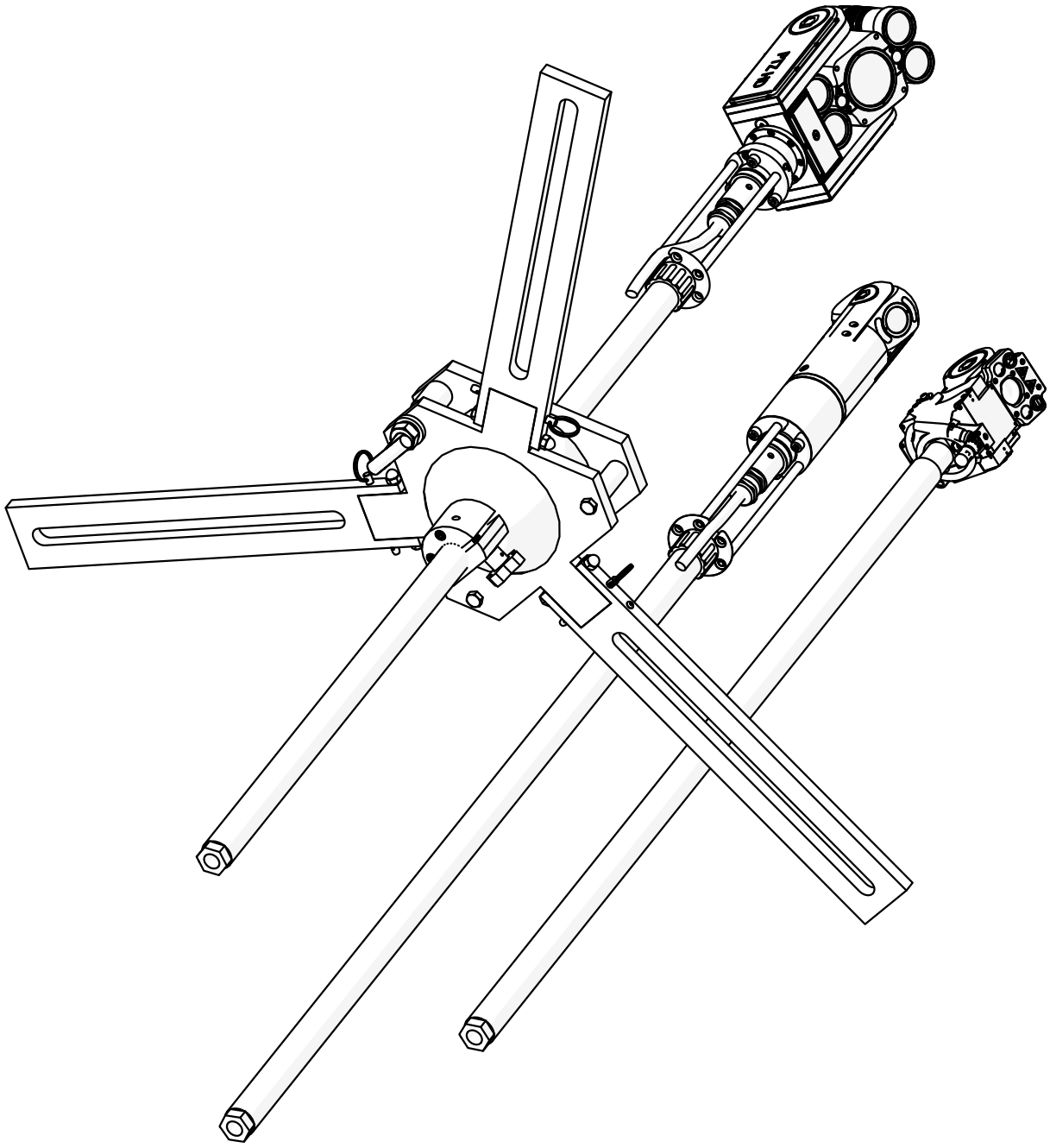
Waygate Technologies

a Baker Hughes business



Everest Ca-Zoom HD

Operating Instructions

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Glossary

EHS	Environmental, Health and Safety
S/N	Serial number
P/N	Product number
WT	Waygate Technologies, a Baker Hughes business
WTR	Waygate Technologies Robotics AG

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1 Safety

This chapter provides an overview of all the important safety aspects for optimum protection of the personnel as well as safe and trouble-free operation.

Failure to observe the operating and safety instructions contained in this document can lead to accidents with damage of equipment or injuries with severe consequences.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.1 Safety references

It is the user's responsibility to apply safe work site practices as per local and general safety regulations in the area where the system is located and used.

	**Read the operating instructions carefully before starting work!**

The operating instructions are a component of the product and must be kept accessible to the personnel in the immediate vicinity of the system.

When transferring the equipment to third parties, provide the operating instructions.

1.2 Symbols used

DANGER: means that death, serious personal injury, or material damage **will** occur if appropriate precautions are not taken.

Safety pictogram(s)	⚠ **DANGER**
	Hazard description, origin, and consequences.
	Measures to be taken to eliminate the hazard.

WARNING: means that death, serious personal injury, or material damage can occur if appropriate precautions are not taken.

Safety pictogram(s)	⚠ **WARNING**
	Hazard description, origin, and consequences.
	Measures to be taken for risk mitigation or elimination.

CAUTION: means that minor personal injury or material damage may occur if the appropriate precautions are not taken.

Safety pictogram(s)	⚠ **CAUTION**
	Hazard description, origin, and consequences.
	Measures to be taken for risk mitigation or elimination.

TIPS or ADVICES:

	**TIPS / ADVICE**
	This symbol indicates application tips or advice for efficient and trouble-free operation of the equipment that do not affect the safety and health of the personnel.

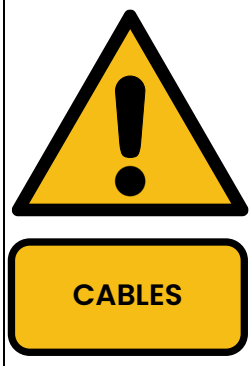
1.3 General safety instructions

The operating instructions are intended for the safe operation of the Everest Ca-Zoom HD system.

	**DANGER**
	Potential explosive atmosphere
	Everest Ca-Zoom HD is **NOT** explosion-proof, intrinsically safe or ATEX compliant. Do not use it in hazardous environments and/or potentially explosive atmospheres.

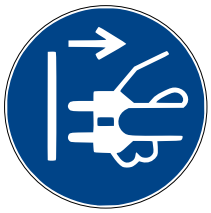
	**DANGER**
	Wrong manipulations by non-trained persons can lead to injuries.
	The operator shall restrict access to non-authorized persons.

 	**DANGER**
	Parts can fall and cause equipment damage or severely injure personnel
	Ensure that: • All screws or pins are correctly tightened and not deformed. • No parts are broken, damaged or subject to torsion or bending. • All equipment is stored safely. • Use tethering best practices for safe elevated work. See chapter 5. • Ensure there is enough room to manipulate the full equipment and move around.



⚠ WARNING
Incorrectly laid cables can lead to injuries by tripping over tangled and untidy cables.
Avoid any risk of cable interference with persons or objects that can potentially move. Otherwise, prevent access to the potentially hazardous area with signage. Unwind the cables to the length required for the interconnection. Wind and attach the remainder with cable ties above ground preferably. Do not lay cables in walking areas. Use cable bridges or suitable cable path tape to safely run cables over the floor if there is no alternative path.

⚠ CAUTION
Cable or connector damage during manipulation.
Use the over-under coiling technique to wind cables to prevent tangling. Some cables are provided with protection caps. Always mount the caps after disconnecting the cables. Avoid dropping the connectors on the ground. Never tension or excessively bend cables. Do not lay cables on the ground in areas where they can be damaged by trampling. Make sure cables are always strain relieved.



DANGER

Electrical shock (100-240 V AC)

Make sure all cables are in perfect condition.

The use of the 100-240 VAC power cord must comply with local and general safety regulations.

Use the supplied AC/DC power supply with a proper earth ground connection.

Disconnect the power when the equipment is not used.

The equipment is intended for indoor use: protect it from water ingress, rain, and dust. **Only PTZ cameras can be immersed in operation.**

Do not open the housings of the devices.

WARNING

Cameras comprise STRONG LIGHTS for illumination. Eye-injury or temporary blinding may occur.

Do not look directly into the lights: **temporary blindness might occur**.

Ensure nobody can look directly at the lights prior to activating them.

It is only permitted to activate lights in an environment where **no personnel can stay in the camera field of view**. Access must be restricted accordingly.

	**⚠ WARNING**
	Hazardous particles or substances collected by the inspection device can contaminate personnel, the equipment, or the environment. Camera housings can get very hot and cause burns.
 	In case traces of unknown substances are observed, make sure to identify the nature of the substances, and to initiate appropriate cleaning measures. **The product must be cleaned before storing in the transport case!** Camera surfaces can be very hot: Use suitable **protective gloves** for **handling and cleaning**.

See safety instructions to handle the equipment in chapter 4.

1.4 Specific safety instructions

For camera pressurization: see section 5.2.

1.5 Operator responsibilities

If the Everest Ca-Zoom HD system is used in the industrial field, the operator is subject to statutory obligations to work-safety. In addition to the safety instructions in this document, the safety-, accident prevention- and environmental protection regulations applicable to the system must be complied with.

Operator responsibilities and duties may include, but are not limited to, the following actions:

- To conduct a risk assessment, identifying any hazards related to the specific work environment and conditions at the place of use.

- To determine potential exposure of the equipment to nuclear radiation or toxic / hazardous substances.
- To take all required measures to eliminate or mitigate identified risks and to apply safe work site practices in compliance with EHS regulations.

Furthermore, the operator must ensure that the system is:

- always in technically perfect condition,
- cleaned before packing and storage,
- subjected to regular functional checks,
- maintained as per specified maintenance intervals (see section 12.2),
- used and stored in the correct environment (see section 11.4 and Appendix A).

1.6 Reasonably foreseeable misuse

- Failing to read and to follow the operating instructions.
- Operation, maintenance, and repairs by non-authorized or non-trained persons.
- Failing to follow the intervals for inspection and maintenance work as described in the operating instructions or as required by regulations.
- Not taking decontamination measures if the equipment was unintentionally exposed to hazardous / toxic substances.
- Returning equipment for service or disposal after exposure to hazardous substances or nuclear radiation.

1.7 Personal protective equipment (PPE)

Personal protective equipment is used to protect persons from impairment of safety and health at work. During the various kinds of work on and with the system, the personnel must wear personal protective equipment:

- as referred to separately in the individual sections of the operating instructions.
- when required by the environment, as defined by site risk assessment, in accordance with local safety regulations.

	**Protective gloves** Protective gloves are used to protect the hands from friction, abrasion, puncture, or deeper injuries, as well as from contact with hot surfaces.
	**Safety shoes** Safety shoes protect the feet from falling parts and slipping on a slippery surface.
	**Hardhat** Industrial protective hardhats protect the head against falling objects, oscillating loads, and impacts on fixed objects.
	**Safety goggles** Safety goggles are used to protect the eyes from moving parts and splashed liquids.

Table 1. Non-exhaustive list of PPE

2 Product overview and functionalities

2.1 Intended use

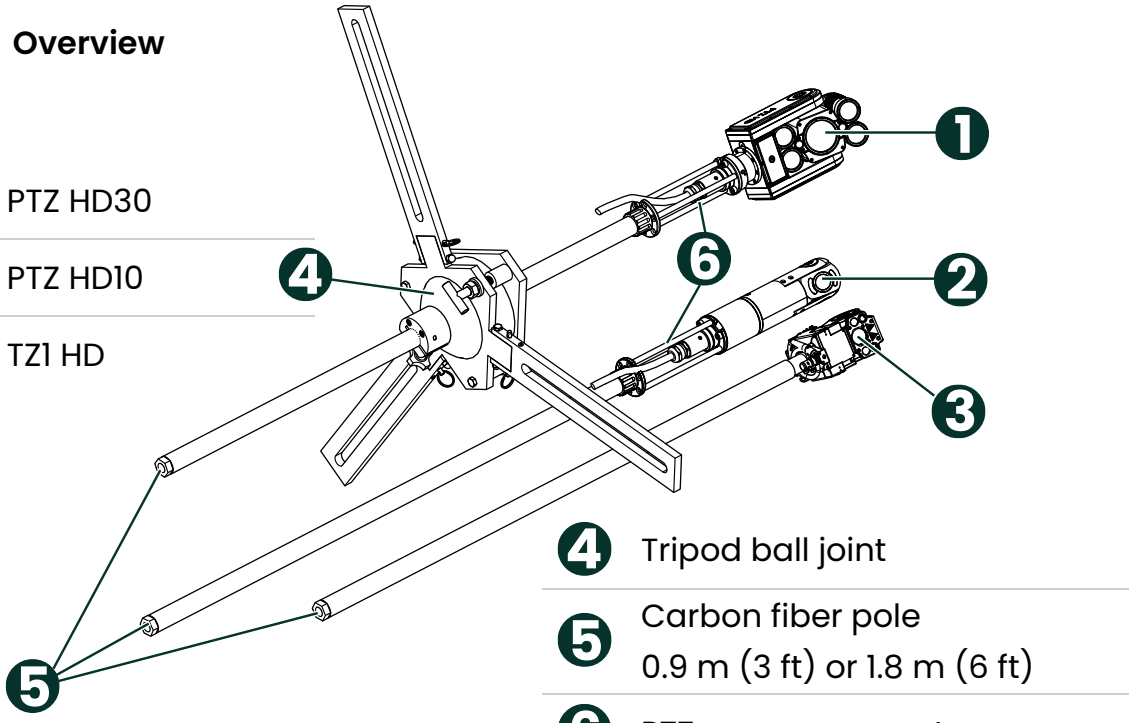
The Everest Ca-Zoom HD System is designed to ensure accurate visual inspections inside industrials assets, including confined spaces. The cameras are manually handled with a pole, held by a tripod ball joint or attached to a fixed or mobile carrying system.

Camera functions can be remotely controlled from a handheld tablet.

PTZ camera heads can be immersed in water, see section 5.2.

2.2 Product parts description

2.2.1 Overview



1. PTZ HD30
2. PTZ HD10
3. TZ1 HD
4. Tripod ball joint
5. Carbon fiber pole
   0.9 m (3 ft) or 1.8 m (6 ft)
6. PTZ camera mount

Figure 1. Cameras mounted on pole

2.2.2 Cameras

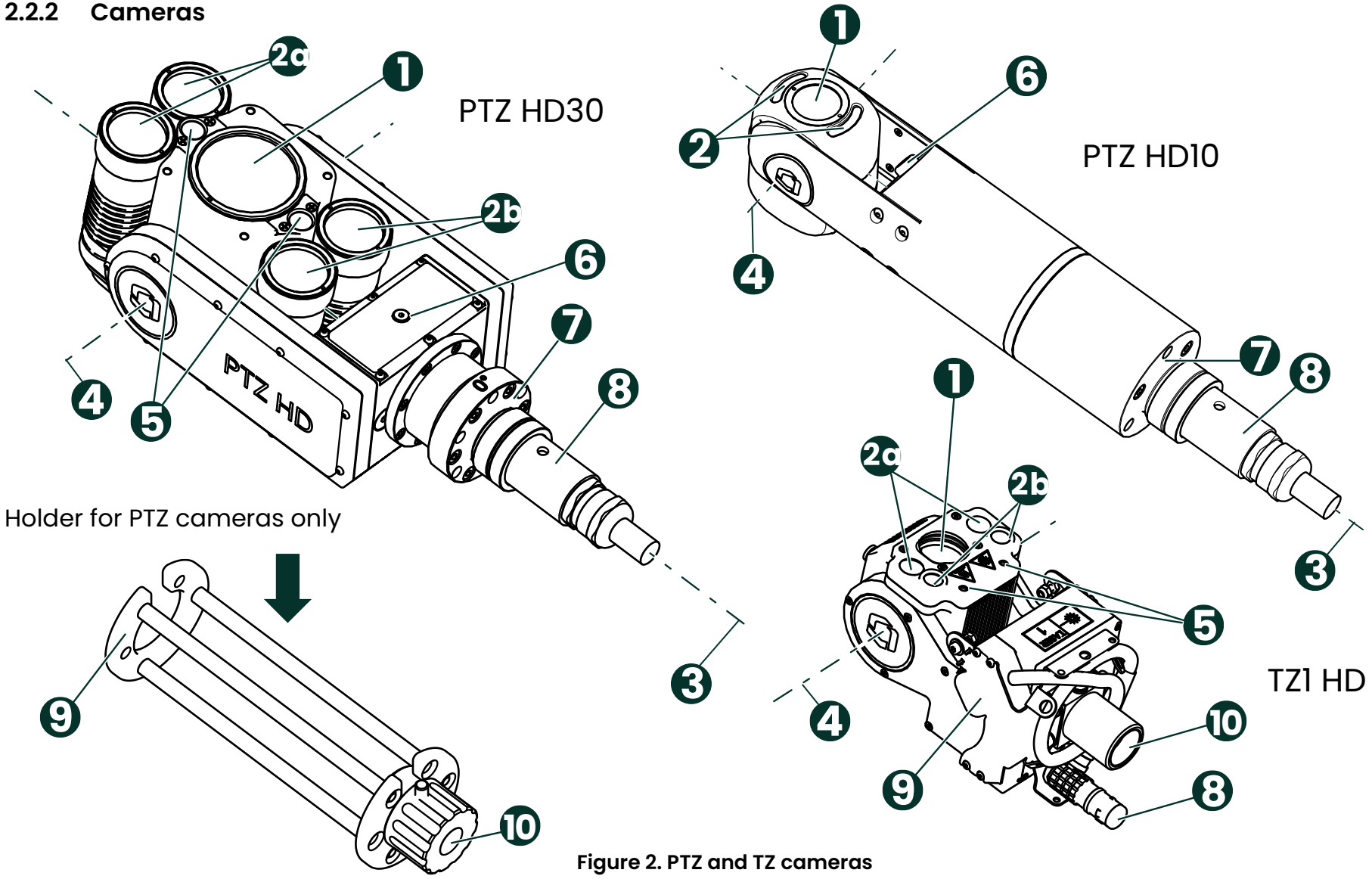


Figure 2. PTZ and TZ cameras

Legend

1	Camera lens	5	Laser emitters
2	LED lamps pair [1)]	6	Check valve with threaded plug
2a	Upper LED lamps pair [2)]	7	PTZ camera interface
2b	Lower LED lamps pair [3)]	8	Cable connector
3	Pan axis	9	Camera mount PTZ interface
4	Tilt axis	10	Interface for V4010 poles

Detailed functionalities	PTZ HD30	PTZ HD10	TZ1 HD
Both lamps 2 are switched on/off simultaneously		✓	
Each lamp 2a 2b can be switched on/off independently	✓		✓
Spotlight 2a and floodlight 2b			✓
Flange 9 is fastened to PTZ interface 7 with three M6x18 screws (hex key 5 mm).	✓	✓	
Mount 9 is secured with two captive screws (TX10).			✓
Check valve 6 is used for pressurization.	✓	✓	
Two lasers for comparative sizing	2 || lines		2 dots
Distance between laser beams	22 mm/0.86″		27.5 mm/1.06″

IP code (water, dust) [camera head only]	PTZ HD30	PTZ HD10	TZ1 HD
IP68: dust-tight, waterproof up to 50 m (164 feet) below surface	✓	✓	
IP65: dust-tight, resistant to low water pressure			✓

2.2.3 TZ1 camera mount details

In the previous figure, this mount is shown assembled with the TZ1 HD camera.

The figure below shows the mount with TZ1 camera cable only.

1. Spacer with tightened M3x12 screws
2. Threaded hole for pole connection
3. Holes for cable ties
4. Camera cable and connector

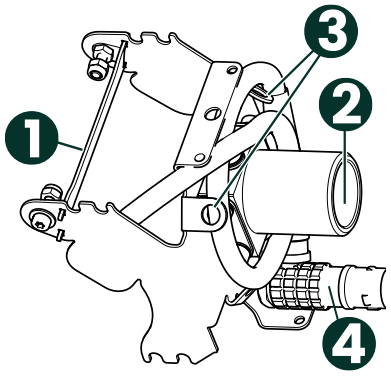


Figure 3. TZ1 camera mount

The TZ1 camera mount does not need to be removed from the camera for storing except for cleaning purposes, for example. See how to remove it in section 12.3.

2.2.4 Tablet

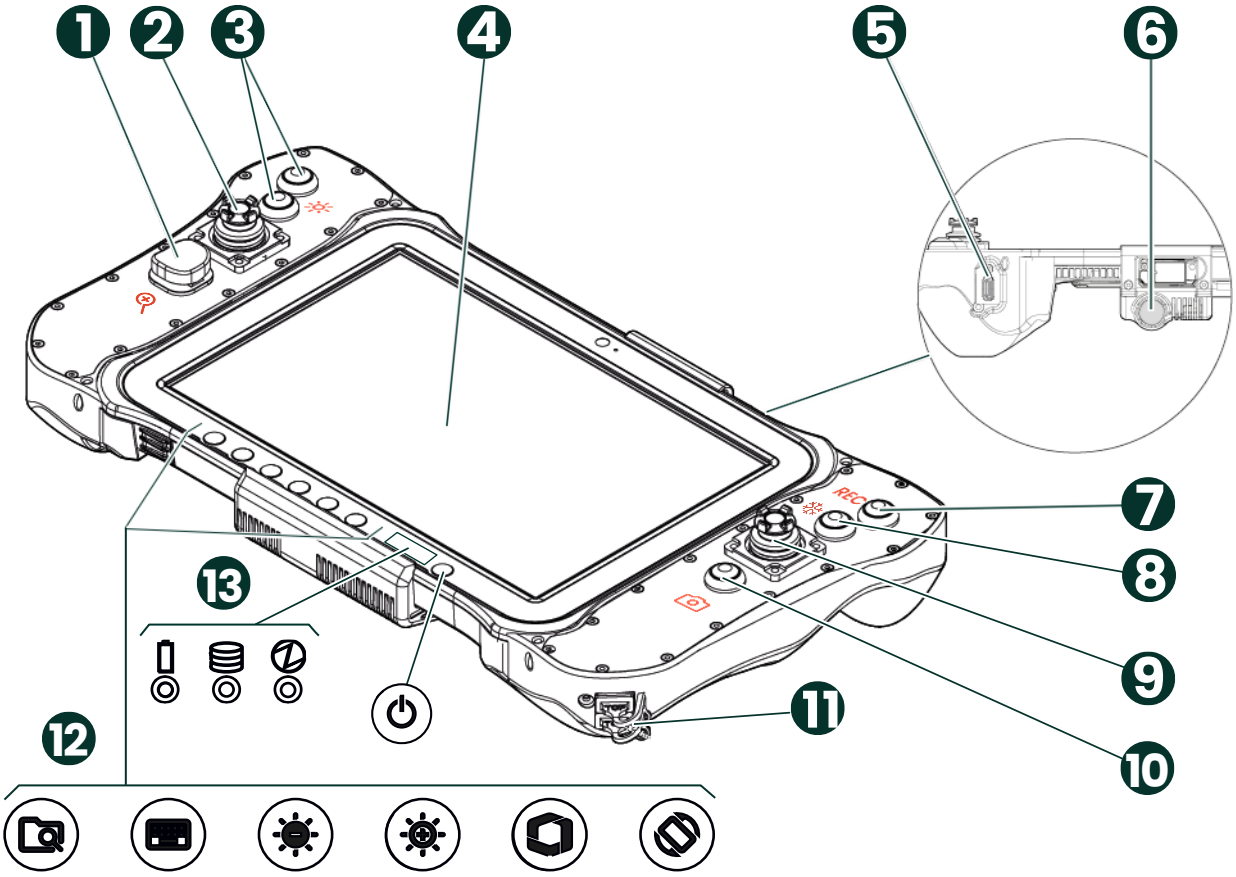


Figure 4. Tablet

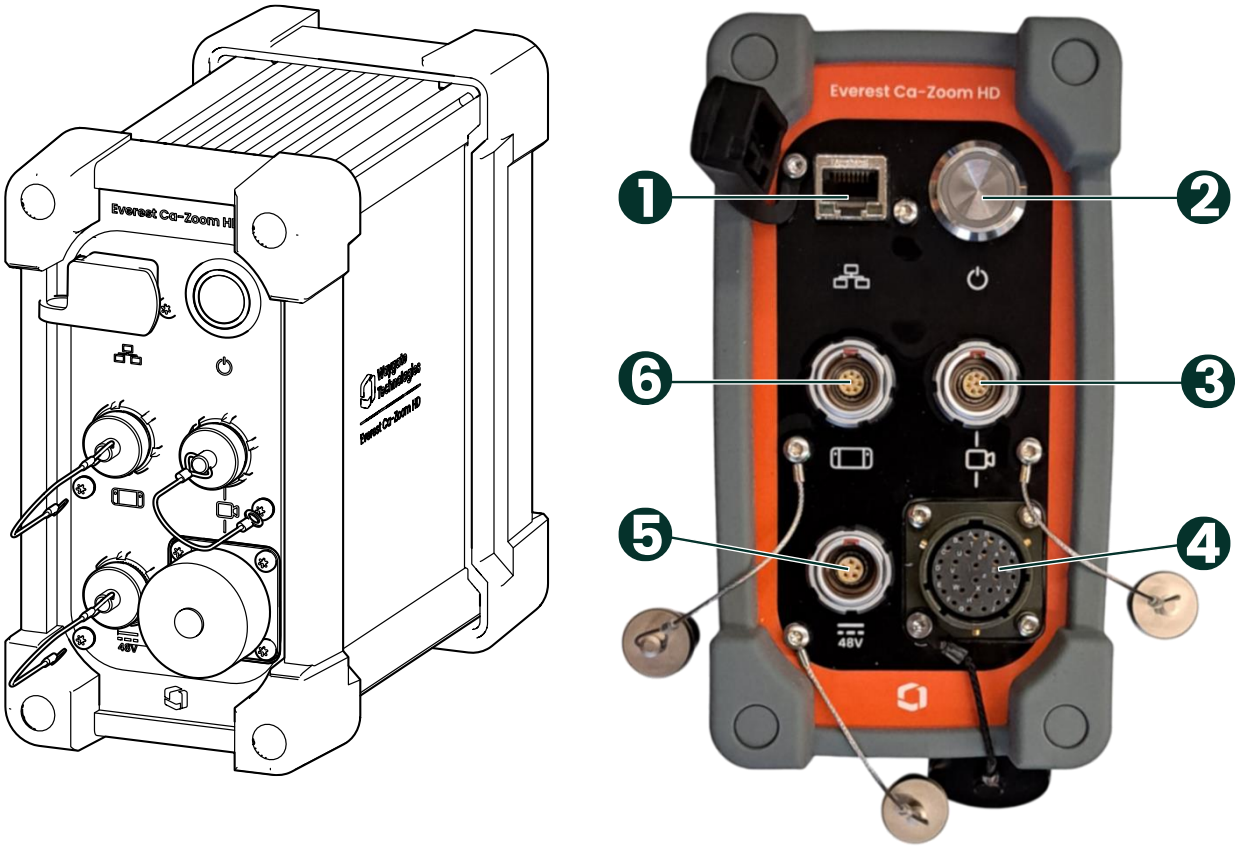
1	Rocker button to zoom in/out	8	Freeze image button
2	Left joystick for pan & tilt control	9	Right joystick for pan & tilt control
3	Light buttons (+/-)	10	Capture image button
4	Touchscreen	11	USB Ports
5	HDMI socket	12	Functional buttons
6	Tablet cable connector	13	LED Indicators
7	Video record button (REC)		Tablet switch OFF/ON
	Open windows explorer		Increase screen brightness
	Show / Hide keyboard		Rotate lock screen
	Reduce screen brightness		Program explorer

Figure 5. Stylus pen

A stylus pen is available in a slot at the back of the tablet. To extract it, pull the attachment to the coiled cord shown in the figure.

LED Indicators	
	Indicates if the battery is connected to a charging circuit, like Power over Ethernet or AC charger. Green: Connected. Off: Not connected
	Activity drive indicator
	Off: Power off/Hibernation Green: Power on Blinking: Sleep Blinking green or orange: cannot power or resume due to low temperature

2.2.5 Camera controller



Perspective view with caps on **View with visible connectors**

Figure 6. Camera controller

1	Ethernet RJ45 jack	4	PTZ camera connector
2	Power button	5	DC power supply connector
3	TZ1 camera connector	6	Tablet connector

2.2.6 Tripod ball joint

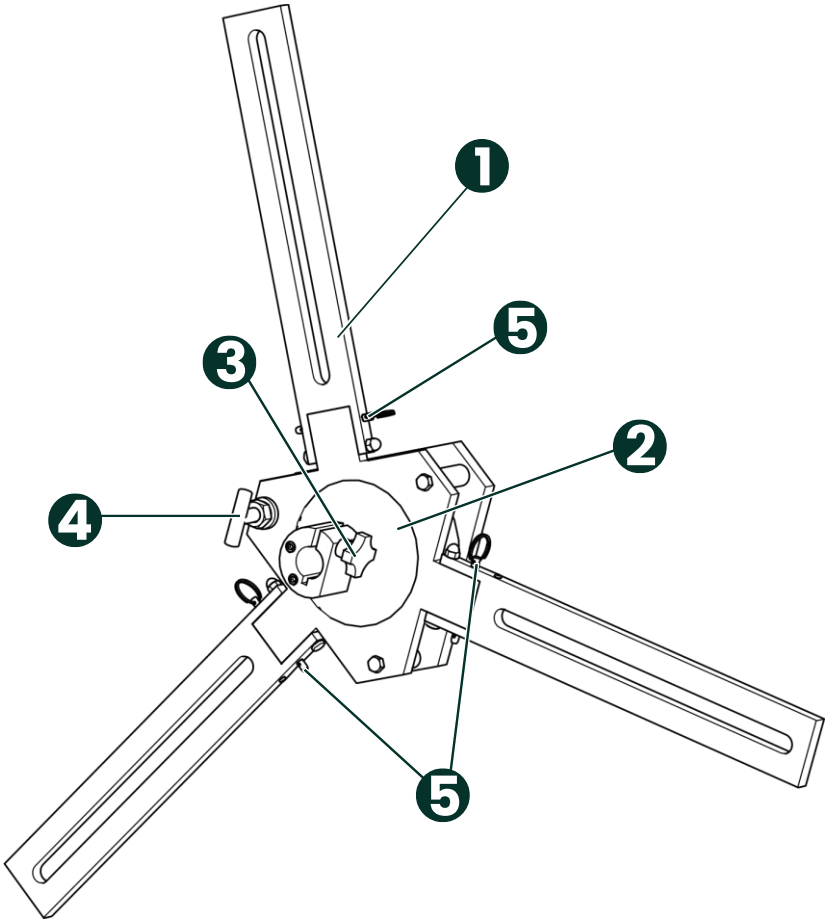


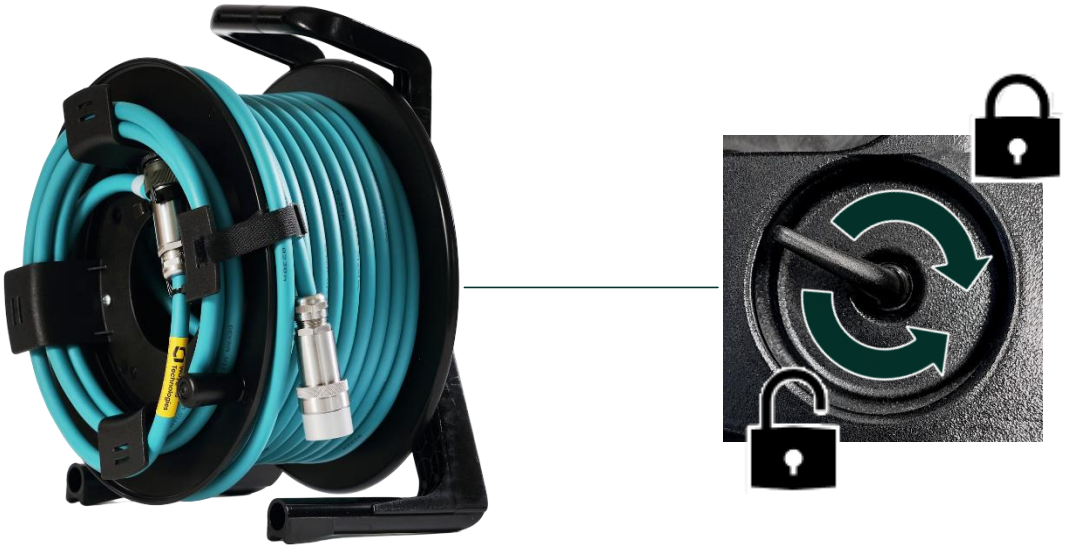
Figure 7. Tripod ball joint

1	Arm (3)
2	Ball joint
3	Pole clamp (cross knob)[1]
4	Ball joint clamp (T-handle)[1]
5	Ball lock pin (3)

[1] See use in section 5.6

2.2.7 Cables

Figure 8. PTZ cable, 10 m / 30 ft length



a) Cable reel b) Drum lock

Figure 9. PTZ cable, 30 m / 100 ft length

a) Cable reel with slip ring

b) Drum lock and winding handle

1	Drum lock
2a	Winding handle retracted (swivel upwards to extract)
2b	Winding handle extracted (pull outwards then swivel downwards to retract as shown by the arrows)

Figure 10. PTZ cable, 70 m / 230 ft

a) 10 m / 30 ft length

b) Cable reel, 30 m / 100 ft length

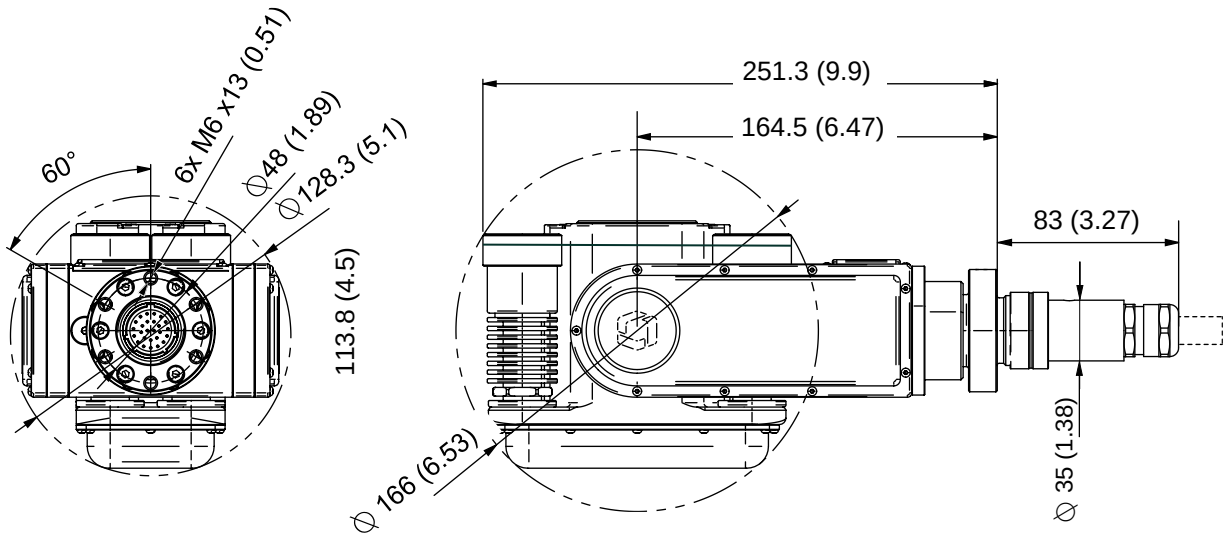
Figure 11. Cables for TZ1 HD camera

Figure 12. Tablet cable, 5 m / 16.5 ft

2.3 Principal dimensions

All length dimensions are in mm (in).

2.3.1 PTZ HD30 Camera



a) **Rear view: Mechanical interface. Diametric dimensions.**

b) **Longitudinal view**

Figure 13. PTZHD30 dimensions (tilt axis at 90°)

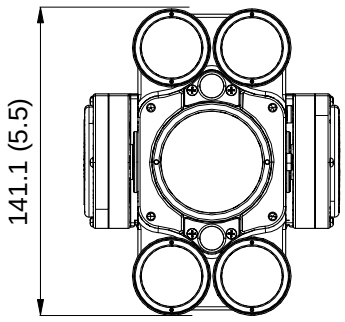


Figure 14. PTZ HD30 dimensions (tilt axis at 0°)

2.3.2 PTZ HD10 camera

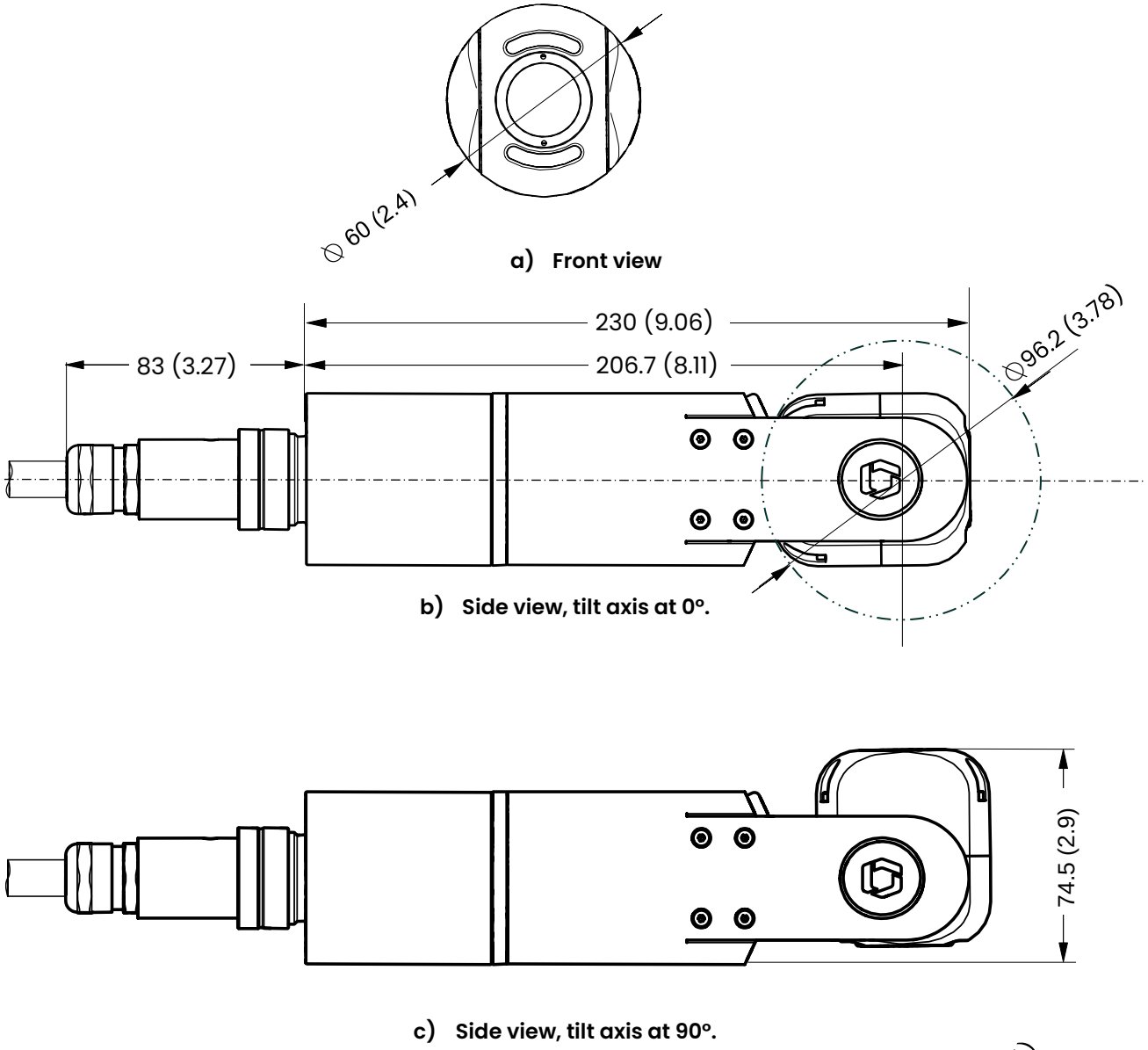


Figure 15. Dimensions PTZ HD10 camera

PTZ HD10 and PTZ HD30 mechanical interfaces share common features (see Figure 13 a). Therefore, they are compatible with the same camera mount.

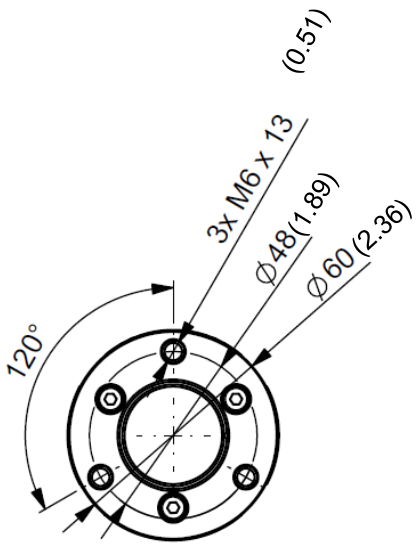
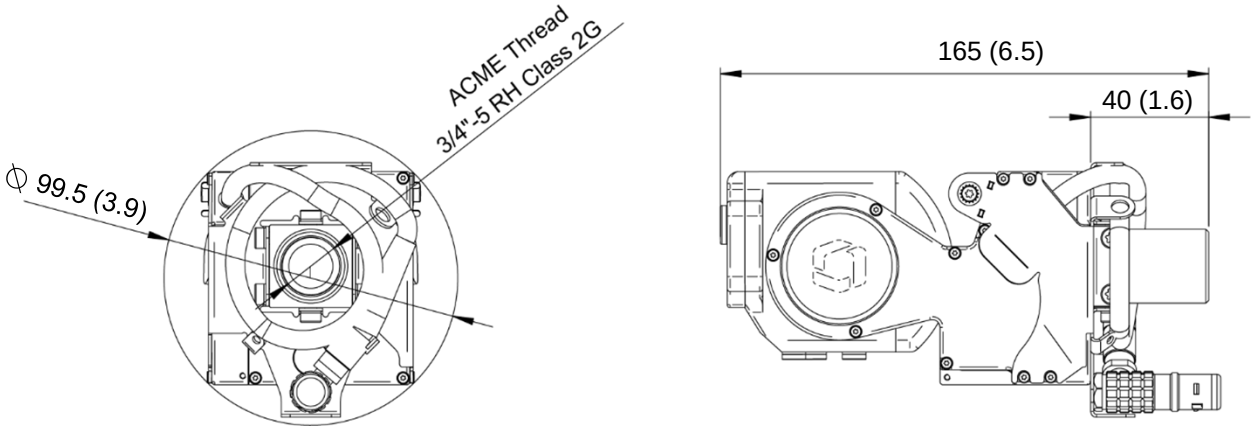


Figure 16. PTZ HD10 mechanical interface.

2.3.3 TZ1 camera



Rear view:
Mechanical interface
Diametric dimensions.

Longitudinal view

Figure 17. Dimensions TZ1 camera

2.3.4 Tripod

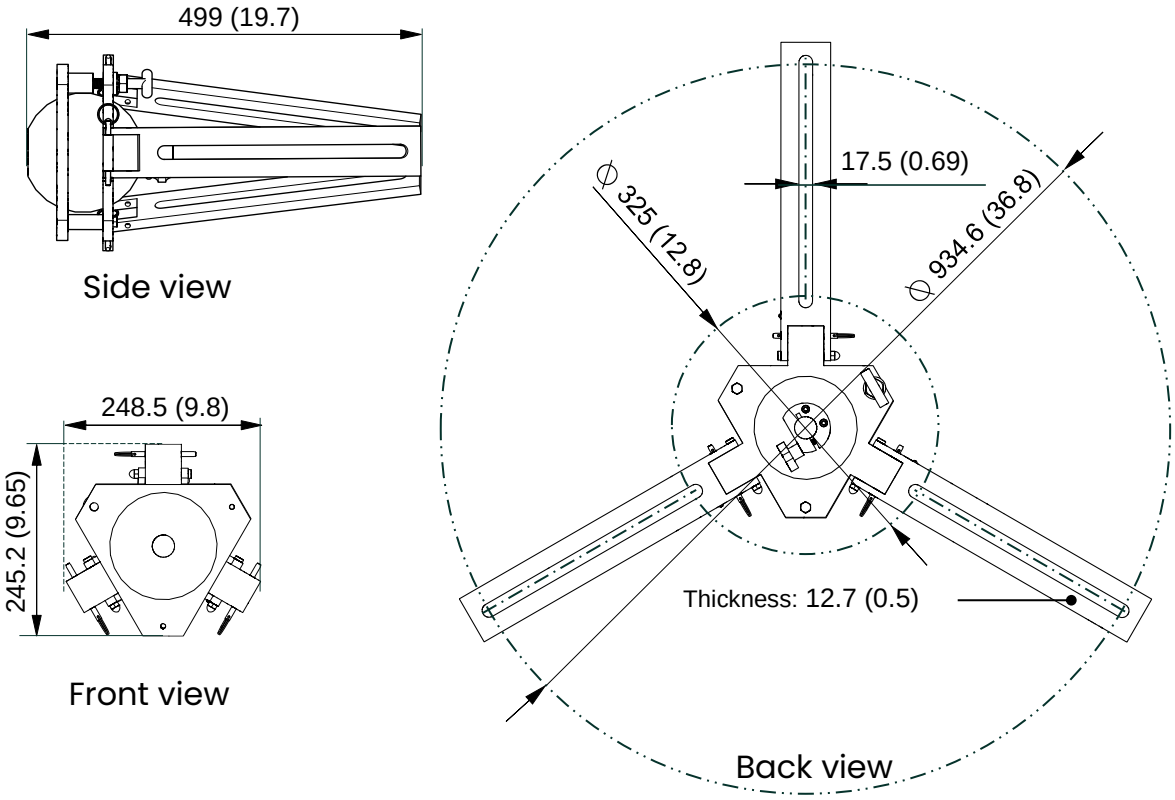


Figure 18. Dimensions tripod

3 Parts and accessories

3.1 Parts list

Part #	Description
PTZ-ACC-PNDNT	Ca-Zoom HD tablet
PTZ-ACC-CASE	Ca-Zoom HD transport case
PTZ-ACC-HD30-HEAD[2]	PTZ HD30 - Inspection camera
PTZ-ACC-HD10-HEAD	PTZ HD10 – Inspection camera
PTZ-ACC-POLEMNT[3]	PTZ HD - camera mount with V4010 pole adapter (camera holder)
PTZ-ACC-C30M	PTZ HD - camera cable 30 m / 100 ft
PTZ-ACC-C10M	PTZ HD - camera cable 10 m / 30 ft
PTZ-ACC-HD30-C70M	PTZ HD - camera cable 70 m / 230 ft
PTZ-ACC-CTRLBOX	Ca-Zoom HD Camera controller with AC/DC power supply
PTZ-ACC-CO2PUMP[4]	CO_2 pressurization device (pump or gas injector)
PTZ-ACC-CO2-3PCS	CO_2 gas cartridge 16 g 3 Pcs
BIKE-ACC-TZ1-CAM	TZ1 HD inspection camera
TZ1-ACC-POLEMNT	TZ1 HD- camera mount for V4010 pole (with pole interface)
TZ1-ACC-C10M	TZ1 HD - camera cable 10 m / 33 ft
TZ1-ACC-C30M	TZ1 HD - camera cable 30 m / 100 ft

[2] All new cameras have this P/N. Earlier models, with marking P/N: PTZ-SYS-HD30-CAM, are compatible.

[3] Earlier models supplied with PTZ HD30 cameras have a 64 mm (2.52 ") outer diameter. New camera mounts produced have a 60mm (2.36 ") diameter to fit to the PTZ HD10 camera.

[4] New devices are designed to fit in the foam inserts shown in the Figure 19. Early models may have a different connector configuration and might not fit to the respective slot.

Part #	Description
PTZ-ACC-TOOLBOX[5]	PTZ HD toolbox
V4010-1036	Tripod ball joint (with three 3 poles V4010-1000)
V4010-1037	Tripod ball joint (without poles)
V4010-1000	Carbon fiber pole – 6 ft (1.8 m) length
V4010-1003	Carbon fiber pole – 3 ft (0.9 m) length
PTZ-ACC-HRNS	Ca-Zoom HD tablet shoulder harness
PTZ-ACC-BKPK	Ca-Zoom HD backpack
PTZ-ACC-PNDNT-C5M	Tablet cable 5 m / 16.5 ft
PTZ-ACC-CORD-EU	Mains power cord C13 EU
PTZ-ACC-CORD-UK	Mains power cord C13 UK
PTZ-ACC-CORD-US	Mains power cord C13 US
PTZ-ACC-CORD-AUS	Mains power cord C13 AUS

3.2 Arrangement in transport case

All devices or accessories are stored in the transport case except:

- cables above 10 m length,
- carbon fiber poles,
- tripod ball joint.

When the site configuration makes access difficult with the standard transport case, WTR recommends the use of the Ca-Zoom HD backpack.

[5] Toolbox includes a set of M6x18 screws, Hex key 5 and 2 mm, 1 cleaning lens cloth, 1 Memory stick and a chart to test the cameras.

1	Ca-Zoom HD Camera controller	7b	TZ1 HD camera
2	Tablet	8	TZ1 HD camera cable
3	PTZ HD30	9	AC/DC power supply with C13 socket
4	PTZ camera mount	10	Pressurization device for PTZ cameras.
5	PTZ camera cable	11	3 slots for optional CO_2 cartridges
6	Tablet cable	12	Toolbox
7a	PTZ HD10 camera		

Figure 19. Arrangement in transport case

Cables for mains are not represented in Figure 19.

4 Equipment handling

chapter 1.

4.1 Transport case

The camera equipment is packed in a wheeled transport case with retractable handle. The transport case has three handles, designed for hand-carried transport.

1	Pivoting handles (3)	3	Lock of retractable handle[6]
2	Retractable handle	4	Wheels (2)[7]

[6] The lock is located close to the retracted handle. To unlock, place the transport case vertically and push upwards. The handle is self-locked when it is pushed in retracted position.

[7] Always roll the case by pulling the extracted handle.

Figure 20. Transport case details

<table>
<tr><td rowspan="2">  </td><td>⚠ CAUTION</td></tr>
<tr><td>The transport case can weight 22 to 24 kg (48 to 53 lbs), depending on included options.

Incorrect handling may result in serious back or shoulder injury.
Wheels can be damaged by rolling across uneven surfaces.</td></tr>
<tr><td></td><td>If you need to move the transport case on foot, use a transport trolley when possible.

Only roll the transport case across reasonable distances and suitable paths.

If you need to lift the transport case, take safety lifting rules in consideration. The loaded case shall be lifted by two persons.

If the site configuration makes access difficult with the standard transport case, consider moving the equipment in suitable smaller packages, which can be transported in compliance with ergonomic principles.</td></tr>
</table>

	**⚠ CAUTION**
	Fingers can be squeezed by transport case latches if correct gesture to open the case is not applied.
	 
	To open the transport case, position your finger under the shorter latch with 6 stripes, and lift-up the latch with your finger. Never place your finger under the longer latch: it can be pinched!

4.2 Tripod

	**⚠ WARNING**
	Hands can be pinched while manipulating the tripod arms.
	Use suitable protective gloves for mounting the tripod. When the tripod arms are not locked with the ball lock pins, do not leave your fingers close to the arm hinges.

4.3 70 m cable reel

	⚠ CAUTION
	The 70 m cable reel weights 24.2 kg (53.2 lbs). Incorrect handling may result in serious back or shoulder injury.
	If you need to transport on foot the cable reel, use a transport trolley. To move the cable reel at height, use suitable lifting equipment. If you must move the cable reel and the path does not allow using a transport trolley, two persons are required to transport it. Always take safety lifting rules in consideration.

	⚠ CAUTION
	The cable reel handle can become a hazard when it is unfolded. It can injure a person walking around or break.
	If you unfolded the handle to wind the cable, do not forget to retract it in transport position, once the cable is completely rolled.

5 Preparation

5.1 Camera use at height

If a camera is deployed at height, vertically or inclined, additional safety measures are required.

Fall risks can significantly increase in situations where the system is not properly mounted, or if an unintentional gesture or event occurs.

Examples:

- If the pole is unintentionally released from the ball joint and the pole is not held by hand or any other mean, it can fall with the camera.
- Poles can break.

<table>
<tr><td rowspan="3">  </td><td>⚠ CAUTION</td></tr>
<tr><td>Equipment fall can severely injure personnel, damage the</td></tr>
<tr><td>Follow procedure for mounting the equipment to the pole or a fixed bracket.

Tether the camera or pole to a safe anchor point, or grasp by hand the camera cable.
For example, you can tether the camera mount with a suitable cable or cord, to secure the whole camera assembly.
By using a tether:
• Consider the path in case of sudden tether or cable tension in work area.
• Control the tether or cable slack continuously.</td></tr>
</table>

	TIPS / ADVICE
	Before installing the camera, check that the lens is clean!

5.2 Immersion in water

PTZ pressurized cameras (2 bars or 29 psi) can be immersed in water, 50 m (164 ft) deep.

TZ1 cameras cannot be immersed !

For underwater use, the camera must be correctly pressurized after cable connection (see section 6.1.1).
For recent cameras, the relative pressure in the camera housing is displayed in the information bar above the camera image. The control software displays an alert, when the pressure value crosses the low-pressure threshold of 0.6 bars (8.7 psi).

5.2.1 Safety instructions related to pressurization

⚠ WARNING

Lack of pressurization, continuous depressurization.
Electronics damage risk.

Before immersing a PTZ camera, the camera **must be pressurized** at minimum 1.9 bar (27 psi), **once the camera is connected**: leaks can occur if the camera is disconnected from the cable.

After disconnecting the camera cable from the camera, always screw the camera cap shown in 6.1.1.1, to mitigate pressure losses through the connector.

Ensure the plug of the check valve is in place when you use or store the camera.

See pressurization procedure in 5.2.2.

⚠ WARNING

Danger from bursting camera.

Camera explodes when over pressurized.

Only use the supplied CO_2 injector to pressurize the camera.

Do not pressurize directly from any other source.

Only use pressurization cartridges approved by supplier.

Do not puncture CO_2 cartridge, heat above 49 °C/120 °F or expose to direct sunlight.

Maximum pressure achievable with this type of cartridge: 2.5 bar (36 psi).

⚠ WARNING

Pressurized CO_2 will suddenly decompress when you press the pushbutton, connect, or disconnect the cartridge from the pressurization device.
Risk of frostbite on skin, dispersion of foreign particles and eye injury (check valve adapter side and cartridge thread area).

Wear protective goggles and gloves when repressurizing camera.

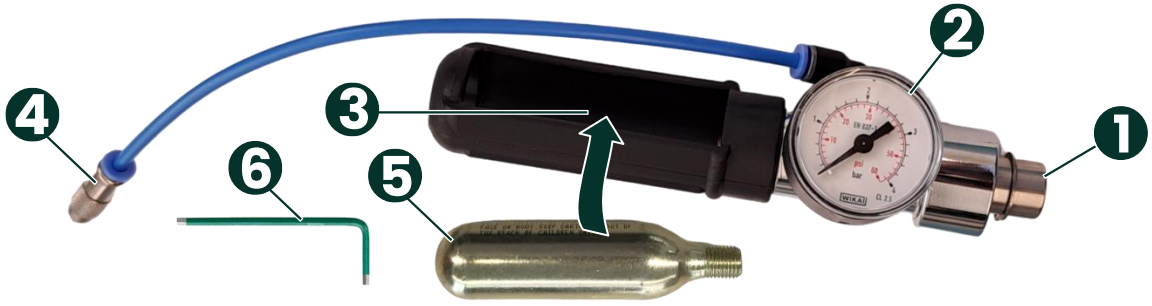
When a new cartridge is installed, screw it fast in one go to minimize CO_2 decompression effects.

Never remove the cartridge with pressure inside: press the button until the CO_2 cartridge is completely empty.

Before pressing the pushbutton, make sure the valve adapter is correctly tightened to the camera.

Do not inhale CO_2.

Do not discharge CO_2 injector towards face or body.



1. Pushbutton
2. Manometer
3. Cartridge housing
4. Valve adapter
5. CO_2 cartridge with 16g CO_2, 3/8-24 UNF threading
6. Hex key, 2mm

Figure 21. Pressurization equipment

5.2.2 Camera pressurization procedure

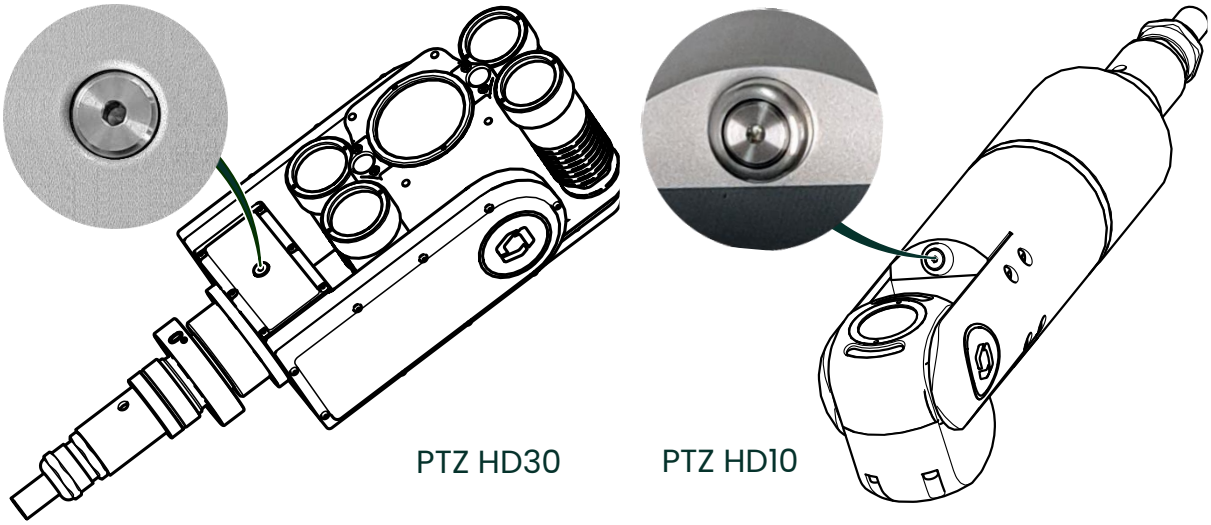


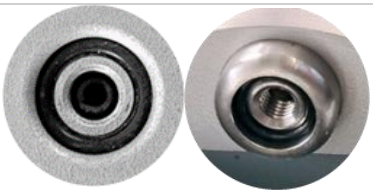
Figure 22. Pressurization valve cap (2 mm hex socket cap screw)

You will need to use the 2 mm hex key supplied in the Toolbox.

Pressurization steps

1. Unscrew the valve screw with the hex key.

2. Ensure the O-ring remains in place.



3. Screw the adapter to the valve.

Press the pushbutton as shown below a few seconds, until the manometer indicates a pressure within 1.9-2,2 bars (27-32 psi) range[8].

4

Figure 23. Pressurization

Alternatively, you can also grasp the cartridge housing with one hand and press the pushbutton with the other palm of your hand.

The pushbutton travel is limited by a ring. Do not alter this function.

5 Unscrew the adapter to disconnect it from the valve.

6 Ensure the O-ring is clean and lightly greased
Tighten the valve screw with the hex key.

7 If you start the camera, you can check the pressure displayed by the control software.

5.2.3 Mount a new CO_2 cartridge

1 If a CO_2 cartridge is mounted in the pressurization device, press the pushbutton until the cartridge is empty (no gas flow). Unscrew half turn to make sure all remaining CO_2 was removed.

[8] If the maximum pressure reached is below 1.9 bar (27 psi), replace the cartridge by a new one (see 5.2.3.).

❷	Unscrew the black cartridge housing: If an empty cartridge remains in the housing, remove it. Insert a new CO_2 cartridge into the housing.
❸	Screw in the cartridge housing until a small resistance is felt, to connect the cartridge to the device. **Tighten it in one go**, without changing your grip, so that no gas escapes or produces frost unnecessarily.

5.3 Camera mount assembly

If the standard pole is used with PTZ HD30 or PTZ HD10 cameras, the following procedure applies:

1	Connect the PTZ camera cable as described in 6.1.1.2.
2	Insert the camera mount along the camera cable. The cable shall slide between the openings of the support flanges.
3	Align the camera mount holes with the corresponding threaded holes of the camera interface.
4	Attach the camera mount to the camera interface with three M6x18 screws.

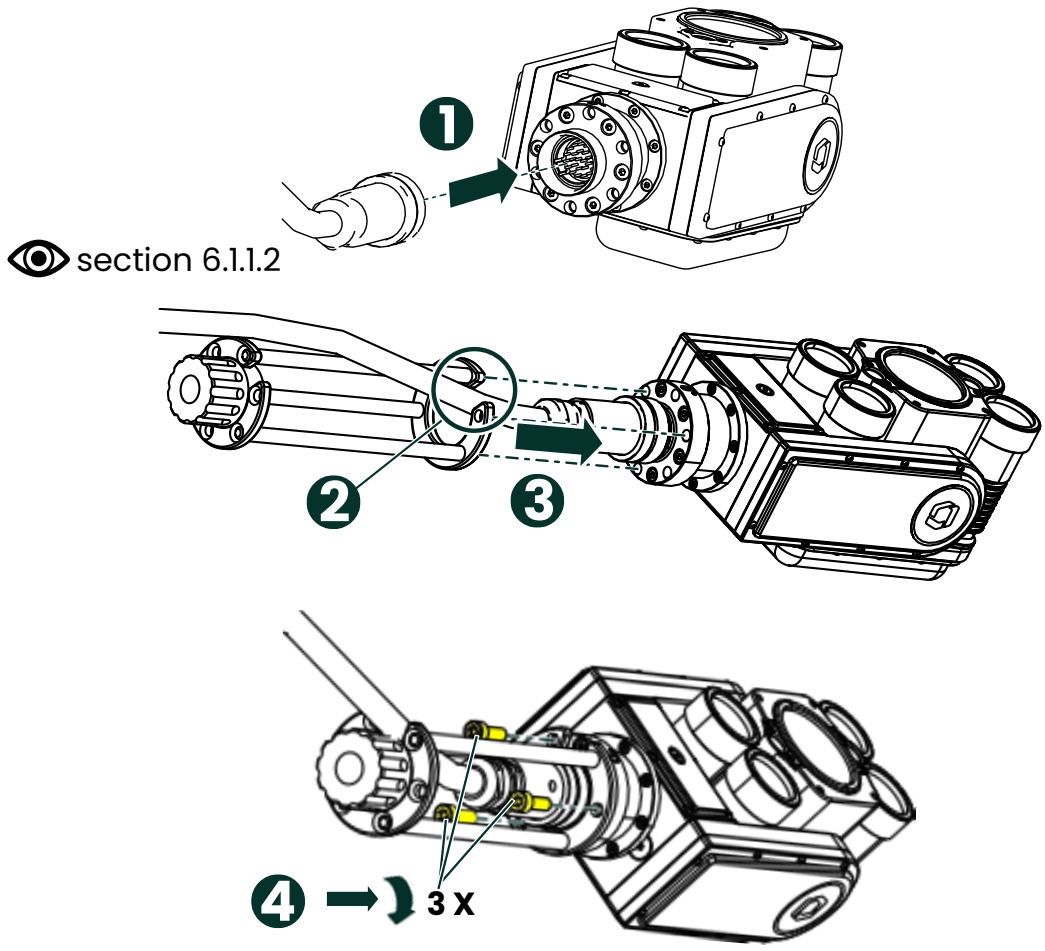


Figure 24. Camera mount assembling (example with PTZ HD30 camera).

5.4 Unfold tripod

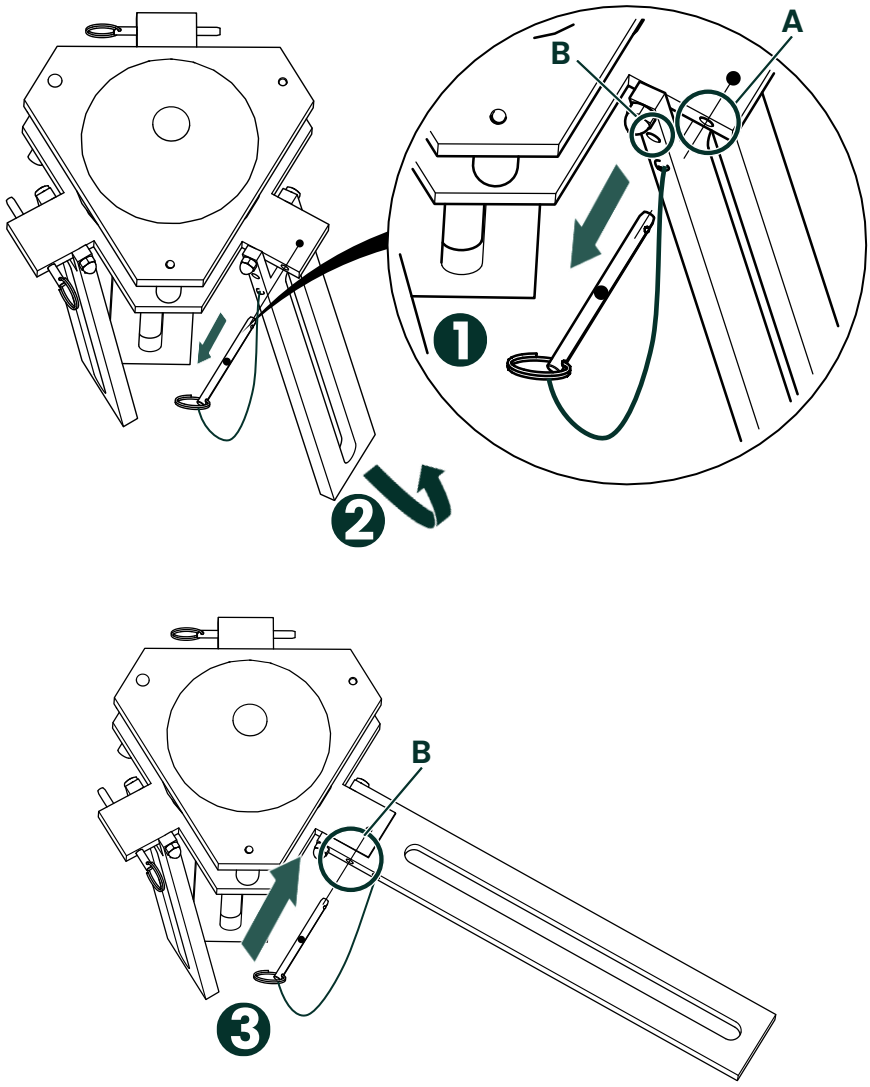


Figure 25. Unfold tripod

For each arm:

1. Remove the ball lock pin.
2. Rotate the arm to align the holes **A** and **B**
3. Secure each arm of the tripod with the respective ball lock pin.

5.5 Assemble pole on tripod

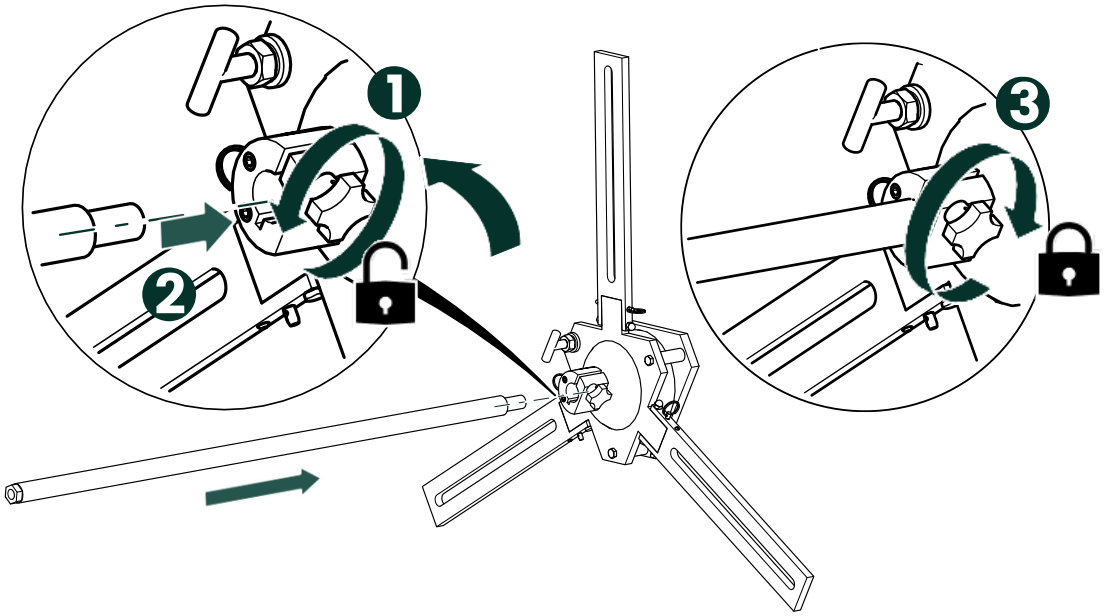


Figure 26. Assemble pole on tripod

1	Loosen the ball-joint insert by turning the cross knob
2	Insert the pole with the threaded side first into ball joint insert.
3	Fasten the pole in the ball joint with the cross knob until you feel it is locked.

5.6 Pole position adjustment with tripod

The pole position is secured by turning clockwise by hand the T-handle and the star knob, until you feel it is blocked. They are shown in Figure 7.

The position can be changed by turning counterclockwise the respective knob (for swivel motion) or T-handle (for translation motion).

⚠ Make sure you lock the pole position before executing another task!

Swivel motion:

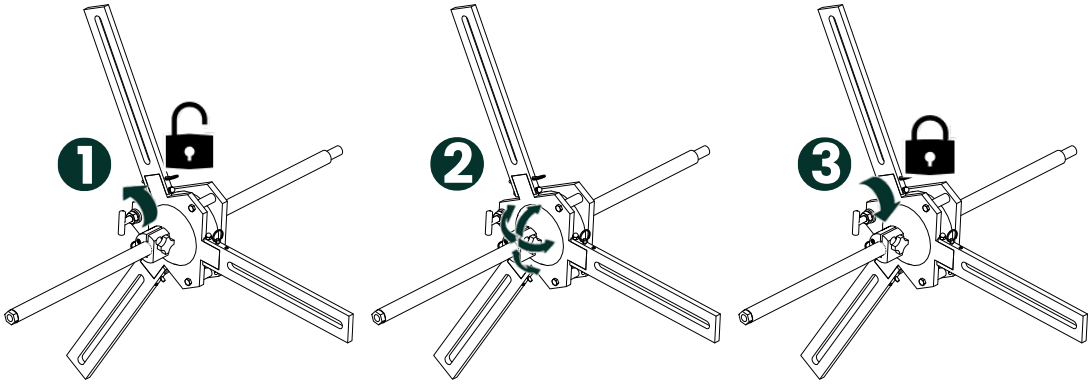


Figure 27. Ball-joint rotation

1	Turn the T-handle until you can rotate the ball-joint.
2	Swivel the pole to the desired angle.
3	Tighten the swivel rotation lock by turning the T-handle clockwise.

Axial motion:

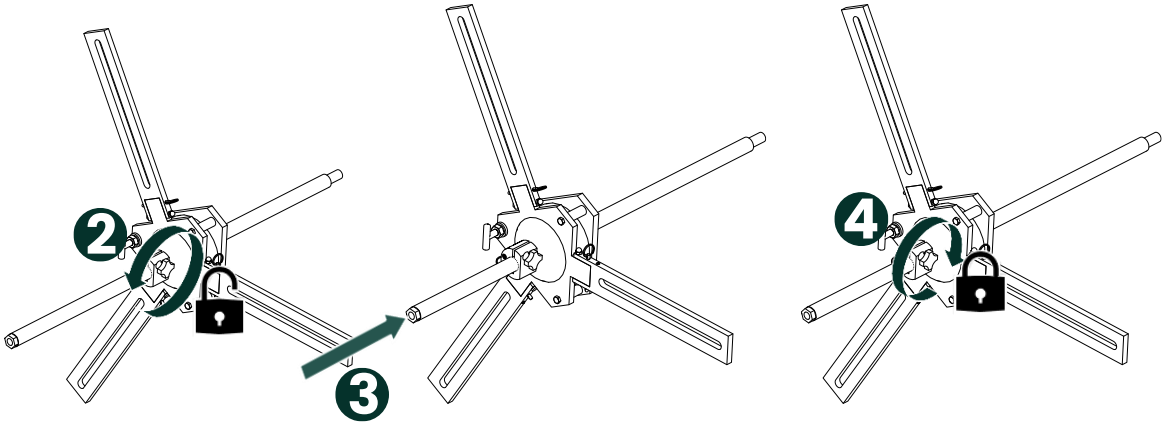
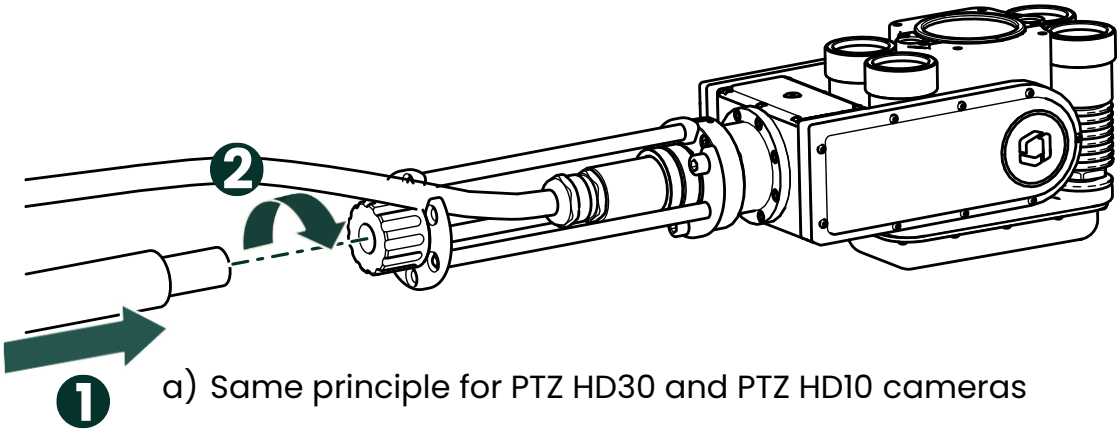


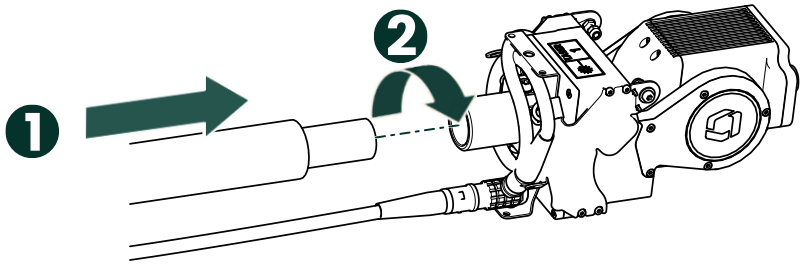
Figure 28. Axial move through the ball-joint

1	Steady the pole by firmly gripping it or by securing it otherwise, to make sure that it does not accidentally slip out of the ball joint or tilt downward.
2	Slowly turn counterclockwise the star knob until you can slide the pole.
3	Move the pole axially through the ball joint to the desired position.
4	Tighten the axial motion lock, by turning the knob clockwise.

5.7 Camera mounting on the pole



a) Same principle for PTZ HD30 and PTZ HD10 cameras



b) TZ1 HD camera

Figure 29. Camera assembly on pole

1	Align the pole threaded end.
2	Screw and tighten by hand.

Two poles can be stacked together:

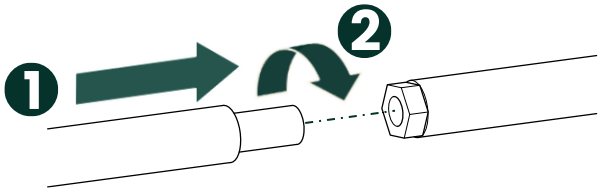


Figure 30. Poles assembly

5.8 Tripod mounting on manhole

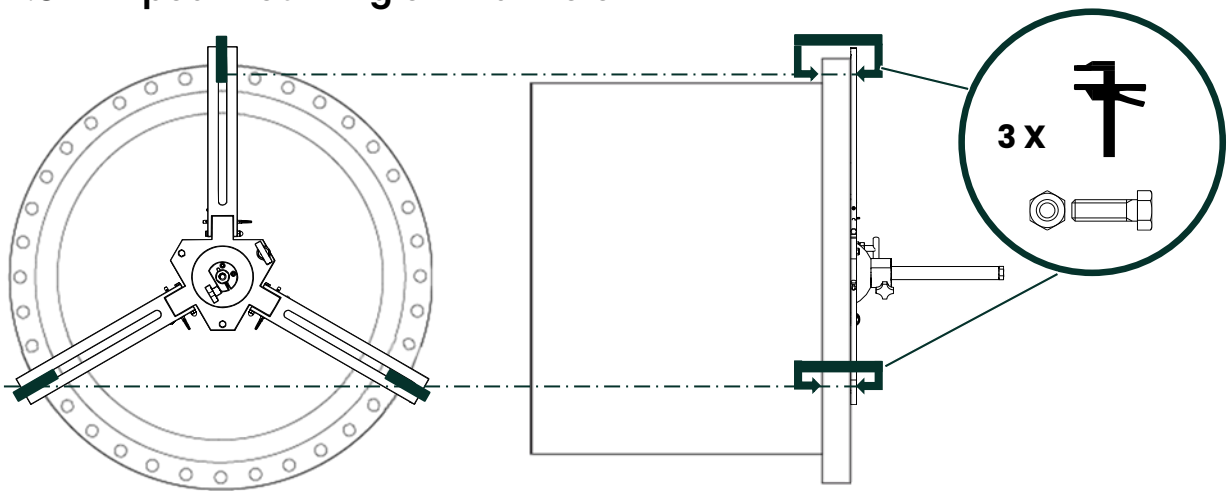


Figure 31. Tripod mount

The tripod is typically used for inspection in confined spaces. It is attached to the flange of the manhole to help the operator maintain a stable camera position inside the confined space.

In many situations this is a two-person operation.

Tripod arms can be either attached either with bolts[9] or suitable clamping systems[10]. Ensure the mounting can support the force induced by the weight of the camera and the pole (up to 11 kg or 24 lbs).

1. Position the tripod (with pole and camera installed) to the manhole as shown in figure above.
2. A second person shall assist to install the clamping devices or to bolt the tripod arms to the flange.

[9] The oblong holes of the arms are designed for M16 or UNC 5/8”x 11 bolts.

[10] One-handed clamps are recommended.

6 Interconnection

	**⚠ CAUTION** Connectors can be progressively damaged if mechanically stressed. • Always replace again the connectors caps or plugs, shown in section 6.1.1.1 and 2.2.5, Figure 6 when the connectors are un-mated. • Do not strain the male connector while you try to align it with the socket before mating: make an additional loop if required. • Do not pull the cables when connectors are plugged. • Do not put any load (axial or lateral) on the plugged connectors. • Always try to optimize the cable path to minimize axial or lateral loads on the plugged connectors.

	**⚠ CAUTION** Defective sealing can induce electrical hazards and operational issues. Check seal integrity and cleanliness on the connectors.

6.1 Connectors and fittings

6.1.1 PTZ Camera cable connection

6.1.1.1 PTZ connector protections

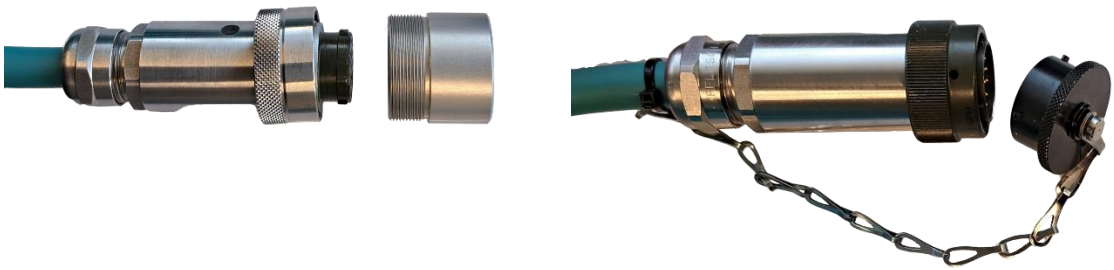
The PTZ HD30 and HD10 cameras have a sealed cap screwed on the electrical socket. It protects the camera connector and minimizes CO_2 leaks when the camera is pressurized.

Unscrew the plug to access to the connector socket.

Figure 32. PTZ socket cap

The PTZ cables have protection caps for both sides.

Always mount them once you disconnect the cables.



a) Screw cap on camera side b) Bayonet cap on controller side

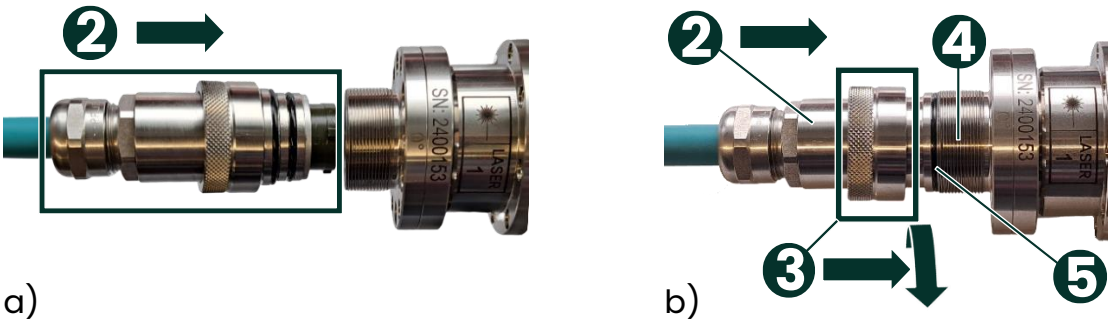
Figure 33. Cable connector caps

	TIPS / ADVICE
	Once you remove the PTZ socket plug or PTZ cable screw cap, keep it safe inside the transport case or the toolbox.

6.1.1.2 Connection to PTZ camera

a) **Camera connector socket** b) **Camera cable plug connector**

Figure 34. Screw-in connectors on PTZ camera side



1	Align the alignment key with the socket keyway (above pin A) to insert it.
2	Insert the plug into the socket and press (see tip below).
3	Screw and tighten by hand the connector ring on the socket thread 4.

Figure 35. Camera cable connection

	TIPS / ADVICE
i	In Figure 35 b), you can see the black O-ring 5 touching the socket. The O-ring shall be manually pressed by pushing the plug against the socket until the threaded ring 3 is tightened with the other hand.

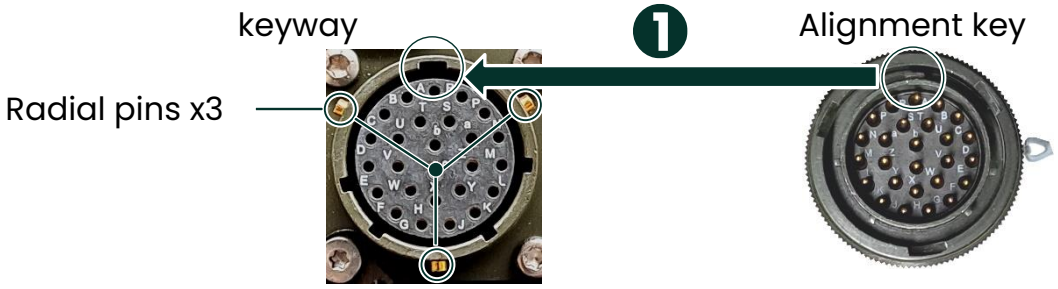
6.1.1.3 Cables with reel

Unlock the drum to unwind the useful cable length required for your application.

If you use 30 m cables, unwind before you connect the cable to the camera controller.

This precaution is not necessary if you use the 70 m cable which has a slip ring.

6.1.1.4 Connection to camera controller



c) Camera-controller connector socket d) Camera cable plug connector

Figure 36. Bayonet connectors on camera controller side

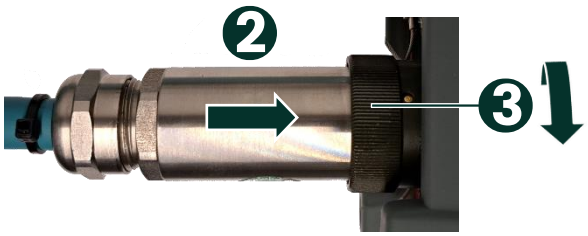


Figure 37. Camera-controller cable connection

1	Align the alignment key to the socket keyway (above pin A).
2	Press the connector to the socket.
3	Turn clockwise the bayonet ring by hand until it is locked by the 3 radial pins.

6.1.1.5 PTZ Camera cable disconnection

To un-mate the PTZ connectors, just unscrew or turn counterclockwise the connector ring.

	TIPS / ADVICE
	Once the PTZ connectors are mated, the PTZ bayonet or threaded rings can be difficult to disconnect. Press the plug towards the socket while un-mating the connectors. It will be easier to loosen the ring, by reducing the friction between the mated parts.

Replace all the connector protections (PTZ camera, PTZ cable on both sides and Camera controller), previously removed to connect the devices.

6.1.2 Push-pull connectors

All other cables have cylindrical push-pull connectors with a self-latching system to facilitate connecting and disconnecting of the connectors.

To **connect** the cylindrical push-pull connectors:

- Line up the red dot on the connector shell with the red index mark on the socket.
- Push the connector in axial direction to engage the latches.

	⚠ CAUTION
	If a connector does not easily fit into the socket, it can incite the operator to apply too much force. As a result, pins can be seriously damaged.
	If a connector does not engage the latches within the socket, never apply more pressure than usual. Re-check for correct orientation of the shell and alignment of the pins.

To **disconnect** the cylindrical push-pull connectors:

- Pull on the outer shell release sleeve of the connector to disengage the latch.
- Remove the connector from the socket.

6.2 Connection between camera controller and equipment

<table>
<tr><td rowspan="3">  </td><td>⚠ WARNING</td></tr>
<tr><td>Trapping, crushing fingers, hands, or arms.</td></tr>
<tr><td>Secure boxes, equipment, and cables to prevent unexpected displacement.

Use safety rope if required.</td></tr>
</table>

All push-pull connectors are the same size. However, they are equipped with coding keys to make sure a plug can only be connected in the right socket.
See Figure 6 to identify the different connections.
The following icons are used:

DC Power supply,


Tablet,


Camera:

- push-pull connector for TZ1 HD camera above icon,
- PTZ bayonet connector below icon.

Connect the system as shown in Figure 38.

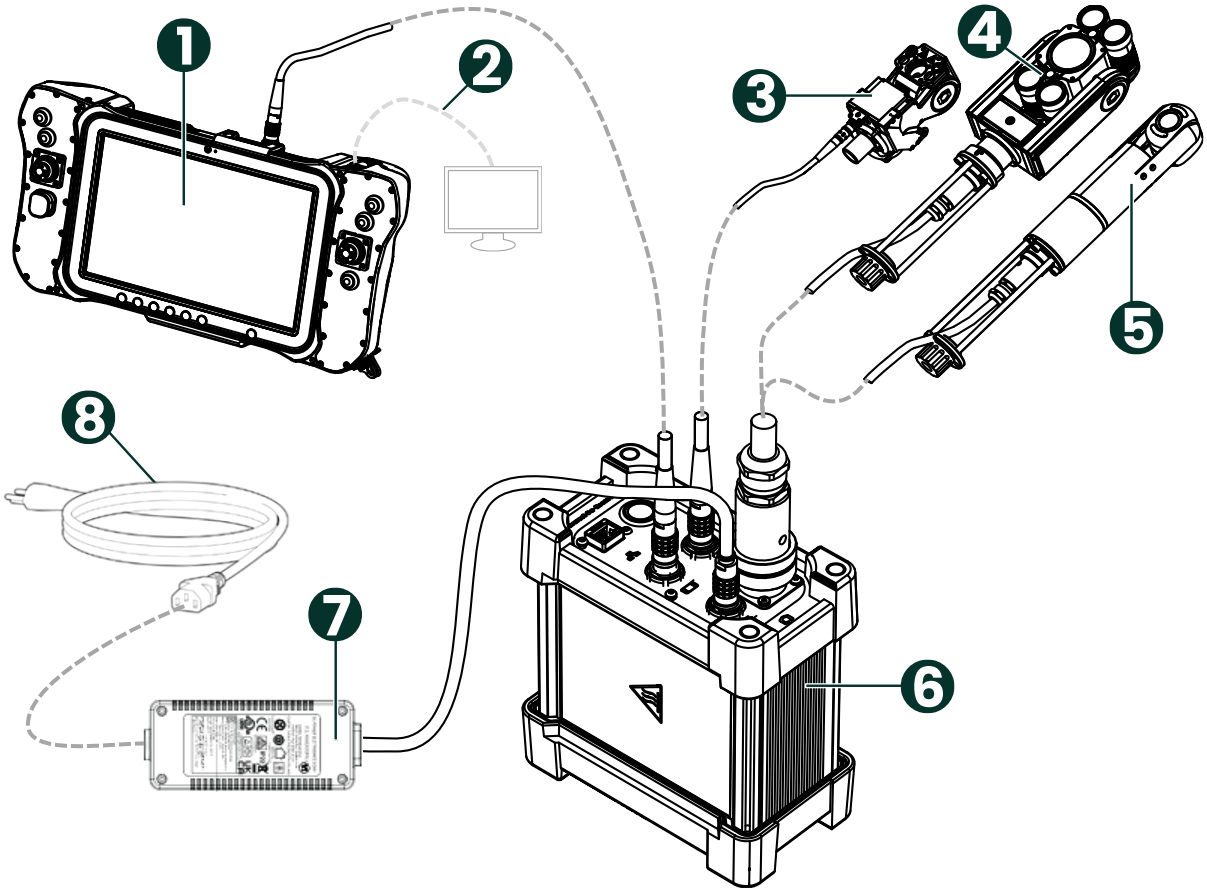


Figure 38. Equipment connection

1	Tablet	5	PTZ HD10 camera
2	HDMI port for optional display	6	Camera controller
3	TZ1 camera[11]	7	AC/DC power supply (150 W)
4	PTZ HD30 camera	8	Mains power cord with ground

6.3 Connection to the mains

Check you have a power cord with C13 connector compliant with the local mains socket.

Once all equipment interconnections are finished, connect the power cord to the AC/DC power supply, then to the mains.

[11] The TZ1 camera cannot be simultaneously used with a PTZ camera.

7 System start

7.1 Power on the Everest Ca-Zoom equipment

	**⚠ WARNING**
	Risk of damage to eyes.
	Do not look directly into the lights when switched on. Temporary blinding might occur.

	**⚠ WARNING**
	Interconnection changes while the system is powered can damage the electronics.
	Do not connect or disconnect camera cables once the camera controller is powered.

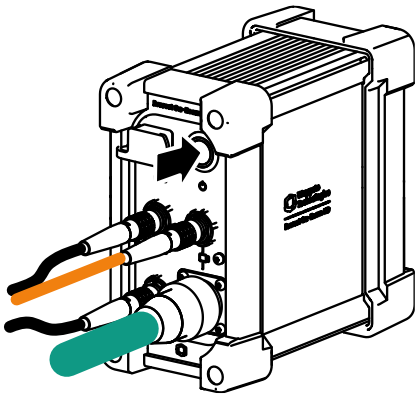


Figure 39. Power on camera controller

Press the power switch button to start the camera controller.

If the camera controller is already switched on and you need to change interconnections for any reason, switch off the camera controller first.

7.2 Tablet start

Press the tablet switch ⏻ and hold until the screen switches on (1-2 seconds).

8 Software

The Ca-Zoom HD software is explained using PTZHD30 camera as an example. The user interface used for PTZ HD10 and TZ1 HD is identical except for some icons related to hardware differences.

Example: the TZ1 HD camera has no pan axis, the PTZ HD10 has no laser and only one switch for two lights.

After startup, the system presents the user with the available camera applications.

Figure 40 Camera App Launcher

Tap on the image showing the connected camera.

8.1 Main screen of the Ca-Zoom HD software

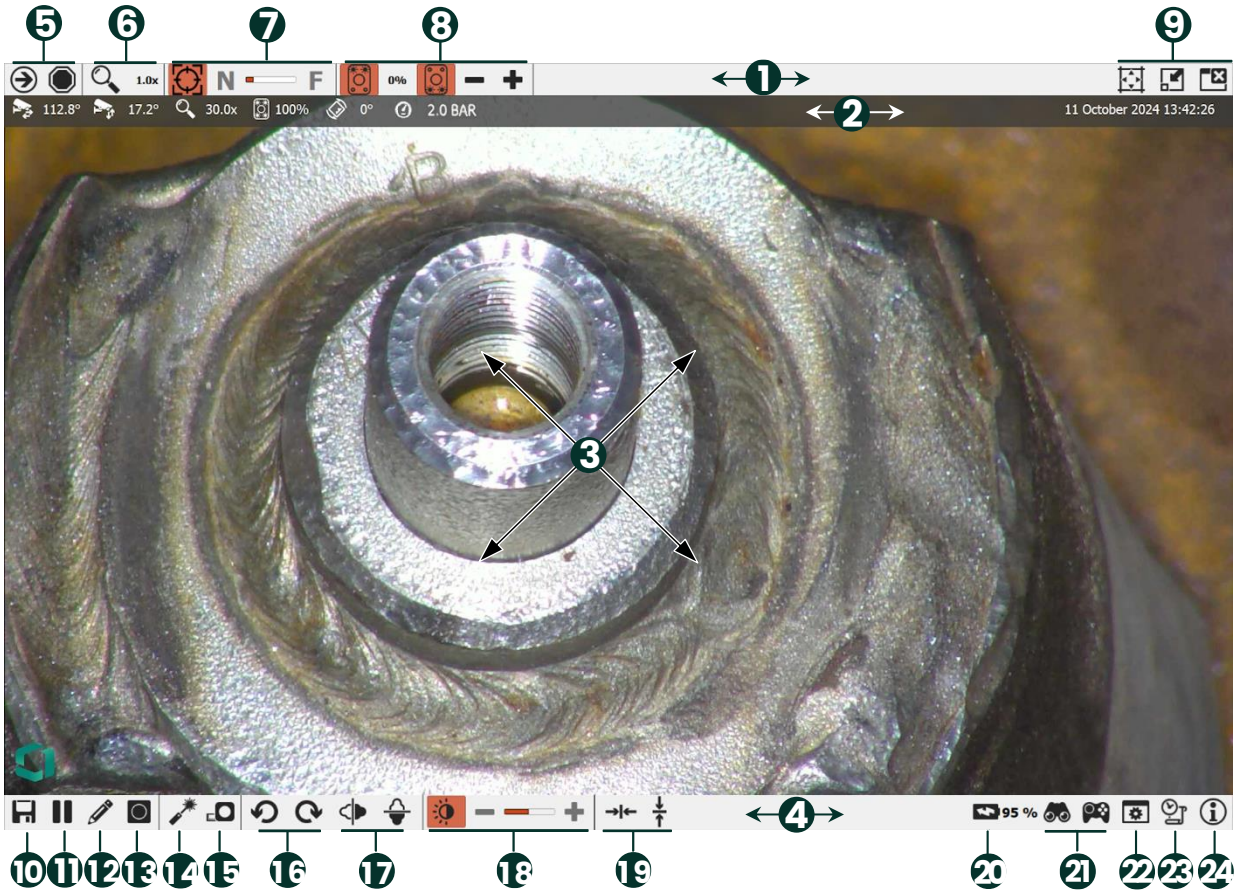


Figure 41. Ca-Zoom HD software application

Functions are available in the main top and bottom bars ❶ and ❹ .

The image overlay bar ❷ displays camera related status information. Details are described in section 8.5.

	TIPS / ADVICE
	The default user interface language is English. The dialog to change the language is shown in section 8.6.2.

8.2 Functional hardware tablet buttons

See functional buttons located in the tablet frame below the screen, described in section 2.2.4 ⓬.

Use this button to activate / deactivate the on-screen keyboard to type text or a value. You can change the keyboard language setting.

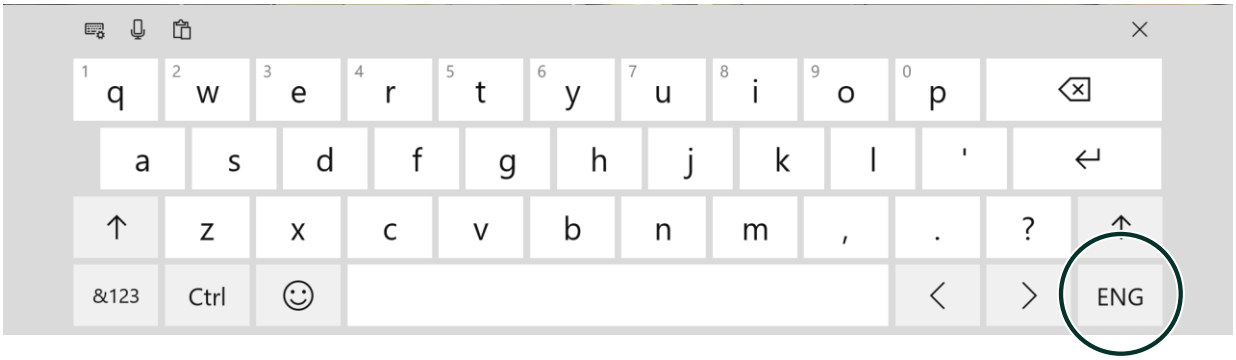


Figure 42. Virtual keyboard (English)

Use this button to manage your files (images, videos) and folders.

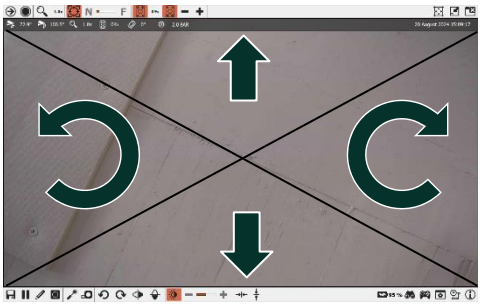
8.3 Software buttons

Tap (briefly touch) on a button with one finger to interact.

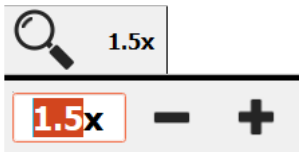
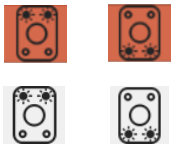
You can make the same gesture with the stylus pen.

Icon	Function status	Action
	Activated	
	Deactivated	

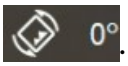
The available functions are described in the following table.

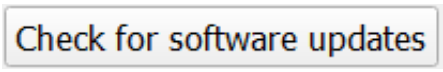
N°[12]	Name	Description
❸	Pan & tilt control	Tap on one of the 4 image sections shown below to move the camera in the arrow direction, by 5° steps.  Tilt axis Pan axis You can also use the left or right tablet pan & tilt joysticks, shown in section 2.2.4 ❷ ❾.
❺	Position group	Displays a sub menu. Example:  Tap **Home** to move to the default deployment position (smallest camera diameter) Tap **Zero** to move to pan 0°, tilt 0°, with 1.0x zoom. All other stored positions can be overwritten by the user. All positions can be exported and imported. Writes the current pan- and tilt-angles and the zoom value to the corresponding position. Edit the position button name. Stops camera motion during a position move.

[12] The number refers to the captions shown in Figure 41.

N°12	Name	Description
6	Zoom group	 Displays the current zoom factor. To modify the zoom setting, tap the magnifier icon: Increase or decrease zoom in steps of 0.1, or by directly typing a value.
7	Focus group	 Automatic focus  Manual focus. Manual focus adjustment by tapping the respective buttons **N** (near) and **F** (far). The manual focus can be set to “discrete mode”, resulting in large course steps or to “continuous mode” with very small steps. The setting can be changed as described in section 8.6.1.
8	Light group	 Activate / Deactivate top lights and bottom lights. (PTZ HD30, TZ1 HD)  Activate / Deactivate all lights together. (PTZ HD10  Adjust the intensity of the lighting in 10% steps.  The tablet light buttons (+/-) do the same. See section 2.2.4 ❸.
9	Window functions	 Full screen  Minimize  Close application

N°12	Name	Description
⑩	 Save image in a file	Saves the current camera view to a file. If a dialog is shown depends on the Automatic file naming setup as described in section 8.6.2.  The camera button on the tablet does the same. See section 2.2.4 ⑩.
⑪	 Freeze image	Freezes the current camera view. Tap again to unfreeze.  The freeze button on the tablet does the same. See section 2.2.4 ⑧.
⑫	 Annotation mode	Activates annotation mode. This mode allows for adding text and graphics to the current camera view. See section 8.7.
⑬	 Video recording	Start and stop video recording. The video file(s) will be stored in the directory, which is set in the menu “Camera setup”. REC The video record button on tablet does the same. See section 2.2.4 ⑦.
⑭	 Laser	Switches the lasers on or off (PTZ HD30 or TZ1 camera), see also section 2.2.2. If Sizing is activated, the lasers will automatically switch on.
⑮	 Sizing	Activates the sizing function. This works in combination with the lasers in PTZ HD30 and TZ1 HD cameras. See section 8.7 and 9.

N°[12]	Name	Description
16	Rotate image	 Rotates the camera image in 90° steps. The resulting orientation is displayed in the image bar  . See also section 8.5
17	 Mirror image	Mirrors the camera image vertically or horizontally.
18	Brightness	 Automatic image brightness.  Manual image brightness with  buttons.
19	Reverse pan / tilt	When using the tablet pan & tilt joysticks:  Reverses pan axis movement direction.  Reverses tilt axis movement direction.
20	 Battery	Displays the battery status and charge in %
21	 Connections	See section 8.4
22	 Setup group	See section 8.6
23	 System log	Opens the system log. This is used for troubleshooting. A log file can be exported to be shared with technical support.

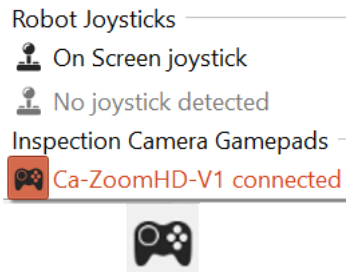
N°[12]	Name	Description
24	Software information	 **Figure 43. Software information window** Displays information about the software.  Starts a software update when connected to the internet[13].

8.4 Connection functions

Icon	Name	Description
	Device discovery	For troubleshooting only. Reconnects operational devices if Ethernet connection was lost.

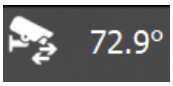
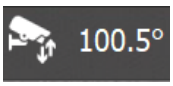
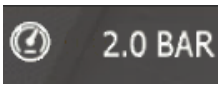
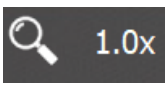
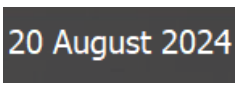
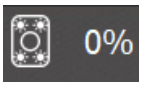
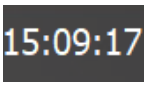
[13] Means to connect the tablet to internet:

- Use a Wireless-USB adapter (connect to a local Wi-Fi network or create a hotspot with Android smartphone).
- Connect the tablet to a wired Ethernet network.

Icon	Name	Description
	Input device	Change the camera control device to joystick alternatives.  Two options are available: 1) A virtual (on screen) joystick. 2) A compatible external gamepad controller connected to a USB port on the tablet. A button mapping example with a Logitech gamepad is shown in Appendix B .

8.5 Image bar

The overlay bar displays the current camera status. Captured images will contain this information.

	Pan angle		Image rotation angle
	Tilt angle		Pressure inside camera
	Zoom value		Date
	Light intensity		Time

If the gas pressure inside the camera falls below 0.6 bar (8.7 psi) the pressure information is shown in red.

8.6 Setup functions

This icon opens the camera setup dialog. To select another setup type, tap on the respective tab (Application, Calibration, ...)

8.6.1 Camera setup

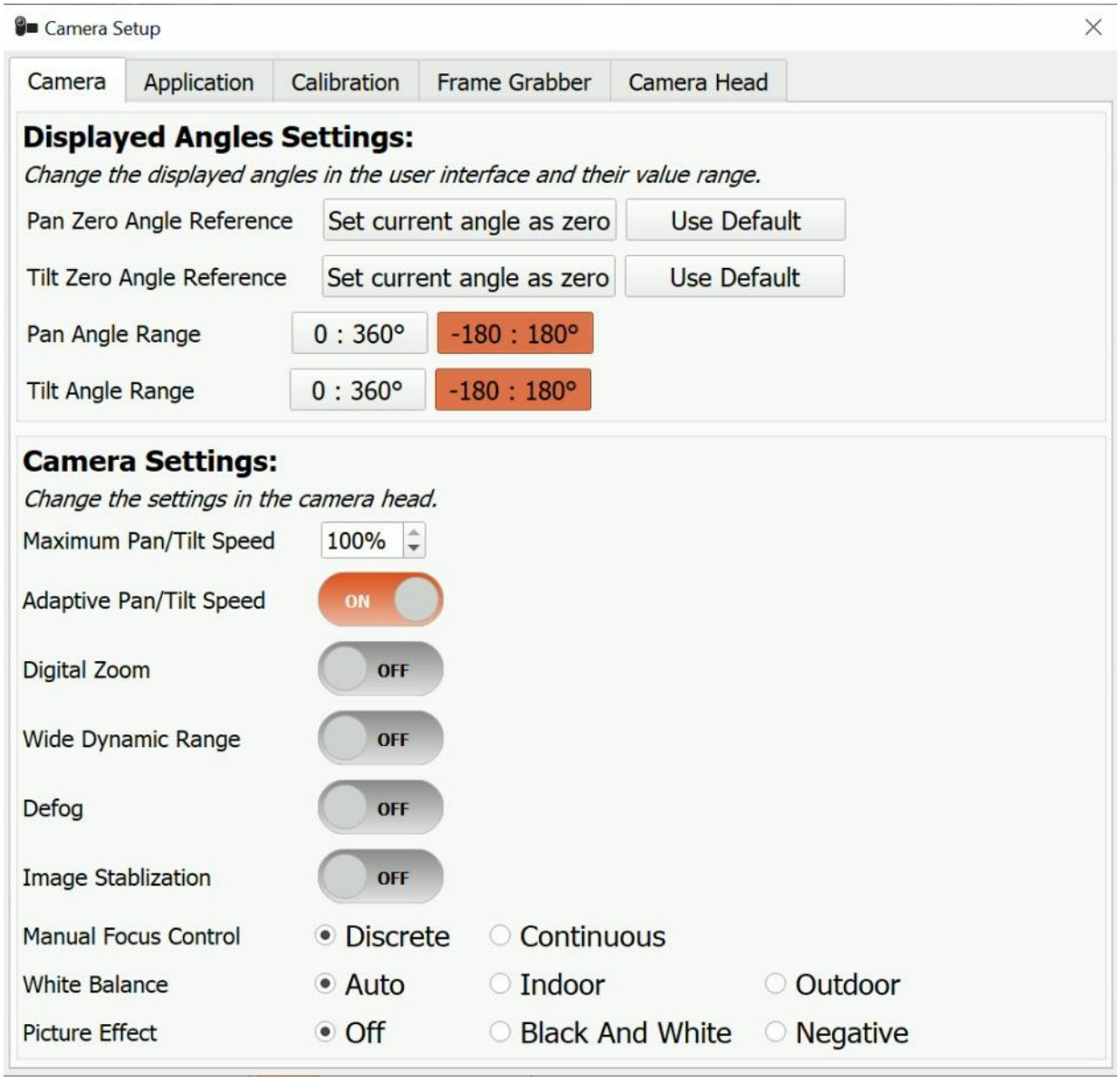


Figure 44. Camera setup for PTZ cameras

The version for the TZ1 HD camera does not include:

- Pan settings
- Calibration tab
- Negative picture effect

Designation	Function
Pan Zero Angle Reference	This can be used to give the camera a new zero point.
Tilt Zero Angle Reference	This can be used to give the camera a new zero point.
Pan Angle Range	Toggle the displayed pan-angle range between [0: 360°] or [-180: 180°]
Tilt Angle Range	Toggle the displayed tilt-angle range between [0: 360°] or [-180: 180°]
Maximum Pan/Tilt Speed	Allows to reduce the maximum pan and tilt speed for joystick use.
Adaptive Pan/Tilt Speed	With adaptive pan/tilt speed applied, the rotation speed of the camera correlates with the current zoom factor: the higher the zoom factor, the slower the rotation speed.
Digital Zoom	Toggle on to add digital zoom to the 30x optical zoom range.
Wide Dynamic Range	Toggle on to compensate for strong differences in contrast and brightness.
Defog	Toggle on to enhance contrast and saturation of the image.
Image Stabilization	Toggle on to use the built-in image stabilization of the camera.
Manual Focus Control	Discrete: Manual focus steps are course, allowing to move the focus quickly with low precision. Continuous: Minimum size focus steps for accurate focus adjustments.

Designation	Function
White Balance	Select the white balance settings to correct colors in correlation to the light source.
Picture Effect	Select a picture effect to make certain defects more visible.

8.6.2 Application settings

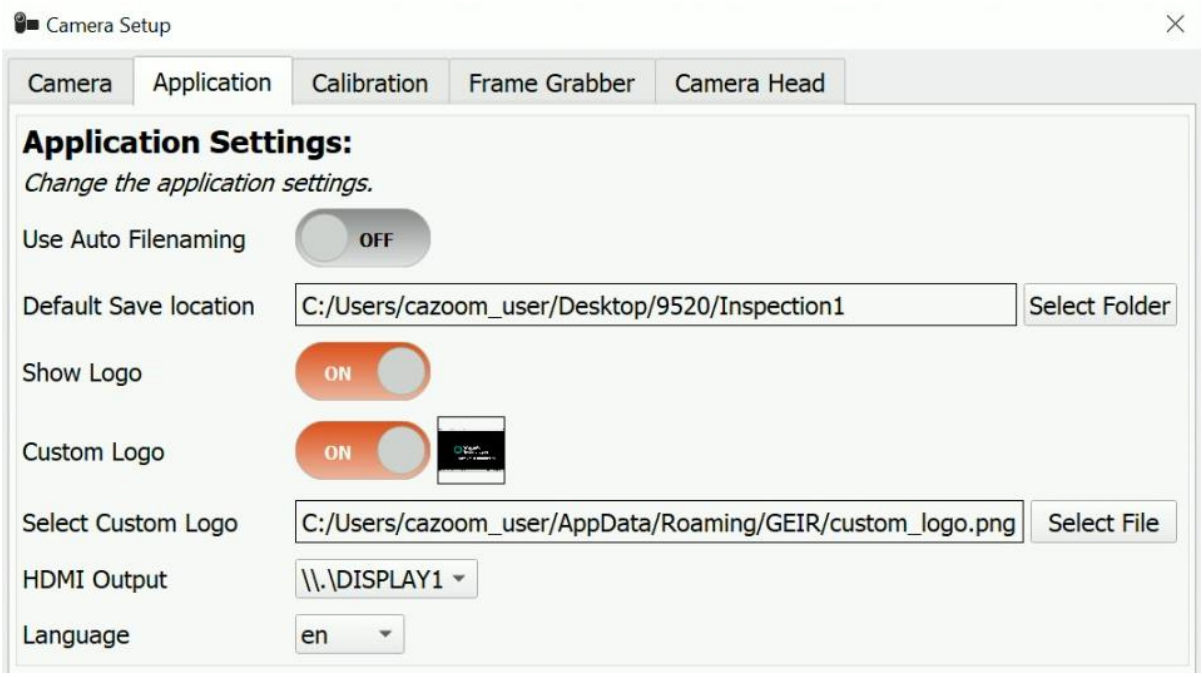


Figure 45. Application settings

Designation	Function
Auto File naming	Toggle on to use automatic naming of the saved files. **Auto File naming enabled:** No dialog will pop up when capturing an image. The image will be stored with the file name "Inspection_Camera_YYYY_MM_DD_HH_MM_SS", in the folder: "/Default location/Inspection_Camera_YYYY_MM_DD/". • YYYY, MM and DD is the current year, month, and date. • HH, MM and SS is the current time in hours, minutes, and seconds. **Auto File naming disabled:** A dialog window will open and proposes to save the image in the Default Save location with the name "Inspection_Camera_YYYY_MM_DD_HH_MM_SS". The location and name can then be changed manually.
Default Save location	Select a folder as the default location for the saved files.
Show Logo	Toggle on to show a logo in the lower left side of the image. The logo will be overlayed on any captured images and videos.
Custom Logo	Toggle on to use a custom logo to be shown.
Select Custom Logo	Allows the user to select a custom logo image file in PNG, JPG or JPEG format. The image is automatically scaled to the correct size.
HDMI Output	Select an additional display connected to the HDMI port.
Language	Select a user interface language. The system must be restarted to apply the changes.

8.6.3 Calibration

This section is applicable for the PTZ cameras only.

	TIPS / ADVICE
	Prior to setting a pan-angle offset perform the pan angle calibration: 1. Zoom fully out to 1x zoom factor. 2. Then use the joystick to perform a full 360° pan move. This will calibrate the pan-angle over the full range and correct any zero-offset.

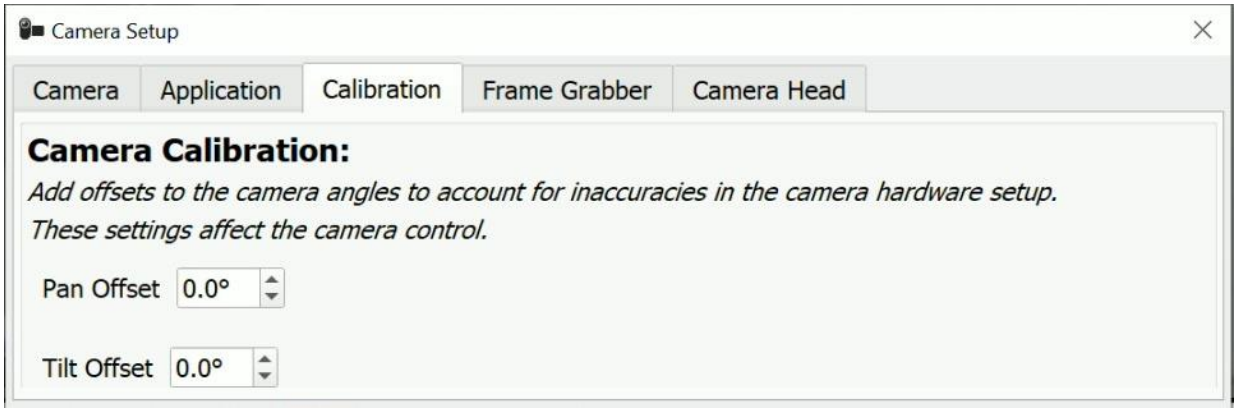


Figure 46. Calibration

Designation	Function
Pan Offset	Use this to adjust for any remaining pan-angle offsets persistent after the 360° calibration move described (see TIPS / ADVICE above).
Tilt Offset	Use this to adjust for any tilt-angle offsets.

8.6.4 Frame grabber, camera information

Designation	Function
Frame Grabber	Displays status information about the frame grabber
Camera	Displays status information about the camera

8.7 Annotations

You can report findings on images taken by the camera, by adding annotations with text and shapes. If you use a PTZ HD30 or TZ1 HD, you also can size specific details under specific conditions, detailed in chapter 9.

It is safer if you freeze the image before doing annotations!

The following actions will display the following bars.

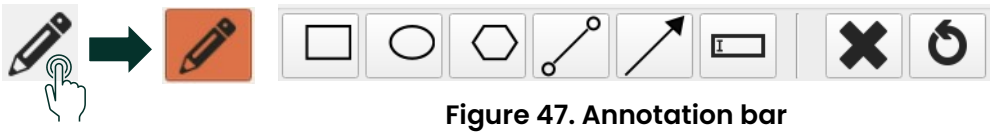


Figure 47. Annotation bar

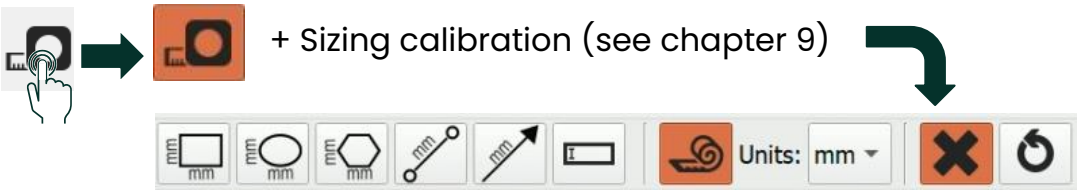
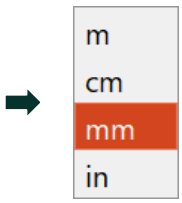


Figure 48. Sizing bar (PTZ HD30 or TZ1 HD)

To change units, tap here to display the drop-down list of available units.

Select a new unit.



If this button is activated, the annotation toolbar displays shapes with units. The calculated dimensions are detailed in chapter 9. See Table 3.

Gestures used for shape manipulation:

Tap once

Touch, hold and drag

Tap 2 times

	TIPS / ADVICE
	When you have multiple shapes, lines, and arrows, it is easier to execute gestures with the stylus pen.

Tap on one of these buttons to create the respective shape in the center of the image:

Rectangle

Ellipse

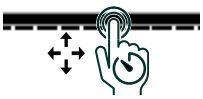
Text box

Line

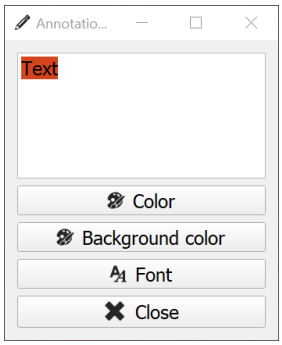
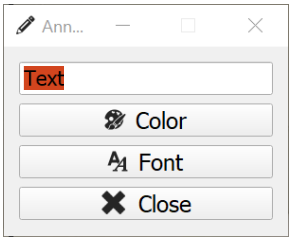
Arrow

Shapes will be displayed with handles, except for text boxes.

Table 2. Gestures for edition

Editing function	Description
 Static selection	Tap the line if it is a line or an arrow. Tap inside the shape or its contour if it is a closed shape. A dashed line is displayed to confirm the selection. Use this function when you have multiple shapes close one to each other.
 Shape unselect	Tap somewhere else out of the shape or select another shape.
 Move	This function works whether the shape was statically selected or not. Touch somewhere inside the shape or its contour, and simultaneously drag the shape. Touch the line precisely, if it is a line or arrow.

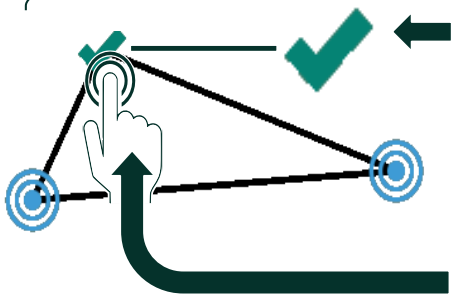
Editing function	Description
 Move point	Touch this blue handle to move a specific point, to change a rectangle or ellipse size, or the edge of a contour. For the contour, this function will work once you confirmed the number of points.
 Rotate	Touch the rotation handle and move. This will rotate the shape around its center.

Editing function	Description
	Double tap on any shape line to add a text or change colors.  For a text box: Edit text, change color font, or background.  For other shapes, edit text, change color font, or background.

Specific procedure for contour shape

Tap where you want to create the first point of your contour.

In distinct locations, tap again where you need the 2nd and 3rd point.



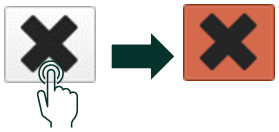
A check mark replaces the 1st handle point.

Tap again in other locations if you need more points in your contour.

Tap the green check mark when you do not need points anymore.

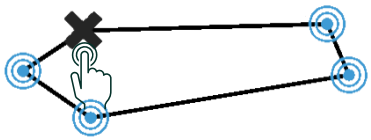
You can now move any point to refine the contour shape.

Shape deletion



Deletion mode activated. All annotations will show a cross nearby as shown below.

Tap the cross to delete the annotation.



Delete all annotations at once

Once you arranged the shapes according to your needs, save the image!

9 Sizing

This section is only applicable for PTZ HD30 and TZ1 HD.

9.1 Prerequisites

Sizing only works:

- On flat surfaces perpendicular to the camera view.
- In environments without bright light sources (no daylight or bright artificial illumination) to ensure sufficient laser visibility.

Sizing results can be vastly inaccurate if used otherwise.

9.2 Sizing shapes

The following table shows the dimensions indicated for each shape.

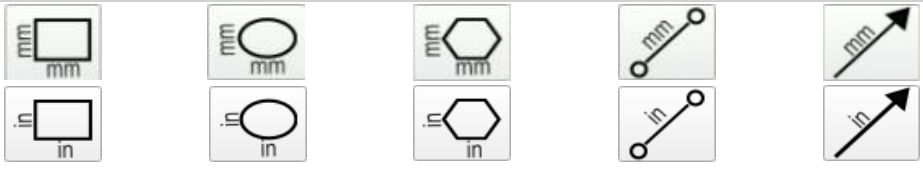
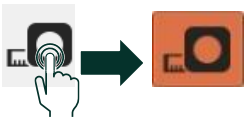
Mode	Rectangle	Ellipse	Contour	Line	Arrow
Annotation					
Sizing					
Length	✓	✓		✓	✓
Width	✓	✓			
Area	✓	✓	✓		

Table 3. List of icons and dimensions for sizing

	TIPS / ADVICE
	The contour shape does not provide length or width indications. Make sure to use a sizing shape if you need to size a feature.

9.3 Main procedure



Activate sizing mode.

The sizing algorithm will detect and highlight the two red laser beams (2 lines for PTZ HD30, 2 points for TZ1 HD) with yellow silhouettes.

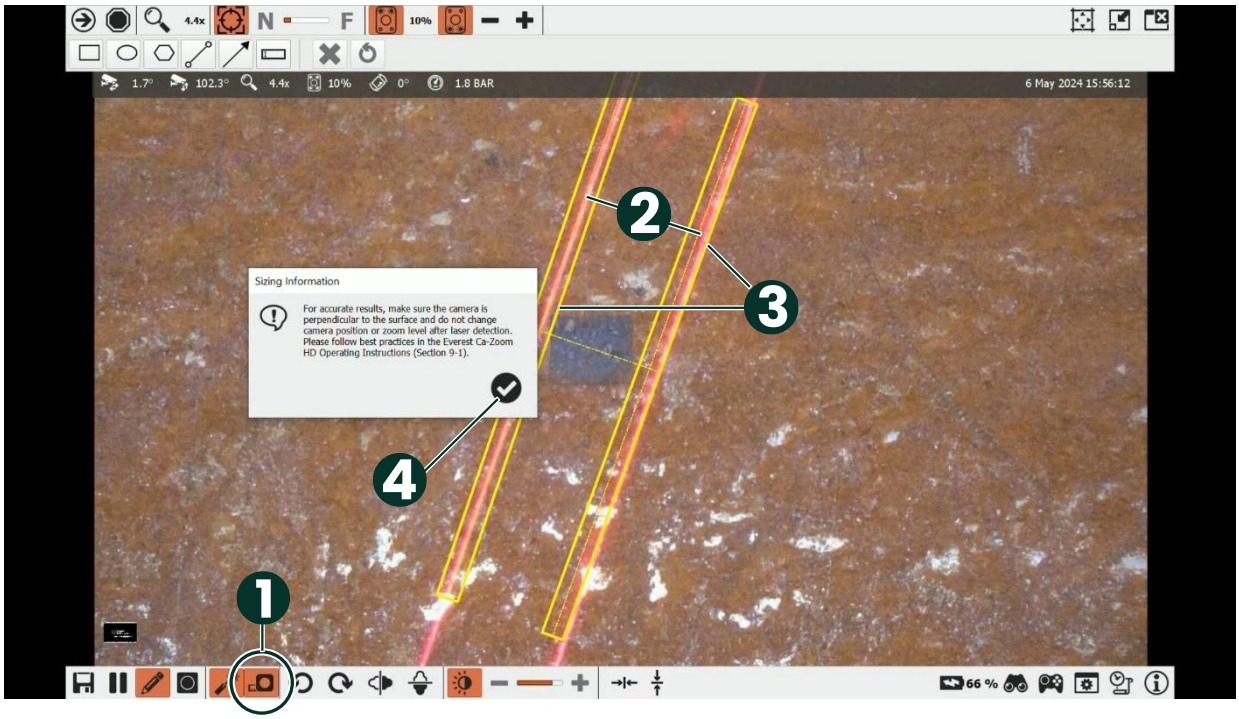


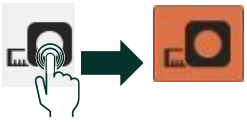
Figure 49. Sizing calibration, example for PTZ HD30

1	Sizing button	3	Yellow silhouettes
2	2 Laser beams activated	4	Warning

TIPS / ADVICE

Use the freeze function before making any annotations, including measurements. This will prevent the image to change due to camera movements or changes in illumination while creating the annotations.

Sizing steps

❶	Activate sizing mode[14] [15]. ➡ 
❷	Check the silhouettes to verify that the lasers were correctly detected.
❸	Read and acknowledge the warning. ➡  Once the warning is acknowledged, the annotation bar for sizing will be displayed.
❹	Create and edit shapes according to your needs
❺	Save the image ➡ 

	TIPS / ADVICE
ℹ	 If you need to add a shape without dimension, deactivate sized shapes; you can reactivate it later for adding more dimensioned shapes. For sizing corrections, use the text annotation feature to record the current working distance directly onto the image.

[14] If lasers are switched off, this action will activate them.

[15] In case the laser beams are not correctly detected, deactivate the sizing mode, then change the lighting of the target, make sure the target is in focus and repeat the procedure.

9.4 Expected Accuracy

- The PTZ HD30 line lasers are calibrated at 1 m working distance.
  For shorter or longer distances, the laser beams will diverge slightly over the working distance of 0.1 m (3.9") to 6 m (19.7 ft). Without error correction, the worst-case sizing error on the PTZHD30 lasers is 50% at 3 m (9.8 ft)distance.
- The TZ1 HD laser beam divergence is negligeable. Therefore, measurements with this camera do not need corrections.

	TIPS / ADVICE
	**Only for PTZ HD30** For more accurate sizing you can calculate corrections based on an estimated or measured working distance from camera lens to the surface.

9.5 Corrections at various working distances

For more accurate sizing of inspected features by using the PTZ HD30, you need to know:

- The laser beam deviation. This can be calculated from the distance between the two laser lines projected on a surface normal to the camera axis, , measured at two different distances from the camera.
- The working distance between the camera lens and the inspected feature you want to size.

A camera calibration data sheet can be obtained through WTR Customer Support. It provides the line separation distance at 1 m (3.3 ft) and 6 m (19.7 ft) from the camera lens. You will need to communicate the last 7 digits of the camera serial number (S/N).

Figure 50. Characterization of the laser alignment specified in the camera calibration sheet (example)

Take note of the working distance and the serial number of the PTZHD30 camera if you use the sizing feature. This will allow for error correction in post-mission processing.

Sizing with correction

1. Perform the main sizing procedure shown in 9.2

2. Take note of the working distance D.

   You can use text annotation to store it on the image (see tip in 9.2) and document the 7 last digits of the camera S/N.

3. Apply[16] the correction formula to convert the distances in the image to true values using the stored working distance D.

   a. Get the alignment values (you can obtain the camera specific values through WTR Customer Support after providing the camera serial number).

      Example from Figure 50:

      $w_{1m} = 22\ mm\ (0.86")$ and $w_{6m} = 29\ mm\ (1.14")$.

   b. Get the working distance D

   c. (Distance from camera lens to object in image)

      Example: $D = 2.8\ m\ (9.2\ ft)$

      If D is in feet, divide the value by 0.3048.

   d. Convert any distances from the image to the true values at distance D.

$$m_{true} = m_{image} \cdot \frac{6 \cdot w_{1m} + D \cdot (w_{6m} - w_{1m}) - w_{6m}}{5 \cdot w_{1m}}$$

[16] This step can be done after the inspection.

Example:

If $m_{image} = 45\ mm\ (1.77")$, $m_{true} = 50.15\ mm\ (1.97")$.

Conclusion:

Considering the camera whose calibration values are shown in Figure 50: if a length of $45\ mm\ (1.77")$ is displayed for a working distance of $2.8\ m\ (9.2\ ft)$, the corrected value is $50.1\ mm\ (1.97")$. This is $11\ \%$ error.

For convenience, a Microsoft Excel Worksheet can be obtained from the WTR Customer Support to perform the above correction calculations.

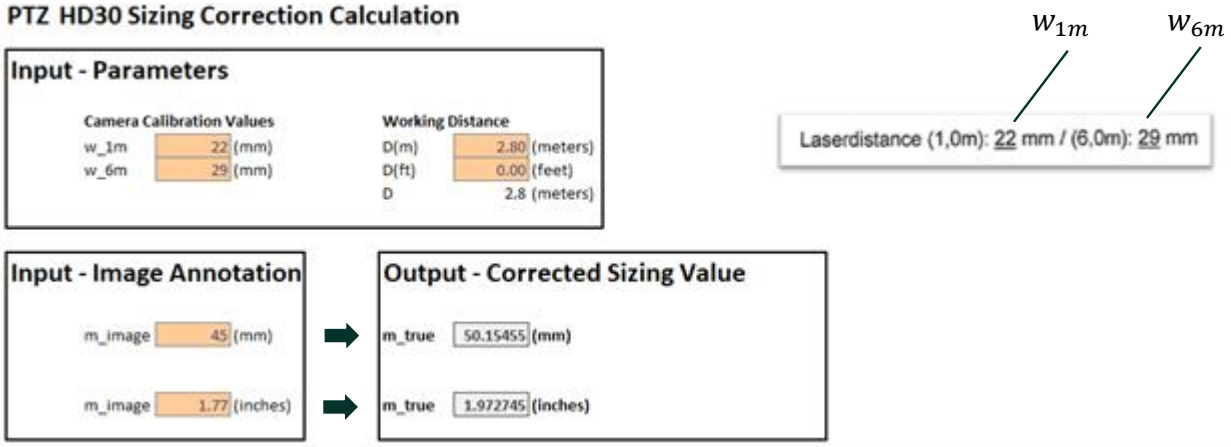


Figure 51. PTZ HD30 Sizing Correction Calculator, example view

10 Shutdown

10.1 Shut down with tablet in sleep mode

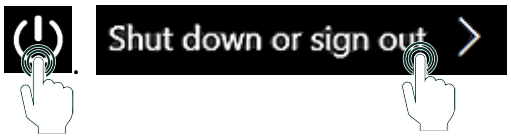
Use this procedure in between usage if the system is expected to be used again any time soon. Startup will be faster. However, the sleep mode will drain the tablet battery slowly over time.

1.  Exit the software application.
2. Press the tablet hardware switch , and hold until the screen is off, to activate the sleep mode. It shall switch off after 1 or 2 seconds.
3. Switch off the camera controller.

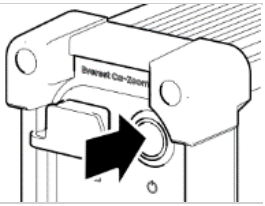
10.2 Complete shut down

Use this procedure for storage or transport. No power will be consumed.

1.  Exit the software application.
2.  Tap the Microsoft Windows icon in bottom left corner.
   The following step depends on how fast you release the Windows button (less or more than one second).
3. Press one of the following menus:

4.  Wait until the tablet is completely shut down.
5. Switch off the camera controller.

11 From disconnection to storage

11.1 Disconnection and mechanical disassembly

Make sure the full equipment is shut down before disconnecting any cable.

To disconnect / disassemble the equipment:

- Disconnect the AC power cord.
- Install the full camera system in a suitable working area.
- Unplug and wind all cables.
- Unmount the pole from the tripod.
- Fold each arm of the tripod, successively:
    - Remove the respective ball lock pin.
    - Fold the arm.  Leave hands far from the arm hinge!
    - For storage, insert the ball lock pin in the respective folded arm.
- Unmount the camera assembly mounted on the pole.
- Unmount the camera holder from the PTZ camera.
- If you used a PTZ camera, replace again the protection caps on camera and cable.

All components should be cleaned before packing.

See instructions in the next section.

11.2 Cleaning

All components should be cleaned after use and before packing:

- To clean the **optics**, exclusively use a clean and soft **microfiber cloth**.
- Clean the cables, the poles and the tripod with a clean cloth and normal water.

- Clean the cameras and the camera controller with a clean cloth and 70 % alcohol.
- Disassemble the TZ1 camera mount from the camera, if required for cleaning: see instruction in 12.3.

	⚠ CAUTION
	Not appropriate cleaning means can damage the components.
	Do NOT use contaminated cleaning clothes, pads, or technical wipes. Do NOT use aggressive pads or hard brushes. Do NOT clean with direct compressed air – or water pressure.

11.3 Packing

All components except pole, tripod, 30 m (100 ft) and 70 m (230 ft)cables shall be packed in the Ca-Zoom HD system transport case.

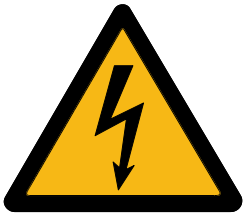
11.4 Storage

Store the packed Everest Ca-Zoom HD System in a clean and dry location.

Temperature range: 0 °C … +50 °C (32 °F … +122 °F).

12 Maintenance

12.1 Safety instructions

	**DANGER**
	Cables and equipment damage.
	Do not open the sealed electric devices, no inside parts require maintenance. Attach a label to any damaged equipment or suspected to be damaged, to prevent the use with electrical power. Consult our technical support.

	**DANGER**
	Exposure to nuclear radiation or toxic vapors or chemicals.
	Ensure EHS decontamination procedures were followed in case of risk exposure.

Refer to safety instructions in section 1.3.

Work related to mechanical or electrical maintenance or repair requires special knowledge and experience. Therefore, it must be performed by personnel who can prove the required qualifications.

The electrical devices must not be opened for regular maintenance.

Please contact the technical support for any additional information.

See contacts in 14.

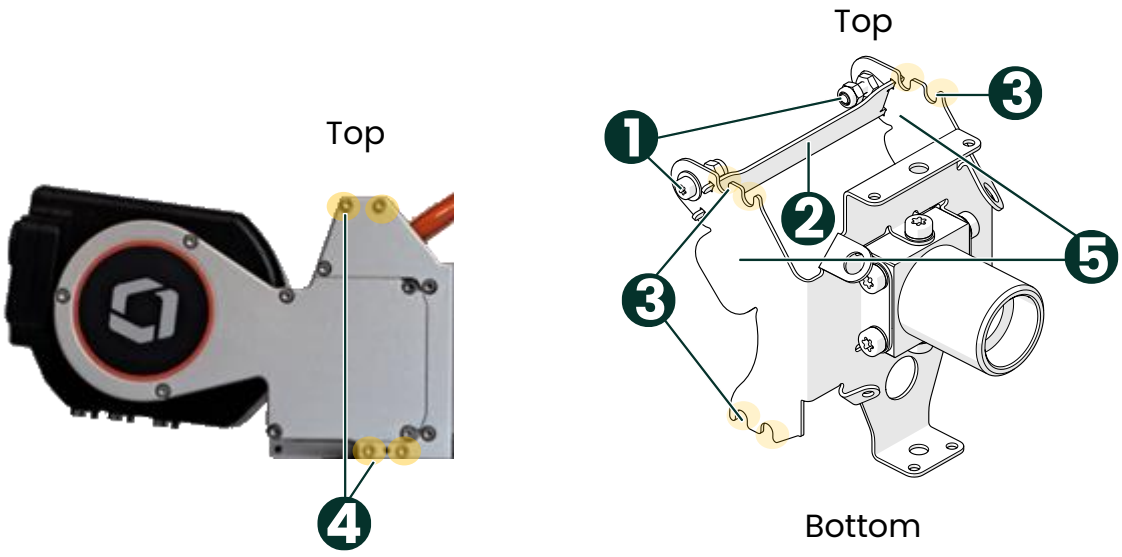
12.2 Inspections before and after each use

	NOTICE
	Regular cleaning, care and maintenance within the intervals described below will ensure efficient operational readiness.

- Cables: visually inspect the cables for integrity (connector outlet, outer sheath, connector O-rings). Check for bent or misaligned pins in the connectors.
- Assemblies, screws, pins, clamps, connector threads: Make sure that the mounted parts and fasteners are not loosened, damaged or dirty.
- Check all camera functions work:
    - Pan and tilt
    - Lights
    - Zoom
    - Focus

12.3 TZ1 camera mount disassembly

This is typically done for cleaning purposes.



a) Screws on housing **b) Mount**

1. M3x12 screw with nyloc nuts (left and right side, total 2)
2. Spacer
3. Notches (left and right side, total 8) designed to fit to M2x4 screw heads on camera
4. M2x4 screws on camera housing (left and right side, total 8)
5. Lateral flanges

Figure 52. TZ1 mounting screws a) and camera mount b)

To remove the mount:

- Unscrew the camera mount if it is assembled.
- Untighten the screws 1, until the nyloc nut is in contact with the spacer 2.
- Spread the top of the lateral flanges and make them slide above the top screw heads 4.

- Slide the camera mount upwards until it is completely detached from the camera.

To reassemble the mount on the camera:

- First untighten the M3x12 screws ❶, to free the lateral flanges. You should be able to separate the flanges from the spacer ❷, with your fingers.
- Position the camera mount above the back of the camera.
- Pass the connector with cable through the space between the spacer and the back of the camera mount.
- Insert the camera in the camera mount by positioning the top and bottom M2x4 screws ❹ in the respective notches ❸.
- Tighten the M3x12 screws ❶ to press the lateral flanges to the spacer. The flanges will then be pressed to the camera housing.

The pole can then be screwed in the threaded hole at the back of the camera mount.

13 Troubleshooting

Problem	Cause	Remedy
The application cannot find devices on the network.	One or more connectors are not plugged correctly.	Check that the connectors are correctly latched.
A connector does not latch correctly.	A pin can be damaged or the connector guiding function is altered.	Try another cable, call the Technical Support. Check connectors for bent pins. Realign any bent pins if possible.
Tablet asks for a password.	Windows settings not properly configured to avoid password prompt.	Username: cazoom_user Password: cazoom.user Contact Technical Support to disable password prompt.
Camera lights on PTZ HD30 camera periodically switch off and back on again.	Early models of PTZ HD30 cameras require permanent pressurization, and indicate loss of internal pressurization by flashing the lights at a slow rate	Pressurize the camera following the instructions in section 5.2.2.
Camera does not properly focus.	a) The camera is unable to autofocus due to image conditions.	a) Switch to manual focus and use the controls to focus until the image is neat.

Problem	Cause	Remedy
	b) The camera is focusing on dust or dirt on the lens.	b) Enable autofocus after testing manual focus. c) Optimize light, zoom or angle of view d) Clean the camera lens at the next possible occasion.
No app launcher window is showing on the tablet.	App launcher was accidentally closed.	Find the Waygate logo in the windows taskbar at the bottom of the screen and tap it to restart the app launcher.

14 Technical Support

For technical support, contact the support service.

Provide the serial number of the device for which you need support.

Mail to: remoteservice@bakerhughes.com

Phone: +1-866-243-2638

	**DANGER**
	Exposure to nuclear radiation. Risk of acute radiation syndrome, cutaneous radiation injuries and long-term diseases like cancer.
	Equipment cannot be returned for service once used in contaminated environment

	**DANGER**
	Contamination due to toxic vapors, chemicals, or substances of high concern. Risk of various serious short and long-term injury depending on chemical substances.
	Equipment cannot be returned for service once used in contaminated environment

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Appendix A Specifications

Cameras		PTZ HD30	PTZ HD10	TZ1 HD
Camera features	Image resolution Frames per second	1920 x 1080 15	1920 x 1080 15	1920 x 1080 15
	Sensor size, and number of pixels	1/2.8" CMOS, 2.38 MP	1/3" CMOS, 5.14 MP	1/3" CMOS, 4.08 MP
	Zoom	30 x optical (12 x digital)	10 x optical (16 x digital)	10 x optical
	Focal length range	4.3 mm..129 mm	3.3 mm..33 mm	3.3 mm..33 mm
	Field of view (in air)	Zoom end: 2.3° 1 x zoom: 63.7°	Zoom end: 6.9° 1 x zoom: 58.2°	Zoom end: 6.7° 1 x zoom: 59.2°
	Min. focus distance [mm (in)]	Zoom end: 1200 (47) 1 x zoom: 10 (0.4)	Zoom end: 800 (31) 1 x zoom: 10 (0.4)	Zoom end: 800 (31) 1 x zoom: 50 (2)
	Focus	Auto and manual	Auto and manual	Auto and manual
	Iris	Auto	Auto	Auto
	Electronic shutter	Auto	Auto	Auto
	Sensitivity	1.4 lx	0.5 lx	0.5 lx
Lasers & Lights	Lights	2 pairs of lights (4 LEDs)	2 sets of lights (10 LEDs)	2 spotlights, 2 floodlights (4 LEDs)
		Total 2980 lumen	total 1400 lumen	total 988 lumen
	Parallel laser beams λ (color), optical power	2 built-in line lasers 650 nm (red), 0.4 mW	no lasers	2 built-in dot lasers 635 nm (red), 2.8 mW
	Laser safety (IEC 60825-1:2014)	Class 1 laser		Class 1 laser
	Laser beam distance	22 mm (0.87 ")		27.5 mm (1.06 ")

Cameras		PTZ HD30	PTZ HD10	TZ1 HD
Motion	Pan	Continuous, 360°	Continuous, 360°	No pan axis available
	Pan speed	max. 9°/s	9.5°/s	Not applicable
	Tilt angle range	338° (-169° to +169°)	314° (-157° to +157°)	227° (-104° to +123°)
	Maximum tilt speed	8°/s	8°/s	22°/s
	Coupling protection	Yes (pan and tilt)	Yes (pan and tilt)	Yes
	Position feedback	Magnetic angle encoder feedback	Magnetic angle encoder feedback	Magnetic angle encoder feedback
Dimensions	Construction	Anodized aluminum	Anodized aluminum	Anodized aluminum
	Weight [kg(lbs)]	3.5 (7.7)	1.5 (3.3)	0.74 (1.63)
	Size without connector [mm (in)]	251 (9.88) x 117 (4.6) x 113 (4.5) Length x width x height	Length: 230 (9.06) Diameter: 60 (2.36)	125 (4.92) x 66 (2.6) x 72 (2.84) Length x width x height
	Min. opening ⌀	130 mm (5.11")	61 mm (2.4")	98 mm (3.86")
Environment	Ingress protection [IEC 60529]	IP68, waterproof up to 50 m (164 feet) below surface.	IP68, waterproof up to 50 m (164 feet) below surface.	IP65
	Internal pressurization	Maximum 2.5 bar (36 psi)	Maximum 2.5 bar (36 psi)	Not applicable

PTZ Camera cables	
Nominal outer diameter	12.3 (0.49) [mm (in)]
Min. setting radius Min. bend radius (slow motion)	62 (2.5) [mm (in)] 93 (3.7)
Weight • 10 m (30 ft) cable • 30 m (100 ft) cable reel • 70 m (230 ft) cable reel with slip ring	 2.7 (5.9) [kg (lbs)] 9.1 (20.1) 24.2 (53.2)
Reel dimensions • 30 m (100 ft) cable reel • 70 m (230 ft) cable reel	 310 (12.2)x 245 (9.7) x 365 (14.4) 418 (16.5) x 388 (15.3)x 466 (18.4) Length x width x height

TZ1 HD Camera cables	
Maximal outer diameter	6.5 (0.26) [mm (in)]
Min. setting radius (static) Min. bend radius (slow motion)	19.5 (0.7) [mm (in)] 65 (2.6)
Weight • 10 m (30 ft) cable • 30 m (100 ft) cable reel	 0.58 (1.28) [kg(lbs)] 2.72 (6.0)
Dimensions: cable reel [mm (in)]	233 (9.2)x 204 (8.0) x 295 (11.7) Length x width x height

Camera controller & Tablet	
Weight • Camera controller • Tablet	 1.64 (3.61) [kg(lbs)] 2.0 (4.4)
Input / output rating • External AC/DC power supply • Camera controller	 100-240 VAC (47-63Hz), 150W / 48 VDC 48 VDC
Tablet battery / output / capacity	1 Li-ion battery/ 11.1 V / 46 Wh
Processor	Intel Core i5-7300U
Memory	8 GB DDR3L SDRAM
Disk Drive	256 GB SSD
Video storage capacity	> 6 hours
Video output	HDMI output on Tablet

Camera controller & Tablet	
Monitor	10.1-in WUXGA (1920x1200) display 10-point multitouch screen Glove compatible
Screen brightness	800 nits
Interconnection cable • Length • Min. setting radius (static) • Min. bend radius (slow motion)	Power over Ethernet cable 5 m (16.4 ft) 35 mm (1.38″) 70 mm (2.76″)
Controls	Buttons and joysticks
Soft buttons	On touchscreen user interface

Environmental ratings	
Altitude	Up to 2000 m (6561 feet)
Conditions of use	Indoor
Temperature (general)	0° C … 40°C (32°F … 104°F)
Temperature, (specific for PTZ HD30 and HD10 camera and PTZ cable)	0° C … 45°C (32°F … 113°F)
Pollution category	Pollution degree 2
Overvoltage category	Overvoltage category II
Humidity	Up to 95%

Appendix B Gamepad joystick example

Example of compatible USB Gamepads:

Logitech F310, Microsoft XBOX 1, XBOX 360

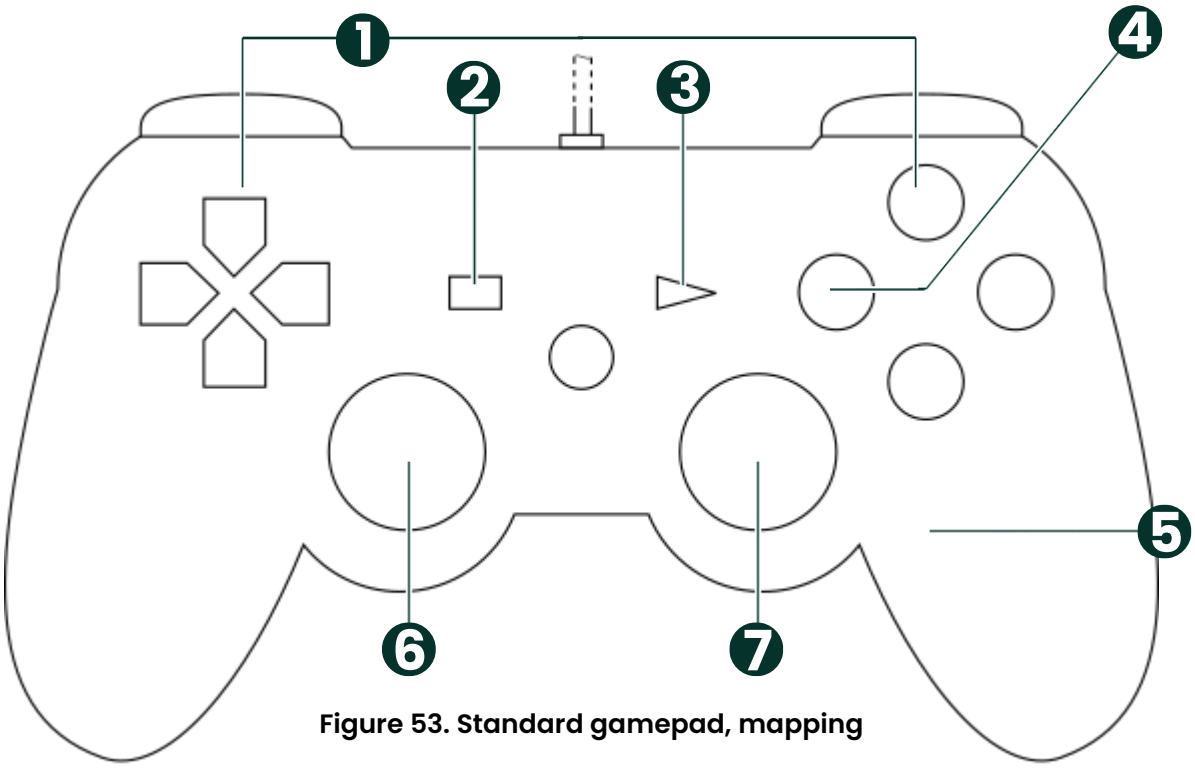


Figure 53. Standard gamepad, mapping

1	Focus control in manual mode : • Left trigger: Near field • Right trigger: Far Field
2	Save image
3	REC Toggle between start and stop recording
4	Increase light intensity
5	Decrease light intensity
6	Pan and tilt move control. Replaces joysticks ❷ ❾ from Figure 4. Press down to move to Zero position.
7	Zoom control. Press down to toggle Auto/Manual focus

Appendix C Regulatory Compliance

European Equipment Classification

Group 1, Class A

The CE mark on this product indicates it has been tested to and conforms with the provisions noted within the 2014/30/EU Electromagnetic Compatibility Directive. The Everest Ca-Zoom HD system is in conformance with the following standard: EN61326-1.

Safety Mark

This device complies with the following standards:

UL 61010-1, IEC 61010-1, EN 61010-1 and CSA-C22.2 No. 61010-1.

FCC Compliance Statement:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1) This device may not cause harmful interference and

2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in industrial environment. This equipment generates, uses, and can radiate radio frequency energy, and if it is not installed and used in accordance with the instruction manual, it may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Industry Canada Regulatory Statement:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1) This device may not cause interferences, and

2) This device must accept any interferences, including interferences that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes:

1) il ne doit pas produire de brouillage et

2) l'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

Complies with the Canadian **ICES-001 Class A** specifications.

Cet appareil numérique de la **classe A** est conforme à la norme **NMB-001** du Canada.

Canadian Notice

This equipment does not exceed the Class A limits for radio noise emissions as described in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

South Korea Regulatory Statement

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.	This equipment is intended for use in industrial environment and may cause interference in a household environment.

The mark indicates that the product including PTZ HD30, and TZ1 cameras comply with all the applicable requirements for South Korea to place it on the market.

Registration No.: R -R -WTz-CHD
Equipment name (Model): Everest Ca-Zoom HD (PTZ-SYS-HD30-TZ1-C)
Manufacturing date: refer to product label(s)[17].
Registrant: Waygate Technologies Robotics AG
Manufacturer/Country of Origin: Waygate Technologies Robotics AG / Switzerland

[17] The product S/N numbers have 2 different formats, as shown below:

Camera controller, tablet serial number and TZ1 HD camera:

S/N: XXXX-1-ZZZZ-YYMM-NNNN.

YYMM provides the manufacturing year and month:

Year: 20YY [YY=starting from 23],

Month: MM [MM=1 to 12].

PTZ HD30 camera:

S/N: XXXX-1-ZZZZ-YYNNNNN.

YY provides the manufacturing year:

Year: 20YY [YY=starting from 23].

Appendix D Environmental compliance

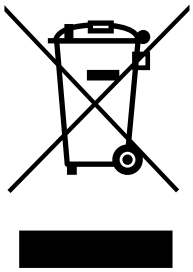
WEEE directive (Waste Electrical and Electronic Equipment)

Waygate Technologies is an active participant in Europe's Waste Electrical and Electronic Equipment (WEEE) take-back initiative, directive 2012/19/EU.

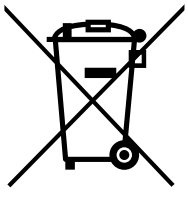
The device that you have bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

To avoid the dissemination of those substances in the environment and to diminish the pressure on our natural resources, we advise you to use the appropriate take-back systems. Those systems will reuse or recycle in an environmentally safe way most of the materials of your instrument which is no longer capable of functioning.

The crossed-out wheeled bin symbol invites you to use those systems.



EU Battery Directive



This product contains a battery that cannot be disposed of as unsorted municipal waste in the European Union. See the product documentation for specific battery information. The battery is marked with this symbol, which may include lettering to indicate cadmium (Cd), lead (Pb), or mercury (Hg).

For proper recycling return the battery to your supplier or to a designated collection point.

What do the markings mean?

Batteries and accumulators must be marked (either on the battery or accumulator or on its packaging, depending on size) with the separate collection symbol. In addition, the marking must include the chemical symbols of specific levels of toxic metals as follows:

Cadmium (Cd) over 0.002%

Lead (Pb) over 0.004%

Mercury (Hg) over 0.0005%

The risks and your role in reducing them

Your participation is an important part of the effort to minimize the impact of batteries and accumulators on the environment and on human health. For proper recycling you can return this product or the batteries or accumulators it contains to your supplier or to a designated collection point. Some batteries or accumulators contain toxic metals that pose serious risks to human health and to the environment. When required, the product marking includes chemical symbols that indicate the presence toxic metals: Pb for lead, Hg for mercury, and Cd for cadmium.

Cadmium poisoning can result in cancer of the lungs and prostate gland. Chronic effects can include liver damage, emphysema (through inhalation), osteomalacia, neurological impairment, testicular, pancreatic and adrenal damage, and anemia.

If you need more information on the collection, reuse, and recycling of recyclable material, please contact your local waste management company.
Visit:
https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en,

for take-back instructions and more information about this initiative.

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