IRIS HD

Integrated Remote Inspection System

Mainline Crawler

PART NUMBER 208009

600 N. Dekora Woods Boulevard
Saukville, Wisconsin 53080
(800) 488-8177 | goinsightvision.com

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If you need to contact Customer Service

For immediate assistance, contact Insight Vision.

Phone:	800-488-8177
Email:	sales@goinsightvision.com
Web Inquiry:	www.insightvisioncameras.com

Please complete the following information for future reference:

Serial Number: _____

Date of Purchase: _____

Place of Purchase: _____

The Serial number is on the front of the unit. Retain this User's Guide with your sales receipt as a permanent record of your purchase, in the event of theft, fire, or warranty service.

FOLLOW, LIKE AND WATCH

Warranty

Insight Vision warrants to the end user that should any of its products prove to be defective in material or workmanship in normal use, within one (1) year from the date of delivery, Insight Vision will, at its exclusive option, repair, replace or exchange the product or any of its parts.

THIS WARRANTY IS SUBJECT TO THE FOLLOWING LIMITATIONS:

1. This warranty does not apply to any product which has been subject to accident, negligence, alteration, abuse, misuse, overload, repair by anyone other than Insight Vision or its authorized representatives, or not maintained in accordance with the manufacturer's suggested maintenance schedule.
2. This warranty applies only to components manufactured by Insight Vision. The appropriate manufacturer's warranty, if any, shall apply to components not manufactured by the company.
3. This warranty does not apply to flex-link connectors, rod, LED light rings, cable, rollers, O-rings, tires and skids, or other parts, which are considered consumable. The replacement of these items is part of normal product maintenance.
4. This warranty shall not apply if the products are used or operated in any manner not consistent with their intended purpose.
5. This warranty is limited to repair or replacement of defective products and parts during the warranty period, and shall be the exclusive remedy. Insight Vision shall in no event have any other obligation or liability of any nature arising from the breakdown, malfunction, defect or other failure of the product, including, without limitation, any liability for service, maintenance, repairs, personal injury, property damage, loss of profits, loss of use or other consequential damages.
6. Any action for any claimed breach of this warranty shall be brought within one (1) year from the date of delivery of the product.
7. The purchaser must return the defective product, part or component to Insight Vision, 600 N. Dekora Woods Blvd. factory in Saukville, WI 53080 or an authorized repair facility at the purchaser's expense, properly and adequately packaged, with insurance and transportation pre-paid. Insight Vision will either repair or replace the defective product, part or component, at its option, and will return it to the purchaser at the customer's expense. In no event shall Insight Vision be liable for delay in repair or replacement and return under this warranty. Insight Vision will endeavor to effect appropriate repairs in the shortest time practical, with respect to the customer having beneficial use of their equipment.
8. Insight Vision neither assumes nor authorizes any person to assume any other liability or make any other warranty in connection with the products.
9. THIS WARRANTY IS EXPRESSLY GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED. INSIGHT VISION EXPRESSLY DISCLAIMS ANY OTHER WARRANTY, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REGARDING THE SOFTWARE, INSIGHT VISION DOES NOT WARRANT, GUARANTEE OR MAKE ANY REPRESENTATIONS REGARDING THE USE OR THE RESULTS OF THE USE OF THE SOFTWARE IN TERMS OF ITS CORRECTNESS, ACCURACY, RELIABILITY, CURRENTNESS OR OTHERWISE. THE ENTIRE RISK AS TO THE RESULTS AND PERFORMANCE OF THE SOFTWARE IS ASSUMED BY YOU.

System Overview

Thank you for purchasing the Insight Vision IRIS HD Mainline Crawler. Reading the documentation will help you make the most of your equipment.

General Overview

The IRIS HD Crawler Inspection System is an integrated remote inspection system equipped with a 3-megapixel digital HD color camera, motion posture sensors, intelligent control terminal, high-power LED lighting, and automatic cable management. It delivers real-time imaging and video recording for sewer and storm water inspection applications. The system supports on-site inspection reports for project evaluation, acceptance, maintenance, and repair options.

System Maintenance Requirements

The following maintenance procedures are recommended for all Insight Vision IRIS. Systems. Standard warranty policy dictates that components and accessories subject to wear and tear are not covered under the One (1) year warranty. Therefore we strongly recommend that all systems be maintained according to the following procedures. Please be advised that Insight Vision will not allow warranty coverage for these items if these procedures are not followed.

Operating the IRIS Control Panel

WARNING: All Insight Vision's IRIS Control units are not water proof. Insight Vision assumes no liability for any water damage, caused directly or indirectly, by improper usage of the system. Damage to the system components, the internal mother board, and injury to you may result if water is applied to the IRIS Control Panel.

Water damage will not be covered under warranty, and may be cause for voiding of the warranty.

What's Included

- User Manual
- High Definition 3MP Digital Camera with LED Lighting, Autofocusing, 360° Rotating and 270° Tilt Camera
- Crawler with Auto Scan, Rewind, and Cruise
- Samsung Galaxy Tab S10 Ultra Flagship Tablet with Custom App for Full Inspection Control
- Aviation-Grade Cable Connectors
- 512 Hz Sonde Attached to the Cable
- Quick-Change Wheel Design with Five Size Options

Safety Guidelines

General Safety Guidelines

WARNING: Failure to follow the warnings and instructions may result in electrical shock, fire, serious injury or damage to equipment.

Work Area Safety Guide

- Keep your work area clean and dry.
- Observe proper confined space safety regulations using triple gas test devices.
- Do not operate equipment in explosive or flammable environments.
- Keep children away when operating the system.

Electrical Safety Guide

- Do not expose equipment to rain or wet environment.
- Keep hands dry and all electrical connections dry.
- Ensure all power cords, connectors and wires are in good working condition.
- It is recommended to use with a ground fault protected AC source (GFCI) to reduce the risk of electrical shock.

Personal Safety Guide

- Be alert and aware of your environment.
- Be prepared and follow instructions.
- Use proper protective clothing when operating equipment.

Use Equipment with Care

- Do not force the equipment.
- Do not allow inexperienced operators to operate equipment.
- Maintain equipment and use only accessories that are recommended by the manufacturer.

Safety Guidelines Cont.

Product, Environmental, and Safety Symbols

Before using this product, please carefully read this section on product, environmental, and safety symbols. Misunderstanding or improper operation may lead to electric shock, fire, or personal injury.

Product Symbols	
	**Warning (Charger):** Keep the charger away from rain and moisture; it is suitable for indoor use only. Keep away from children. Ensure the charger matches the product battery. Disconnect the charger once the battery is fully charged to prevent damage.
	**Warning (Power Adapter):** Risk of electric shock. Waterproof protection required. Ensure the generator output is stabilized at 120V before connecting the power adapter. Keep away from children, heat sources, and flammable/explosive environments.
	**Warning (Battery Charging):** Avoid overcharging or deep discharging, which may cause irreversible damage to the battery chemicals, short circuits, or reduced lifespan. Charge or store the machine in a dry, ventilated area to avoid leakage or short circuits.
	**Warning (Generator Use):** When using a generator, strictly follow the generator's operating procedures, and only use the manufacturer's voltage stabilizing adapter.
	**Warning (Helium Gas Cylinder):** Store in a cool, dry place, away from heat, flammable/explosive materials, and children. Follow all safety labels and handling procedures. Only trained personnel may operate or handle cylinders and valves.
Environmental Symbols	
	**Waterproof Protection:** Indicates that chargers, adapters, batteries, cameras, and the robot body must be protected from moisture and water ingress to prevent damage.
	**This Side Up:** Indicates the package must be transported upright and not inverted.
	**Fragile:** Handle with care during transport. Avoid crushing or deformation of LCD, metal housing, or other components.
	**Keep Dry:** Protect from rain to prevent short circuits and internal electronic damage.
	**Stacking Limit:** Indicates maximum stacking limits during transportation or storage.

Safety Guidelines Cont.

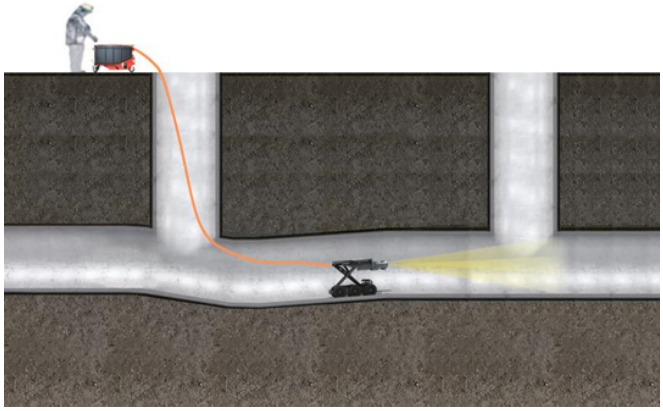
Environmental Symbols Continued	
	**Do Not Roll/Tip:** Package must not be rolled or heavily tilted during handling.
Security Symbols	
	**Heavy Object Warning:** During assembly/disassembly, be cautious of falling tools or parts that may injure feet.
	**Open Manhole Warning:** When opening manholes in residential, industrial, or road areas, use caution to prevent falling accidents.
	**General Safety Alert:** Indicates potential hazards that may cause injury or death if ignored. Always follow safety guidance.
	**Electrical Shock Warning:** Check power cables and sockets for damage before connecting. Ensure proper grounding and waterproofing to avoid electric shock.
	**Danger Symbol:** Indicates unavoidable hazardous conditions that will cause death or serious injury.
	**Warning Symbol:** Indicates potentially hazardous conditions that could cause death or serious injury.
	**Caution Symbol:** Indicates potentially hazardous conditions that may cause minor or moderate injury.
	**Notice Symbol:** Indicates safety-related information to prevent property damage. Read the manual before operation.
	**Wear Protection Symbol:** Always wear protective shields, safety goggles, and stay focused during operation.
	**High Voltage / Rain Hazard Symbol:** In rainy environments, keep away from high-voltage power lines, poles, and cables to prevent electrical shock.

Product Introduction

Main Application Areas

The pipeline inspection robot system is mainly used for rapid inspection and diagnosis or municipal drainage pipelines. Equipped with a high-power lighting system and a portable control system, it is suitable for fieldwork and mobile job sites.

The maximum supported length is 656 ft. (200 m), allowing the device to be deployed to the required inspection position. The robot body is designed with waterproof protection; actual performance depends on the underwater environment.



Main Technical Parameters

Product Model IRIS HD		
Crawler Body	Applicable Pipe Range	6” - 60”
	Operating Voltage	48 V
	Maximum Output Power	360 W
	Traction Force	245.25 N
	Crawling Speed	0 ~ 108 ft / min
	Drive System	All-wheel drive
	Motors	Dual motors, 2 x 91 W
	Climbing Capacity	35°
	Dimensions	27” x 5” x 5” (with ø2.8” wheels, minimum height with lifting mechanism)
	Weight	26.7 lbs (with ø2.8” wheels and lifting mechanism)
	Operating Temperature	14°F to 131°F
	Protection Grade	IP68
Front Camera	Image Sensor	1/2.8” ProgressiveScan CMOS
	Resolution	2048 x 1536

Product Introduction Cont.

Product Model IRIS HD		
Front Camera	Optical Zoom	10x (Focal length 0.19”)
	Focus	Auto focus
	Minimum Illumination	Color: 0.005 Lux @ F1.6 (AGC ON) B/W: 0.001 Lux @ F1.6 (AGC ON)
	Wide Dynamic Range	120dB
	Illumination	8 x 2 W high-brightness LEDs
	Low-Light Enhancement	Intelligent 2D/3D noise reduction for clear night images
	Rotation	Pan 360° continuous, Tilt 270°
	Dimensions	ø4.1” x 7.1”
	Weight	4.3 lbs
	Operating Temperature	14°F to 131°F
	Protection Grade	IP68
Rear Camera	Image Sensor	2 MP CMOS
	Resolution	1920 x 1080
	Minimum Illumination	0.1 Lux
	Illumination	2 x 2 W LEDs
	Wide Dynamic	Digital WDR supported
	Operating Temperature	-20°C to +55°C (-4°F to +131°F)
	Protection Grade	IP68
Cable Reel CDA-600	Cable	ø0.3”, 656.2’
	Drive	Automatic or manual reeling/unreeling
	Dimension	22” x 22” x 21” (including wheels, labeling panel, and handle bracket)
	Weight	121 lbs
	Operating Temperature	14°F to 131°F
	Protection Grade	IP54
Handheld Multifunctional Control Tablet (SAMSUNG Galaxy Tab S10 ULTRA)	Dimension	8.2” x 12.9” x 0.2”
	Display	14.6-Inch touch screen
	Operating System	Android
	System Memory	12 GB RAM
	Storage	256 GB (Expandable up to 1.5 TB)
	Processor	MediaTek Dimensity 9300+
	Resolution	2960 x 1848 (WQXGA+)
	Control Software	PipeClimber
	Battery	Lithium 11200 mAh
	Weight	1.6 lbs

System Components & Functions

This product series mainly consists of the following five parts:

1. **Robot Body**
2. **Camera (Front & Rear)**
3. **Cable Reel**
4. **Power Supply (Adapter, Lithium Battery, Charger)**
5. **Control Tablet**

By operating through the tablet's user interface, the robot body can be controlled to travel inside pipelines, while the captured internal images are transmitted in real time through the cable to the main controller for live monitoring.

The controller is equipped with 256 GB / 1.5 TB (expandable) storage capacity, supporting image and video storage. When pipeline damage or blockage is detected, the operator can record videos or capture snapshots of the defective section for documentation, repair, and maintenance purposes.

On the tablet display interface, the operator can monitor the robot's status in real time, including:

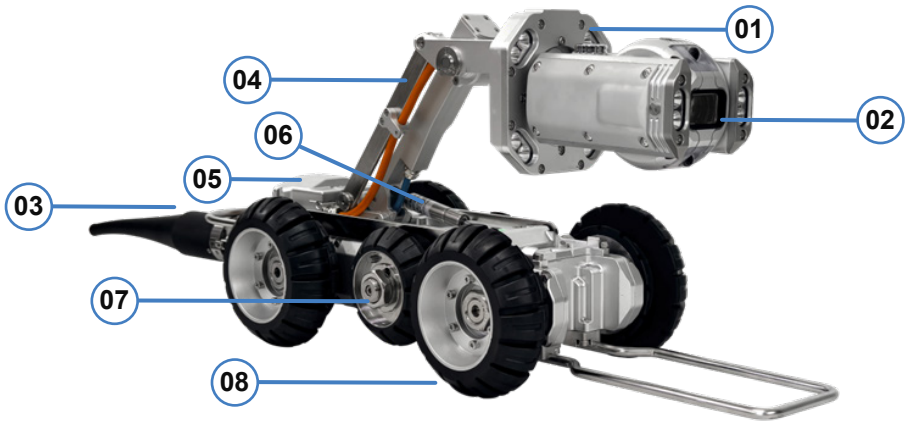
- Tilt angle
- Internal Pressure
- Distance Traveled
- Speed
- Platform Elevation
- Date/Time and Other Parameters

Inspection videos can be edited and archived with dedicated software. Reports can be exported into Excel format for documentation.

The pipeline inspection robot system is a highly practical, easy-to-operate, and feature-complete inspection tool equipped with GPS positioning capability.

System Components & Functions Cont.

Robot Body ICS-040



01 Auxiliary Light

02 Front Camera

03 Reel Connection Port

04 Electric Lift Frame

05 Rear Camera

06 Gas Spring

07 Ø100mm Wheels

08 Ø130mm Wheels

System Components & Functions Cont.

Front Camera PTZ CAM 10x

01 Dome Housing

02 Integrated Zoom Module

03 Main Light Source

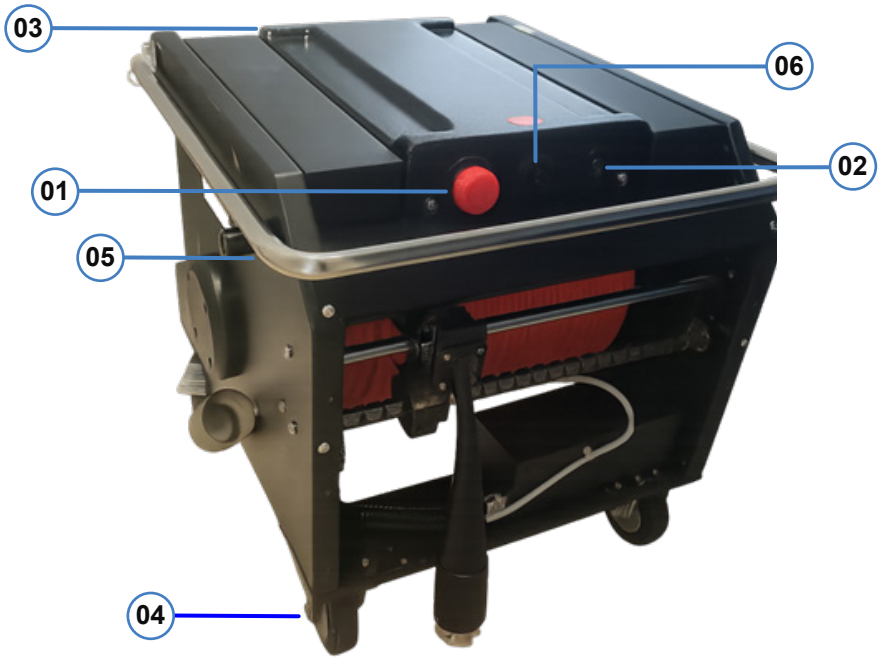
04 Main Body Housing

05 Air Nozzle Cap

06 Connector

System Components & Functions Cont.

Cable Reel CDA-600



01 Emergency Stop Switch

02 Power Switch

03 Ethernet Port (LAN)

04 Locking Swivel Caster

05 Pull Handle

06 Reel-in Button

Power Adapter

Power Adapter

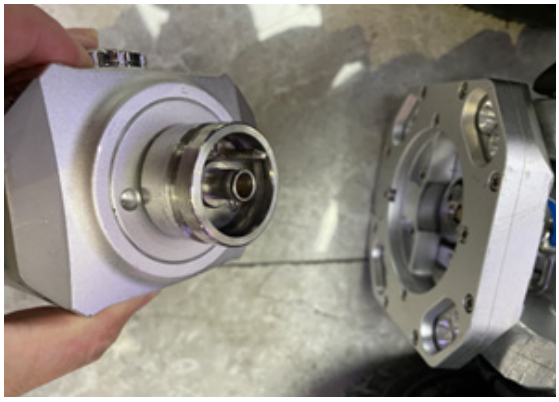
Input: AC 100-240 V 50 / 60 Hz
Output: DC 48 V 7.5 A

Product Installation & Operation

Note: When using the equipment in harsh environments (such as very low temperatures), please preheat the device indoors (power on the equipment) for 10-20 minutes before use.

1. Connecting the Camera to the Crawler Body

1. Take the camera and align the positioning post with the slot on the crawler body, then insert it until it is in place and does not move loosely.

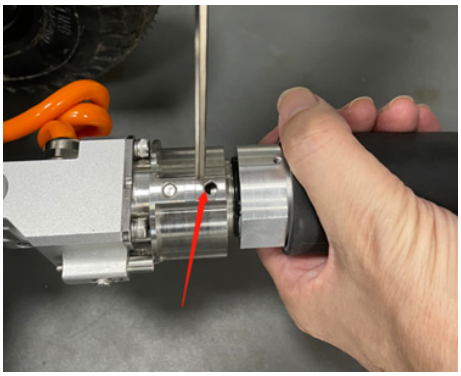


2. Install the fixing block and tighten the screws using an M5 hex wrench.

2. Connect the Body with the Cable Reel

1. Align the rear connector of the crawler body with the waperproof socket on the cable reel.

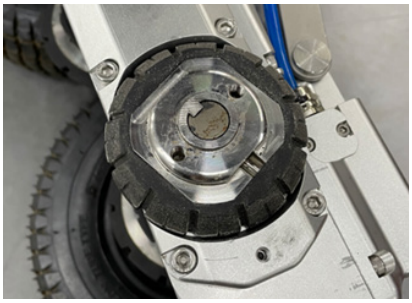
2. Insert the connector, rotate the locking ring clockwise, and tighten the locking pin as shown in the picture.



Product Installation & Operation Cont.

3. Installation of 4" Wheels on the Crawler

1. Align the 4" wheel with the base of the 2.75" wheel and place it on top.



2. Prepare two M5 hex socket screws and tighten them using a hex key.

4. Installation of 5" Wheels on the Crawler

1. Align the 5" wheel with the 4" wheel and place it on top.

2. Install the washer and M20 nut, then tighten the nut with a wrench.

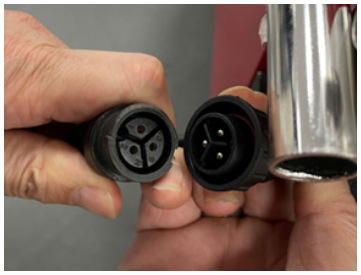
5. Installation of 8" and 9" Wheels on the Crawler

1. Align the 8" or 9" wheel with the 4" wheel and place it on top. Install the washer and M20 nut, then tighten the nut with a wrench.

Product Installation & Operation Cont.

6. Connecting the Cable Reel to the AC Adapter

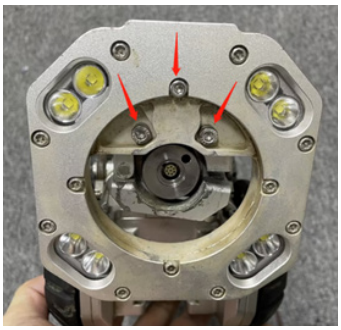
1. Align the AC adapter connector with the cable reel connector and insert firmly.



2. Tighten the locking ring to secure the connection.

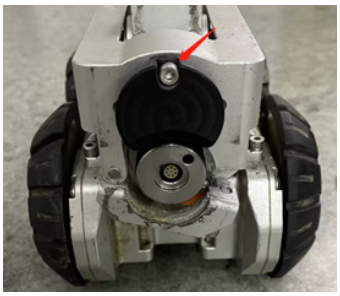
7. Auxiliary Light Removal and Blind Plug Installation (ND150 pipe)

1. Remove the three screws shown in the figure and take off the auxiliary light.



2. Insert the blind plug with O-ring into the auxiliary light connector port.

3. Use one M4x12 hex socket screw to fix the blind plug in place.



Product Installation & Operation Cont.

8. Usage and Installation Method of the Anti-Collision Bar
(Pipelines of 8" and larger require installation of the anti-collision bar)

1. Turn the crawler upside down and align the four positioning posts on the anti-collision bar with the corresponding positioning holes on the bottom of the crawler, then insert them securely.

2. Fasten the anti-collision bar using the mounting holes located on the bottom of the crawler with four M5 x 16 screws.

9. Usage and Installation Method of the 512 Hz Transmitter Bracket

1. Install the bracket onto the cable gland, aligning the front end of the bracket with the metal handle.

2. Align the threaded hole on the bracket with the red positioning mark on the connector.

3. Fasten the bracket securely using four M3 x 10 screws.

Product Installation & Operation Cont.

10. Installing the Battery for the 512 Hz Transmitter

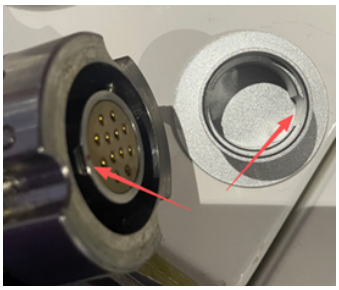
1. Rotate the transmitter cover counterclockwise to open it.

2. Insert AAA battery into the transmitter as shown in the illustration
3. Rotate the transmitter cover clockwise to tighten it; the transmitter will begin operating.
4. Install the transmitter with the battery installed onto the transmitter bracket by rotating it clockwise.

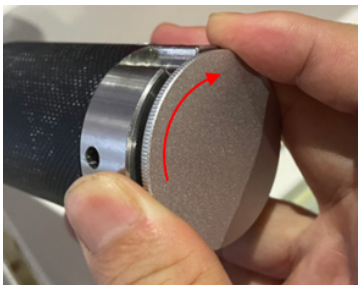
Note: After use, remove the battery from the transmitter immediately to prevent battery depletion.

11. Installation Method for Aviation Plug Protective Cover

1. Align the notch on the protective cover with the red mark on the plug.



2. Firmly press the protective cover onto the plug and rotate it clockwise to lock it in place.



Product Installation & Operation Cont.

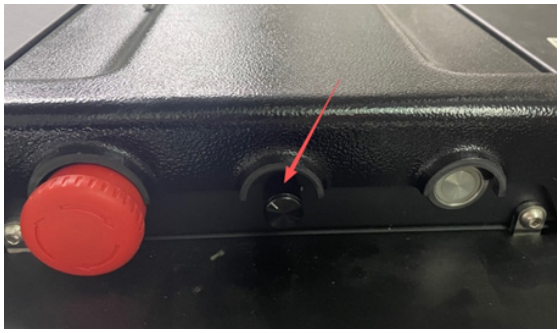
12. Wired Connection Method

1. Connect the Ethernet connector of the data transmission cable to the Ethernet port on the cable reel.

2. Connect the Type-C connector of the data transmission cable to the tablet's Type-C port.

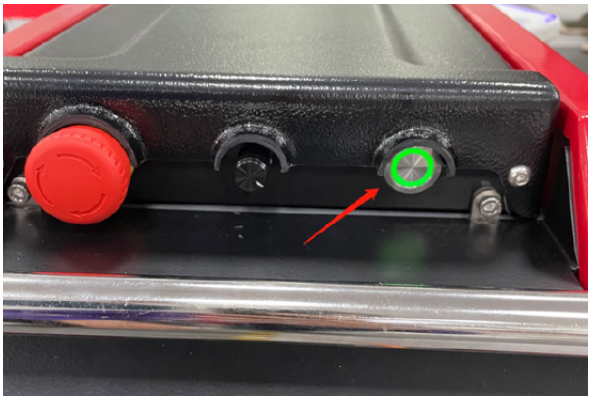
13. Instruction for Using the Cable Retraction Knob

1. Rotate the cable retraction knob clockwise to retract the cable. Turn the knob slowly—larger rotation angles will result in a faster cable retraction speed.



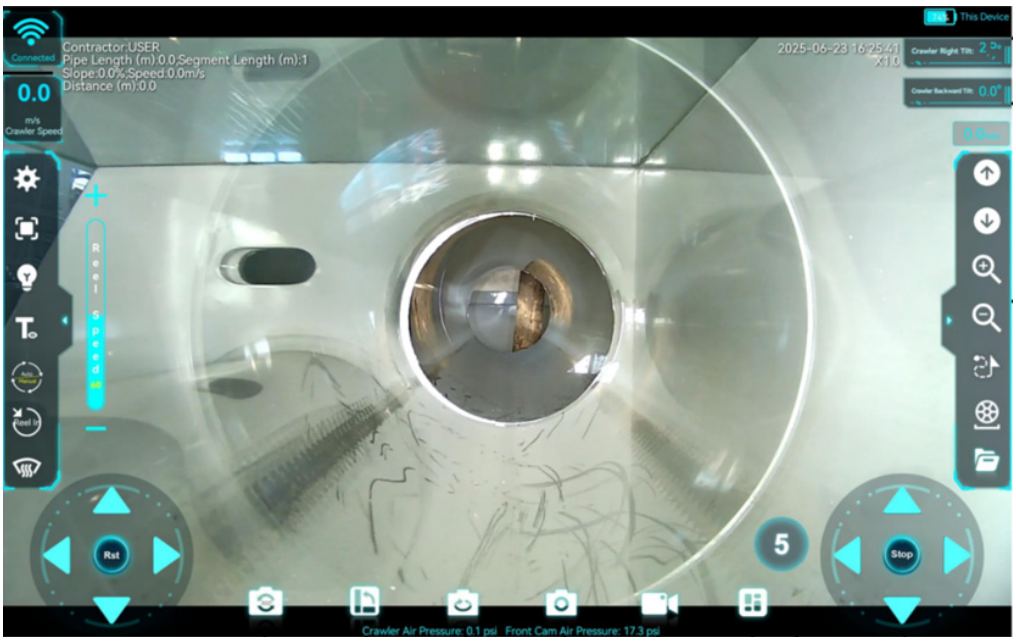
Product Installation & Operation Cont.

14. Device Power-On (Control Tablet Computer)



1. After connecting the cable reel, crawler body, and power supply (lithium battery), turn on the Power Switch and pull out the Emergency Stop Switch on the cable reel.

2. Press the power button on the control tablet.
   - Open **Settings** → enable **WLAN**.
   - Select the Wi-Fi network corresponding to the wireless transceiver (Check the label on the cable reel for the specific SSID).
   - Default password: **12345678**.
3. Launch the control software, which opens the crawler's operation interface. 



You may also configure the Wi-Fi directly in the software:

- Open **Settings**  → select the Wi-Fi network.
- Default password: **12345678**.

Pipeline Inspection Control Software Operation & Parameter Definitions

(Handheld Multi-Function Control Tablet)

1. Overview of the Robot Control Software Interface

01 Network Connection

02 Video Subtitles

03 Crawler Speed

04 Left Function Bar

05 PTZ Control Joystick

06 PTZ 360° Rotation

07 PTZ Quick 90° Rotation

08 Rear Camera View (Switch to Rear Camera)

09 Snapshot (Capture Image)

10 Video Recording

11 Extended Functions

12 Speed Adjustment

13 Crawler Motion Control Joystick

14 Tablet Battery Status Indicator

15 Crawler Left/Right Tilt Angle & Elevation

16 Crawler Front/Rear Tilt Angle

17 Camera Up/Down Height Indicator

18 Right Function Bar

19 Laser Measurement

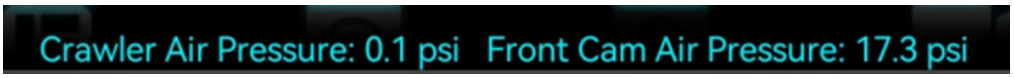
20 Screen-key Synchronization

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

2. Basic Settings of the Crawler

1. Air Pressure Gauge

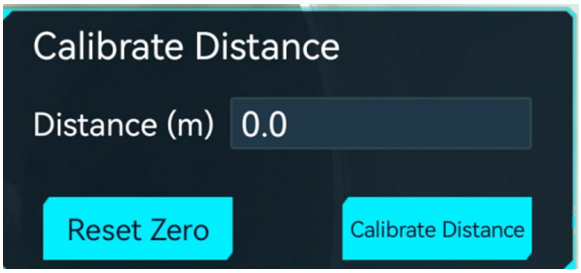


- Normal value is displayed in **blue**.
- When air pressure is in the danger zone, the value will turn **red** and a voice alarm will be triggered.

Air Charging

- **Before charging, make sure the air system has already been calibrated (factory default is calibrated).**
- Because freshly injected air may fluctuate and remain unstable, wait until the progress bar turns blue before the value is considered normal.

2. Counter: Measuring Distance and Speed



- Distance: During pipeline inspection, shows the length of cable released/retrieved.
- Zero Reset: Used to reset the odometer to zero at the starting point.
- Calibration: Used to set an initial cable length value.

3. Crawler Status Display

- Roll (Left/Right Tilt): Displays the crawler's side-to-side tilt angle.
- Pitch (Forward/Backward Tilt): Displays the crawler's front-to-back tilt angle.
- Lift Height: Displays the crawler's lifting platform height in numeric values.

When tilt angle or pitch angle exceeds the alarm threshold, the value turns red and a voice alarm is triggered. If the crawler is moving at that moment, it will immediately stop automatically.

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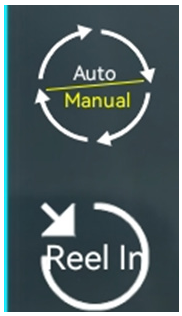
Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

4. Platform Lift Control
    - Lift Up: Press and hold “UP”, release to stop movement.
    - Lower Down: Press and hold “DOWN”, release to stop movement.



5. Cable Reel In/Out Control
    - Reel In: Press and hold “Reel In”, release to stop reeling.
    - Manual/Auto Switch: Toggles between manual and automatic reel-in mode.
        - In Auto Mode, the cable will automatically reel in when the crawler moves in reverse.
    - Manual cable Reeling Knob: When the cable pile-up is excessive and rapid retraction is required, you may manually turn the cable reel knob to reel in the cable.
        - At the beginning of retraction, do not rotate the knob too far. Gradually increase the rotation angle according to the reeling speed.

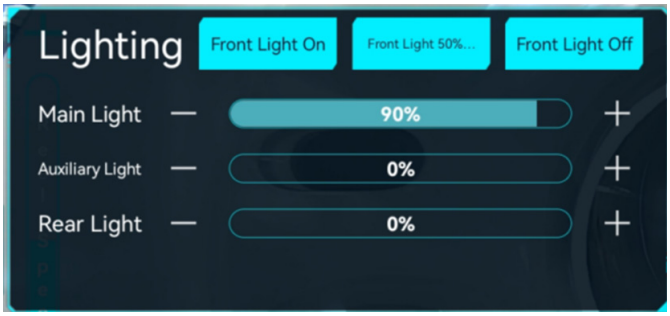
6. Front Camera PTZ Control, Menu & Parameters

- **Pan Left**: Camera rotates left (Pan), real-time precise response to command, rotation range **0-360°**.
- **Pan Right**: Camera rotates left (Pan), real-time precise response to command, rotation range **0-360°**.
- **Tilt Up**: Camera tilts upward, precise response to command, rotation range **0-270°**.
- **Tilt Down**: Camera tilts downward, precise response to command, rotation range **0-270°**.
- **RST (Reset)**: Returns the PTZ camera (dome, motors) to its initial position.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

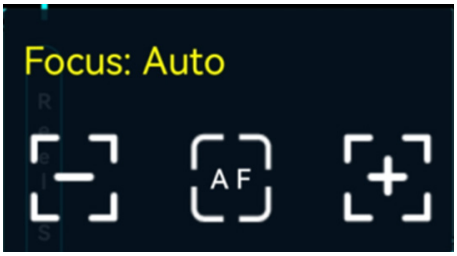
7. Main / Auxiliary / Rear Light Adjustment



Adjusts brightness of the **main light**, **auxiliary light**, and **rear light**.

- Press + to increase brightness.
- Press - to decrease brightness.
- Shortcut keys available for rapid adjustment.

8. Focus Control



- **Focus In**: Press and hold the "+" button, release to stop focusing.
- **Auto Focus**: Tap the "AF" button to focus automatically.
- **Focus Out**: Press and hold the "-" button, release to stop focusing.

9. Zoom Control (Real-time adjustment of the camera's zoom ratio)

- Zoom In: Increase zoom (magnification)
- Zoom Out: Decrease zoom (magnification)

10. Crawler Motion Control

This inspection software displays crawler tilt, speed, distance, and other parameters, allowing real-time monitoring of the crawler's operational status.

- **Forward**: Moves the crawler forward (cable reel automatically switches to unreeling mode).
- **Backward**: Moves the crawler backward (cable reel automatically switches to reeling-in mode).
- **Turn Left**: Left wheels move forward, right wheels move backward → crawler turns left.
- **Turn Right**: Right wheels move forward, left wheels move backwards → crawler turns right.
- **Stop**: Stops crawler and cable reel movement.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

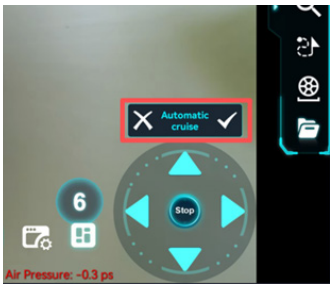
11. Speed Gear Adjustment

Tap the Speed Gear button to open the speed adjustment menu.

Tap "+" or "-" to adjust the following parameters individually:

- **Crawler speed**
- **Turning strength**
- **Camera tilt rotation speed**

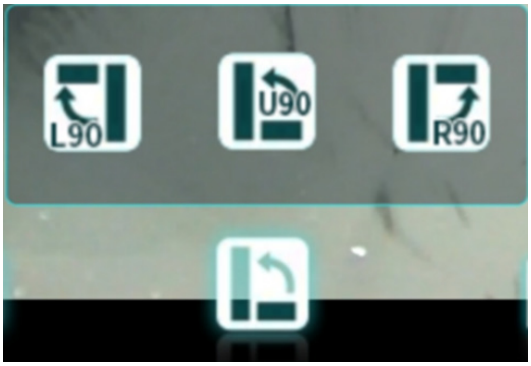
12. Automatic Cruise Function



Press and hold the **Forward** or **Reverse** button to bring up the auto-cruise menu.

Select "✓" to enable auto-cruise mode, or select "X" to cancel auto-cruise.

13. One-Key PTZ Rotation



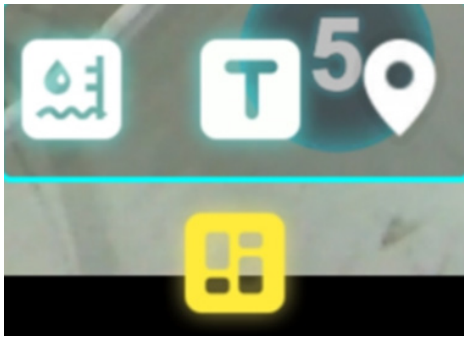
The PTZ camera supports quick positioning with one-click shortcuts:

- Left 90° View: Instantly rotates the camera head to -90°, providing a direct left-side view.
- Upward 90° View: Instantly rotates the camera head to -0° (horizontal/forward), then tilts upward to provide a vertical view.
- Right 90° View: Instantly rotates the camera head to +90°, providing a direct right-side view.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

14. Extended Functions



Some infrequently used functions are included in the extended functions and can be used after opening.

The **Extended Functions** menu contains additional tools that are used less frequently but may be enabled when needed:

- **Water Level Measurement**: Simulates the water level inside the pipeline using a digital water-level ruler overlay. Useful for assessing partial flow conditions.
- **Temporary Subtitles**: Allows the operator to insert temporary text notes at any position on the video screen. These subtitles can be used to highlight defects, annotate inspection progress, or mark specific pipeline features.
- **Positioning**: Displays the crawler's geographic coordinates (latitude and longitude) on the interface. Click the icon again to disable the function.

The positioning service relies on available GPS or network-based sources (WLAN, cellular data, Bluetooth, or IP) to provide location information. GPS only works on tablet location and only in open air environments.

15. Water Level Measurement

Tap the **Water Level Measurement** button to display the on-screen scale. You may select the desired scale color and enter the pipe diameter (mm). Then drag the scale so that its center aligns with the center of the pipe in the image, after which the water level height can be determined.

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Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

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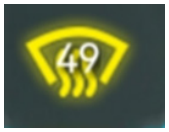
16. Defogging

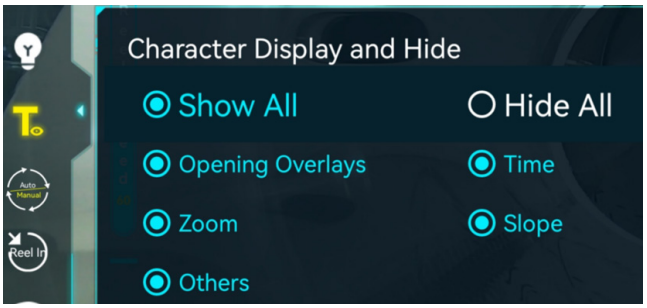
Press this button to activate the defogging function with a countdown timer. The defogging automatically turns off when the timer ends. You may also stop it manually before the countdown finishes.



17. Subtitles

Allows selection of whether subtitles are displayed on video.

- **Show All / Hide All**
- Options: Title, Zoom, Time, Other

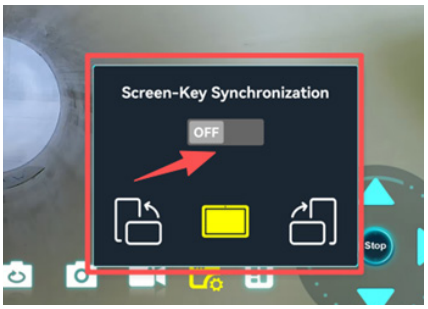


18. Wheel Size Selection

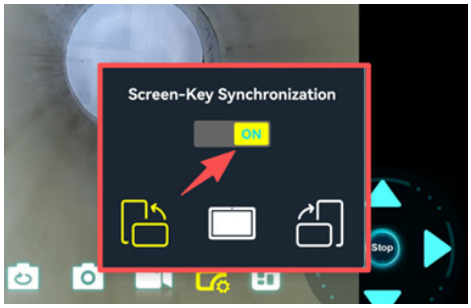
Before starting the inspection, tap the **Wheel Size Selection** button to open the selection menu. Choose the correct wheel size according to the crawler's actual wheels. Only when the correct wheel size is selected can the system properly match the speed during **automatic cable retraction.**

19. Screen-Key Synchronization

When the **Screen Synchronization** function is **turned off**, the display image will **not** rotate automatically when the PTZ camera performs a one-key 90° rotation. The user must manually select the screen rotation option.



When the **Screen Synchronization** function is **turned on**, the display image will **automatically rotate** together with the PTZ camera's one-key 90° rotation and no manual screen rotation selection is required.



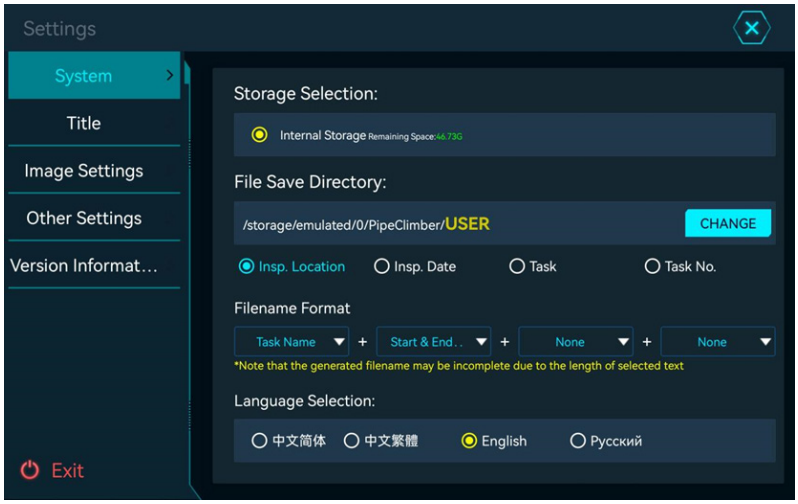
Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

3. System Menu Settings

Click **System Options** to configure system parameters.

1. System Options

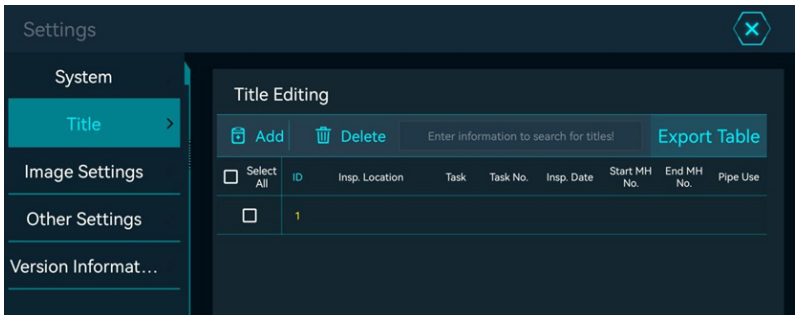


- **File Save Directory:** Users can set the save path for captured images and recorded videos for easy access.
- **Language Options:** English and Chinese
- **Measurement Units:** Default is **metric (meters)**, can be switched to **imperial (feet).**

2. Edit Header Information

Users can add metadata to inspection records, including:

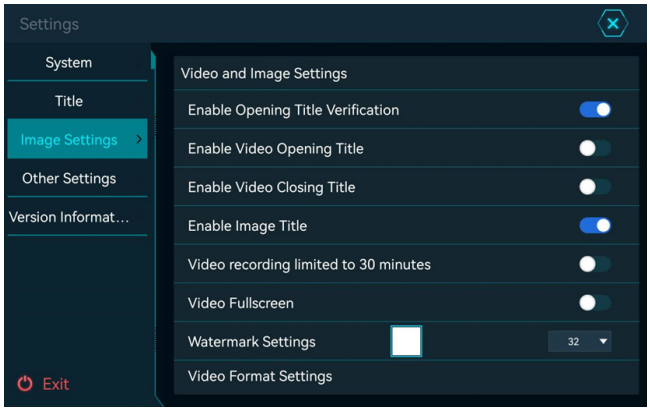
- Monitoring location
- Task number
- Pipe section number
- Date / time
- Inspection unit / operator

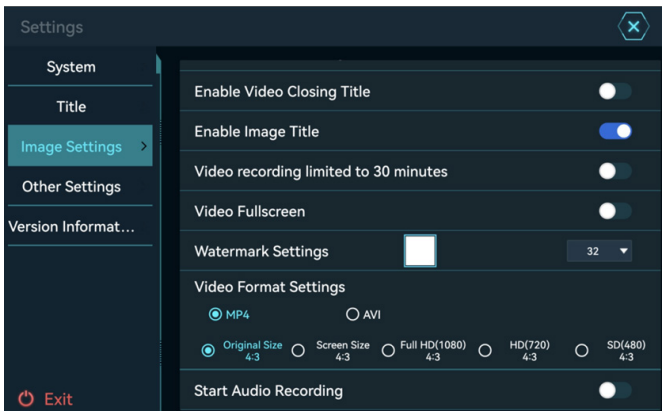


- Notes or remarks

Click **Add** to enter inspection data such as monitoring point, collection info, and GPS data. After editing, click **Confirm** to save the information.

If you click **Cancel**, the edited information will not be saved.





3. Image Settings

Enable Header Verification: Automatically checks manhole ID information at the video header. If a duplicate manhole ID is entered, the operator will be notified.

Enable Video Header: Records header information at the beginning of the video. (Press and hold the **NEXT** button to switch to mid-video information.)

Enable Video Trailer: Records trailer information at the end of the video. (After pressing the **Stop Recording** button, the system automatically switches to trailer information and continues recording for several seconds.)

Enable Image Editing: Allows editing of captured images during video recording.

Video Recording Limit - 30 Minutes: Recording will automatically stop after 30 minutes.

Full-Screen Video Display: Video fills the entire screen.

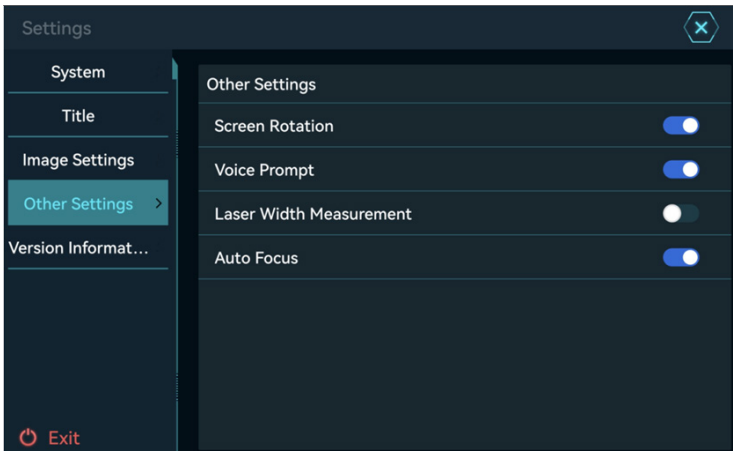
Watermark Settings: Adjust character color and size.

Video Format Settings: Select video format and resolution.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

Enable Audio Recording: Records the operator's voice from the tablet into the video.



4. Other Settings

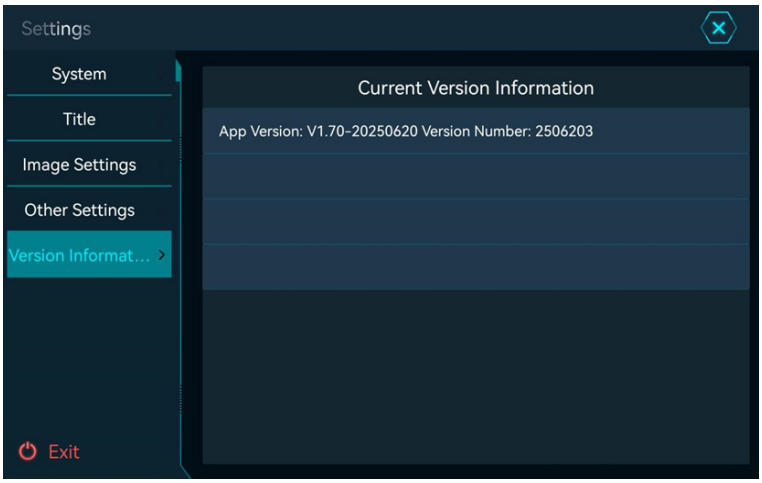
Screen Rotation: The display content rotates automatically when the screen is rotated.

Voice Prompt: Provides spoken notifications for operation information.

Laser Measurement: Activates the laser light on the lens, which can be used to measure defect dimensions.

Auto Focus: The lens automatically adjusts focus.

5. Version Information: You can view the APP software version and the software versions of other components on this page.



Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

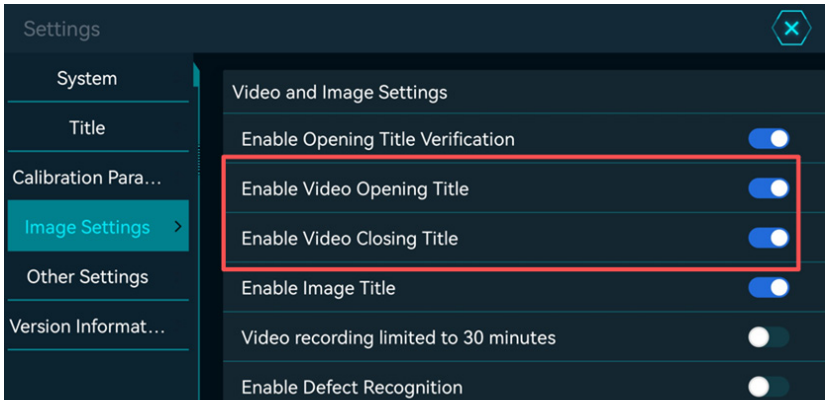
(Handheld Multi-Function Control Tablet)

4. Photo and Video Recording Functions

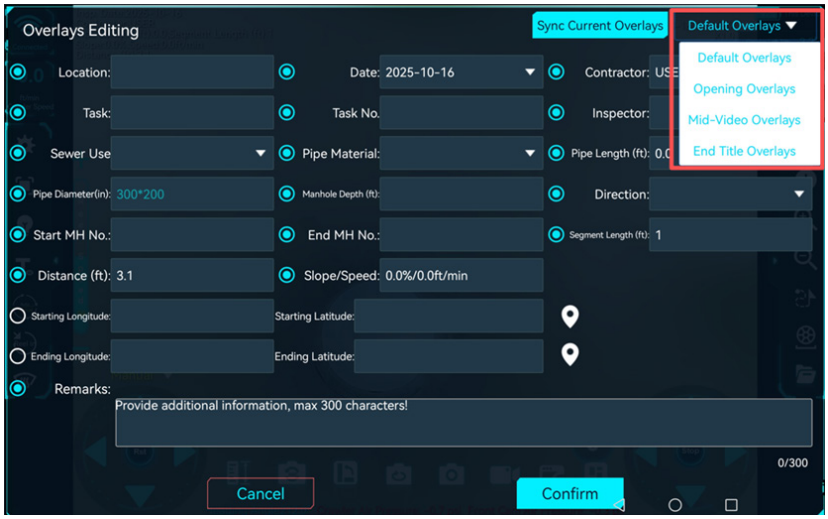
1. Take a Photo:
   - Click the camera icon on the lower icon bar to take a photo.
   - Edit photo or continue

2. Video:
   - Click the video icon on the right to start recording, and click it again to stop recording.
   - The video file is in MP4 format. You can click the playback icon to view the video.

3. Video Overlay:
   - If opening and ending overlays are required during recording, first enable the **Opening Title** and **Closing Title** options in **Video and Image Settings** on the Settings page (both are disabled by default).



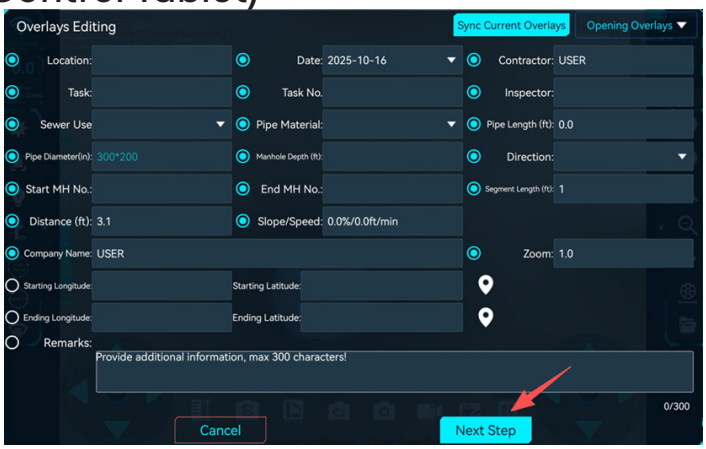
   - When the **Record** button is pressed, the subtitle editing interface will appear, allowing you to edit the **Opening**, **Mid**, and **End** overlay information separately.



Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

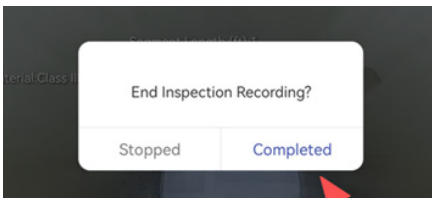
- After completing the overlay editing, tap **Next Step**.



- Tap **Save** to begin recording.

- During recording, if you need to switch to the **Mid Overlay**, press and hold the **Next** button.

- When recording is finished, tap **Completed** — the system will automatically record the **End Overlay**.



4. Pause Recording:
   - Stop recording and resume normal recording.
5. Taking pictures during a video:
   - In the video state, you can directly click to capture.
   - You can correspondingly select functions such as storage path, defect type and defect description for editing.
   - Click OK to save the picture to the default or created root directory.
6. Switch between front and rear cameras:

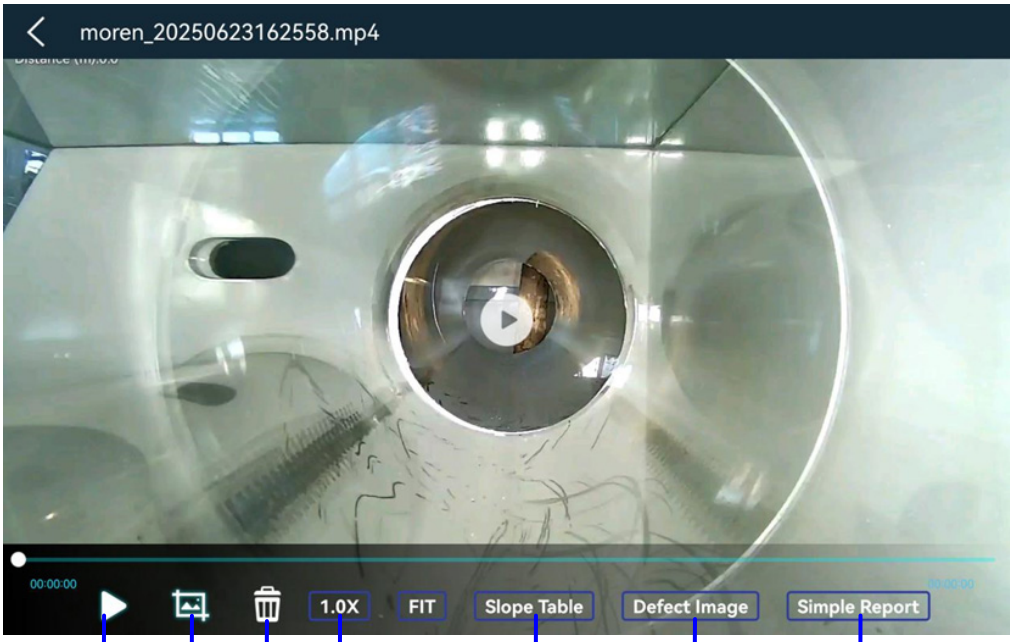
7. Open the file:
   - Click the folder to open video files (currently support video files with suffix.MP4/.AVI) and images files (currently support image files with suffix.JPG).

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

You can rename edited pictures and presets, copy videos and pictures. Click on a picture to view its information, delete or edit it. You can also select all, invert selection or delete all pictures or videos.

Video Replay

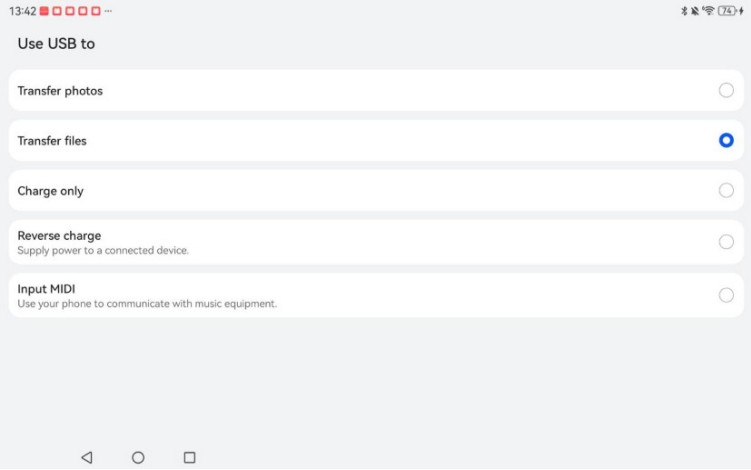


Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

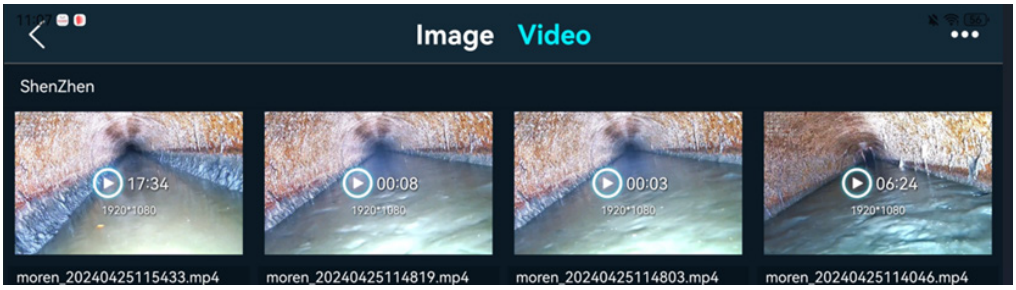
5. Files Export

1. Connect the device to the computer using the data cable that comes with the device. The tablet page will pop up a message asking "Do you allow access to device data?" Select "Yes" to access the data.
2. Pull down the status bar at the top of the screen → File transfer via USB → Click "Transfer Files"
3. At this time open the internal storage, and export the required files. When exporting the video, the corresponding files need to be exported at the same time (one is the video file and the other is the data file).
4. After the video files is copied into the computer, it supports the video playback characters show the well number, detection date and time, ranging, zooming, pipe diameter, detection location, and custom information.

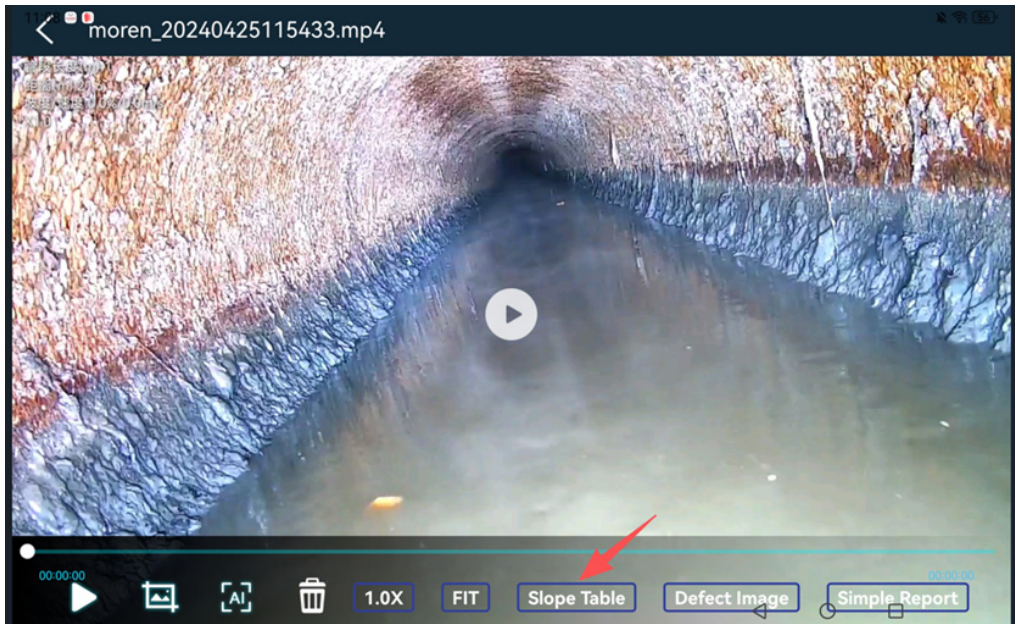


6. Slope Table Report Generation Method

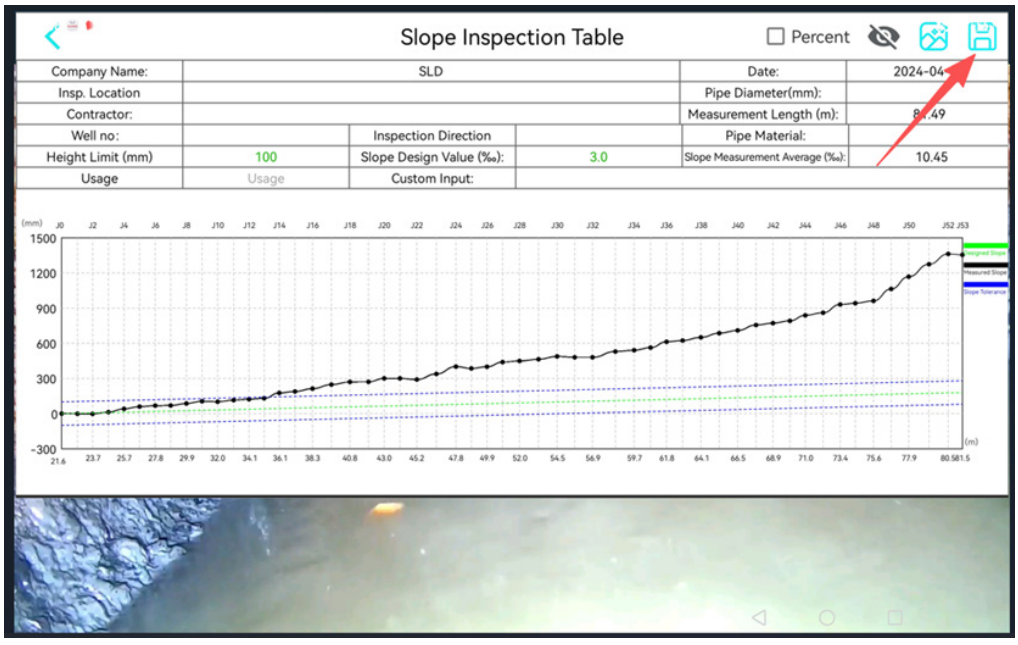
1. Enter the folder and select the inspection video for which you want to generate a slope table.



2. Click the “Slope Table” button.



3. The slope table will be generated automatically. Click the “Hide” button to display the slope curve, then click “Save”.

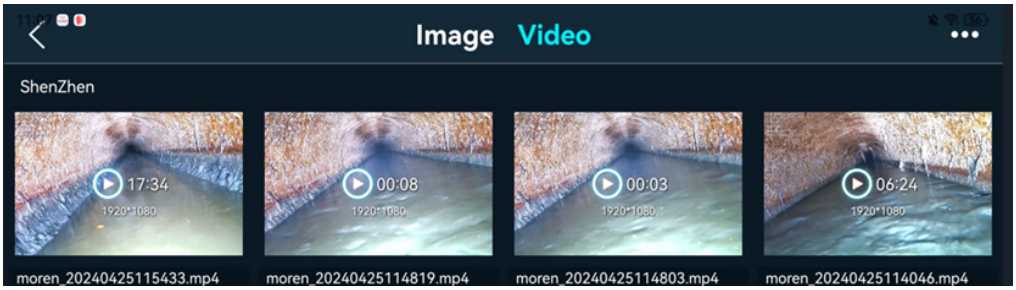


Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

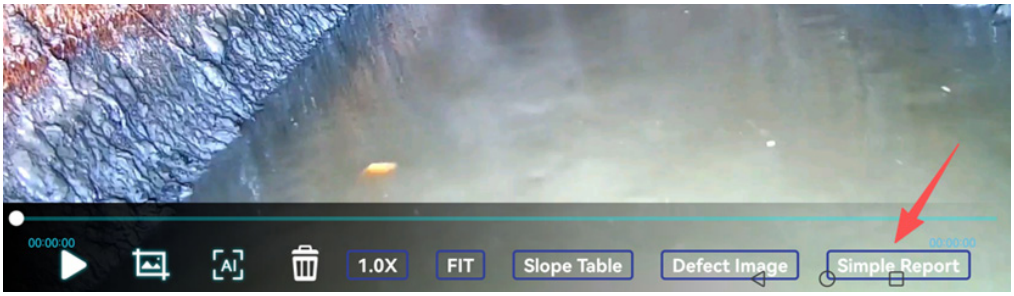
(Handheld Multi-Function Control Tablet)

7. Method for Generating a Simple Inspection Report

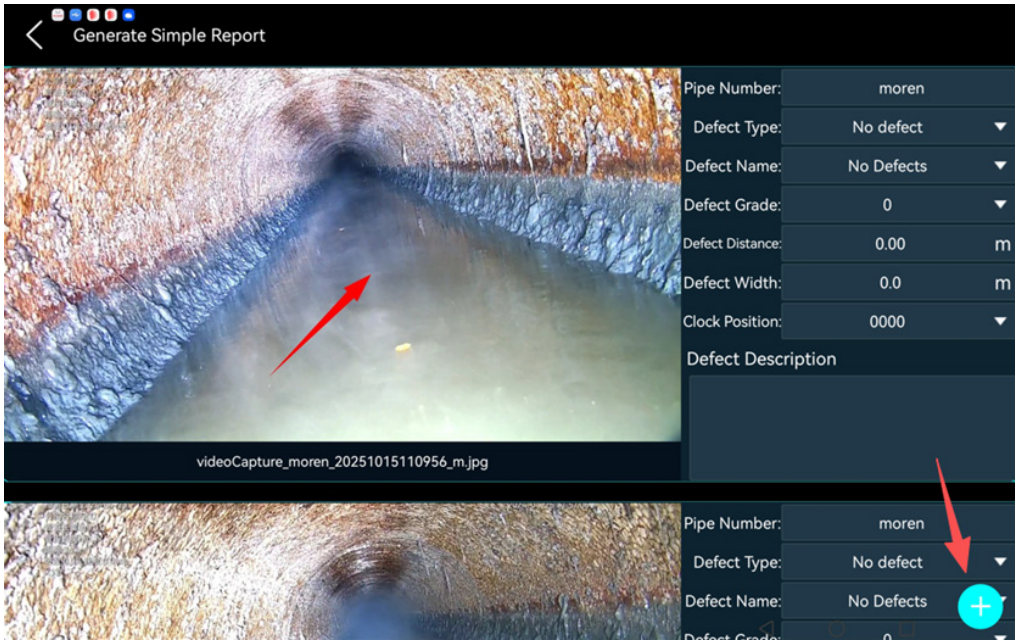
1. Enter the **File Folder** and select the inspection video for which you want to generate a report.



2. Click the **Simple Report** generation button.



3. Click the "+" button in the lower-right corner.



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Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

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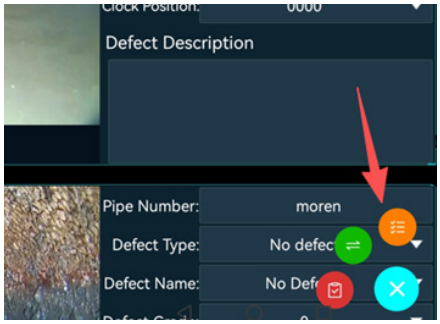
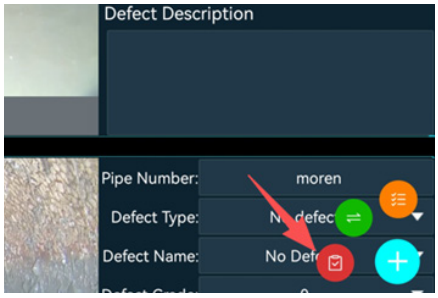
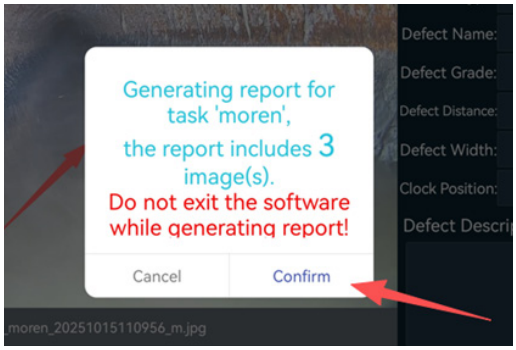
4. Click **Select All** to select all defect images.



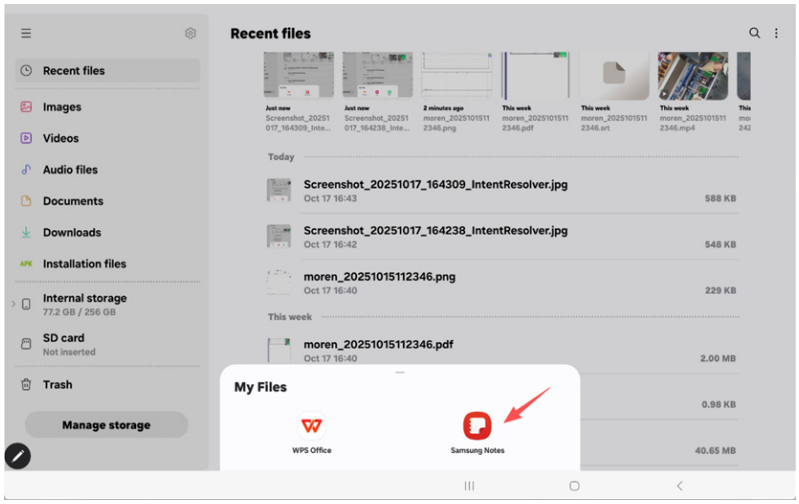
5. Click the **Report** button in the lower-right corner to generate the report.



6. Click **Confirm** to complete report generation.



7. Open the **Samsung Note** to view the generated report.

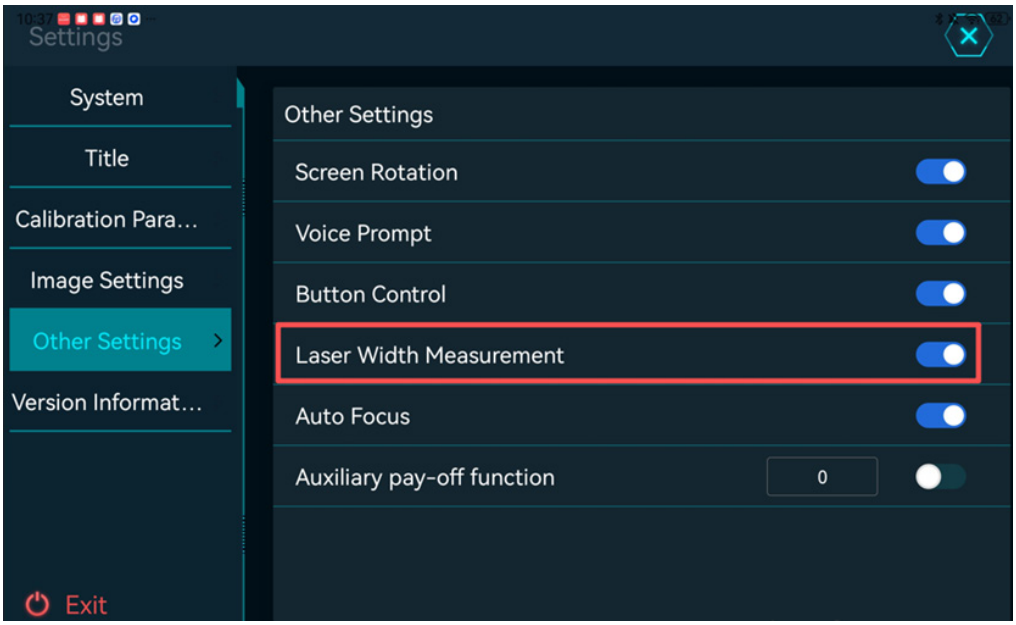


Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

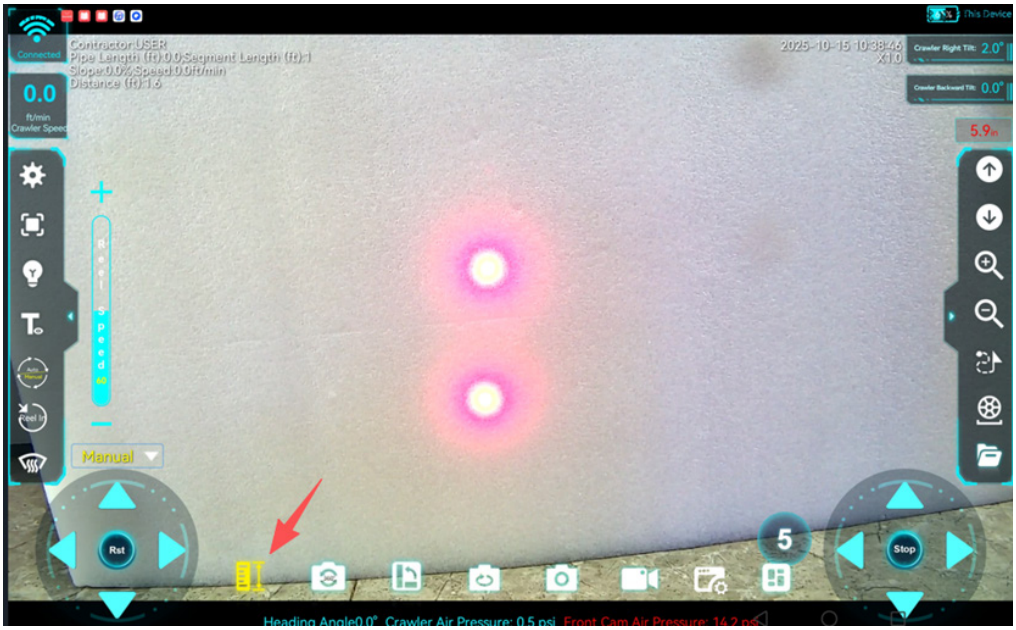
(Handheld Multi-Function Control Tablet)

8. Laser Measurement Operation Method

1. Turn on the Laser Measurement option in the settings.



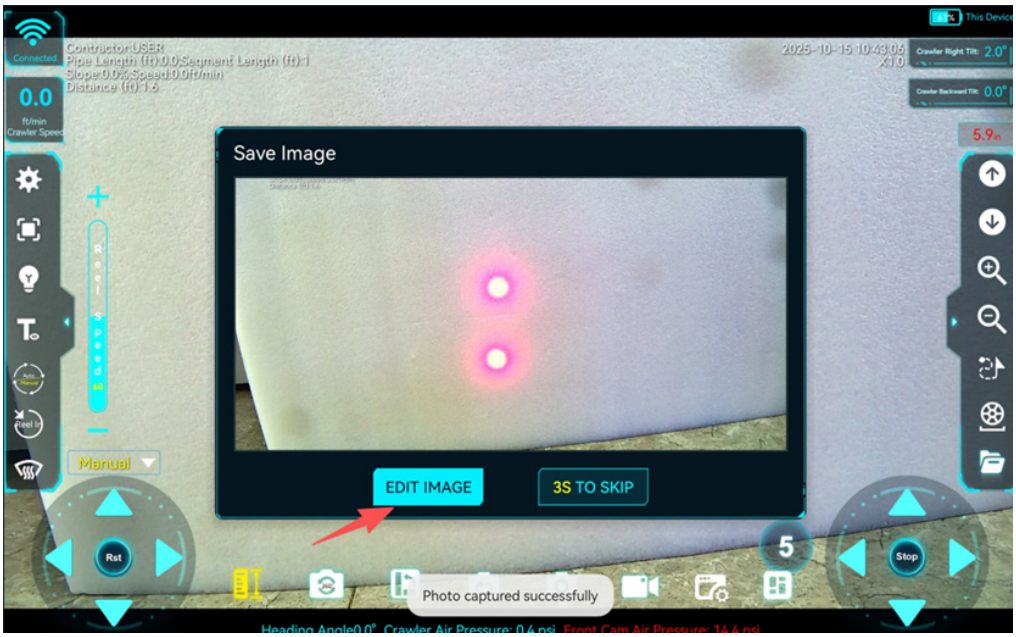
2. Click the Laser Measurement button — the laser lights on the camera will turn on, and two laser dots will appear on the screen.



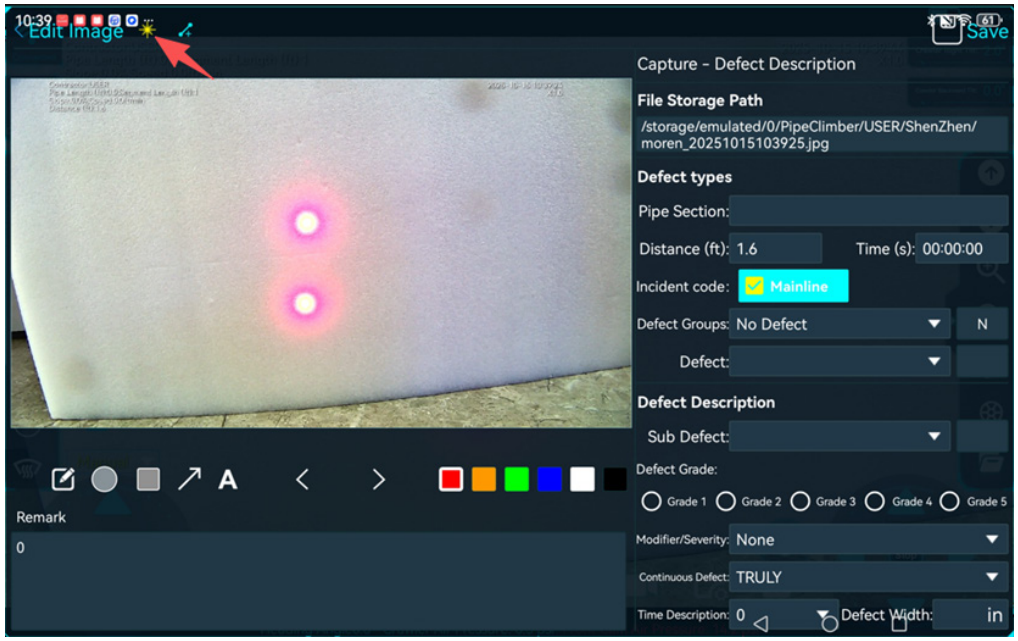
Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

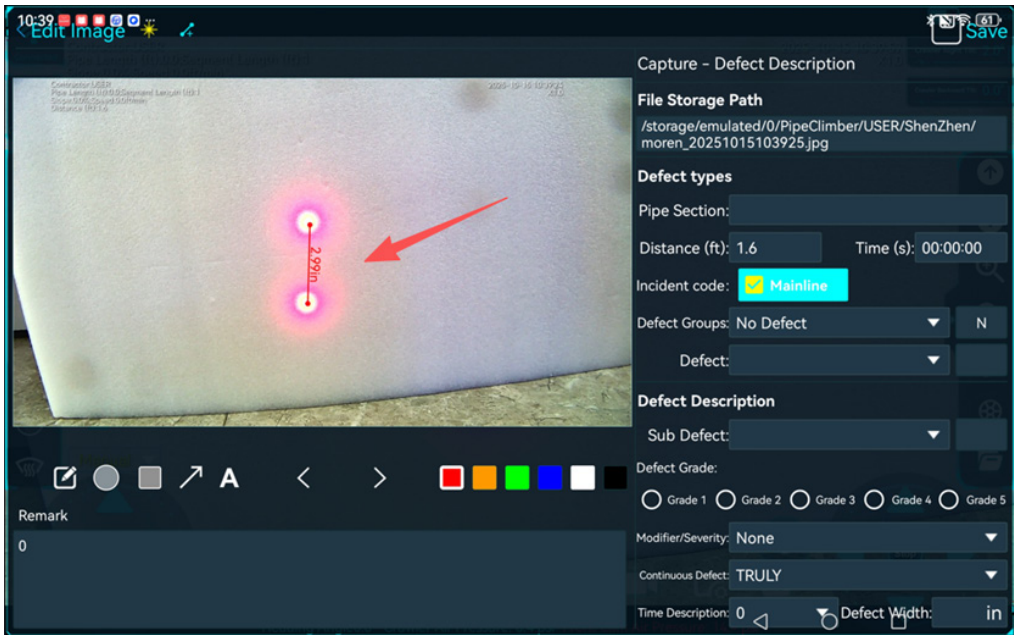
3. Click the Capture button, then click Edit Image.



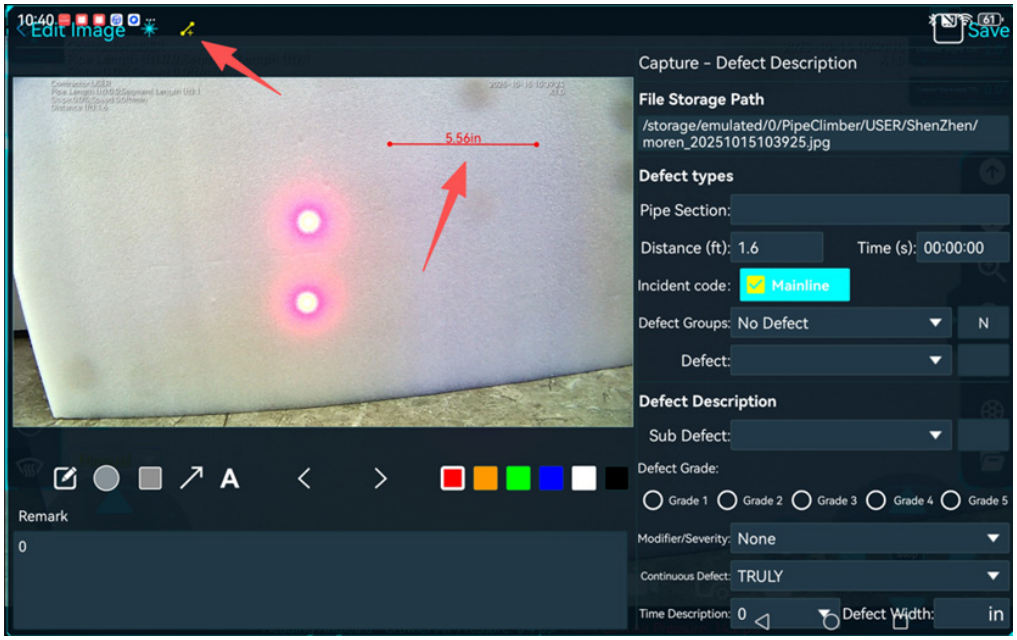
4. Click the Laser Calibration button to perform distance calibration.



5. Click the two laser dots in sequence to complete calibration.



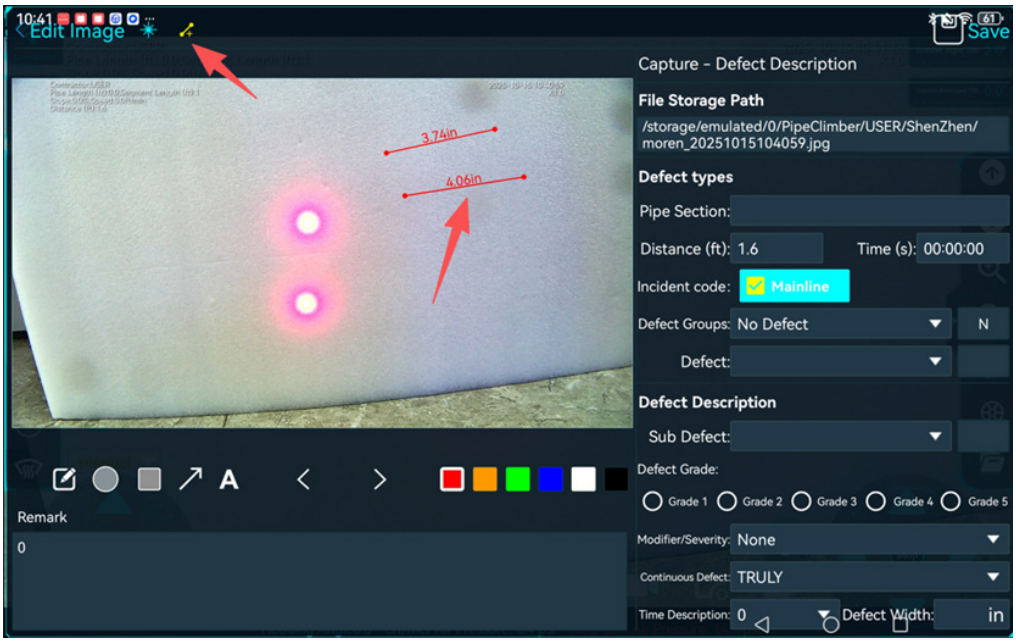
6. After calibration is complete, begin measurement — first click the Measure button, then proceed with measurement.



Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

7. Click the Measure button again to perform another measurement. After completing all measurements, click Save.



9. Controller Usage Instruction

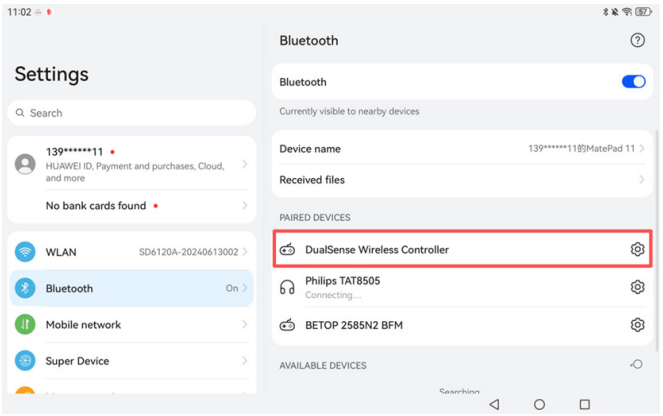
1. Press and hold the **Power Button** on the controller until the indicator light turns on.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

2. Tap the **Settings** icon on the control tablet.

3. In the Bluetooth settings, locate **DualSense Wireless Controller** and initiate pairing.



4. After pairing is complete, open the control software. You may now operate the system using the controller. To view the function of each button, press the controller's **Power Button** again.

Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

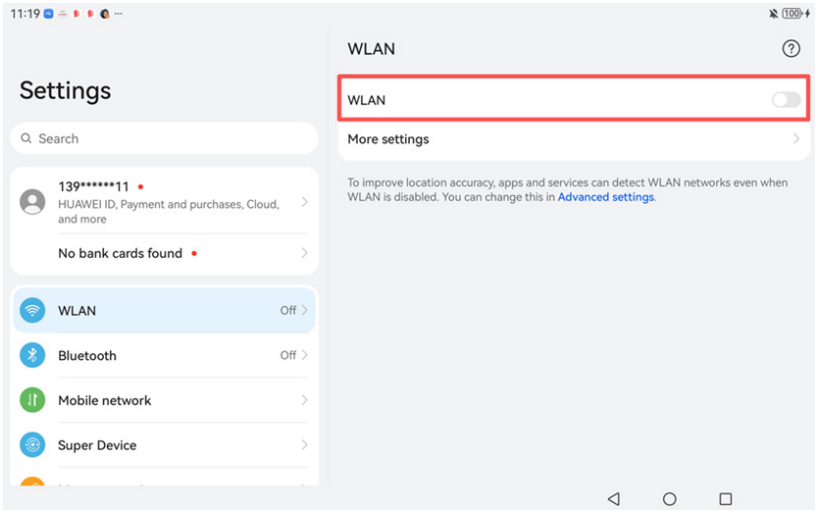
(Handheld Multi-Function Control Tablet)

10. Description of Three Heading Modes

1. **Manual Mode:** The crawler's forward direction is fully controlled manually by the operator.
2. **Adaptive Mode:** The crawler automatically corrects its tilt angle to maintain a level and stable forward movement.
3. **Directional Mode:** The crawler continuously maintains a fixed heading while moving forward.

11. Software Update

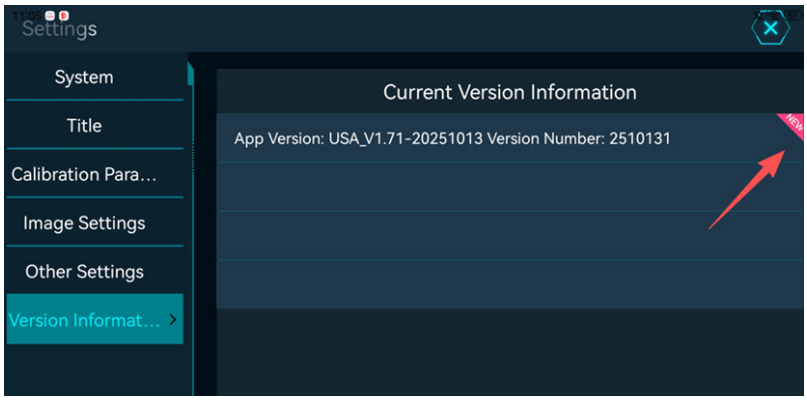
1. Open the tablet's **Settings** page and connect to a Wi-Fi network with internet access.



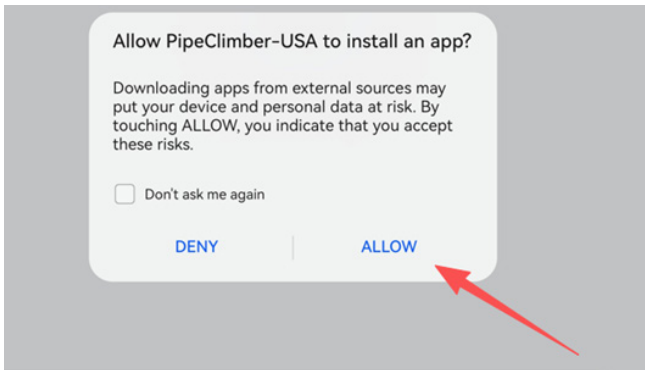
Pipeline Inspection Control Software Operation & Parameter Definitions Cont.

(Handheld Multi-Function Control Tablet)

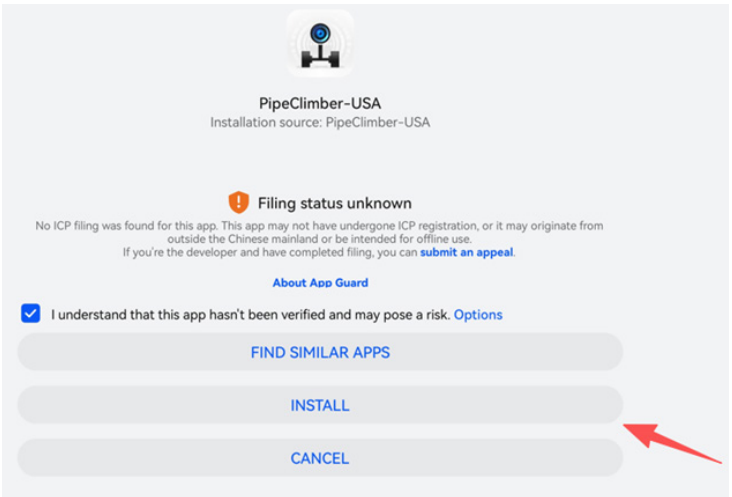
2. Enter the app, go to **Settings** → **Version Information**, and tap the new software version to begin downloading.



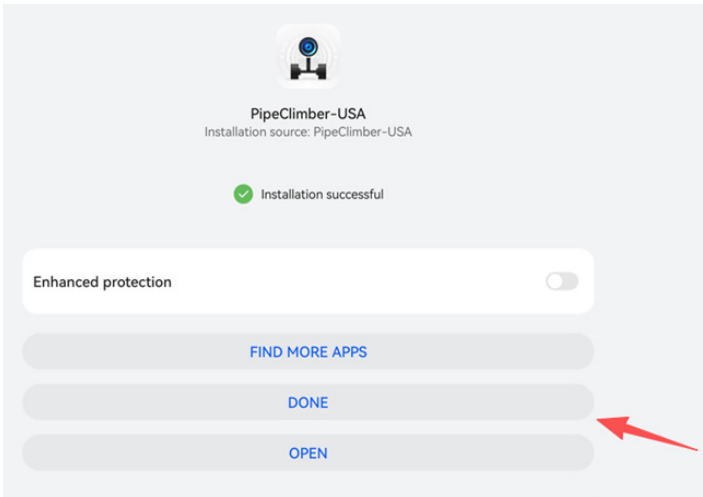
3. After the download is complete, the installation process will start automatically.



4. Tap the **Install** button to proceed.



5. Once installation is complete, the software update is finished.



Cleaning & Maintenance of Crawler & Components

Since the pipeline inspection robot is often used for municipal drainage inspection, outdoor exploration, and mobile site operations (e.g., inspecting sewage pipelines, monitoring and assisting in blockage removal, or sludge cleaning), the crawler and its cable connections are prone to corrosion or contamination from foreign substances (such as acidic or alkaline materials). Therefore, it is necessary to rinse, clean, and maintain the crawler and cables after each use.

Preparation Before Washing

- Prepare a high-pressure washer before cleaning the crawler.
- The crawler body can be detached for separate cleaning (note: DO NOT spray water directly into connectors such as the camera port or cable reel port). Cleaning without disassembly is also acceptable.
- During washing, DO NOT spray directly on the cables. Avoid directing water at the cable reel body or controller power section to prevent equipment damage. (Ensure all power is turned off before cleaning.)

Cleaning the Crawler

- Select an open working area and connect the high-pressure washer.
- Hold the washer nozzle with both hands at least 50 cm to 1 m away from the crawler (distance depends on washer power and water pressure settings) to avoid splashing wastewater onto the operator. For safety, operators may wear waterproof clothing such as boots, raincoats, or work overalls.
- Once everything is ready, turn on the washer and spray the crawler body and dirty areas until the crawler is thoroughly clean.

Cable Reel Cleaning

Use a basin or bucket of clean water and a soft cloth dampened with water to wipe the dirty areas of the cable reel housing.

Notes:

- Before cleaning, disconnect all related devices from the cable reel, unplug the charger, switch off the power, and move the cable reel away from children and flammable/explosive materials.
- Do not allow water to enter the battery, power socket, or video signal port. Moisture ingress can cause short circuits, damage the circuit board, or result in the reel failing to power on or transmit video.
- If water accidentally enters the battery, charger, or plug, allow the unit to dry thoroughly for several days before reconnecting to power, to avoid electrical hazards.

Cleaning & Maintenance of Crawler & Components Cont.

Cleaning the 48V Power Adapter

1. Unplug the adapter from the power outlet.
2. Use a damp soft cloth with clean water to wipe the exterior and interior surfaces of the 48V power adapter.

Notes:

- The warning label area must be kept dry. If water enters, wait several days for the adapter to dry completely before reconnecting to power, to avoid damage.

Routine Maintenance

1. After field inspection, do not immerse the device in water for cleaning. Use a slightly damp soft cloth to clean the monitor and the crawler housing, then wipe dry with a clean towel. Store in the safe and dry area to prevent impact, vibration, or unnecessary damage.
2. When not in use, switch off power. Store the device in its safe and dry area to ensure safety and prolong service life.
3. Do not operate outside the temperature range of -4°F to +122°F.
4. If the display shows low battery, recharge immediately. Do not overcharge. When charging, the indicator turns green when complete - disconnect the charger promptly. For long-term storage, charge the battery at least once a month to keep it in standby condition.
5. Do not use the device in hazardous or explosive environments.
6. For long-term storage, keep the device in a dry, ventilated location. If not used for more than six months, inspect the camera module seals. If any abnormalities are found, return the unit for maintenance.

Troubleshooting

Before seeking assistance, please refer to the table below for possible causes and solutions:

Cause	Solution
Fails to Power On	1. Verify the power button has been pressed. 2. Check to make sure the e-stop is pulled out. 3. Verify the power cord is plugged in.
Cannot Record Video	1. Check internal storage of tablet; confirm sufficient storage space. 2. Check if record button is responsive (file size may vary depending on brightness conditions).
No Image at Startup	Inspect lens for dirt or obstructions. Verify zoom/focus keys were not pressed excessively, causing the image to zoom in/out or focus incorrectly.
Image Blurry/ Unclear	Inspect lens for dirt or obstructions. Check connectors are properly seated and cables are secure.
No Control Response	1. Check whether connectors are properly plugged in. 2. Check if cables are loose.

Notes:

If the crawler malfunctions during operation, immediately switch off the circuit breaker or disconnect from the power supply to prevent electric shock or fire hazards.

Do not attempt unauthorized repairs. All maintenance must be carried out by qualified technical personnel to avoid risks of electric shock or fire.

Key Inspection Checklist

Before operating the equipment, please follow this checklist to perform functional inspections:

Class	Inspection Item		Test Standard	Test Result
Functional Check	PTZ Camera	Pan Rotation Function	360°	
		Tilt Rotation Function	270°	
		Zoom In	1-10x	
		Zoom Out	10-1x	
		Reset (RST) returns lens to initial position	≤5° deviation	
		Front/Rear Camera Switching Function		
		Normal Focus Adjustment (+/-/AUTO)		
		Main Light Brightness Adjustment	0-10 Levels	
		Auxiliary Light Brightness Adjustment	0-10 Levels	
		Rear Light Brightness Adjustment	0-10 Levels	
	Crawler Body	Lift Up Function	0-6”	
		Lower Down Function	150-0m	
		Forward Motion (controlled via motion joystick)	Forward	
		Reverse Motion (controlled via motion joystick)	Reverse	
		Left Turn		
		Right Turn		
		STOP Button		
		Speed Adjustment	0-9 Levels	
		Steering Sensitivity Adjustment	0-9 Levels	
		Lift Height display matches actual height	0-6”	
		Pitch Angle display matches actual tilt	0-90°	
		Roll Angle display matches actual tilt	0-90°	

Key Inspection Checklist Cont.

Class	Inspection Item		Test Standard	Test Result
Functional Check	Cable Reel	Odometer Measurement	Accuracy ± 0.3%	
		Reel Automatically Retracts Cable		
		When in linkage mode, reel automatically unreels; when disengaged, reel does not unreel automatically		
		Emergency Stop Button Shuts Down Control System		
		Interfaces Function Properly		
		Reciprocating Lead Screw Moves Normally		
		Battery Power Sufficient (≥25%)	≥25%	
	Control Software	System Option	Available	
		Header Editing	Available	
		Parameter Settings	Available	
		Image Settings	Configurable	
		User Account	Manageable	
		Storage Path	Configurable	
		Recording/Snapshot	Functional	
		Remarks Function	Applicable	

All functional checks completed. System initial inspection finished.

Appendix I - Manhole Entry Operation

Preparation Before Entry

Before lowering into the manhole, ensure that the power is switched off, the lifting mechanism is fully lowered, the crawler is securely connected to the rear connector, and the camera head screws are tightly fastened. Before each manhole entry, the user must ensure all screws are locked and the crawler tail connector is firmly secured.

Pressurizing the Equipment

1. Unscrew the nut on the crawler's air inlet.
2. Connect the helium cylinder outlet securely to the crawler air inlet.
3. Open the valve and release air inside, then fill the crawler with helium until all air is discharged.
4. Close the exhaust valve, then continue filling until the crawler reaches a pressure of **10-14 PSI**.

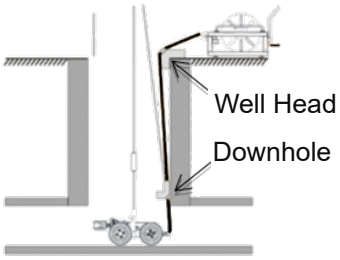
If helium is not available, dry nitrogen or other filtered dry gas may also be used.

Lowering the Crawler

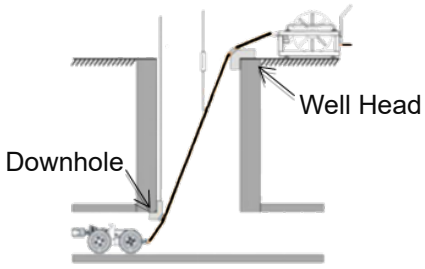
1. Turn on the controller and start the inspection software. Verify that the system is functioning normally before beginning the lowering operation.
2. Connect the crawler body with the cable reel and attach the lifting hook.
3. Secure the lifting device with a rope or hoist, keeping the crawler level while lowering to avoid swinging and contact with the manhole wall.

If vertical lowering is used, the crawler must be positioned head-up (camera head at the top).

WARNING: Under no circumstances should the crawler be lowered head-down.



Vertical Lifting Method



Horizontal Lifting Method

Appendix I - Manhole Entry Operation Cont.

4. When approaching the manhole bottom, guide the crawler tail into the pipeline first, then release the cable to let the system settle horizontally.
5. Ensure the cable passes through the protective sleeve and pulley system at the manhole opening to prevent abrasion.
6. Adjust the pulley size and place it properly at the manhole opening; thread the cable through the pulley before lowering.

Inspection Operation

1. After the crawler reaches the designated inspection position, ensure the equipment is stable.
2. Press the controller power switch, then press the start button once to boot into the computer interface.
3. Adjust the lifting mechanism to set the front camera system to a proper height.
4. Turn on the main and auxiliary lights and adjust them to meet image requirements.
5. Drive the crawler forward slowly and adjust the guiding pulley to a suitable position and secure it.
6. After confirming that the cable is feeding normally, adjust the crawler's traveling speed according to inspection needs.
7. During inspection, closely monitor parameters on the HMI interface, especially the crawler tilt status, to prevent rollover.
8. During operation, acceleration and deceleration should be gradual; avoid sudden braking or stopping.
9. When reversing the crawler, switch on the rear camera and use the cable reel to pull the crawler back. If the pipeline has bends, use the reverse key to reduce speed, ensuring the retrieval speed is close to the reversing speed.
10. When the crawler turns inside the pipeline, set the turning speed within the range of 3-5. When reversing inside the pipeline, set the gear to 2 on the wireless controller or main controller to avoid excessive speed that could cause collision with the pipe wall and damage the crawler.

Note: During pipeline operation, the crawler's turning speed must be set to 4-5, and the reversing gear must be set to 2.

Appendix II - Recommended Pipe Diameter Range for Different Wheel Sizes

Wheel Size	Minimum Applicable Pipe Diameter	Recommended Pipe Diameter Range	Remarks
2.8” Wheels	5.9”	6”~8”	For 6” pipe, auxiliary light needs to be removed
3.9” Wheels	7.9”	8”~12”	
5.1” Wheels	9.8”	10”~16”	
7.9” Wheels	11.8”	12”~24”	
9.1” Wheels	15.7”	16”~40”	

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