



SPARTAN

FOR TOUGH CUSTOMERS.

SINCE 1943



PRODUCT MANUAL



Sewer Inspection Camera

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Introduction

The pipe inspection system is a powerful set of tools that helps you locate and diagnose problems in a pipeline system. The system is widely used in inspections of sewer, central air conditioning, chimney, plumbing, building, cable pipe and pipe ventilation systems and other places.

The following pages provide and grant you the authority to undertake certain functions with the Sentinel HD camera system. Spartan Tool, LLC requires you to read this carefully before using the inspection system and the related accessories. It provides important notes to help you avoid accidents, damage and injury.

GENERAL SAFETY RULES

Read all safety warnings and instructions. Failure to follow warnings and instructions may result in electric shock, fire and/or serious injury.

1. Save this operation manual for future reference.
2. Do not operate this device in explosive atmospheres, such as in the presence of flammable liquids, gases, hazardous chemicals, superheated liquid or heavy dust. It may create sparks which may ignite the dust or fumes.
3. The camera head and the push cable are waterproof (when camera installed on rod cable); however, the keyboard and DVR inside the control box are not. Do not expose them to water or rain when the control box is open. This will increase the risk of electrical shock.
4. Avoid using the device in environments of extreme cold, heat or humidity as it may damage the device.
5. Do not drop or press hard on the device.
6. Always back up your data before inserting your SD memory card to this system. The manufacturer is not responsible for any data loss or damage on your SD memory card for any reason.
7. Do not disconnect the unit while recording or playing back. It may damage the unit and/or the SD memory card.
8. Only qualified persons are allowed to repair this device. Service or maintenance performed by unqualified person could result in injury.
9. Do not use this device in places where there is high voltage equipment. The device doesn't contain high voltage protection and isolation.

APPLICATION

Suitable for pipes at diameter of 25mm-200mm. Ability to go through 90° bends in pipe DN45mm (for 23mm camera with 5.2mm rod); and in pipe DN32mm (for 14mm camera with 4.8mm rod) and in pipe DN52mm (for 23mm camera with 6.8mm rod).



The pipe inspection system includes the following four main parts: camera head, cable reel, frame and control box (including DVR, control device, battery, and keyboard).

The camera head includes high-light white LEDs and a highly scratch-resistant sapphire lens cover; this coupled with stainless steel housing allow the camera to withstand repeated hits in various pipes.

Flexible stainless steel spring and associated components make the camera head possible to go through bend pipes. The battery pack provides power supply for the system and the DVR monitor can record video and take photos.

The stable and open composite structure is easier to clean.

CAMERA HEAD

1. Sapphire Lens
2. PC lens
3. Stainless Steel Shell
4. Stainless Steel Spring
5. Camera O-ring
6. Gold Connector

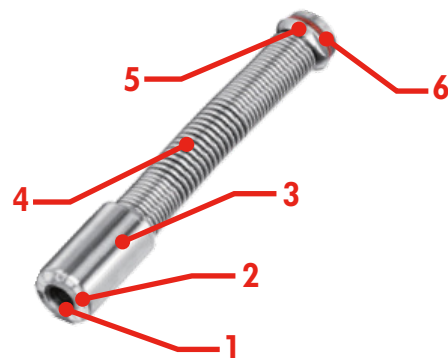


FIG. 1
Camera Head

CABLE UNIT

1. Support Frame
2. Coil Wheel
3. Push Cable
4. Entry Component
5. Wireless Keyboard Receiver
6. Socket (connect to toolbox)
7. Connects Cables
8. Control Box Holder
9. Coil Fixing Plate
10. Hook
11. Ball Lock Pin
12. Cable Connector (To Camera)
13. Camera Head
14. Cable Stop Housing
15. Camera Holder

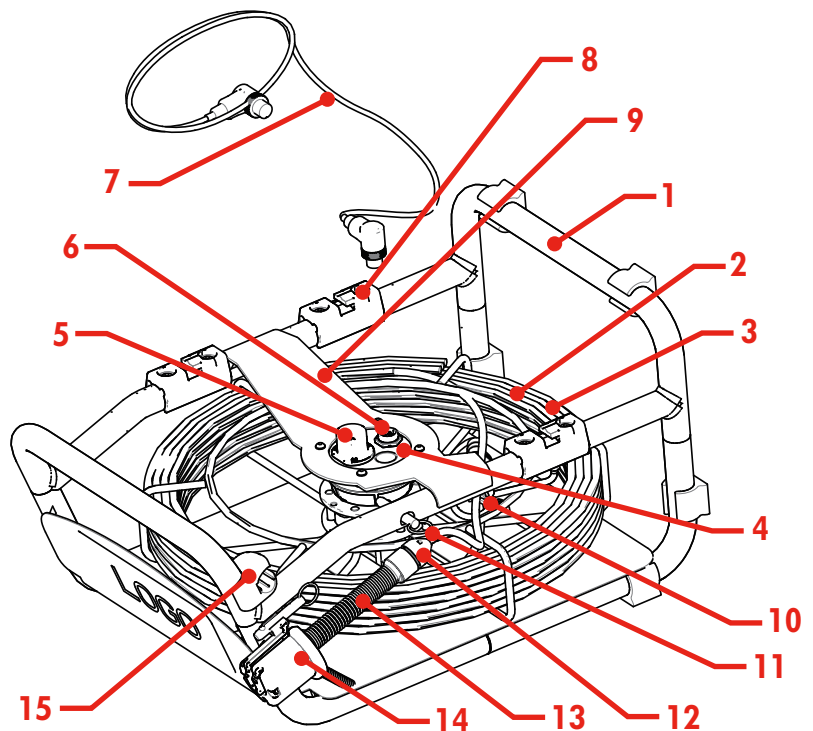


FIG. 2
Cable Unit

Know Your Tool

CONTROL BOX

1. Switch button
2. SD card slot
3. Sunshade
4. High-definition color LCD display
5. DC input
6. Meter counter zero-set button
7. Wireless keyboard
8. Aviation socket
9. Playback mode
10. Menu settings
11. Charging and working indicator
12. Image zoom/exit and return
13. Select left/rewind
14. Downward selection
15. Select right/fast forward
16. LED brightness
17. Remote control receiver
18. Start/stop recording
19. Photo shoot button
20. Image rotation
21. Upward selection
22. Confirmation/Pause
23. Control Box lock

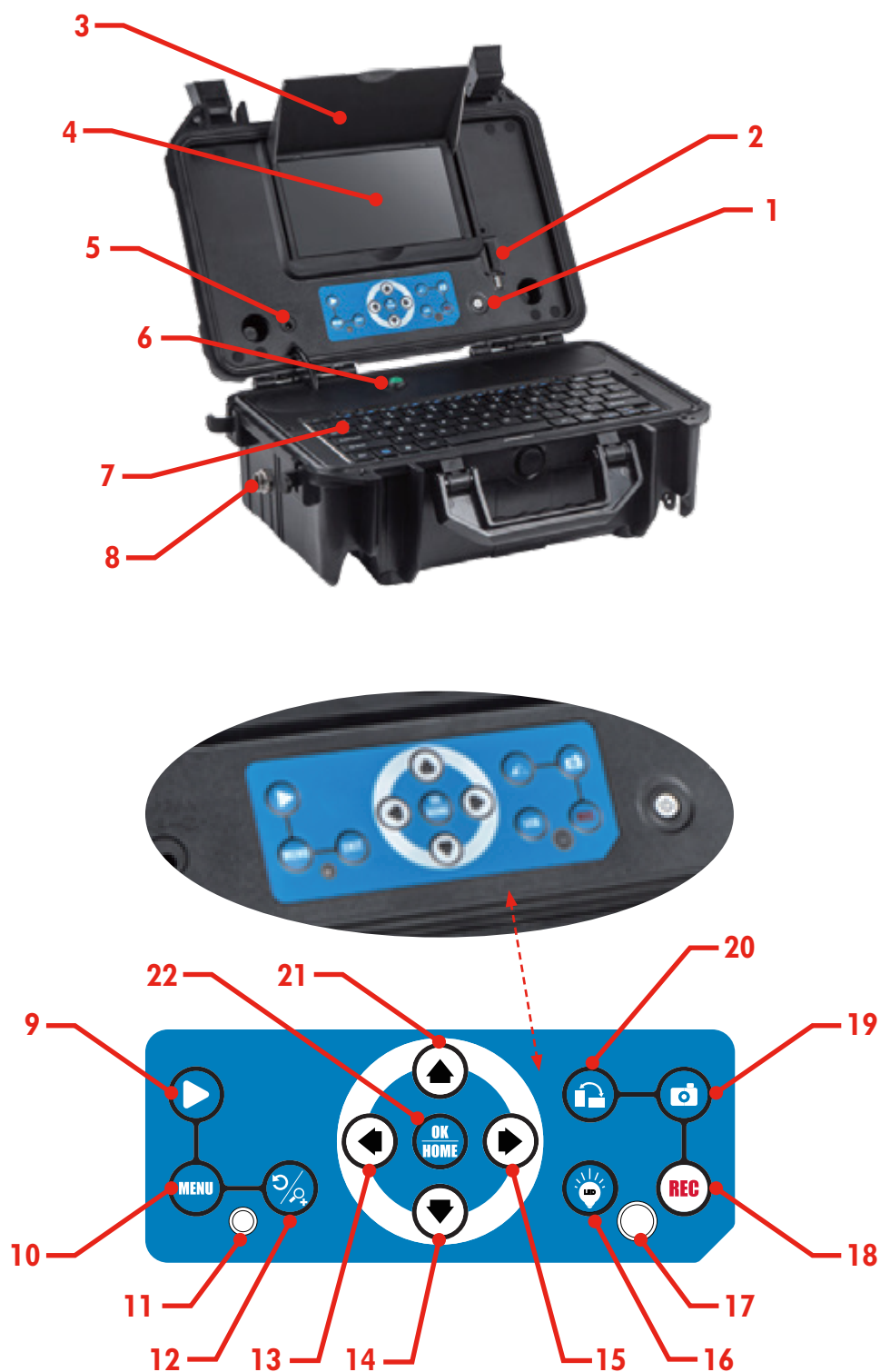


FIG. 3
DVR and Control Box

REMOTE CONTROL

1. Menu settings
2. Playback mode
3. Reserved function expansion
4. Image zoom /exit and return
5. Upward selection
6. Confirm / Pause
7. Select left / rewind
8. Select right / fast forward
9. Select downward
10. Image rotation
11. LED brightness
12. Start / stop recording
13. Photo shoot button

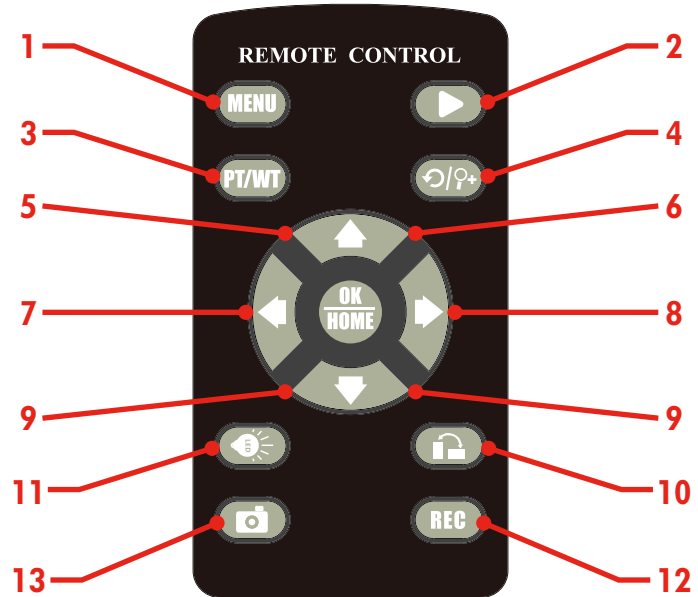


FIG. 4
Remote Control

PACKAGE CONTENTS

1. Panel with DVR
2. Wireless keyboard
3. Adapter
4. Car charger
5. Remote control
6. 46mm and 80mm skids for 23mm camera
7. 28mm skid and Hexagon Spanner, for 14mm camera head
8. Screw (2x), nut (2x) and waterproof-ring for 23mm camera head / waterproof-ring for 14mm camera head
9. Hexagon Spanner
10. Screw Driver
11. Operation manual
12. Camera Head
13. Coil Wheel
14. Connects Cables
15. Support Frame

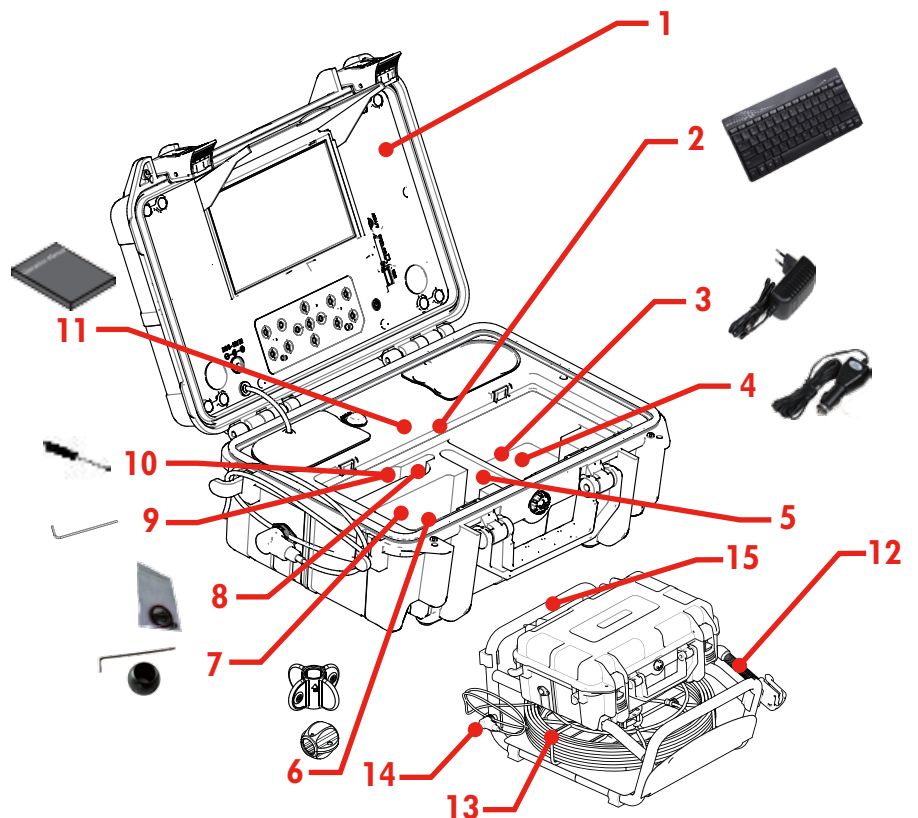


FIG. 5
Package Contents



Specifications

	ITEM	PARAMETER	
General	Operating Temperature	-10° to 50° C / 14° to 122° F	
	Operating Humidity	30% RH to 90% RH	
	Storage Temperature	-20° to 60° C / 4 to 140° F	
	Power Adapter	Input: 100-240V AC, Output: 12V DC 1500 mA	
	Measurements	55cm x 43.5cm x 34.5cm (L x W x H)	
	Weight	11.5-13.0 Kg (approx)	
Camera		<u>Ø23MM CAMERA HEAD</u>	<u>Ø14MM CAMERA HEAD</u>
	Sensor	1/3" CMOS	1/4" CMOS
	TV Line	420/480 TV Line	400 TV Line
	View Angle	120°	90°
	Focus Distance	20cm (approx)	6-8cm (approx)
	Depth of Field	100cm (approx)	20cm (approx)
	Camera Size	Ø23mm x 51mm (main body)	Ø14mm x 21mm (main body)
	Camera Length	155mm	125mm
	Front Lens	Sapphire	Sapphire
	Shell Material	304# Stainless Steel	304# Stainless Steel
	Lighting	Built-in 15x LED (white)	Built-in 4x LED (white)
	Waterproof	20m water (camera fix on cable)	10m water (camera fix on cable)
	Power Supply	DC9-15V	DC9-15V
DVR	Current Consume	40 mA (LED off), 95 mA (LED on)	40 mA (LED off), 60 mA (LED on)
	Screen	Super bright high-definition color LCD screen	
	Screen Resolution	1024 x 600	
	Image	Support image rotation	
	Video Resolution	AHD 1080P / AHD 720P / CVBS D1	
	Video Encoding	High Compression H.264	
	Photo Resolution	1920 x 1080	
	Audio Recording	Support local sound	
	Output	TV output	
	External Memory	Support SD memory card up to 64GB	
	LED Driver	Built-in dimmer	
	Play Back	Video and Photo	
	Language	English, Simplified Chinese, Traditional Chinese, Japanese, Korean, Russian, German, French, Italian, Spanish, Portuguese, Thai	
	Power Supply	DC 6-12V input	
	Current Consume	700 mA max	
	Battery Capacity	7.4V 5200 mAh Li-on Battery	
	Single Charge Work Time	~ 6 hours	
	Charge Time	~ 8 hours	

	ITEM	PARAMETER		
Wireless Keyboard	Keyboard Compatibility	Support specific PC wireless keyboard		
	Typing Language	English		
	Max Characters	384		
	Hide Characters	Quick one key hiding		
	Precision of Meter	Counter $\pm 0.5\%$		
	Meter and Feet Switch	Support		
	Set Zero	Support		
	Power Consume	40 mA @ 12V DC		
	Waterproof	P66 (for connection ports panel only)		
Cable Reel	Cable Diameter	Ø4.8mm	Ø5.2mm	Ø6.8mm
	Cable Length	20/30/40m (optional)	20/30/40m (optional)	20/30/35m (optional)
Control Box	Size	380 x 260 x 150mm (L x W x H)		
	Box Color	Black		

Installation



To reduce the risk of serious injury during use, follow these procedures for proper assembly.

1. INSTALL CABLE REEL (FIG. 6)

Put the cable reel into the frame from the right side, place it in the right direction and then tighten the screw and nut. Pull out the cable with care, thread it through the hook and lead the cable out.

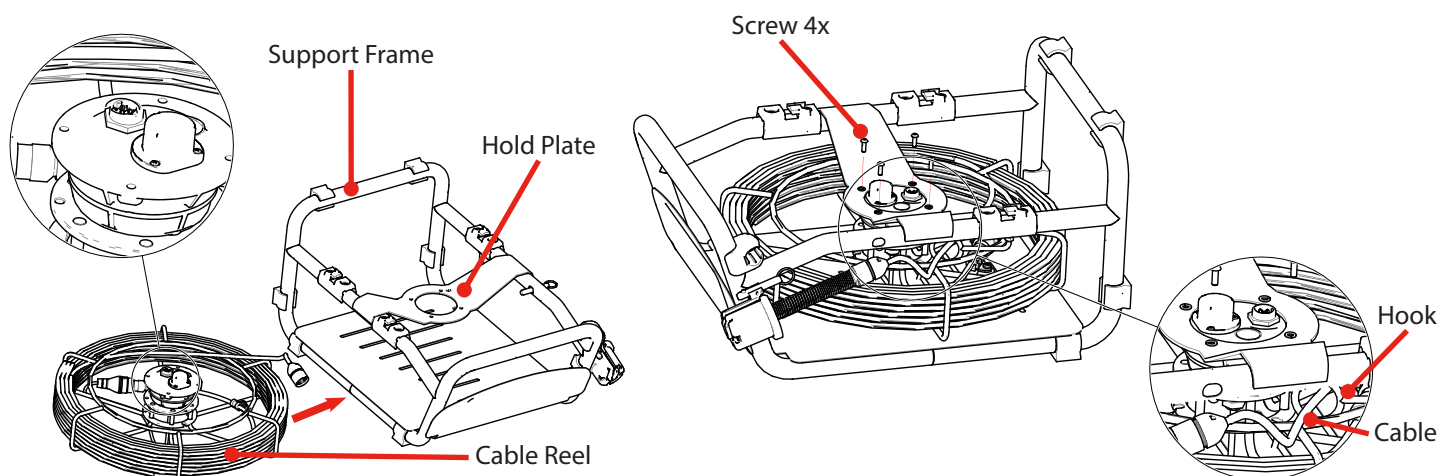


FIG. 6
Install Cable Reel

Installation

2. INSTALL CONTROL BOX (FIG. 7)

1. Plug one end of the spring cable into the cable wheel aviation socket according to the direction (direction of long straight cable), and tighten the screw.
2. Clip the control box holder into the fixed seat on the frame, and push it inside according to the direction.
3. Thread the ball lock pin through the control box holder and the frame.
4. Connect the other end of the spring cable with the aviation socket of the toolbox and tighten the screw (direction of long spring cable).

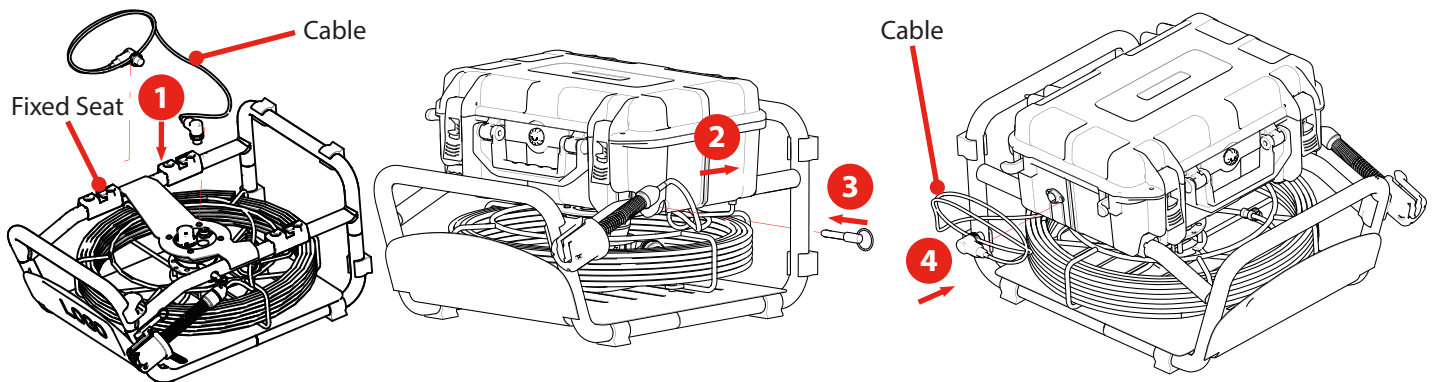


FIG. 7
Install Control Box Unit

3. INSTALL CAMERA HEAD (FIG. 8)

Hold the cable connector in one hand, then screw the camera and fix it on the cable tightly.

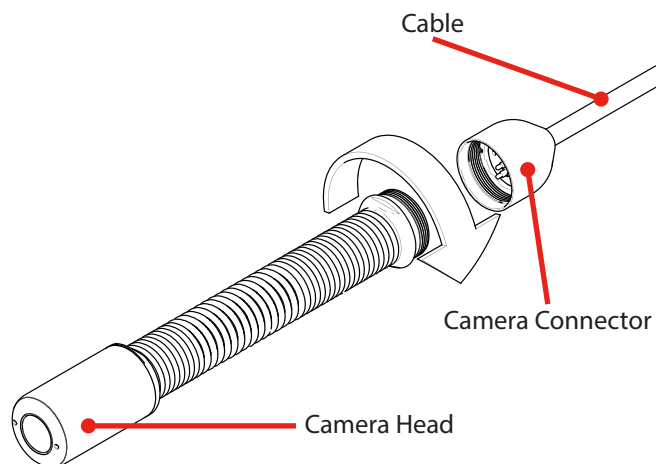


FIG. 8
Install Camera Head

4. INSTALL GUIDE FITTING

Roller skids are used to keep the camera head in the center of different sized pipes and also to keep camera head away from mud at the bottom of pipes, in order to keep camera head clean and also view best quality images.

23mm Camera Head

1. **Install 26 support guides (Figure 9).** Mount the 40 support guide onto the stainless steel camera head. Then tighten the screw with a screwdriver.

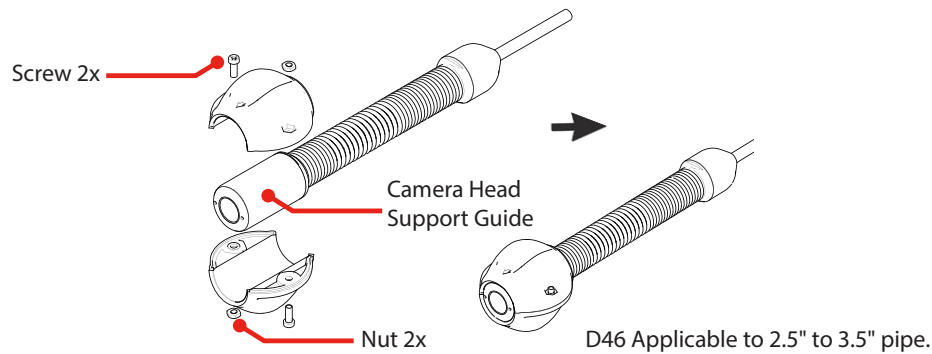


FIG. 9
Install 46 Support Guides

2. **Install 80 support guides (Figure 10).** Mount the 80 support guide onto the stainless steel camera head. Then tighten the screw with a screwdriver.

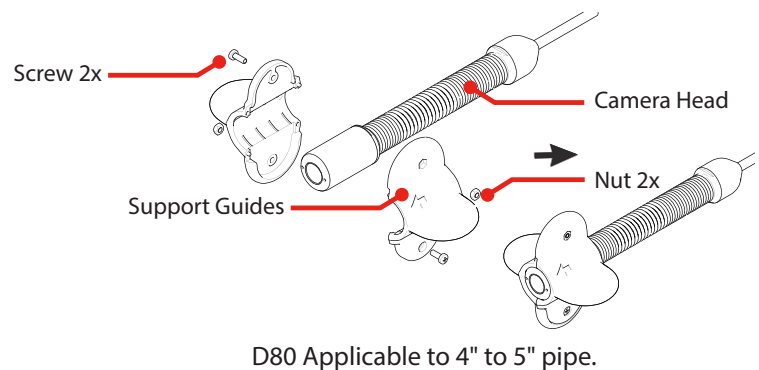


FIG. 10
Install 80 Support Guides

14mm Camera Head: Install 28 support guides (Figure 11).

Mount the 28 support guide onto the stainless steel camera head. Then tighten the screw with a wrench.

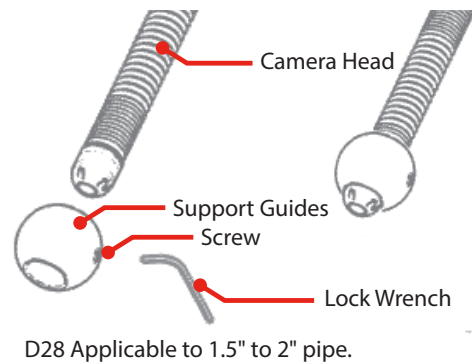


FIG. 11
Install 28 Support Guides

Installation

5. INSTALL SD CARD (FIG. 12)

The SD card needs to be inserted into the DVR card slot.



FIG. 12
Install SD Card

6. TURN ON THE DVR



Function Guide & Operating Instructions

DVR ICON INTRODUCTION

1. LED brightness
2. Meter counter display (meters)
3. Meter counter display (feet)
4. Record indication
5. Time indication
6. Date indication
7. Sound recording indication
8. SD card
9. Battery level indicator



FIG. 13
Screen Icons

Function Guide & Operating Instructions

DVR OPERATION

1. Insert the card.

Please insert the SD card before using the device. (Hint: In order to ensure the normal operation of the device, please use a Class10 high-speed branded SD card. Please format the SD card for the first time using it.)

2. Turn on/off

Press the  key to turn on/off, and it will automatically enter the real-time image mode when it is turned on.

3. Function Buttons

- **Light adjustment:** In the real-time image mode, press the  to decrease or increase the brightness of the LEDs.
- **Image rotation:** In real-time image mode, press the  to realize image rotation.
- **Take a photo:** In the real-time image mode, press the  to take a photo, and the photo will be saved in the photo folder of the SD card.
- **Record a Video:** In the real-time image mode, press the  to start/stop recording a video, and the video file will be saved in the video folder of the SD card.
- **Menu setting:** In the real-time image mode, press the  to enter the menu setting.
- **Image magnification:** In the real-time image mode, press the  to realize image magnification.
- **Exit/Return:** During parameter setting and file management, press  to exit or return.

4. Parameter Settings

- Under real-time image mode, press  to enter the parameter setting; press  and  to select the menu you need to change, press  and  to select the submenu that you need to change, and press  to confirm the submenu you need to change; press  and  to select the value you need to change, press  to confirm and save the settings; press  to exit the setting.

4.1 Recording Settings

- Video size: To set the resolution of the recorded video files.
- Loop recording: 2min/5min/10min, the recorded files are divided according to the set size, and the system will automatically prompt on screen when the card is full.
- Encoding type: To set video compression format according to the requirements of use.
- Sound switch: you can turn on or off the recording sound.
- Exposure setting: The sensitivity of photo and video shooting can be set according to the brightness of the environment in order to improve the shooting effect.

4.2 Display Settings

- Screen brightness: You can set the display brightness of the screen.

Function Guide & Operating Instructions

4.3 System Settings

- Format: The capacity of the SD card can be displayed, and the user can format the SD card.
- Language settings: Simplified Chinese, English, Traditional Chinese, Japanese, Korean, Russian, German, French, Italian, Spanish, Portuguese, Thai.
- Light source frequency: different light source frequencies can be set according to actual needs.
- Volume: To set the volume of the recorded sound.
- Date and time: To adjust date and time.
- Time zone selection: You can choose the actual time zone of your area.
- Restore factory settings: In case of abnormality, the factory settings can be restored.
- Device information: System version information.

5. File Management

In the real-time image mode, press the  key to enter the folder, and the user can browse, play or delete recorded videos or photos.

- Browse files: After entering the folder, press the  and  keys to browse the media files.
- Playback files: After entering the folder, press the  and  keys to select the media file to be played back, press the  key to play or pause the play. During playing a video or photo, press the  key to play the previous file, press  key to play the next file.
- Fast forward and fast rewind: During playing a video, press the  key to fast forward playback, press the  key to fast reverse playback, and press the  key to pause playback.
- Delete Files:
 - a. After entering the folder, press the  and  keys to select the media file to be deleted. Press the  key to enter the delete mode, press the  and  keys to select whether or not to delete the media file, and press the  key to delete or cancel the deletion of the media file.
 - b. During playing back a file, you can also delete or cancel the deletion of media files according to the above steps.

Wireless Keyboard Operation



The keyboard text writer is used to type characters with the wireless keyboard and display on screen. The characters can be displayed in recorded video or captured photo. It supports max. 384 characters and quick one key hiding characters.

TEXT INPUT

1. Typing characters with wireless keyboard. Using arrow key to move cursor, backspace key to delete ,and enter key to change a new line.
2. Esc key to hide or appear all characters. Press Ctrl + Del to delete all characters.
3. You can type and edit characters while recording, the typing and editing will be recorded in the video files.
4. The typed characters will be stored in memory.

BACKSTAGE OPERATION

You can press “F1” or “F2” key within 5 seconds after DVR monitor starts to enter F1 or F2 backstage operation.

1. The first line is reserved for user to type company name, name of operator, phone number etc., and these contents won't be hid by pushing ESC button. You can edit the contents by using F1 key, and press Enter key to save and exit.
2. Please refer to meter counter operation prior to this operation. Using F2 background key to select the unit of length or the total length of push cable (this is designed in case the total length of push cable is changed). When the “L=” flashes, press up or down arrow key to select the unit of length, or select the correct total length. Press enter key to save and exit.

Meter Counter Operation



1. Press the meter-zero button to set the meter to zero on screen display.
2. Change the unit of length or the total length of push cable, please refer to 'F2 backstage operation' contents in the wireless keyboard operation.



NOTE 1: The deviation of MC will increase if the total length is not correct. You need to select the correct total length to decrease the deviation. Use this function to change the displayed total length when the push cable is cut off for more than 3 meters.



NOTE 2: Turn on the system before pulling out the push cable from the cable reel. It can decrease the deviation of the MC.



Push Cable & Camera Operation

1. Always wear rubber gloves to operate the camera for health and safety reasons. Properly positioning the cable reel will save time and strength to push out and in the cable, and minimize the rate of equipment damage.
 - When pushing, the end of your stroke should be as close to the entry as possible. Standing too far back with an excess of cable between your hands and the entry may cause the cable to fold on itself outside the entry and damage the cable.
 - Try to keep the push cable away from sharp edge of a pipe entry because this may cause damage. If the camera does not seem to go any farther, **DO NOT FORCE TO PUSH THE CAMERA!** Try another entry if possible.



NOTE: Hands should be close to the line opening. DO NOT catch the cable on the edge of an entry and continue to push.

2. Always try to run water down the pipe under going inspection. This will keep the system much cleaner, and allow you to push noticeably farther with less friction. If the water is preventing you from seeing an area of importance, temporarily turn it off.
3. When push the push cable through the pipeline by steady and slowly, a short distance entry per time, keeps the hands at the entrance, so that can control the push cable and prevent it stuck, bent or scratch.
4. When inspecting a pipe, most of the time a slow steady push through the system works the best. At changes in direction such as P-traps, Tee's, Y's, Elbows, etc. It is usually necessary to give a little extra push in the bends. Back the camera head approximately 8" (20cm) from the bend, if necessary, and give it a quick push, "popping" the camera through a turn, using the least amount of force required. Try to be as gentle as possible, and do not hammer or snap the camera head through corners. After some practice, you may learn that the best way to inspect a section of pipe is to push the camera through quickly. Then draw the camera back home slowly and evenly.
5. Make sure the sapphire window is clean prior to entry. Some users claim that a slight film of detergent on the lens minimizes the possibility of grease sticking to the port. If necessary, take advantage of any standing water in the pipe to wash the front of the camera by jiggling it in the water.
6. When you place the camera head into the pipe remember, as the materials of pipe vary, it will be necessary to adjust the lighting settings to maximize picture quality.
7. The system can travel through multiple 45 and 90 degree bends and wyes. Do not, however, try to force it through a P-trap or tee if there is a large amount of resistance.



NOTE: Do not try to use the camera head to clear obstructions. This System is a diagnostic tool, not a drain cleaner. Using the camera head to clear obstructions could damage the camera head or cause it to be caught in the obstruction.

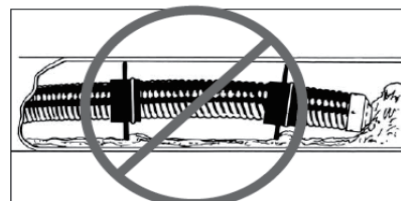


FIG. 14

Improper Operation

8. Do not attempt to remove or store push cable on the reel solely by turning the reel itself. You can manually push or pull cable from the reel and wind or unwind it.
9. If the camera sits in a pipe, or an enclosed environment, heat will build-up. This may lead to the camera head overheating which will cause fuzzy lines to appear on the monitor. In the event, this happens, turn off the system, remove the camera from the pipe (or enclosed environment) and let the camera head cool for 10 to 15 minutes. Running water into the line will also help cool the camera head. Always use the minimum illumination required to maximize picture quality and to avoid excessive heat build-up.



NOTE: The camera head can get HOT! When finished with your inspection, or if taking a prolonged break in the middle of the inspection, turn off the system.

Push Cable & Camera Operation

Retrieving the Push Cable

1. Once the inspection has been completed, pull the push cable back with slow, steady force. Do not force the push cable or exert excessive force. This could damage the camera or push cable. The push cable may get hung up while being retrieved, and may need to be manipulated as did during insertion.
2. While take back the push cable, running water can be used to flush down the push cable. After recycling, you can wipe the push cable with a towel.



NOTE: NEVER USE SOLVENTS to clean any part of the system. Substances like acetone and other harsh chemicals can cause cracking of the camera ring, which could affect waterproofing.

3. Storing the push cable into the cable reel. One hand holds the push cable, the other hand close to the cable wheel. Slowly and gently push the push cable slide via the hook of the handle, cable reel will rotate and store the push cable inside.



NOTE: The hands should be close to the cable wheel when storing the push cable. Push the push cable a small piece every try. Push a long distance can cause the push cable bend or broken.

Battery Safety & Use Guide



USING SAFETY

Read the following battery precautions before charger, to reduce the risk of electrical shock.

1. Recharge batteries with accessory charging units.
2. Check the power units every time before using the equipment, be sure no problem, use of unauthorized parts may result in electrical shock, fire and/or serious personal injury or damage other instruments and system.
3. Never connects the car charger to any 24 volt cigarette lighter slot. It will harm the battery and DVR.
4. Do not short circuit; it may cause fire, electrical shock.
5. Do not charge the battery under rain or wet conditions. Water entering the charger will increase the risk of electrical shock.
6. If the charger and battery are damaged, do not use or stop to charge. It may cause electrical shock.
7. Don't disassemble the case, only qualified repair person can repair and maintenance.
8. Properly dispose of the battery. Exposure to high temperatures can cause the battery to explode. So do

not dispose of in a fire. Some countries have regulations concerning battery disposal. Please follow all applicable regulations.

9. Do not touch anything which out from battery, which would burn or damage the skin, once touches please flush with water. If in eyes, immediately get medical help fast.

USING GUIDE

Follow the steps as below to reduce the injury of the electric shock.

1. Power indicator LED will be red during charging, will be turned to green when charged fully. If battery empty for a long term, it will pre-charge the battery automatically in 10 minutes, and LED will be blinking in red.
2. It needs about 8 hours to charge the battery fully. The battery can charge online, charging and supplying of work will not increase charging times.
3. User can use a power adaptor or car charger to charge the battery. If no use in a long term, take a recharge per 6 month, to ensure the battery in normal working status.



Other Information

TROUBLESHOOTING

PROBLEM	POSSIBLE FAULT LOCATION	SOLUTION
No image	Cable connection faulty or loose	Check cable connection, clean and reconnect if necessary.
	Camera connector soiled	Clean the camera connector.
	Wrong SD memory card	Turn off power and replace SD card.
	Wrong setting	Enter the setup menu and select reset.
DVR can not boot	No power	Recharge.
	Transient short circuit in the cable cause the battery short circuit protection	Recharge the DVR more than 2 seconds with adapter or car-charger to activate battery.
Can not input characters	The wireless keyboard has low battery	Change battery.
	Wireless keyboard or receiver fault	Check the keyboard receiver and the keyboard on a PC.
The deviation of MC is more than 0.5%	Select the wrong total length	Re-select the correct total length. You can press the F2 key when the machine boots within 5 seconds to enter background to select it.
	Pull out cable more than 3 meters before turning on the system	Turn on the system before pulling out the push cable from the cable reel
DVR charging indicator lights up green and cannot be charged	The battery temperature exceeds the range of -5° to +40° C.	Put the product under normal temperature for 30 minutes to automatically resume charging.
When charging, the yellow and green charging indicator lights are not on	Power adapter failure	Replace the power adapter.

FCC 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.
2. This device must accept any interference received, including interference that may cause undesired operation. Any changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the device.

CE

This product complies with standards including Low Voltage Device Directive 73/23/EEC.

EMC

Directive 89/336/EEC. It passed the subject tests by the authority concerned and is authorized to bear CE mark.



CAMERA HEAD H23MTO

23mm camera head with built-in 512Hz Sonde (optional) for 5.2mm or 6.8mm rod cable



FIG. 16
Camera Head H23MTO

Type	Item	Parameter
Image	Sensor	CMOS
	TV Line	420 TV Line
	Resolution	960 x 480
	View Angle	120°
	Focus Distance	20 cm (approx)
	Depth of Field	100 cm (approx)
	Front Lens	Sapphire
Transmitter	Frequency	512 Hz
	Transmit Mode	Constant
	Transmission Distance	6 meters open area (max)

CAMERA HEAD H23MTS

23mm camera with both self-leveling and 512Hz Sonde (optional) for 5.2mm or 6.8mm rod cable

Type	Item	Parameter
Image	Sensor	CMOS
	TV Line	420 TV Line
	Resolution	720 x 576
	View Angle	120°
	Focus Distance	20 cm (approx)
	Depth of Field	100 cm (approx)
	Front Lens	Sapphire
Transmitter	Frequency	512 Hz
	Transmit Mode	Constant
	Transmission Distance	6 meters open area (max)



FIG. 17
Camera H23MTS



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