by the one without a pulley.



11. Firmly secure both rings with a bowline knot.

12. Then thread the ring without a pulley over the knot to create a loop that can be threaded onto the winch's wheel.

13. Take the other end of the rope and pull it taut enough to pull the strain relief system on the opposite side 2-2.5 m into the pen. Tape the rope before cutting to avoid it fraying too much.



14. Twist out this end too until the white and blue lines are as absolutely straight as possible, and tie a bowline knot in the ring with the pulley.

See the next chapter for how to install the underwater camera and cable.

4.4 Underwater camera

- Do not connect the 230V until everything else has been fully connected.
- Disconnect the power before disassembly.
- Inspect the metal camera mounting hoop for damage before lowering the camera into the water.
- After the camera socket has been turned off: remove any sand and fouling using isopropyl alcohol before applying Molykote and reassembly.
- **The camera cable must be disconnected from the camera during storage.**

- Tie the camera rope from the winch to the hoop on the underwater camera.
- Apply a thin layer of Molykote 44 (about 1/10 of the length of the plug, about 1 mm)

- Connect the camera cable to the camera.
- Make sure the camera is hanging the right way round such that the rope holds the plug in the right position.

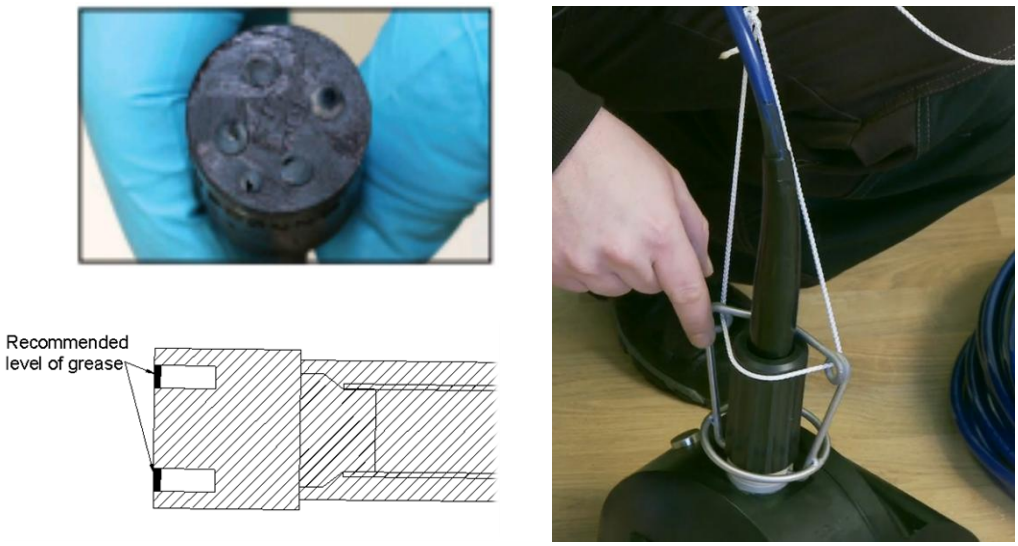
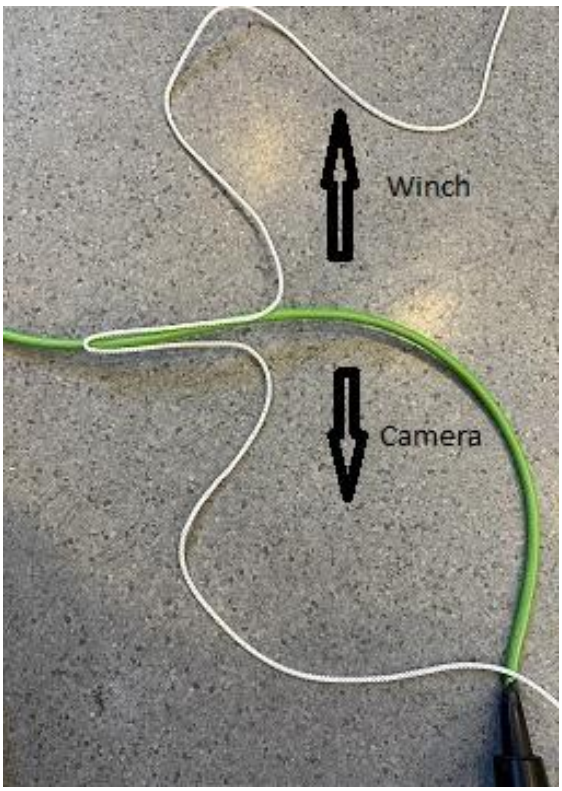


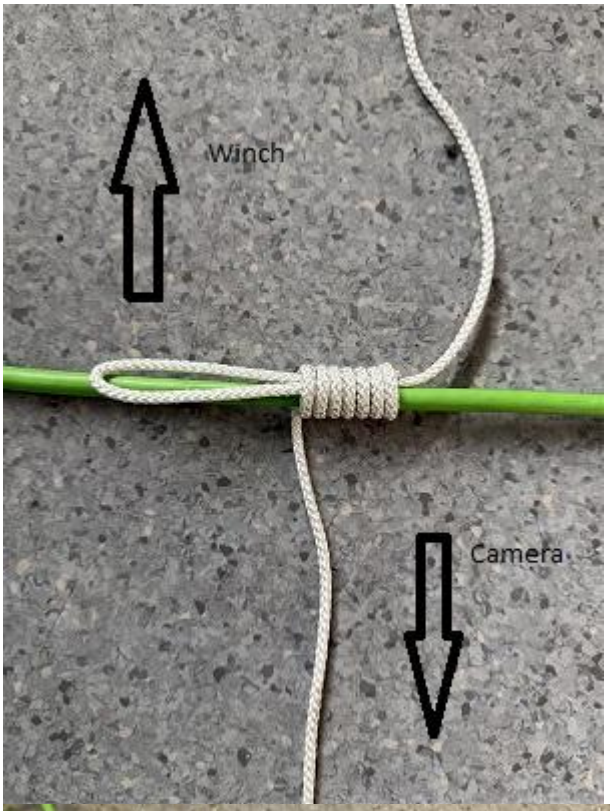
Figure 37 Camera socket, metal camera mounting hoop and camera rope

- The job of the camera rope is to relieve strain on the camera cable, such that both the camera and the camera cable are lifted off the rope (from the winch).
- Lower the camera into the sea and feed the camera cable out into the pen.
- Cut off a few metres of the white winch rope and tie a strain relief to the camera cable. Secure it to the top ring. This is done to avoid unnecessary strain on the plug in the CIU.
- Connect the camera cable to the CIU's "Camera" socket. When a green camera cable with a network plug is used, it must be plugged into an available "Ethernet" socket in the CIU.

4.4.1 Camera Strain Relief Knot Guide

Step 1: Make a loop in the rope as shown in the picture. Start the loop approximately 1 meter from the bottom of the camera connector. Leave about 1.5 meters of rope towards the camera end to use for securing the knot and attaching it to the camera.





Step 2: Use the rope end that goes toward the camera and wrap it around the loop until only a small loop remains at the end. Insert the end through the small loop and tighten slightly by pulling both ends of the rope.

Step 3: The result should look like this after tightening both ropes.

Step 4: Tie a bowline knot.

This way, the tension is mainly applied to the bowline knot rather than directly on the cable.

Step 5: Secure it to the camera using a bowline knot, with the loop around the camera connector to keep it in place. Make sure the weight is supported by the rope and not the cable.

4.4.2 Orbit-39x0 connection and installation guidelines

4.4.2.1 Notices

Overheat in air

Orbit-39x0 camera will overheat if it is left on in air. If CPU and GPU temperatures achieve > 70 degrees the video pipeline will be off, if it is still increasing, the camera will be shutdown completely. If the temperature is reduced to normal condition (for example by putting it in water), the video will start automatically.

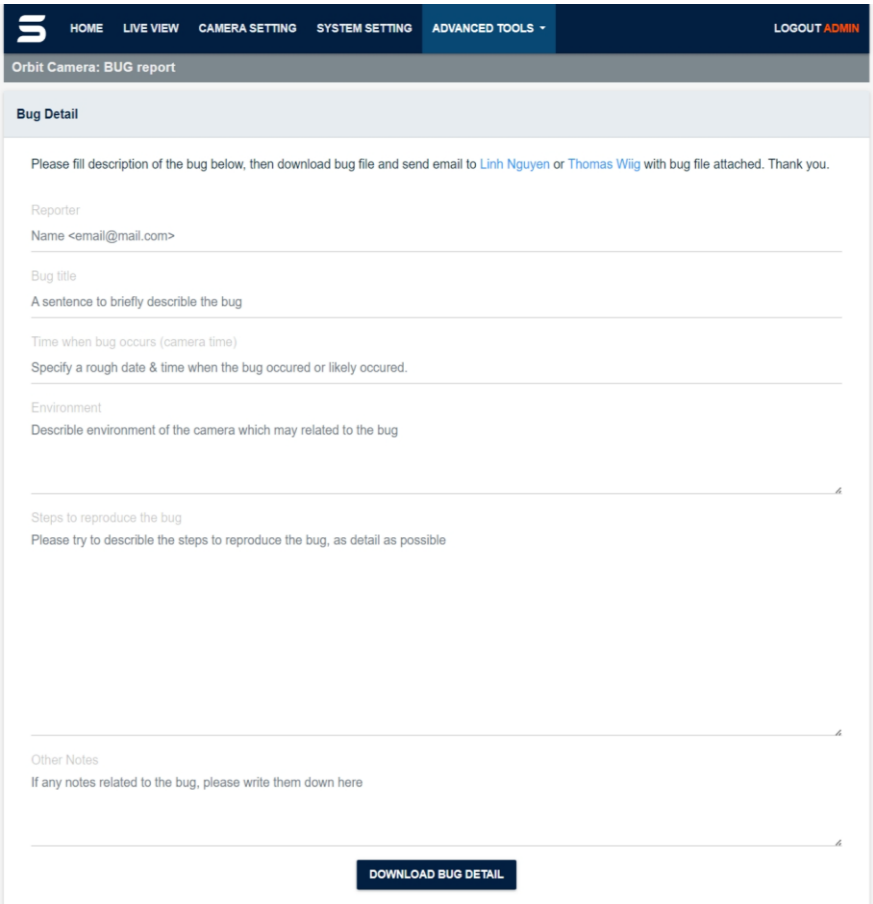
4.4.2.2 Find camera IP

By default, camera has set to a static IP address 10.10.1.10 when it is manufactured.
The camera's IP can be discovered via: True Manager (similar to HD camera) or any other clients that support ONVIF discovery (Onvif device manager, happytimesoft onvif client, …).
Note:

- IP changing is not supported by True Manager. It's only available on web or ONVIF network setup.
- Camera web URL only supports https, so must use **Error! Hyperlink reference not valid.**> URL to access web.

4.4.2.3 Bug report

Bug report is available on camera's website. It collects logs and information of the camera that helps developers to troubleshoot/analyze the issue easier. The page can be found under "Advanced Tools" menu of camera's web.

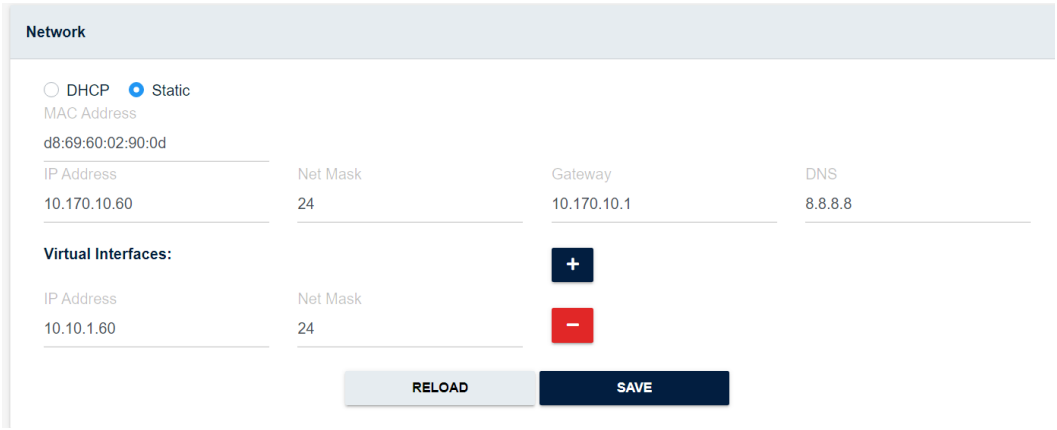


If there is any issue with the camera, you can include bug report file to report the issue further. This can be found under “Advanced Tools” -> “Bug Report”. Please fill all the required information, download the file and sent it to the Support.

4.4.2.4 To set camera IP, gateway and time using the WEB GUI

This can be found under “System Setting” in menu.
The **MAC address is always set by factory production**, it is related to serial number of the camera. Please always leave it **unchanged**.

The camera can have one primary IP with gateway and multiple other IPs with different subnets, called virtual interface. The virtual interface can be added/removed by “+” and “-“ button in the form. Once the network setting is saved, user **must reboot** the camera to take effect.
Remember to **set DNS** in case you would like camera to be able to connect to the Internet.



The camera can always be reached by using fix virtual IP address: **192.168.119.2** when the primary IP is established. This doesn’t work when the network is set as DHCP mode, h there is no DHCP server on the network it connects to. And remember that all Orbit 39x0 camera will have the same virtual IP 192.168.119.2, so if you have multiple Orbit 39x0 camera in your network, you will never know which camera the IP 192.168.119.2 is pointing to.

4.4.2.5 To change IP in switch

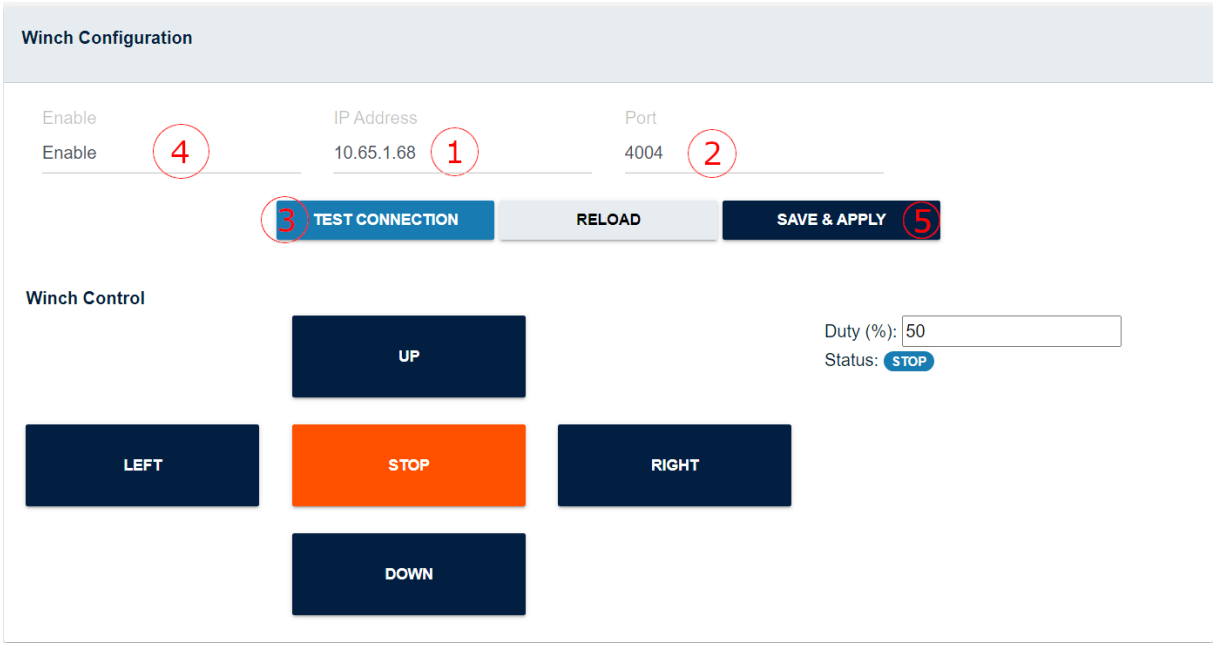
Refer to CIU manual

4.4.2.6 To change IP address in MOXA

Refer to CIU manual

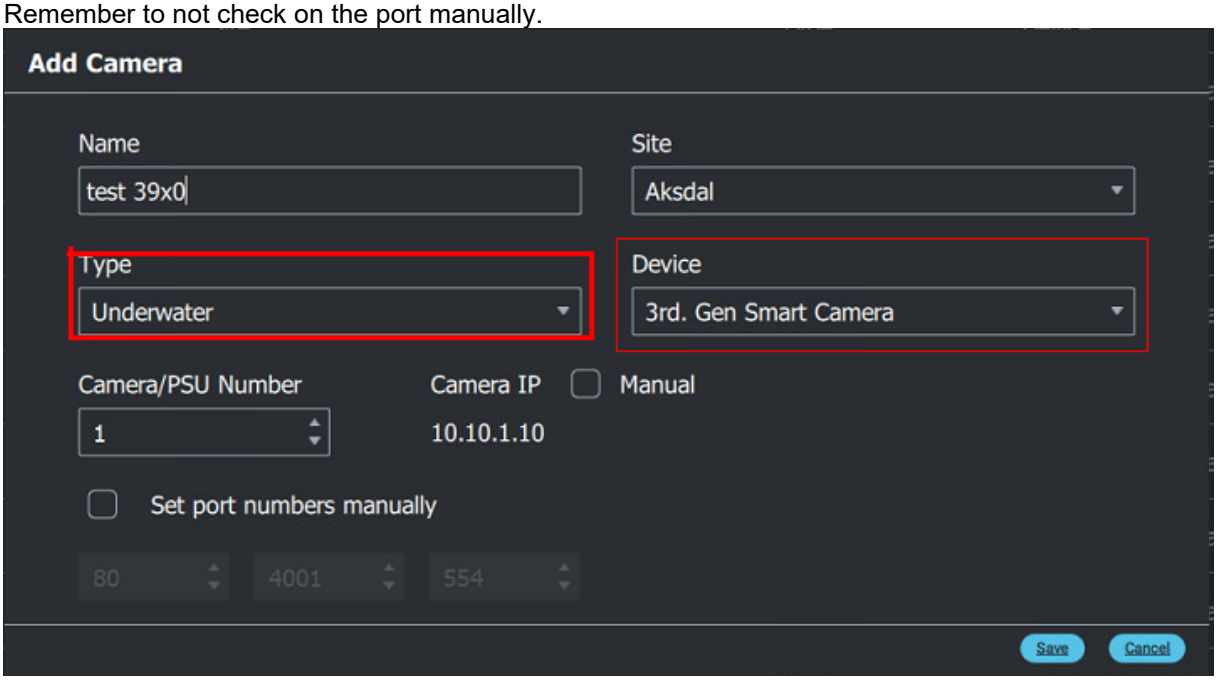
4.4.2.7 How to configure winch settings through Orbit-39x0 camera

Orbit 39x0 has capable to control digital winch from the camera. So, Vision will not have winch setting for the combination of Orbit 39x0 camera and digital winch. This will be configured in camera web. After that, Vision will know and enable winch control on its UI.
To configure winch control in Orbit 39x0, go to camera’s web, “Advanced Tools” and then “Winch Control”.
Firstly, let test the connection to the winch will be connected to, fill IP address of the moxa inside CIU, and enter the port number that winch connected to, then press on “TEST CONNECTION”, result will be succeeded or failed. If success, the winch is available to control. Then remember to change the selection to “Enable” and save the setting.
After saved, the winch will be available to control, via web or via Vision. Remember to restart Vision to take effect. With this combination, there is no configuration/setup is needed in Vision side.



4.4.2.8 How to add Orbit-39x0 in Vision

See the Vision User Manual for more detailed instructions on using the Vision application.
For Orbit 39x0 camera, the Type “Underwater” and device “3rd. Gen Smart Camera” will be used.
Remember to not check on the port manually.



4.4.2.9 Image settings

The camera’s default settings are optimized for seeing pellets. It is possible to change the default settings if the user for some reason is not satisfied with the image quality. Before making any changes, make sure that it is not a bad image due to low bitrate. Use 8 Mbit or higher when tuning.

There’s a lot of settings available, but most should not be touched. The three most important settings are listed below

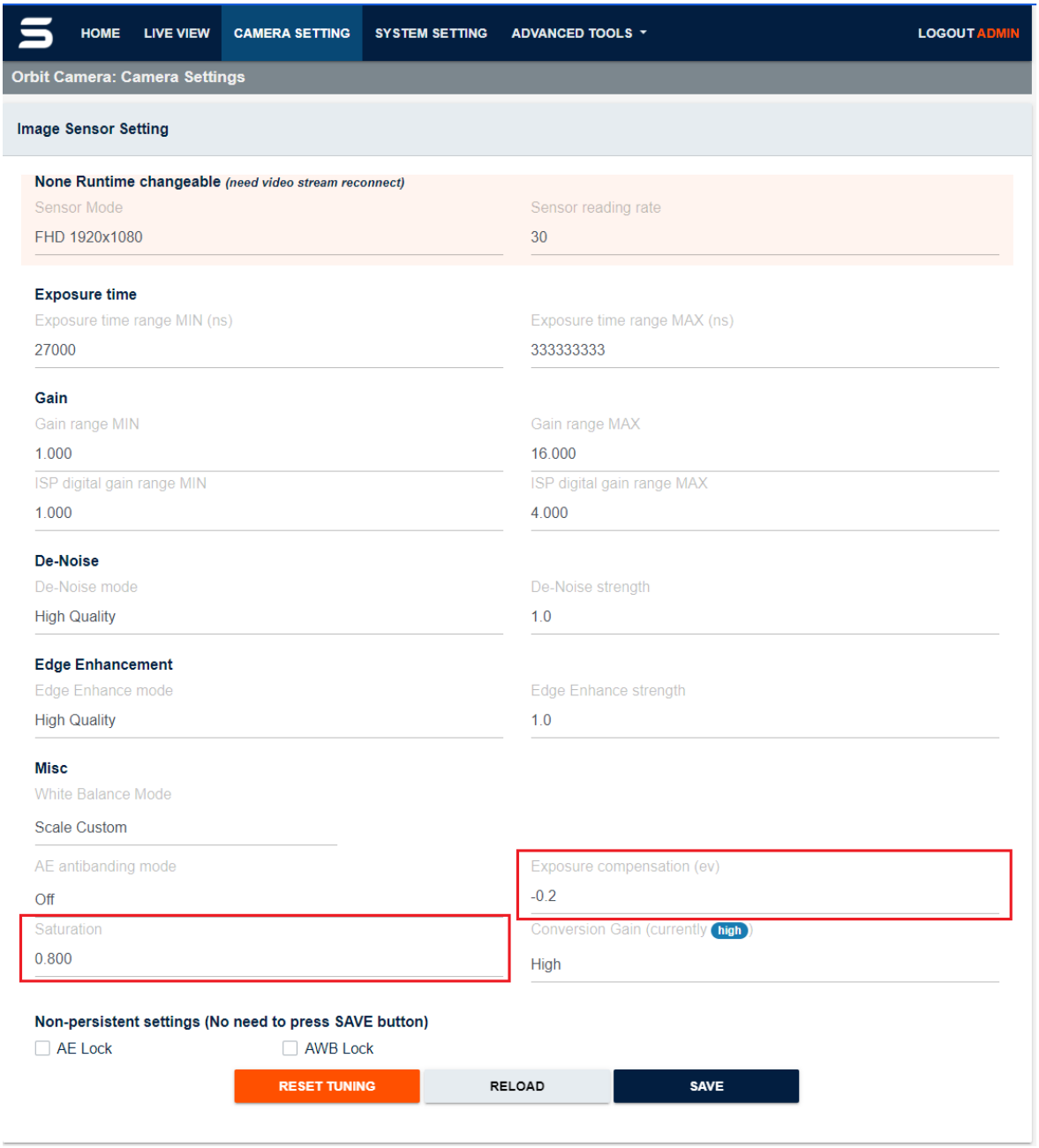
Exposure compensation
This parameter can be adjusted if the image is overexposed. For example, if the camera is looking upward and you get a bright spot where the sky is, and you cannot resolve objects close to it. Be aware that reducing this value will worsen dark part of the image.


Exposure compensation 0.5. Nothing is seen within the bright spot

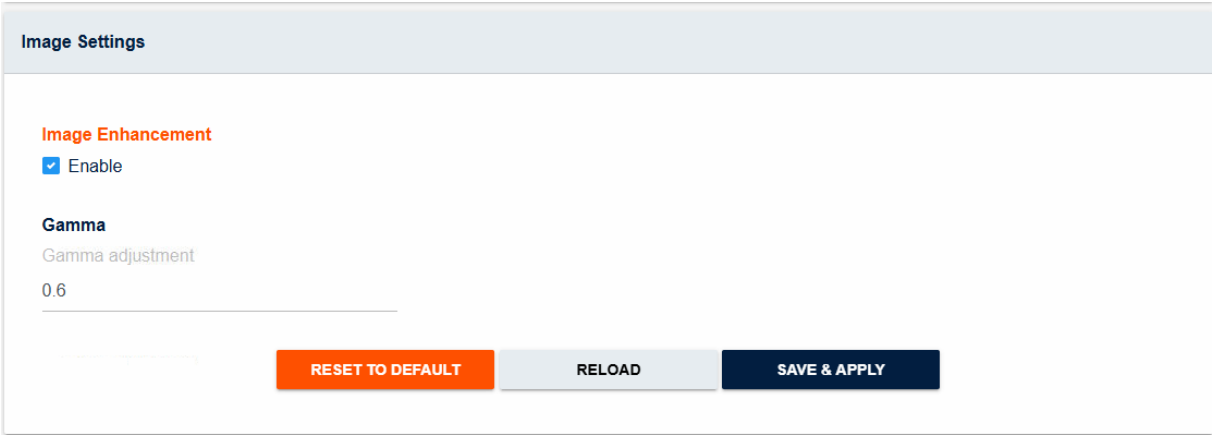

Exposure compensation -0.2. Particles are resolvable in the bright spot

Saturation
Saturation is the “colorfulness” of the image. Increase the value to make the image more vibrant/vivid. Setting saturation to 0 will make the image grayscale.

Gamma
Gamma can be adjusted to get better contrast in darker **part**s of the image. A lower value will make it easier to distinguish pellets from the dark underside of the fish. The downside is that the image will feel a bit brighter than natural. Setting gamma to 1.0 will make the image look more natural, which can be desirable to some.



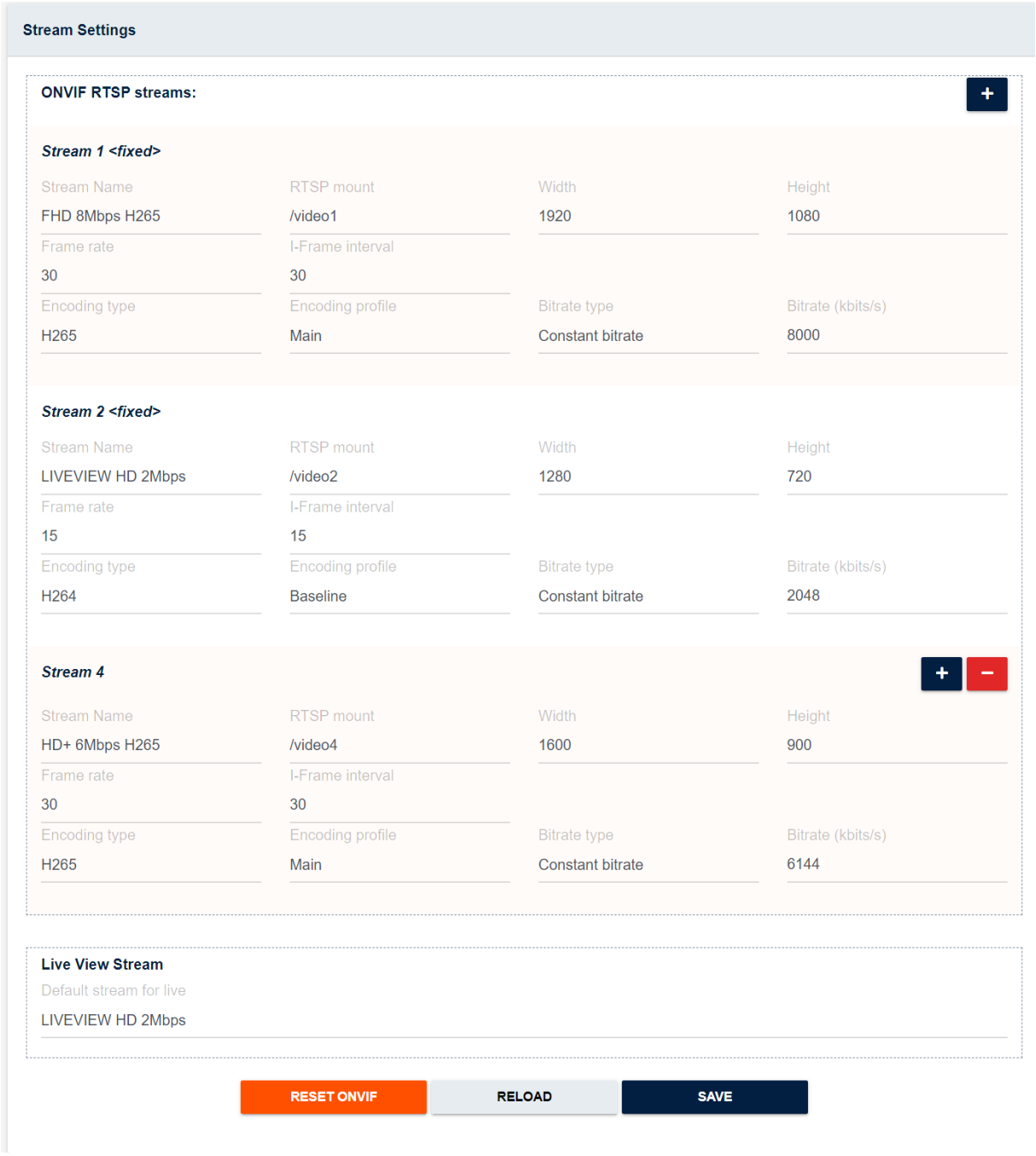
Exposure compensation and saturation is found under Image sensor settings.



Gamma adjustment is found under Color Settings

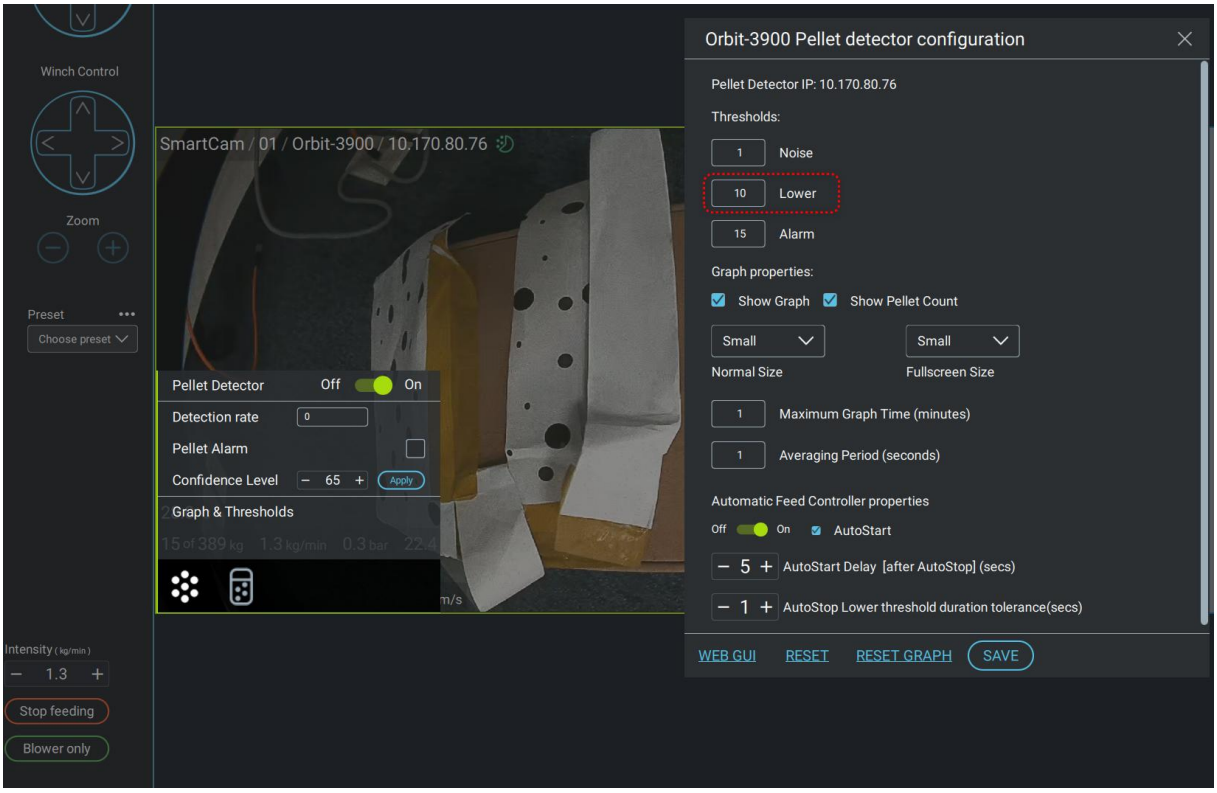
4.4.2.10 Video stream setting

This is a form under “Camera Settings” menu in camera’s web. It allows user to add/remove/change video profile.
There are two profiles are fixed by default (has <fixed> postfix in stream number), these two are not able to delete.
It is required to have at least one video profile that is able to stream to web live view, it must use H264 baseline encoding. Liveview after that can be chosen between streams that are satisfied to live.
User can add or delete stream profile by “+” or “-“ button in the form. After saved, Vision must be restarted to load new configurations.



4.4.2.11 How to activate pellet detection in vision for Orbit-39x0

Orbit-39x0 has a built-in pellet detection. To activate it, one should switch from off position to on in the Pellet Detector, as shown in the image below.

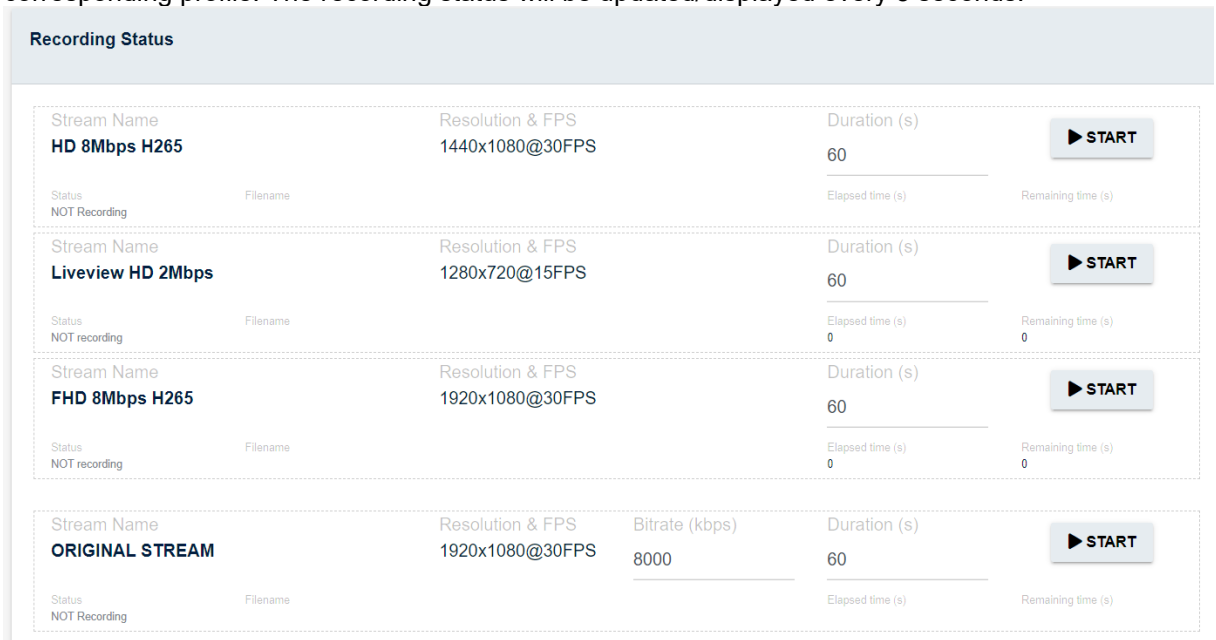


4.4.2.12 Record video from the camera on web

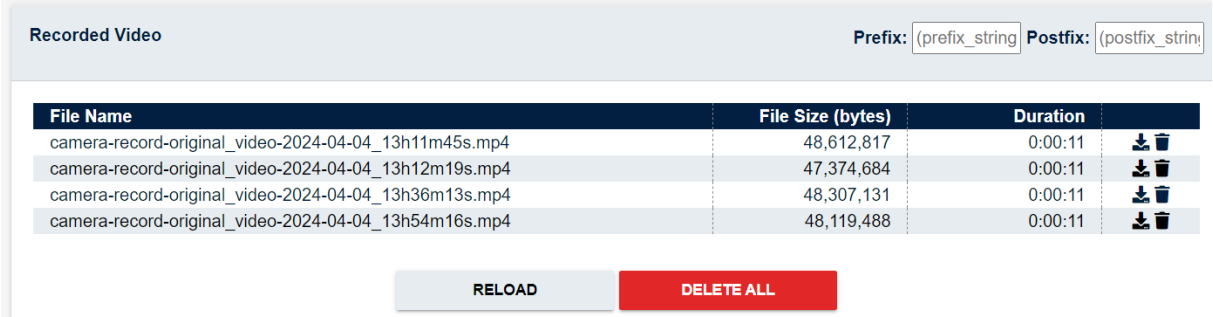
The video recording is normally will be done through Vision. But this feature is also available on camera itself. This is useful in some cases, like Vision PC is not available, collecting video for analyzing, auto recording, etc.

Navigate to “Advanced Tools” -> “Video Recording” to open this feature. It will list all available video profile, including “Original stream” is the stream where no post processing was applied.

To start a record, enter number of seconds into duration field, then press “START” button on corresponding profile. The recording status will be updated/displayed every 5 seconds.

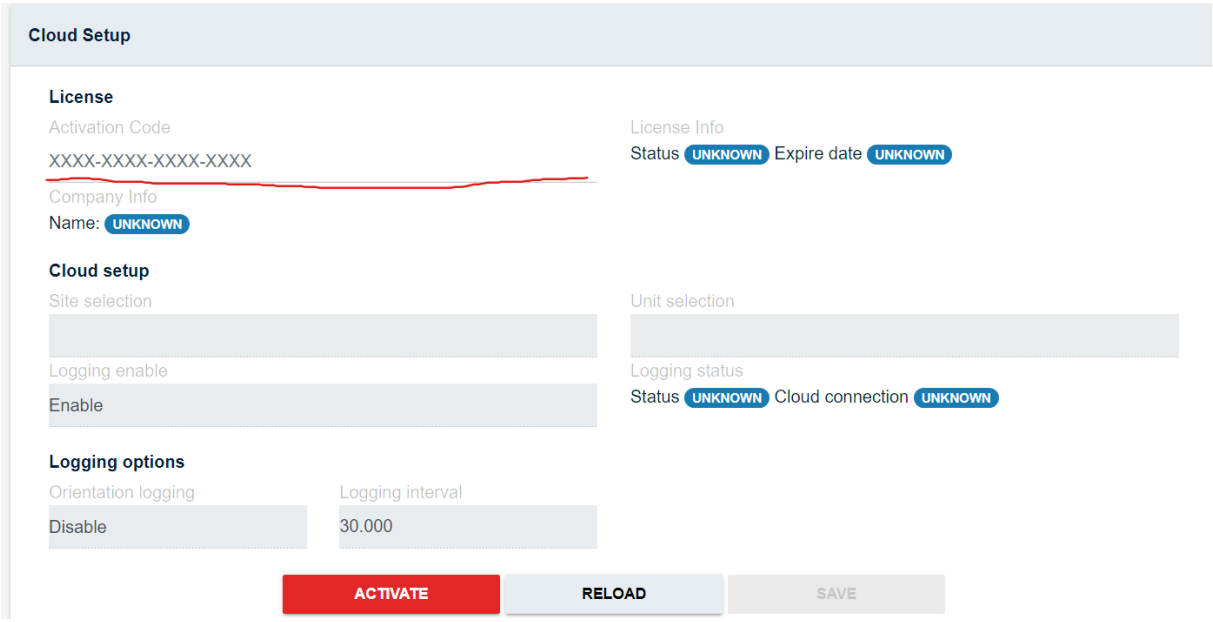


The recorded file will be list in bottom form. On this list, user can download recorded video, or delete it. To add prefix/postfix string into download file name, fill the string into “Prefix” & “Postfix” fields.

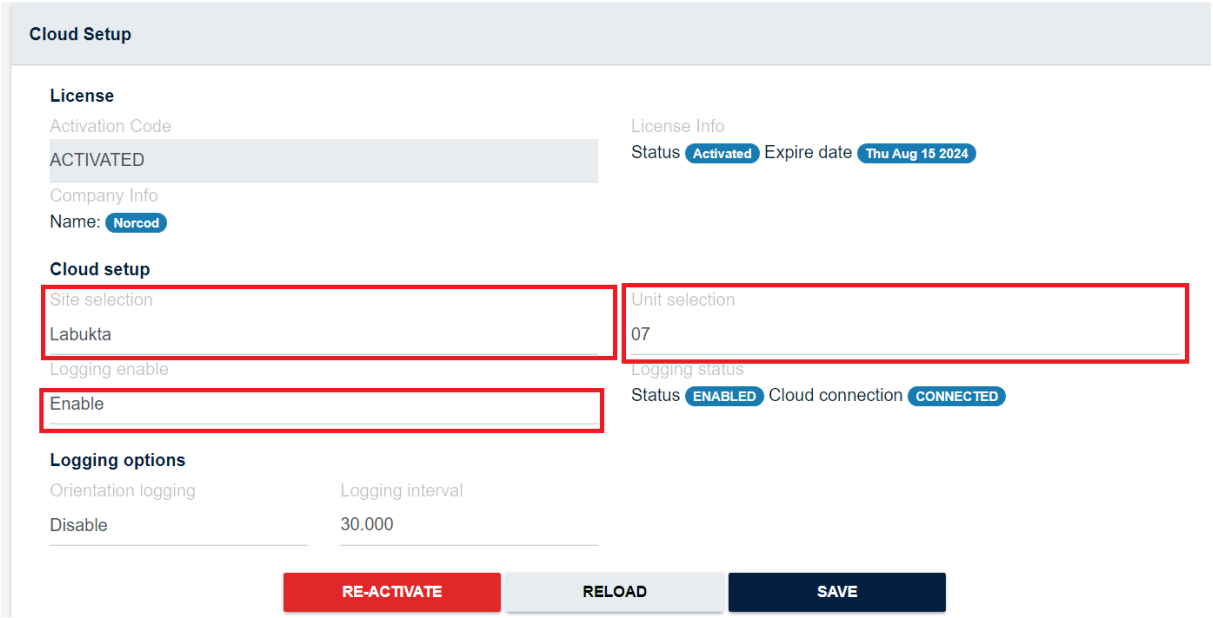


4.4.2.13 UniteAQ cloud setup

The Orbit 39x0 camera has capable to log sensor value directly to UniteAQ cloud. But it needs to be activated & configured, and camera must have internet access (check DNS server in Network setting). By default, the camera is not activated, so you will need to have an activation code from UniteAQ team. Fill the code into form, then click on “ACTIVATE” button to activate the camera. Check if the activation is succeeded or failed.



After activated, the configuration form will be shown with some basic information from license status, expire date, site information, etc. On this form, user can choose the unit of the camera (pen number) and choose to Enable or Disable the logging. Then save the setting.
Remember to check the logging status after that to confirm that the connection is good.



4.4.2.14 Camera health check

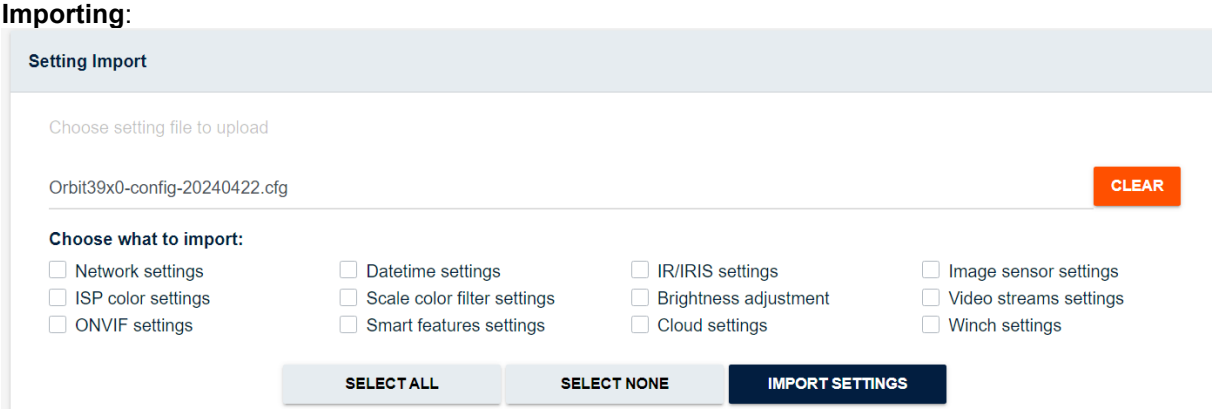
This can be found under “Advanced Tools” -> ”Camera Health Check” on camera’s web menu.
The main purpose of this feature is to provide as much information as possible to production man, so he will not need to navigate around pages in web to collect them. However, this feature is also helpful when user want to have a quick check on camera status (hardware correction, leakage, temperature, etc.).
Note: in “Motor Housing” section, the “Current magnetometer status” shows current status of magnetometer inside motor housing, and this is not in good status when the camera stay still. But rotating the camera some rounds back and forth will make this status changes to good.

4.4.2.15 Setting export/import and factory reset

This can be found under “Advanced Tools” -> “Maintainance”.

Exporting: Click on “EXPORT SETTINGS” button to download setting file. This file will contain almost setting of the camera.

Importing:



From exported setting file, user can import part of settings or full settings depending on what sections are selected.

Factory reset: have two option in “Factory reset” section of the page,

- Factory reset settings: this will delete current settings files, then replace them by default settings.

- Factory reset everything: this will clean everything including settings, data, cache data, (except recorded video) to default in firmware. The production information will be kept.

4.4.2.16 Firmware upgrade

Camera firmware

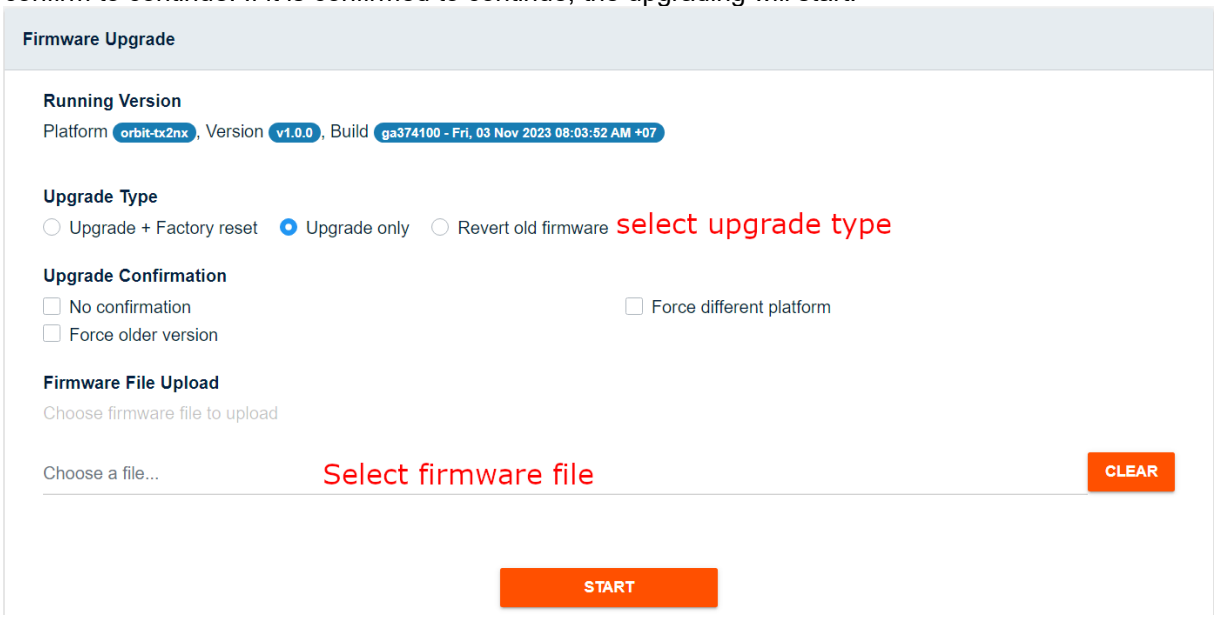
This is under “Advanced Tools” -> “Firmware Upgrade” in web menu.
NB:

- Revert old firmware is not working, **don’t choose this option.**
- The firmware file is big (around 1.3-1.5GB), so the uploading takes time, and needs a stable network connection.
- Firmware is big so the upgrade process takes time, around 10-15minutes. Need to keep the power & camera connection stable during the upgrade process.
- If factory reset is chosen, after camera rebooted, its IP will be changed to factory default 10.10.1.10. So you have to change the URL to correct IP to gain access to the camera again.

There are two upgrade types available:

- Upgrade only: this will keep all the settings of the camera the same, just upgrade firmware (or downgrade). This is mostly used for general firmware upgrade.
- Upgrade + Factory reset: settings and data will be cleared (except recorded video and production info).

Select the firmware file by click on “Choose a file…”, then browse to the firmware file you want to upgrade, then click on “START” button. The firmware file is firstly uploaded into the camera, saved into storage, then information like platform, version number, build number will be shown to compare and confirm to continue. If it is confirmed to continue, the upgrading will start.



Motor board firmware

Requires firmware version v1.1.2 or later for Orbit 39x0 camera

- Go to Maintenance page under Advanced Tools menu
- Click on "START EPR30 TCP BRIDGE" under Admin Tools
- Use SW100035 – Firmware Upgrade tool to upgrade EPR30 firmware
- Fill in Orbit 39x0 camera IP, port 4001.
- Select mode CAMERA ORBIT-34x0/36x0
- Check that the bootloader version can be read out
- Uncheck “Enable compare mode”
- Select firmware file
- Click “Program”
- **Note:** After EPR30's firmware upgrade, it is required to reconfigure it in "Production" page -> "Motor Housing Only" form.

4.5 Installation Guide Submerged Systems – Equipment

The net roof must include openings designed to allow safe transfer of equipment into and out of the pen. These openings must be secured to prevent them from accidentally opening.

Special care must be taken with regards to winch placement relative to the net roof openings, to allow for as smooth operation as possible.

Equipment is secured in a similar manner as in a standard pen, but careful consideration must be given to whether it should be fixed in place using stop knots or allowed to move freely.

Specific guidelines for ScaleAQ Subsea system can be found in the Subsea user manual. If other submerged systems are used, their respective user manuals must be consulted for additional requirements or considerations.

4.6 Surface camera – Orbit-210

Secure the Orbit-210 to the top of the mast on the side of the pen. Orient the camera in the direction you want to look.
Plug the Orbit-210's camera cable into an available socket on the multi socket base plate. This will provide both power and network access for the camera.

The camera cable must be secured to the mast with plastic ties. This will also act as a secondary means of securing the camera and minimise the risk of the camera falling into the netting.

Figure 38 Surface camera

4.7 Surveillance camera – Orbit-360

It is recommended that the camera be mounted at the top of the mast for the highest possible clearance against waves due to IP66. This must be considered when choosing the appropriate locations where the camera is to be installed.

A secondary means of securing the camera can be added by securing the camera cable to the mast with plastic ties. This will minimise the risk of the camera falling into the netting.

- Use the bracket supplied and mount it on a support leg or wall, depending on where it will be mounted. The Orbit-360 can be used on the side of the pen as well as a surveillance cameras on the barge. If you want to mount it on a mast, mount the camera on a mast bracket. If not, the connector base can be installed directly on the desired wall/ceiling.

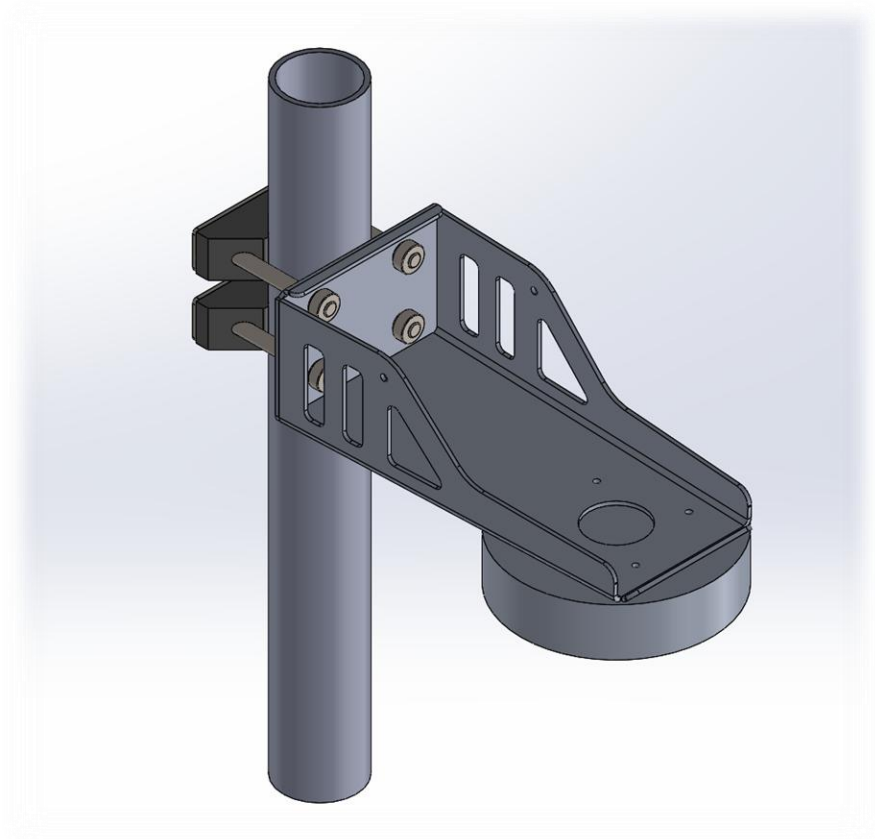


Figure 39 Mast bracket for the Orbit-360

- Secure the supplied connector base to the bracket.

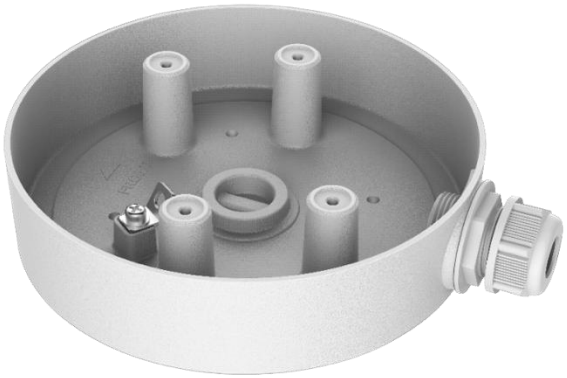


Figure 40 Connector base for the Orbit-360

- Insert the network cable into the nipple and replace the network housing to ensure a better seal for the network cable.

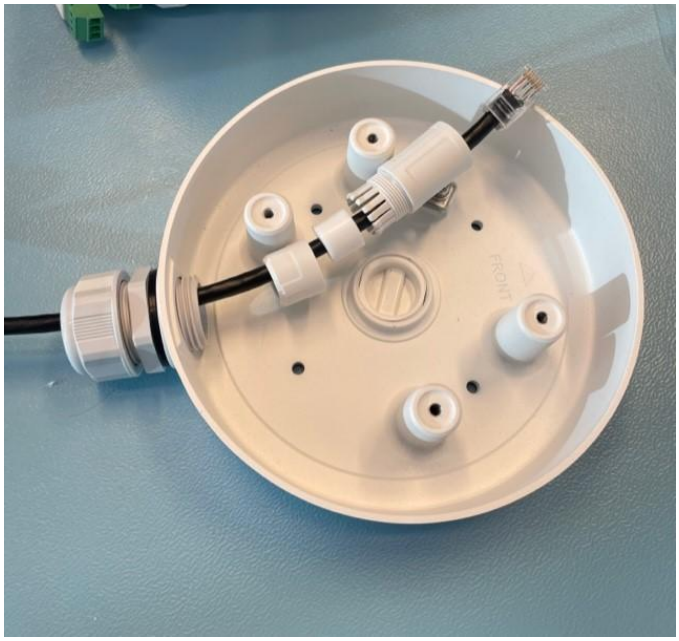


Figure 41 Connector base with network cable for the Orbit-360

- Insert the cables from the camera into the connector base and position them as well as possible. If any extra connections have not been taped/taped with vulcanised tape, this should be done to ensure an even better seal against water penetration.

Figure 42 Connector base with all of the cables for the Orbit-360

- The camera is secured to the connector base's adapter plate by screwing it into the right position. Next use the set screw to prevent it coming loose and falling off during manoeuvring.

Figure 43 Connector base with set screw for the Orbit-360 camera

- On the pen, the other end of the cable must be plugged into an "Ethernet" socket in the CIU. On the barge, this can either be plugged into a switch or in an "Ethernet" socket in the BIU.

4.8 Surveillance camera – Orbit-311

- Secure the Orbit-311 to the mast on the barge (after attaching the mast to the combo mount).
- Use the 40 mm U-bolts, washers and nuts supplied.
- **NB: This camera must not be mounted on the side of a pen!**
- Plug the camera cable into a “Multicontact” socket in the BIU on a barge. The camera cable is fitted with both a 7-pin plug and a 15-pin plug. The 7-pin plug should be connected to the camera, while the 15-pin plug should be plugged into the receiver unit.

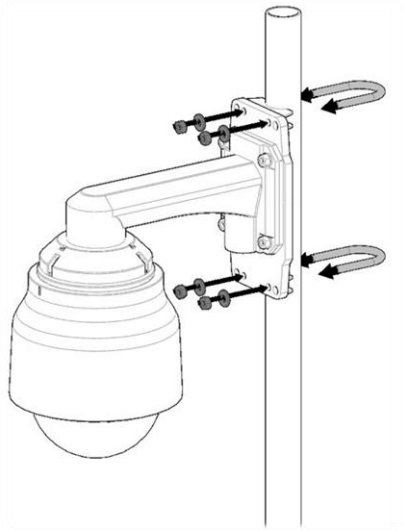


Figure 44 Surveillance camera

5 OPERATING INSTRUCTIONS

5.1 Winch/underwater camera

The camera system is mainly controlled via Vision software on a PC or via an inside control desk on the barge or on shore.

It is also possible to operate the winch on the side of the pen to make accessing the camera during inspection/maintenance easier. The winch has three buttons. These are labelled “Up”, “Down” and “Sideways”:

1. Press and hold "Up" to move the camera up
2. Press and hold “Down” to move the camera down
3. Press and hold “Sideways” to move the camera towards the winch
4. Press and hold “Sideways” to move the camera away from the winch

Alternatively, an older winch may have only two buttons, where one raises and lowers the winch, one moves it sideways, and both buttons must be used to move the camera towards/away from the winch.

5.2 Surveillance cameras

Surveillance cameras are controlled via our Vision software. They can be controlled using a hand controller, the arrows on a PC’s keyboard or by clicking on the various arrows in the software.

Some of the controller’s functions described below.

See the Vision User Manual for more detailed instructions on using the software.

Figure 45 Hand controller top

Figure 46 Hand controller back

6 MAINTENANCE

6.1 Routine checks and periodic maintenance

Table 19 Recommended routine checks and periodic maintenance

Component	Description	Interval		
		Daily	Weekly	Monthly[1]
Entire system (including cables and antennas)	During the winter months, check for icing on all components. Remove all ice present on the components.	■		
Screws on CIU/Winch	Check that all cover screws are screwed tight and are in place.		■	
Winch	Wipe around cables to prevent mussels attaching themselves to the plate and rope cables. Check that the washer on the mounting rod is intact so that the winch moves freely		■	
Underwater camera	Manoeuvre the camera to both sides of the pen to prevent fouling.	■		
Underwater camera	After use, position the camera in the middle of the pen at a depth of 10 m with the lens pointing downwards to minimise fouling on the lens.	■		
Underwater camera	Wipe the camera lens.		■	
Surveillance/surface/dome cameras	Visually inspect the lenses and plugs/cables for damage/fouling – wash or replace if necessary.			■
Antennas	Visually inspect the cables, plugs and suspension mechanism for kinks/damage. Visually inspect the dome.			■
Ropes	Scrape the knots in the ring clean of fouling/shells.		■	
Ropes	Visually inspect them.			■
Combo mount	Check their attachment to the pen: check that bolts and suspension mechanisms are secure.			■
Winch ropes	Visually inspect them for damage/leaks.		■	
Winch ropes	Visually inspect them for fouling.		■	
Sensor station	Wipe down the membrane on the sensor station2F[2].		■	
Strain relief systems	Visually inspect them.			■
Counterweights	Wash to remove any fouling.		■	
Suspension rings.	Visually inspect them.			■
Cables	Check that the cables do not have kinks/damage.			■
PC on the barge	Check it has sufficient air flow and that its fans are not clogged with dust or other unwanted objects.		■	
Hand controller	Keep clean with a damp cloth to prevent buttons sticking. NB: Not watertight!			■

[1] When you have the chance while at the pen
[2] Use a soft cloth/Q-tips to avoid scratching/tearing the membrane.

6.2 Larger repairs and modifications

All servicing must be performed at ScaleAQ or at an authorised partner.

ScaleAQ recommends sending the underwater camera in for service every generation, while the winch and CIS/PSU can be sent in every second generation.

Underwater cameras must be sent to ScaleAQ for calibration or replacement of the oxygen film if this is required due to damage. The estimated service life without damage is 5 years.

6.3 Storage and maintenance

Disconnect the power supply before disassembly.

ScaleAQ recommends that the equipment be stored indoors. This also applies to combo mounts and ropes.
Disconnect any cables that can be disconnected.

1. Clean any fouling off the rope and rinse it clean with water. Check for areas of wear and tear and order a new one if necessary.
2. Flush aluminium parts with clean water. Apply grease to contact surfaces/threads to prevent corrosion and salt build up.
3. Rinse, clean and dry cables to remove all salt residues. Check for wear and tear damage, replace if necessary. Coil the cables together for storage. **Cables should be disconnected wherever possible.**
4. Wash the camera clean of fouling. ScaleAQ recommends sending the camera in for a service at the end of its deployment (e.g. to replace gaskets and calibrate sensors).
5. Wash the winch and CIU/PSU clean of salt and check all the plugs/sockets. Consider whether they should be sent in for a service so that they are ready for a new deployment without any problems. Store indoors to prevent moisture penetrating the sockets and covers when not suspended in the intended position (sockets pointing downwards).
6. Fibre cables: if the plug on the fibre cable has got saltwater on it during disconnection, it must immediately be rinsed well in clean water. Allow it to dry completely before replacing the cover. When coiling cable, take care not to cause kinks in the cable. The minimum radius for coiling should be 50 cm to avoid damaging fibre cable.

6.4 Maintenance

6.4.1 Depth gauge on underwater camera

There are a few things that can be done by on-site personnel with respect to underwater cameras. They can service the depth gauge if this showing the wrong depths. The process is simple, although you must have the right silicone oil and membrane available (if this is damaged, it must be replaced).

Figure 47 Opening the depth sensor cover

Open the depth sensor cover. This can be done with special equipment or with the aid of a couple of hex screwdrivers inserted into the hole and something to twist around between these. Take care not to push anything hard in inside the cover as this can damage the membrane.

Remove fouling, shells and vegetation from the cover as this can also affect depth readings. When there is no fouling, you can refill with silicone oil. Remember to remove any old glycol (used previously) or oil. Silicone oil is used to prevent the sensor from coming into contact with seawater and to prevent corrosion on the sensor.
Pay attention to the orientation of the membrane; one side is for up and one is of down. In case of damage, replace it with a new membrane.

Figure 48 Removing the membrane

After removing the membrane and old fluid. Refill with new silicone oil until it rises above the membrane. Put the membrane on and make sure that there are no air bubbles when it is lowered to the bottom of the depth sensor. Make sure that the membrane is oriented properly and that it is flat and not crumpled.

Figure 49 Membrane placement

Screw the cover back on, taking care not to tighten the screws too much. This can cause the cover to cut into the membrane.
Test whether the membrane is properly positioned with a small hex spanner with a rounded end. When the spanner is gently pressed down, it should not hit a hard surface directly, rather the membrane and oil.
By applying gentle pressure here, you should be able to see the depth value on the camera image change in the Vision software. Stop when you see you get a change in depth to avoid damaging the membrane.

If there is no change in depth – try again.

Figure 50 Testing the depth sensor

6.4.2 Cleaning the oxygen sensor

This applies to those cameras fitted with an oxygen sensor where a film is used for measurement, the Orbit-3500 and Orbit-36X0 series.

If a sharp object is used to physically remove fouling, this will also destroy the film at the same time, which, in the worst case scenario, will mean the camera having to be sent in for a service to replace the sensor.

Interval
As needed. This will vary depending on the fouling conditions at the location. The sensor measures the oxygen level at the front of the oxygen sensor. If fouling prevents water penetrating to the film's surface, cleaning will be required. Even only partial coverage by fouling/algae could affect measurements.
Regular cleaning is important, as is cleaning when the product is brought up for storage or sent in for a service.

Cleaning method:
The sensor can be cleaned using a toothbrush and water. A medium toothbrush should be used. Using Q-tips is not recommended as this can easily damage the film during cleaning.

Fouling consisting of calcareous organisms can be removed by cleaning with a weak vinegar solution. The recommended solution is one part fresh water and one part 7% clear vinegar. Rinse with (sea)water afterwards to neutralise the solution. If the cleaning is performed immediately after the camera is removed from the water, it will normally not be necessary to use a vinegar solution.

Figure 51 Cleaning a fouled oxygen sensor on an Orbit-3500 camera

Figure 52 Cleaning a fouled oxygen sensor on an Orbit-36X0 camera

6.5 Troubleshooting and fault fixing

Problem	Possible cause	Solution
Multiwinch is not moving	Fouling on ropes	Remove fouling
Multiwinch is not moving	The multiwinch's rope is stuck	Unravel knots
Multiwinch is not moving	Broken winch cable	Check the cable is whole and in good condition with no visible marks/damage. If the cable is broken, replace faulty cable and plugs or sockets in the CIU/PSU.
Multiwinch is not moving	The camera rope is on the outside of the top ring.	Move the camera rope to the inside of the top ring.
Multiwinch is not moving	Fuse blown	Check the fuse inside the CIS/PSU and replace it if it not working. **NB:** Only authorised personnel are allowed to do this.
The multiwinch moves in jerks or stops before it reaches the bottom	Incorrectly positioned bottom stop switch	Lift the hoop stopper [3] stop screw. You should hear a click from the switch inside the winch at about 5 mm from the bottom position. If the hoop needs to be lifted by 1 cm or more, the bottom stop switch is positioned incorrectly.
The multiwinch moves in jerks or stops before it reaches the bottom	The motor protection function on the circuit board has failed	The motor protection function kicks in when the load on the motor is too high, and the winch should disconnect the motor when the camera has been lifted about 1 m above the surface of the water. This is to prevent the motor causing wear and tear on ropes or burning out. If the motor is unable to lift the camera in the water, we recommend that the winch be serviced.
Image comes and goes	Broken camera cable	Replace the camera cable with a new one or test the camera with a camera cable from another pen.
"No video" displayed on PC screen	Camera not connected to the CIU	Check that the camera is connected properly.
"No video" displayed on PC screen	Faulty camera fuse	Use "Camera tools" in the software to check the status of the fuse. If the fuse has blown, verify what caused this before replacing the fuse.

Table 20 Troubleshooting

[3] The hoop that holds the winch rope up.

6.6 Visual inspections

ScaleAQ recommends carrying out regular inspections that cover all parts of the camera system. You do not need to inspect everything at the same time, although every component should be checked at least once every month, preferably every week. Parts of the system particularly subject to wear and tear should be checked daily and weekly to detect faults before they can do more damage. Damaged equipment (including equipment where leaks are suspected) must be taken out of service immediately.

Worn ropes should be replaced before they break. A camera cable with a hole must be replaced before water penetrates the cable (or, in the worst case scenario, down into the camera or into the CIU).

6.6.1 Underwater plug – corrosion or white coating

If the underwater plug has a white coating or has begun to corrode, this is a clear sign of water penetration in either the cable or camera housing. It could also be that both have suffered water penetration as a result of one being penetrated first. This can be detected based on random errors in camera images, while in older camera systems (analogue) the impact will manifest as flickering camera images or the image dropping out altogether.

Figure 1 : Underwater plug with corrosion and white coating

6.6.2 Flickering camera image

Depending on whether a digital or older analogue camera is involved, such faults will have different causes.
With a digital system it may be caused by voltage/current fluctuations, although there may also be an internal fault in the camera that means the camera must be sent in for servicing to repair it. With an analogue system, the fault could be caused by a faulty camera cable or camera. Therefore, try changing the cable and/or camera first to eliminate possible causes, and then just send in the defective component.

6.6.3 Camera rotates poorly

If the camera rotates poorly up and down when in the sea or in air, this may be a clear sign that the camera should be sent in for a service. The motor may be starting to fail, or other mechanical parts may be faulty or becoming very worn.

7 SPARE PARTS AND PRODUCT NUMBERS

7.1 Underwater cameras

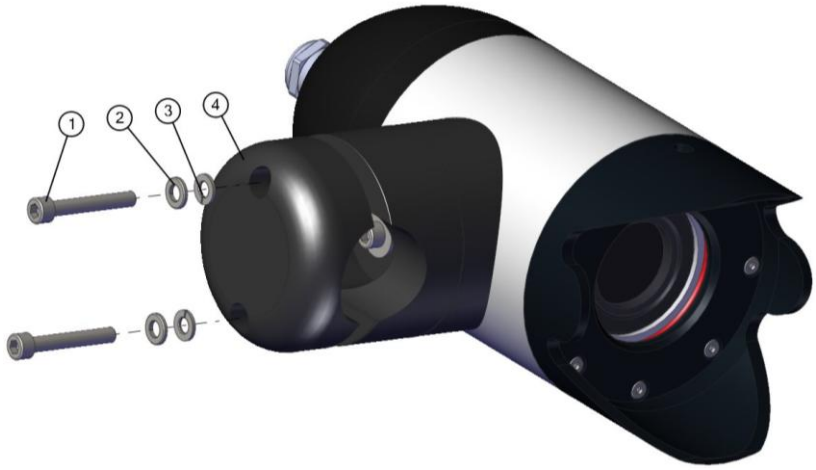
Orbit-3450: 449447
Orbit-3650: 449448

Pos. no.	Description	Item number	Quantity
	Silicone oil Membrane	406293	1

Orbit-3700: 450354
Orbit-3710: 450355

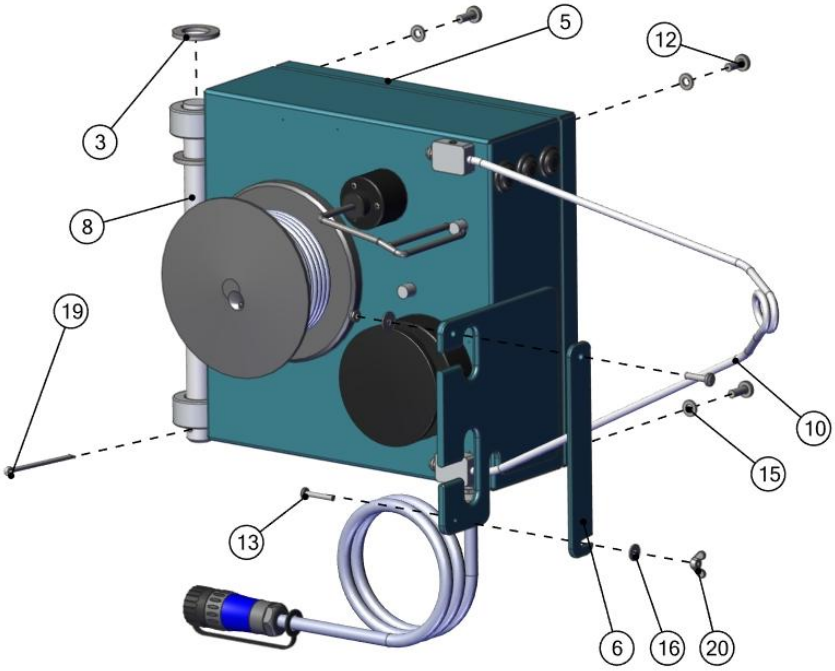
Orbit-3900: 502213
Orbit-3910: 502214
Orbit-3920: 502215
Orbit-3930: 502216

7.2 Orbit-210 (430755)



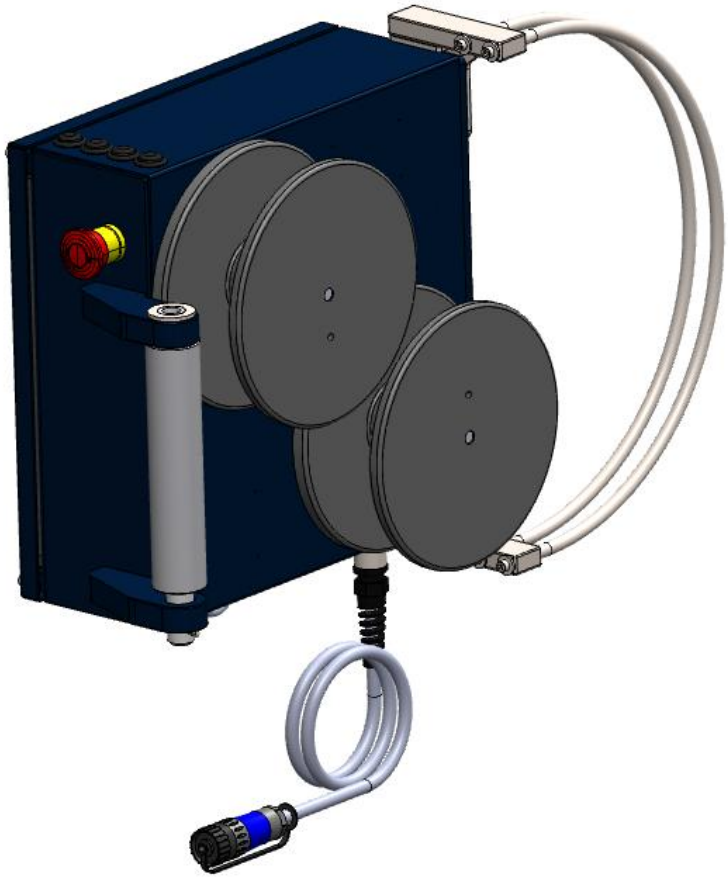
Pos. no.	Description	Item number	Quantity
1	ISO 4762 M6 x 40 mm A4		2
2	Washer DIN 125 - W 6.4 - 300HV		2
3	Spring washer DIN 128 - A6		2
4	Clamp 2	406467	1
Optional	Winter sunshade	406615	1

7.3 Multiwinch (100069)



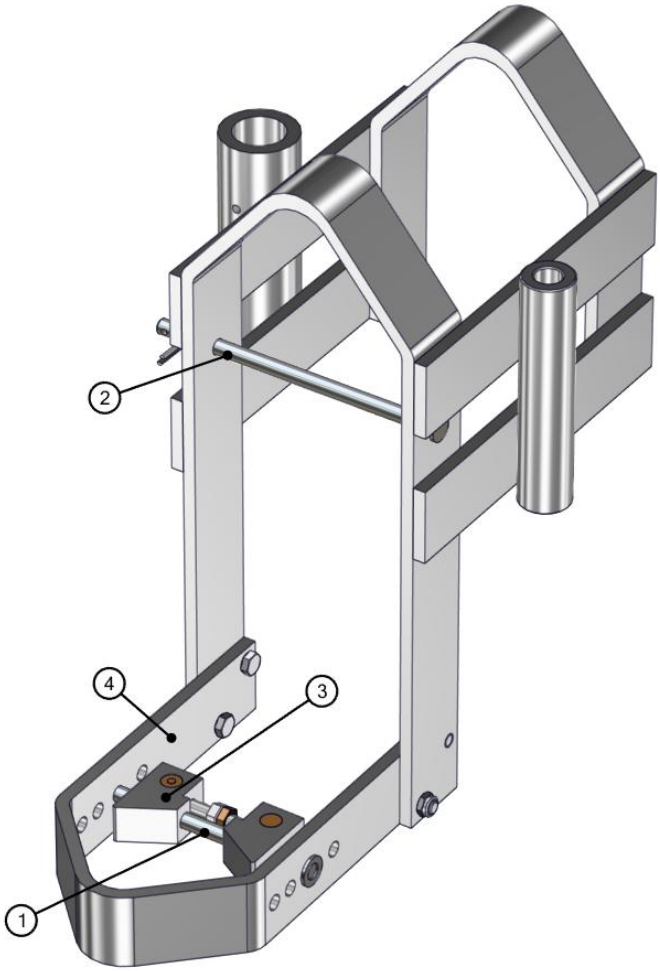
Item no.	Product	Product no.	Qty.
3	Washer for shaft		1
8	Bolt for winch	405571	1
19	Split pin	401670	1
10	Hanger	401311	1
	3 mm nylon rope	403620	100 m
12	Pan head cross recess screw M6 x 16 mm		4
13	Pan head cross recess screw M4 x 16 mm		1
15	Plain washer M6		4
16	Plain washer DIN 9021-4.3		1
20	Wing nut M4	401611	1
6	Locking plate	405819	1
5	Winch cover	432039	1

7.4 Smart Winch



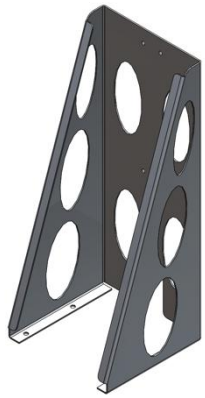
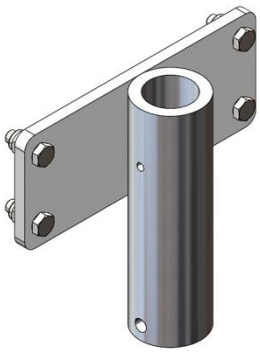
Pos. No.	Description	Item number	Quantity
1	Smart Winch – Linear setup	504263	1
2	Smart Winch – Accessory Kit – Linear Setup	504839	1
	Contains pos. 3-7:		
3	Rope-Pulley Solution	504690	1
4	Double Pulley Tråd	504296	1
5	Twisted Shackle A4 M-12 x2	504297	2
6	Carabiner hook/screw lock 100x10A4	451062	1
7	Rope 60m 6mm12fl Dyneema SK78	504779	1
8	Pulleyblock Nylon 4mm rope Ø37	504015	2

7.5 Orbit – mounting bracket for the top ring of a pen with clamp (V-Clamp) (442778)



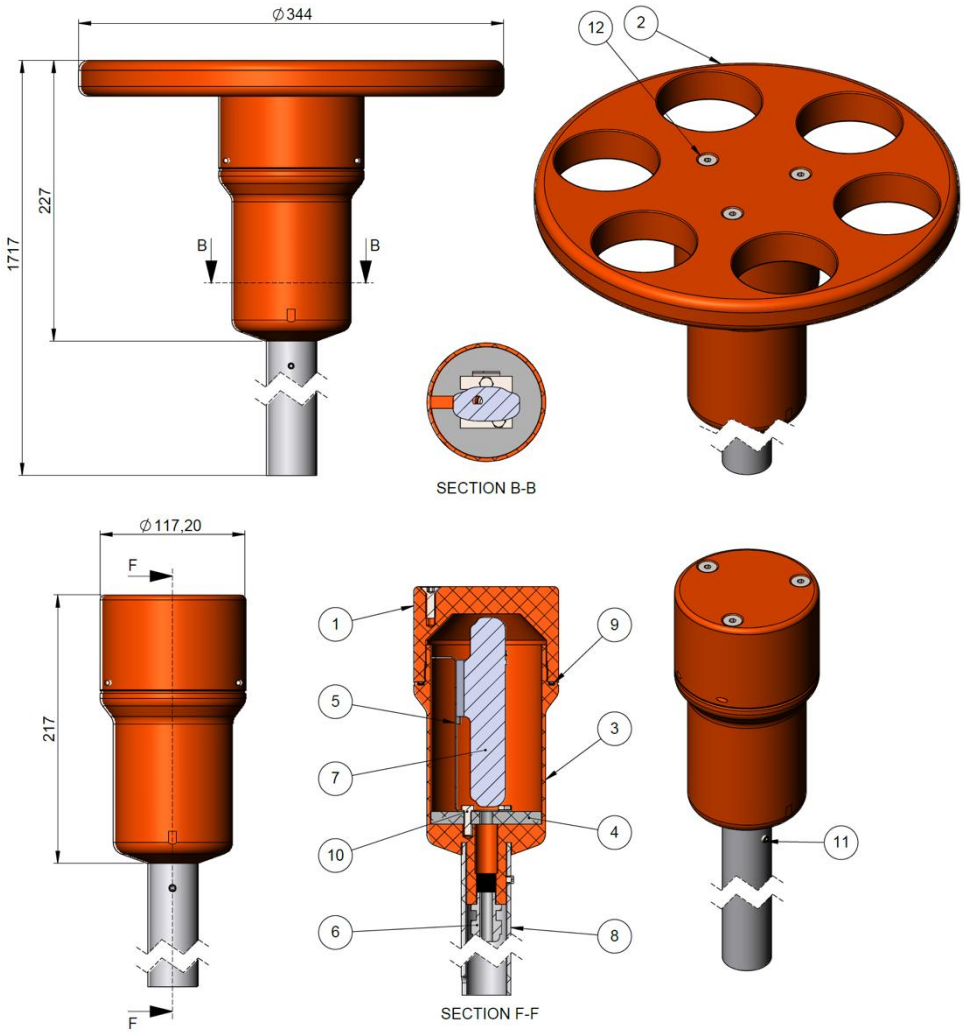
Pos. No.	Description	Item number	Quantity
1	12 mm locking bolt 196 mm	405721	1
2	12 mm locking bolt 237 mm	405830	1
3	V-Clamp Assy	420297	1
4	Mounting bracket (small) Mounting bracket (large)	417314 420304	1
	Bolt set	442197	1

7.6 ScaleAQ bracket

		
1	2	3

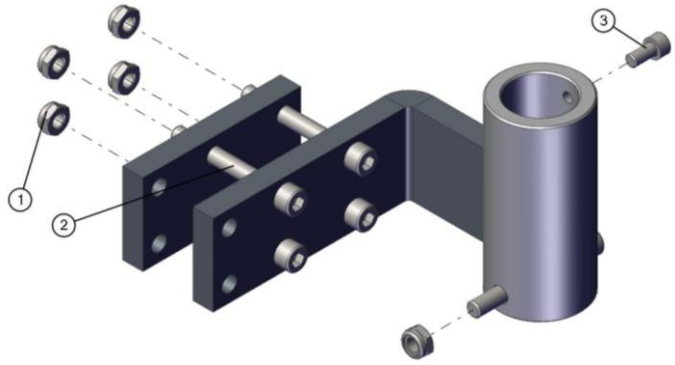
Pos. no.	Description	Item number	Quantity
1	Mounting bracket for base plate	447424	1
2	Base plate tube support	447425	1
3	Orbit winch hinge plate	447426	1
	Lifting-eye M8 x 13 mm DIN 580 A4	430995	1

7.7 Antenna with tube (411859)



Pos. no.	Description	Item number	Quantity
1	Top cover	405259	1
2	O-ring 77 x 4.0	405263	1
3	Antenna	447964	1
	Cable (complete) 2.5 m	420441	1

7.8 Strain relief system (420438)

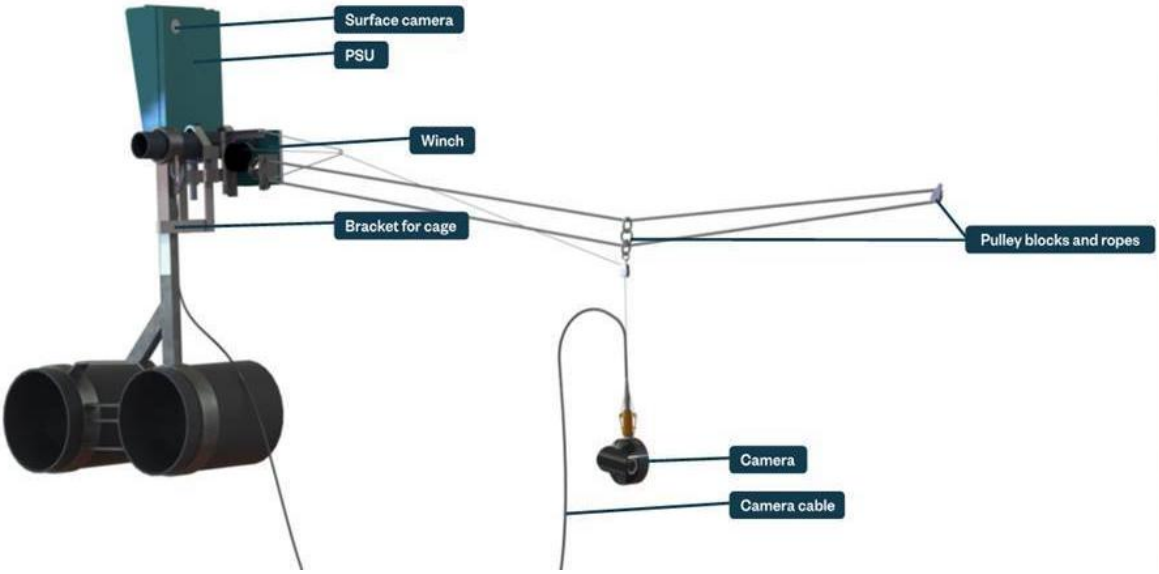


Pos. no.	Description	Item number	Quantity
1	DIN EN ISO 10511 – M10		5
2	DIN 912 M10 x 80 mm		5
3	DIN 912 M8 x16 mm		1

7.9 Orbit-311 (446165)

Pos. no.	Description	Item number	Quantity
1	ODG100222-1	447974	1
2	Bracket for Orbit-311	447965	1
3	Adapter for Bracket Orbit-311	447966	1
4	Cap UTS14DCGE	406806	4
5	ODG100106-3 cable for dome 24V	410807	1
6	Clamp for 40 mm tube	405570	2
7	U-hoop for Ø40		2

7.10 Ropes and suspension



Pos. no.	Description	Item number	Quantity
1	Pulley block 18 mm	401475	1
2	Pulley block for camera rope	405850	1
3	3 mm nylon rope for winch	403620	1
4	Rope – Orbit 80 m RP-80 (winch)	405503	1
5	Rope – Orbit 100 m RP-100 (winch)	405695	1
6	Orbit counterweight for winch rope	405696	1