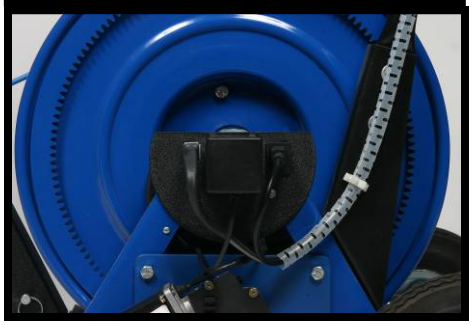
Quick Set-Up for the R-Cam 1000

Unpack the system and inspect parts.

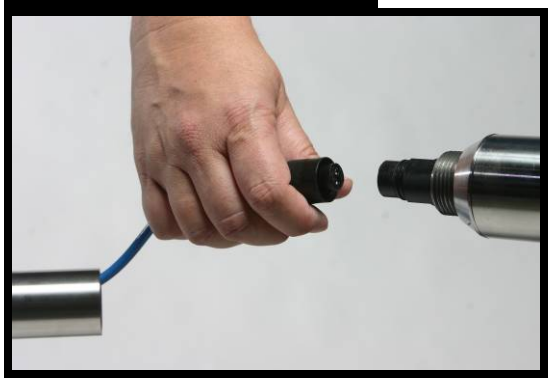
Put the fuse in the battery and charge the unit for 24 hours.



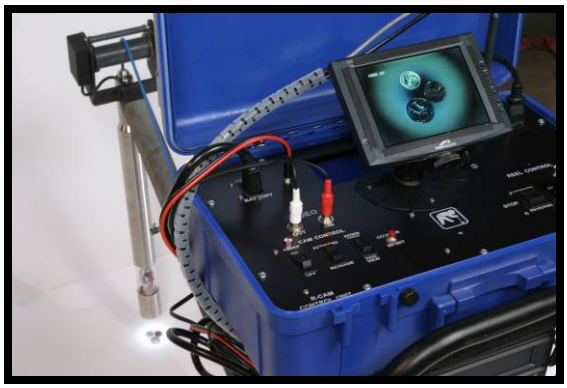
Plug the control cable into the reel.

Plug the other end of the control cable into the control panel.

Set up the DVDR and the monitor.



Thread the cable head through the centralizer and the cable head cover sleeve and connect the camera.



Connect the monitor – There is also a sunshade included which you may choose to stick to the camera with the white Velcro tape.

Connect the camera, battery and control cables. Do not power on until all cables are connected. Power off before disconnecting.

Before using the first time, set up the system in an office to become familiar with it and to test it.

OPERATING CHECKLIST:

BEFORE STARTING

1. Position the Reel Assembly and extend the Boom Arm so when the Camera is connected it will be approximately centered over the well.

2. Position the DVDR on the shelf located on the left of the control box. Position the Control Unit on the shelf.

3. Position all Control Unit Switches to **OFF** or center positions and REEL CONTROL **SPEED** to **MIN**.

4. Connect the System Interconnect Cables as per figure 6.

5. Connect the 12 VDC Battery Pack to the Control Unit **12VDC BATTERY** input.

6. **BE SURE THE FUSE IS IN THE BATTERY AND THE BATTERY HAS BEEN CHARGED FOR 24 HOURS**

CONNECTING THE CAMERA

1. Position the Control Unit CAM CONTROL **ON-OFF** Switch to **ON**. The CAM CONTROL **POWER** Indicator Lamp will be on.

2. Position the REEL CONTROL **ON-OFF** Switch to **ON**. The REEL CONTROL **POWER** Indicator Lamp will be on.

3. Position the REEL CONTROL **FORWARD-REVERSE** Switch to **FORWARD** slowly increase the **SPEED** Control to “Pay-Out” approximately 10 feet of cable. Reduce the **SPEED** Control to **MIN** and place the **FORWARD-REVERSE** Switch to **OFF** (center position).

4. Position the REEL CONTROL **ON-OFF** Switch to **OFF**.

5. Position the CAM CONTROL **ON-OFF** Switch to **OFF**.

6. Before connecting the Camera to the Cablehead Connector inspect the “O”-Rings in both connectors to be sure they are clear of debris or any contamination. Also check for any wear or damage. The “O”-Rings should also be re-lubricated on a regular basis. Use a nema-rated O Ring lubricant.

7. Slide the Centering Band Assy. and Upper Support Tube, beveled end first, over and past the Cablehead. Connect the Twist Locking Cablehead

Connector to the Camera by carefully positioning the connectors together and twisting the lock until seated. Thread the upper Centering Band Support Tube to the top of the Camera. Position the lower Centering Band Collar on the Camera Housing just above the Side View Port (DO NOT ATTACH THE CENTERING BAND COLLAR TO THE GLASS PORT). Position the upper Collar on the support tube so that the Centering Bands are extended to approximately ½ inch less than the diameter of the well or borehole being inspected.

NOTE: Always set the Centering Bands to approximately ½ inch less than the diameter of the casing.

8. Position the CAM CONTROL **ON-OFF** Switch to **ON**. Turn on the LCD Monitor (provided with the system is a Sun Shield for the LCD Monitor to assist when viewing outdoors). Switch between side and down views, by using the CAM CONTROL **DOWN VIEW-SIDE VIEW** Switch, while watching the Monitor to verify operation. The LED lighting should also be switching with the view selected. Check the rotation by using the CAM CONTROL **FORWARD-REVERSE** Switch; both the Down View and Side Views will rotate.

9. Rewind the excess cable, by using the REEL CONTROL functions, and position the Camera in the well, near the top. Press the CAM CONTROL **COUNTER RESET** Switch to reset depth counter to 000.0f. You are ready to proceed with the survey.

OPERATING NOTES AND PRECAUTIONS

NEVER POINT THE DOWN HOLE OR SIDE VIEW CAMERAS DIRECTLY AT THE SUN EITHER WHILE ON OR OFF

1. **DO NOT** connect or disconnect the Camera with the Control Unit CAM CONTROL **ON-OFF** Switch **ON**.

2. **DO NOT** operate the R-Cam 1000 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, Battery Power to the Control Unit be sure the CAM CONTROL **ON-OFF** Switch is **OFF**, REEL CONTROL **ON-OFF** Switch is **OFF**, **SPEED** Control is set to **MIN**, and **FORWARD-REVERSE** Switch is **OFF** (center position).

4. **NOTE:** You **CANNOT** switch between **DOWN VIEW** and **SIDE VIEW** while the Camera is rotating.

5. When the recorder is not used with the R-Cam 1000 System, you must install the Video (Control Unit to recorder) Jumper Cable between the Control Unit **VIDEO OUT** and **VIDEO IN** connections (In other words, by-pass the recording device).

6. **NOTE:** Anytime 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.

7. The 12 VDC Battery Pack provided with the system should be charged for at least 24 hours prior to the first survey. To help ensure longer battery life it is recommended to charge the battery after each operation.

8. The Battery Level Monitor, on the Battery Pack, should be monitored during the survey to determine approximate battery level remaining. The system will operate to approximately 10.0 VDC.

   NOTE: During operation, even with the Battery at full charge, the Battery voltage will drop momentarily while the winch is in operation.

9. **NOTE:** In the event of a Battery Pack failure or a survey running longer than battery power available, the R-Cam 1000 System can be operated by use of the Emergency Pull Out Cable, which will connect to your vehicle battery terminals.

10. **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.

11. **NOTE:** To help find features with the side view camera, remember that the side view and down view cameras are oriented to the 12:00 position. In other words, if you're looking with the down view and you see an interesting feature you want to inspect, rotate the image until it is at the top of your monitor (like "noon" on a watch face). Then switch to side view, and lower the camera about 6 inches and you'll be right on the area you're trying to inspect.

DESCRIPTION OF EQUIPMENT

The R-Cam 1000 Color Video Water Well Inspection System is equipped with two cameras in a single housing, each with a wide-angle lens, for viewing down hole and side view images in water wells or boreholes. Low light level CCD sensors allow the cameras to detect images with minimal lighting power, as low as 1 LUX.

Light Emitting Diodes (LED's) are housed in the Camera and provide lighting for the Down Hole Image and the Side View Image. LED's 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 R-Cam Control Unit supplied with the System and is not compatible with other types of closed circuit survey systems.

A single coaxial Cablehead Connector on the rear of the Camera is connected to the Cable by a watertight pressure rated connector.

The R-Cam Control Unit provides all the controls to operate the Camera and Reel Assembly, and is equipped with a 7" LCD Color Video Monitor.

A DVDR Video Recorder is also provided to record the survey.

A 12 VDC rechargeable gel cell battery pack is used to power the System and Video Recorder making the entire System completely portable. The Battery Pack will provide approximately 4-5 hours of operation depending on the amount of Video Recording and/or Reel usage.

CAMERA HOUSING:

The Camera electronics and LED lighting are housed in a stainless steel outer housing (Fig. 3) 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 side view Pyrex Glass Port protects the side view lens and LED lighting.

ELECTRIC POWERED REEL ASSEMBLY:

A portable 12 VDC electric powered reel (Fig. 2) equipped with a variable speed motor and 1,000 feet of coaxial cable is used to lower or raise the Camera in the well. The coaxial cable is lightweight and Kevlar reinforced for strength.
A shelf is located on the Reel Assembly to support the DVDR and R-Cam Control Unit during operation.

An extendable Boom Arm on the Reel Assembly supports the Camera over the well when lowering or raising the Camera during the survey. An Electronic Encoder is mounted at the Boom head and is used to display accurate footage information of the Camera's depth on the Control Unit Video Monitor. When the system is not in use the Boom Arm can be repositioned for easier storage, (Ref: figure 6) by simply removing the locking pin at the base of the Boom Arm, removing and rotating the Arm 180 degrees, placing the Arm back on the base and replacing the pin.

POWER SUPPLY:

A marine 12V DC battery and an external battery charger are housed in a black box with a lifting handle. An LCD volt meter is included on top, with a protective cover.

When fully charged, the typical reading on the volt meter will be about 13.0 and it will decrease as the unit is used. Camera functions will start to diminish when the volt meter reads 10.0. Expected run time for the battery is 4 to 5 hours, depending on amount of motor activity.

We recommend always keeping the battery recharging on an AC plug in your office when not in use. The battery will not develop a depleted "memory" and the trickle charge is best for battery maintenance. When charging, MAKE SURE THE FUSE IS IN THE BATTERY.

CONTROL UNIT:

The R-Cam Control Unit houses the LCD Video Monitor, all the controls, and necessary electronics, needed to operate the Camera and Reel Assembly, in a lightweight, portable, hard cover, carrying / storage case.

The front panel controls on the Control Unit are shown in figure 1.

12 VDC power is supplied to the **12 VDC BATTERY** connection from the Battery Pack.

NOTE: In the event of a Battery Pack failure or a survey running longer than battery power available the R-Cam 1000 System can be operated by using the vehicle battery in conjunction with the Emergency Pull out Cord (Part No. 125206 – this is not a standard part)

The REEL **CONTROL** and **POWER** cables are connected to the Reel Assembly to provide Camera control, Depth Encoder information, and Drive Motor power and control functions.

For DVDR set-up and connections, see DVDR Quick Start Guide on Page 10

The **VIDEO IN/OUT** connects to the DVDR (or Auxiliary Equipment) Video input with the RCA splitter cord.

NOTE: When the DVDR (or any Auxiliary Equipment) **is not** used with the R-Cam 1000 System, you must loop an RCA jack patch cord from the INPUT to the OUTPUT on the control unit to bypass any recording device.

CAM CONTROL FUNCTIONS:

The **ON-OFF** Switch routes power to the Camera and the Camera LED lighting when switched to the **ON** position. The **POWER** Pilot Light indicates when 12 VDC power is on and powering the Camera and LED lighting.

The **FORWARD-REVERSE** Switch rotates the Camera's Side-View and Down-View images, and is spring loaded to the **STOP** (center) position when released.

The **DOWN VIEW-SIDE VIEW** Switch controls the image to be viewed on the LCD Monitor and recorded on the VCR, and is spring loaded to the center position when released.

NOTE: You **CANNOT** switch between DOWN VIEW and SIDE VIEW while the Camera is rotating.

The **COUNTER RESET** Switch is used to set the depth counter to zero (000.0f) after positioning the Camera near the top of the well prior to the start of the survey.

NOTE: Anytime 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 **ON-OFF** Switch routes power to the Motor Drive controls when switched to the **ON** position. The **POWER** Pilot Light indicates when 12 VDC Motor Drive power is on.

The **FORWARD-REVERSE** Switch controls the Cable Drum to either lower or raise the Camera in the well, and is used in conjunction with the **SPEED** Control.

The **SPEED** Control is used to control the rate at which the Motor Drive Pays-Out or rewinds the Cable, and should always be used to start and, returned to **MIN** to, stop the Motor Drive.

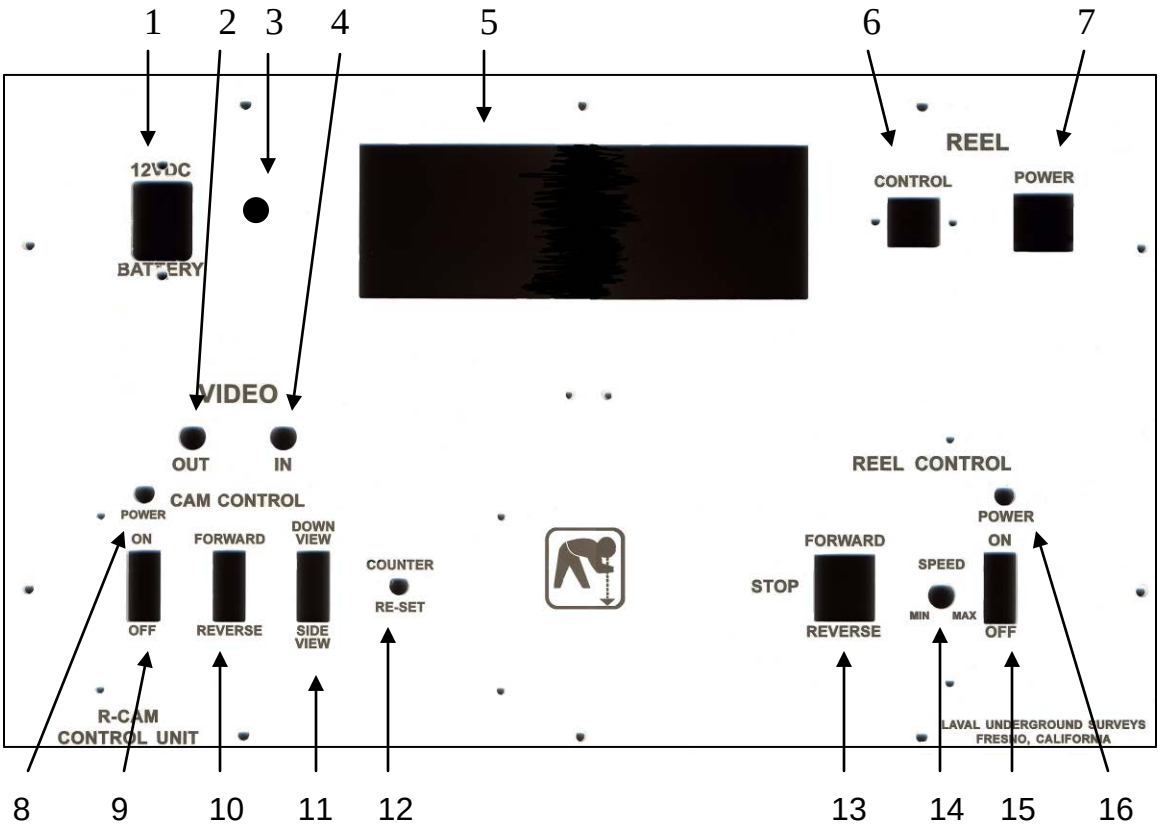
The LCD Monitor is mounted on a swiveling and tilting pedestal, which can be used to control the viewing angle, of the Monitor, for operator comfort. The Swivel Lock can also be loosened and the Swivel positioned to allow the Monitor to be stored in the Control Unit case.

DVDR QUICK START GUIDE:

1. Remove the DVDR from its box and set it on the installed shelf
2. Plug the DVDR power cord into the rear of the DVDR and the other end into the control unit where it reads 12V VCR Power
3. Take the video splitter and plug the two ends into the “VIDEO OUT” and “VIDEO IN” on the control unit
4. Take the other (single) end of the RCA Video Cable and plug it into the “VIDEO IN” on the DVDR
5. Now turn the DVDR on via the power button on the top of the DVDR. WARNING: make sure you are already connected to the 12V Portable Battery.
6. Press the eject button on the right side of the DVDR to eject the DVD Tray
7. Insert a blank DVDR into the tray and press the eject button to close the tray.
8. The video screen on the DVDR will now say it is “LOADING” wait for the DVDR to load the disc then the DVDR will say “FORMATTING.” When finished you will see the preview of the video from the camera on the screen.
9. WARNING: PRESS THE MENU BUTTON AND SCROLL TO SETUP TO CHOOSE THE QUALITY OF THE RECORDING. THE HIGHER THE QUALITY THE LESS RECORDING TIME YOU HAVE ON THE DVDR.
10. The DVDR is now officially ready to begin recording the survey
11. Once you are ready to take the survey, just press the round “RECORD” button on top of the DVDR..
12. When you are finished recording, press the “STOP” button and the recording will be stopped.
13. **VERY IMPORTANT**: After you have stopped recording you will need to finalize the DVD so it can be played on any DVD player. To finalize the disk you will press the LEFT ARROW OF THE MENU BUTTON. The Next Screen will list the menu options. Scroll down to “SETUP” and select that option. Then scroll down the REC FINALIZE and select that option.
    The DVDR Screen on the DVDR will then ask you to “RECONFIRM” press “SELECT” again to select OK.
14. FINALIZING can take a few minutes but it is necessary to Finalize the disk for playback.
15. Once the disk has been finalized and the survey is complete, you can use the video editing software (often available on-line) to edit the video on your computer.

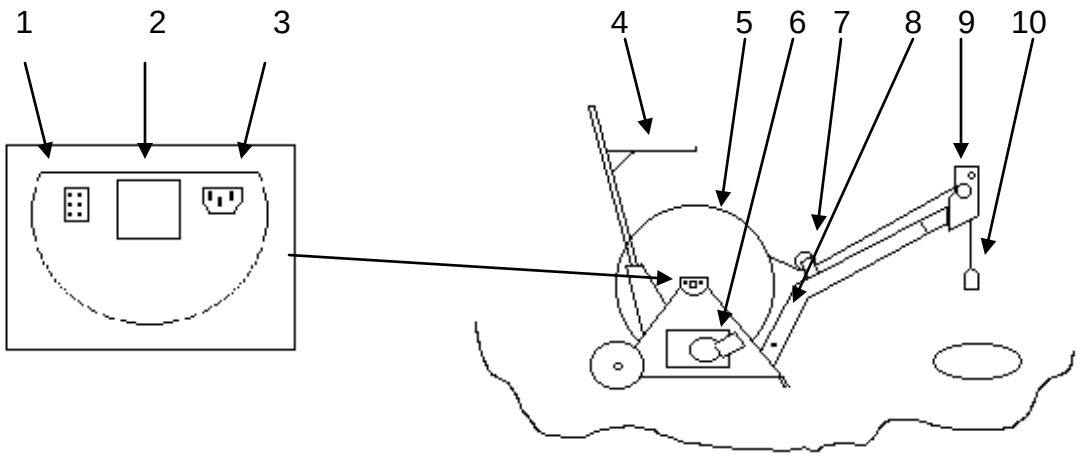
NOTE: PLEASE ALSO REFER TO THE “QUICK START GUIDE” THAT CAME WITH THE DVDR, WHEN YOU USE THE DVDR FOR THE FIRST TIME, AS WELL AS THE MANUAL FOR ILLUSTRATIONS AND FURTHER DETAIL. BOTH ARE AN IMPORTANT SOURCE OF INFORMATION.

THERE IS NO A/C ADAPTOR INCLUDED WITH THE UNIT AS MENTIONED IN THE MANUAL. THIS ADAPTOR WAS MODIFIED FOR USE WITH THE R-CAM 1000.



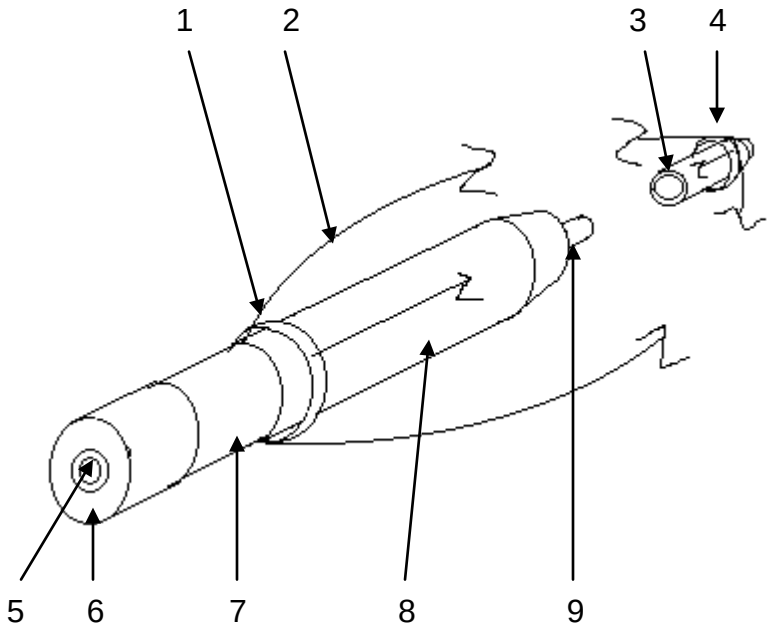
(1) 12 VDC power connection from Battery Pack
(2) Video Signal output connection to DVDR (or Auxiliary equipment) Video input
(3) 12 VDC power out to DVDR
(4) Video Signal input connection from DVDR (or Auxiliary equipment) Video output
(5) LCD Color Video Monitor storage well
(6) Control function, Video, and Depth Encoder connection to Reel Assembly
(7) Motor power and control connection to Reel Assembly
(8) Camera and Control Unit Power on Indicator Lamp
(9) Camera and Control Unit Power ON-OFF Switch
(10) Camera Rotation FORWARD-STOP-REVERSE Switch
(11) Camera DOWN VIEW-SIDE VIEW Selector Switch
(12) Depth COUNTER RESET Switch
(13) Reel Assembly Motor drive FORWARD-STOP-REVERSE Switch
(14) Reel Assembly Motor drive MIN-MAX Speed Control
(15) Reel Assembly Motor drive Power ON-OFF Switch
(16) Reel Assembly Motor drive power on Indicator Lamp

R-Cam Control Unit
(monitor removed for clarity)
(figure 1)



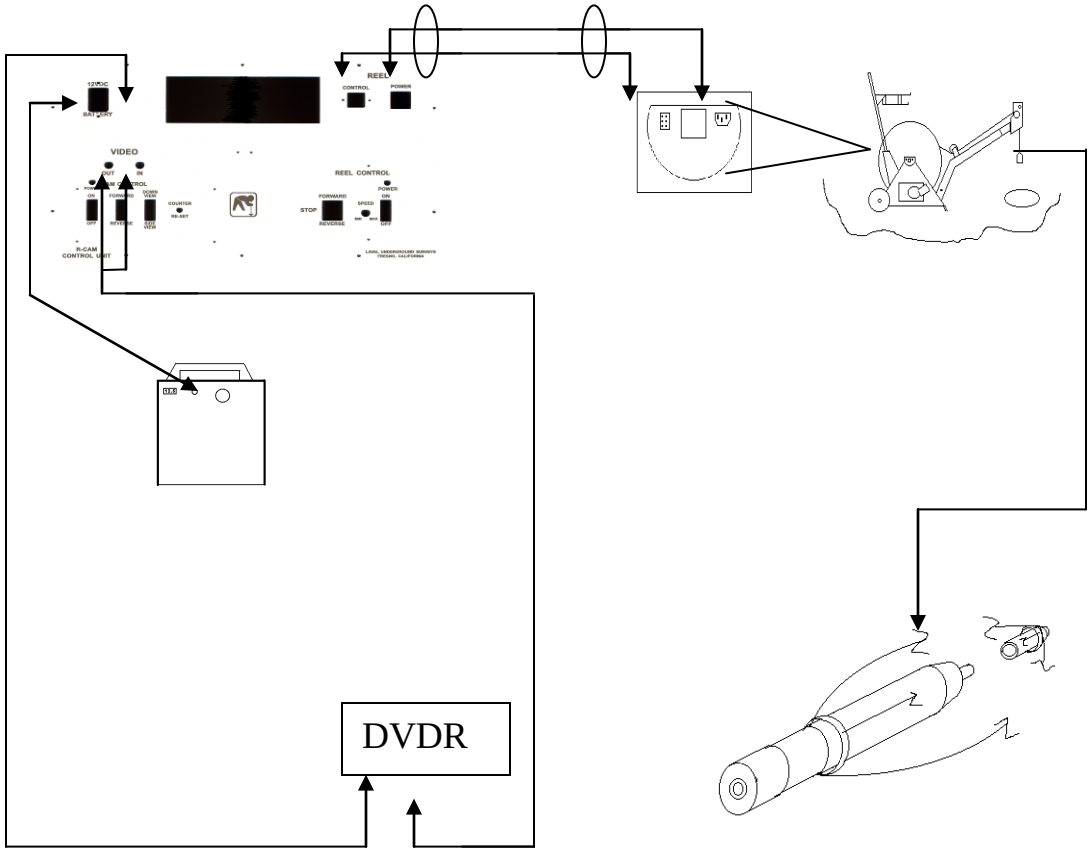
(1) Control function, Video, and Depth Encoder connection from Control Unit
(2) Slip Ring Housing
(3) Motor Power and Control connection from Control Unit
(4) Equipment Shelf
(5) Cable Drum
(6) Drive Motor and Gear Head
(7) Cable Guide Roller
(8) Boom Arm Locking Pin
(9) Encoder Assembly and Roller
(10) Twist Lock Cablehead

Electric Powered Reel Assembly
(figure 2)



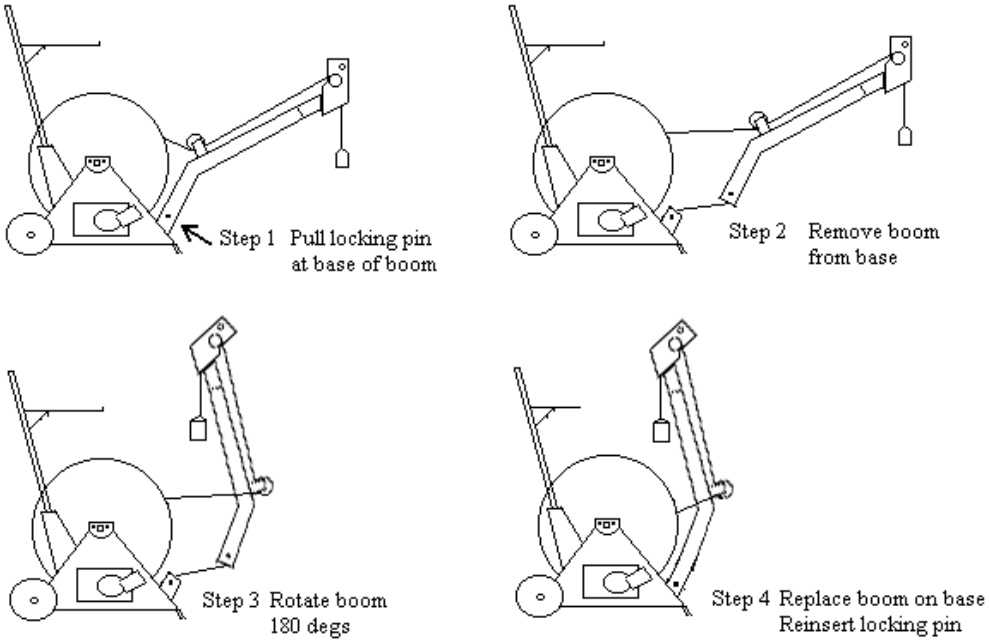
1. Lower Centering Band Collar
2. Centering Bands
3. Upper Centering Band Support Tube
4. Upper Centering Band Collar
5. Down View Lens Port
6. Down View LED Lighting Port
7. Pyrex Glass Side View Lens and LED Lighting Port
8. Camera Housing
9. Twist Lock Cable Connector

Camera
(figure 3)



1. Connect Battery Pack and CONTROL UNIT **12 VDC BATTERY**
2. Connect Control Unit DVDR **12 VDC POWER** and VCR DC-12V
3. Connect Control Unit **VIDEO OUT** and **VIDEO IN** to VCR (**VIDEO OUT** to DVDR Video-In and VCR Video-Out to **VIDEO IN**)
4. Connect Control Unit REEL **CONTROL** and **POWER** to the Electric Powered Reel Assembly
5. Connect the Twist Lock Cablehead from the Reel Assembly to the Camera Cablehead connector

R-Cam 1000 Interconnect
(figure 5)



Boom repositioning for storage
(figure 6)

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 the 12 VDC Battery Pack prior to each survey.

2. It is estimated that one fully charged battery would last approximately 4-5 hours of normal operation. This time may be extended or reduced dependant on use of the recorder, rotation of the Camera, and Reel Assembly Motor Drive use.

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.

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 plan here 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 ports can be soaped literally 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 R-Cam 1000 Camera in contaminated, acidic, or salt environments. If the R-Cam Camera and Cable is 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 fully charged and make a habit of returning it to AC power for charging after each use. Remember, the volt meter on the battery takes a long time to move from 12.5 to 12.0 and from 12.0 to 11.5. However, it moves much faster from 10.5 to 10.0 to 9.5. So always keep a close eye on the volt meter.
2) **Connections are loose** – Double check that all connections are tight, including the recording device's RCA jacks and power supply
3) **Finalize the disc** – After recording onto a DVDR, remember there is one more step or you won't be able to view the DVDR.
4) **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 happen when the camera is on a desk or in a car. Keep the camera secure and protected at all times, and inspect for cracks every time you're about to get it wet.
5) **Make sure the fuse is in the battery, or it will not charge**.

PROBLEMS AND THEIR SYMPTOMS

1) **Jumping digits on the monitor** – Usually an indication that the battery is too low. It can also be caused by the camera and the control unit being slightly out of tune with each other. 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) **Battery won't take a charge** – This can be caused by one of two reasons: Either the fuse has not been plugged into the back of the battery, or the battery has sat idle (not charging) for too long and it's past the point of taking a charge. If that's the case, you will need a new battery. Also remember, for emergency situations we make an Emergency Pull Out Cord to by-pass the battery and run directly from the 12V DC battery terminals of your vehicle. So you should never be left with having to pull a camera out of the hole by hand.
3) **Camera view won't switch from down view to side (or vice versa)** – This is usually the result of a battery being too low on power. By-passing the battery with the Emergency Pull-Out Cord may help this.
4) **Camera won't rotate, or will rotate only in one direction** - This is usually the result of a battery being too low on power. By-passing the battery with the Emergency Pull-Out Cord may help this.
5) **The depth counter is inaccurate** – This can happen when the cable is not going directly off the bottom roller of the boom arm, directly down the borehole. If you have a tripod over the hole and the cable is running uphill to the tripod, or even at a flat angle, it's possible that the cable will be slipping as it contacts the bottom roller (where the encoder is for the

depth counter). You can eliminate that slippage by installing a roller at the bottom of the boom arm, and running the cable from there up to the tripod. In this way, the cable keeps the same amount of contact on the bottom roller.