

LAVAL UNDERGROUND SURVEYS
SC-350/SC-500
OPERATIONS MANUAL



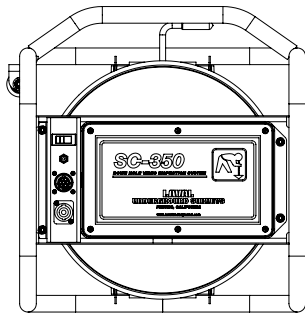
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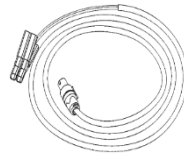
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System Unpack and Check

Carefully unpack the shipment and check the unit for the following:



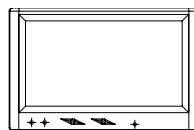
Winch



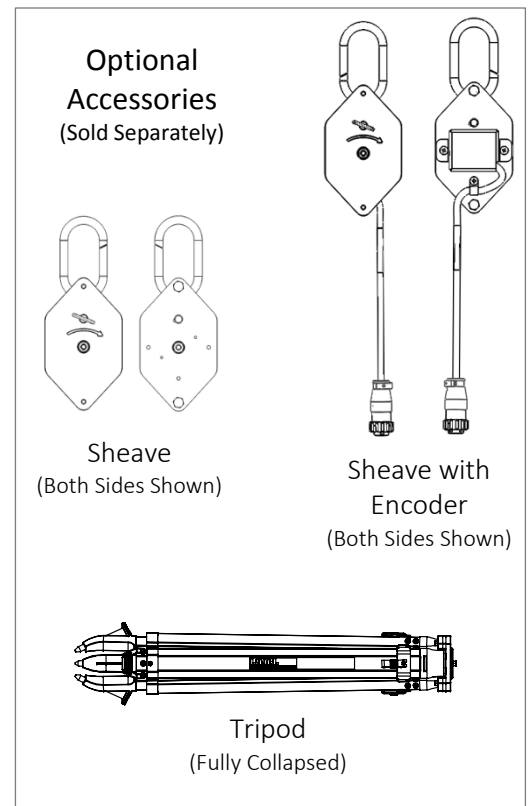
Power Cable



Camera

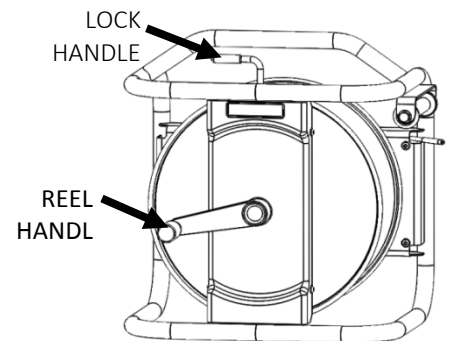


Monitor

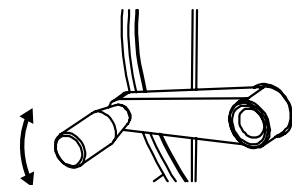
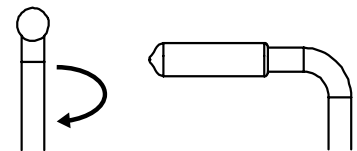
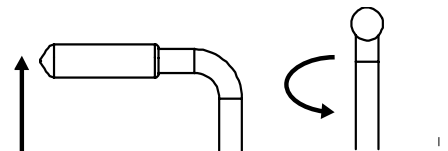


Carefully read the following reel and lock handle operation before setting up:

Hold reel handle and do not release unless reel is locked. The reel will spin freely once lock is disengaged.



1. To disengage lock lift lock handle and then rotate counter clockwise 90 degrees out. Reel is now free to spin.
2. To engage lock rotate lock handle counter clockwise back and let drop.
3. Lock may not fully engage after drop. Before releasing the reel handle verify spool is locked in place by moving the reel handle.



Operating Checklist

Before Starting

1. Position the ON/OFF switch to **OFF**. (Figure 2 Item 1)
2. Position the reel assembly (Figure 1 Item 1) and tripod (Figure 1 Item 2) with encoded sheave (Figure 1 Item 3) so when the camera is connected it will be approximately centered over the well.
3. Connect the system encoder cable (Figure 1 Item 4). (See Figure 2 Item 3)
4. Connect the 12 V DC Battery supply cable to the side of the SC Unit **12VDC BATTERY** input. (See Figure 2 Item 4)

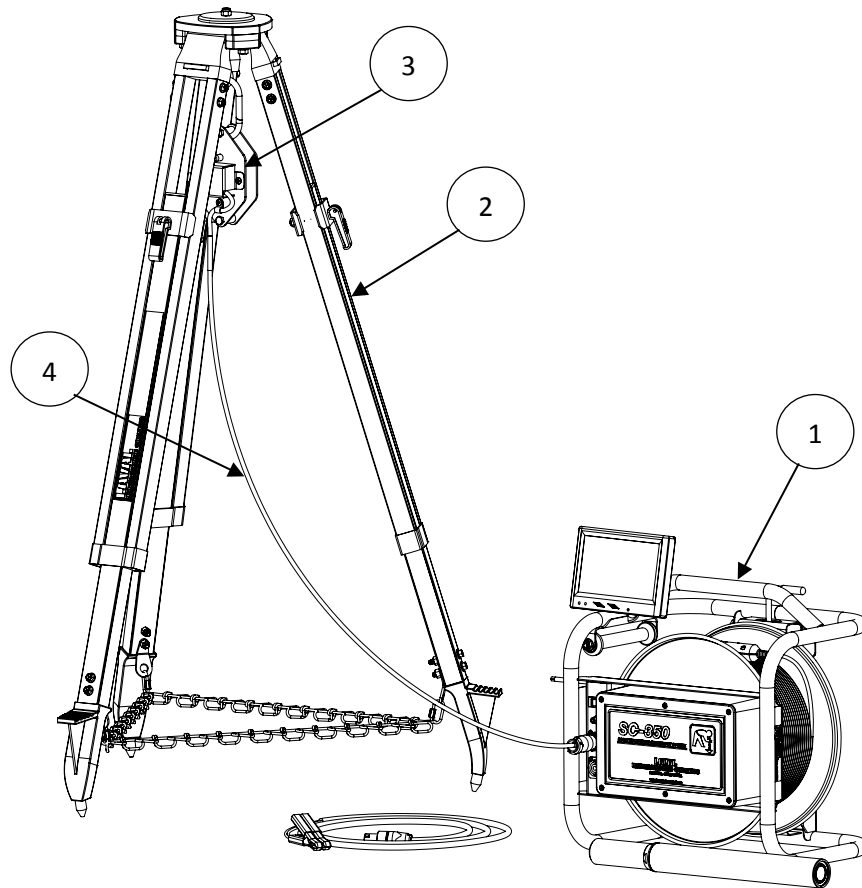


Figure 1

NOTE: This picture above shows the SC Unit set up if most accessories were purchased. Only follow instructions which are applicable.

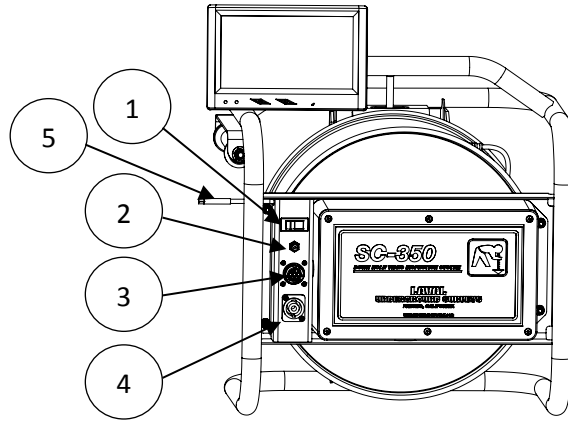


Figure 2

Connecting the Camera

1. Position the reel assembly **ON-OFF** Switch (Figure 2 Item 1) to **OFF**.
2. Connect the power supply cable to the reel assembly power in plug (Figure 2 Item 4).
3. Attach opposite end of power supply cable to a 12 volt power supply or battery. Be careful to attach the positive (red) clamp to the positive terminal and the negative (black) clamp to the negative terminal.
4. Before connecting the camera to the cable head connector, inspect the O-rings in both connectors to be sure they are clear of any debris, contamination, damage, or wear. The O-rings should also be re-lubricated on a regular basis using a NEMA-rated O-ring lubricant.
5. Slide the upper support tube, beveled end first, over and past the cable head. Connect the twist locking cable head connector to the camera by carefully positioning the connectors together and twisting the lock until seated. **Important:** the cable head connector should only be hand tightened. Never over-tighten the connectors or upper support tube.
6. If applicable, connect encoder cable to the encoder input (Figure 2 Item 3) and position the camera in the well, near the top. To reset the depth counter to 000.00f or 000.000m turn system OFF then ON again using power switch (Figure 2 Item 1).
7. If a DVR or other recording device is desired, use the video out/RCA plug (Figure 2 Item 2).
8. Connect monitor to the monitor cable (Figure 2 Item 5) and assemble mount to reel frame (See Figure 3 Item 4).

9. After all connections are made, position the SC unit **ON-OFF** Switch (Figure 2 Item 1) to **ON**. Turn on the LCD monitor (an optional sun shade is available). Watch the monitor to verify operation. The LED lighting should be visible in the view selected.
10. You are ready to proceed with the survey.

Operating Notes and Precautions

NEVER POINT THE CAMERA DIRECTLY AT THE SUN IN EITHER THE ON OR OFF POSITION

1. **DO NOT** connect or disconnect the camera with the SC Unit **ON-OFF** Switch **ON**.
2. **DO NOT** operate the SC System in salt water, acidic or contaminated wells. Whenever the camera and cable have been exposed to acidic or brine water, be sure to wash immediately after use with fresh water.
3. **CAUTION** Before connecting 12 VDC Power to the SC power supply cable, be sure the SC unit **ON-OFF** Switch is **OFF**.
4. **NOTE:** Anytime the SC Unit **ON-OFF** Switch is turned **OFF**, or power from the battery supply is interrupted, the depth footage numbers displayed on the LCD Monitor will be reset to 000.00
5. The power supply used should be monitored during the survey to determine approximate battery level remaining. The system will operate down to approximately 10.0 VDC.
6. **NOTE:** If the camera is in bright, ambient light (such as when testing out of the well), the picture may be washed out, making it difficult to determine if the camera is operating. Placing something in front of the lens to limit the light can help present an image to be viewed.

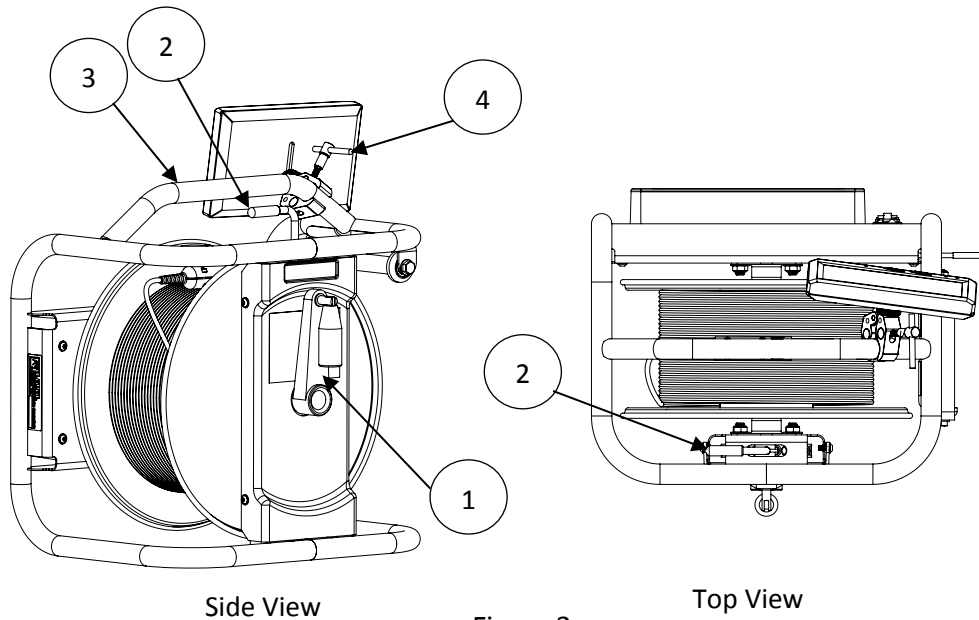
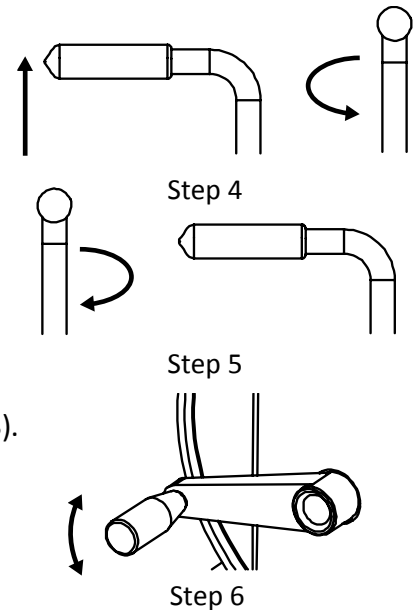


Figure 3

Crank and Lock Operation

1. The operator must keep their hand on the crank handle at all times when lowering or raising the camera.
2. The SC System reel is operated by rotating the side folding crank handle (Figure 3 Item 1). Rotating clockwise will lower your camera and rotating counterclockwise will raise the camera.
3. The handle can be unfolded by pulling out on the hand piece and releasing into crank position.
4. To disengage the reel lock, pull the lock handle up (Figure 3 Top View Item 2) and turn counter clockwise to face outward.
5. To engage the reel lock, spin the lock handle (Figure 3 Item 2) towards the back of the reel assembly away from the cable exit.
6. Always verify lock is engaged by moving the reel slightly.
7. The reel assembly should only be carried by the handle (Figure 3 Item 3).
8. The video screen can be adjusted to any position by turning the adjustment knob (Figure 3 Item 4) on the back of the screen mount assembly.



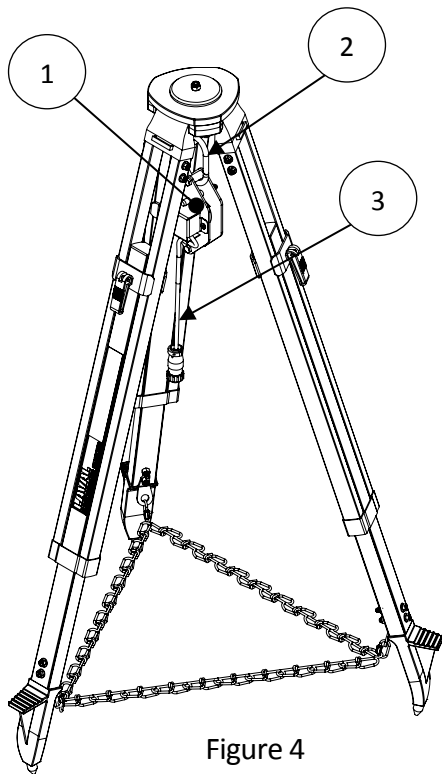


Figure 4

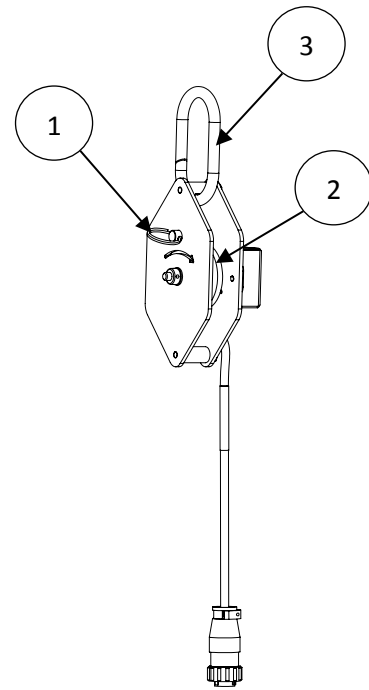


Figure 5

Tripod and Sheave Mounting

1. Extend the three tripod legs fully away from the center of the unit until it is in a stable position. The encoded sheave assembly (Figure 4 Item 1) is mounted to the center eyebolt with the use of a mounting clip (Figure 4 Item 2) above.
2. The encoder cable (Figure 4 Item 3) should be screwed in to the reel assembly (Figure 2 Item 3) and kept clear of the camera and camera cable.
3. Remove the quick release pin (Figure 5 Item 1) by pulling it out of the sheave assembly. Thread the camera cable through the sheave assembly following the direction of the arrow. Lay the cable over the sheave wheel (Figure 5 Item 2) with the cable head in the direction of the arrow. Then place the quick release pin (Figure 5 Item 1) back into position to trap the cable. Once the mounting clip (Figure 5 Item 3) is clipped to the assembly, you are ready to mount it to the tripod.
4. Adjust the length of legs by lifting the red Lock (Figure 4 Item 4) and sliding each leg to the desired length. Lower the red Lock back to lock the leg in place.

NOTE: Sheave mounting remains the same without encoder accessory

Description of Equipment

The SC System color video water well inspection system is equipped with a single wide angle lens camera for viewing down hole images in water wells or boreholes. Low light level CCD sensors allow the camera to detect images with minimal lighting power, as low as 1 LUX.

Light Emitting Diodes (LEDs) are housed in the Camera and provide lighting for the Down Hole Image. LEDs are shock proof and long lasting, providing approximately 5000 hours of use.

The video output from the camera duplexes with the control signals and power, going down to the camera, on a single conductor armored, Kevlar reinforced coaxial cable. The camera is therefore operable only with the SC Control Unit supplied within the SC Winch System and the Laval R-Cam line of equipment. The camera is not compatible with other types of closed circuit survey systems.

A single coaxial cable head connector on the rear of the camera is connected to the cable by a watertight pressure rated connector.

The SC System unit provides all the controls to operate the camera and is equipped with a 7" LCD color video monitor.

A DVR video recorder is also available (but not included) for recording the survey.

Camera Housing

The camera electronics and LED lighting are housed in a stainless steel outer housing which, when assembled, is water tight at external pressures of 500 PSI.

The forward view port protects the down hole view lens and LED lighting.

The portable SC reel handle is used to lower or raise the camera in the well. The coaxial cable is lightweight and Kevlar reinforced for strength.

An optional, adjustable height tripod can be purchased for use with the SC System reel assembly which supports the camera over the well when lowering or raising the camera during the survey. An electronic encoder is also available for purchase and is mounted on the tripod sheave and is used to display accurate

footage information of the camera's depth on the SC video monitor. When the system is not in use the tripod can be collapsed for easier storage by simply depressing the locking leg height pins, sliding the lower leg tube into the upper leg tube and folding the legs to the center.

Power Supply

A 12V DC AUX battery supply cable is included with the SC System unit. A suitable 12 V DC supply (not included) should be used to power the unit during operation.

The 12 volt supply should be kept charged at or near 12-13 volts. Camera functions will start to diminish when the voltage approaches 10.0.

Control Unit

The SC System includes a LCD video Monitor, control console, and necessary electronics needed to operate the camera and reel assembly in a lightweight, portable unit.

A 12 VDC AUX power supply cable is included for connection to a **12 VDC BATTERY** or power supply.

The reel is hand operated to provide camera control. An optional depth encoder provides real time information.

The **VIDEO OUT** connects to the DVR (or Auxiliary Equipment) video input with the RCA cable.

Camera Control Functions

The **ON-OFF** switch routes power to the camera and the LED lighting when switched to the **ON** position.

NOTE: Any time the control unit CAM CONTROL **ON-OFF** Switch is turned **OFF**, or power from the Battery Pack is interrupted; the depth footage numbers displayed on the LCD Monitor will be reset to 000.0f

Reel Control Functions

The SC System reel is controlled manually by the side crank handle. Fold out the handle and rotate the reel to extend or retract the camera cable. The reel position lock is operated by pulling up or allowing the lock handle to drop to be disengaged or engaged. If the lock does not engage on your initial try, move the reel position slightly until the lock falls into place.

Survey Procedure Recommendations

Although users of the system will most often develop their own unique survey methods, the following recommendations may be of some value.

1. Always fully charge your 12 V DC battery supply prior to each survey. The battery should be charging at all times when not in use.
2. It is estimated that a fully charged truck battery can last approximately 24 hours during normal operation.
3. Before the camera is lowered into the well, the depth counter should be reset to zero at some arbitrary reference point relative to the camera housing and the top of the well. This can be done by powering the SC unit on and off.

Water Well Clarification

There will be occasional wells containing water too dirty for viewing or photography. This condition is generally caused by colloidal particles (rust, dirt, minerals) in suspension in the water column. Often the dirt will settle out if the well is allowed to stand undisturbed for a period of 12 to 24 hours.

If settling will not clear the water, replacing the well fluid with clear water is a rapid and safe way to achieve visibility. Even the flow from a garden hose for 4 to 12 hours will clear the well. The goal is to add at least twice the volume of water in the well rapidly enough to force the dirty water back into the formation. Preferably, the water should be introduced below standing water level to avoid driving entrapped air into the fluid column in the well. If this is not possible, the top 40 to 200 feet of the below-water portion of the well will be full of gas bubbles, interfering with vision or photography. It will take a couple of hours for this area to clear after the water flow has been stopped.

Turbid well water can be cleared by flocculation. This is a chemical process that forces an ionic exchange, causing the particles to migrate and clump until they are heavy enough to fall out like snowflakes.

There are many commercial flocculants available that are generally used to clean up boiler water and municipal water supplies. Throughout the world we have found that certain soleplates used in conjunction with an increase in the pH of the well water will work under the greatest variety of conditions. Choose the combination that gives the heaviest flock and fastest clearing.

Occasionally viewing through well water is hampered by algae. Particles are dislodged from the sidewalls by the passage of the camera, and the appearance on the screen or pictures is like being in a heavy snowstorm. An algaecide, fungicide, or a shock treatment of swimming pool chlorine (wet or dry) will kill this growth and make it settle out. A couple of gallons of laundry bleach (Purex or Clorox) will clear the average well in 2 to 12 hours.

Where the area you wish to see is buried, an air jet pump can quite successfully be used to remove the overburden. The action of this type of pump is so gradual it clears the adjacent water very well, often leaving the well in condition for immediate viewing.

Obviously, a well with an actual flow through it, bringing in silt particles, will only clear during “off flow” conditions. This may be due to a season of the year, or in the case of a well field or common water strata shared with other wells, a particular time of the day when the other pumps are off.

Sometimes you can shut off the entire field to achieve a static condition; or in an Artesian field, turn on all the other pumps to stop the muddy flow.

Falling water generally only creates a problem near the surface because it drives air into the water column.

Drilling mud in suspension is a very difficult problem, only occasionally curable by flocculation. It may require pumping the well clear.

Well cleaning chemical and drilling detergents interfere with any chemical clarification process. Again, pumping until clear is the solution.

Often a layer of oil will be encountered on the top of the water surface, especially when inspecting oil lubricated pump well casings. If oil is anticipated, the outside of the lens view port can be soaped liberally with a liquid detergent. The camera visibility will be restricted out of the water, but once the oil layer (often 20 feet deep) is penetrated, the detergent may be washed off the viewing port by raising and lowering the camera. The oil should be wiped from the cable and camera when removing from the well.

Air bubbles may accumulate on the lens port when first entering the water. Raise and lower the camera until the bubbles are removed.

At least ten wraps of the cable should always be left on the Reel Assembly Cable Drum at maximum depths.

Caution should be taken not to operate the SC-166 camera in contaminated, acidic, or salt environments. If the SC-166 and cable are exposed to a contaminated or salt intruded well, all exterior surfaces of the housing, Kevlar cable, cable head and centering bands must be thoroughly cleaned and rinsed with fresh water immediately after being removed. Warranty to the system may be voided if damage occurs as a result.

Trouble-Shooting

- 1) **Battery voltage too low** – This is the number one cause of problems with the system. Always keep your battery supply fully charged.
- 2) **Connections are loose** – Double check that all connections are tight, including the recording device's RCA jacks and power supply
- 3) **Inspect the camera before putting it down the hole** – A crack in the glass is half the job to repair when compared to a flooded camera. Nearly all breaks in the glass occur due to handling outside of the well. Keep the camera secure and protected at all times, and inspect for cracks every time you're about to get it wet.

Problems and Their Symptoms

- 1) **Jumping digits on the monitor** – Usually an indication that the battery charge is too low. This usually will not result in wrong readings, but it's distracting. If you can't clear it up by re-charging the battery, you should contact Laval Underground Surveys.
- 2) **The depth counter is inaccurate** – This can happen if the encoder in the encoded sheave assembly is not properly assembled. Ensure the set screw on the encoder wheel is tightened to the shaft and the cable is trapped under the quick release pin.



WARRANTY

LAVAL UNDERGROUND SURVEYS warrants all products and materials manufactured by it and described herein to be free from defects in workmanship and materials for a period of one year from date of shipment, with the exceptions of lights, fuses, connectors, plugs, and the CCD chip.

Any article not manufactured by LAVAL UNDERGROUND SURVEYS and described herein is sold with only such warranties as are made by the manufacturer thereof. No other warranties expressed or implied, of merchantability, fitness for a particular purpose, or otherwise, are made by LAVAL UNDERGROUND SURVEYS other than those set out in the immediately preceding paragraphs.

All repairs shall be made by LAVAL UNDERGROUND SURVEYS at its factory or as otherwise authorized by Laval Underground Surveys in writing. All unauthorized repairs will void warranties.

Warranty is void on any equipment that is abused or mishandled by customer.

