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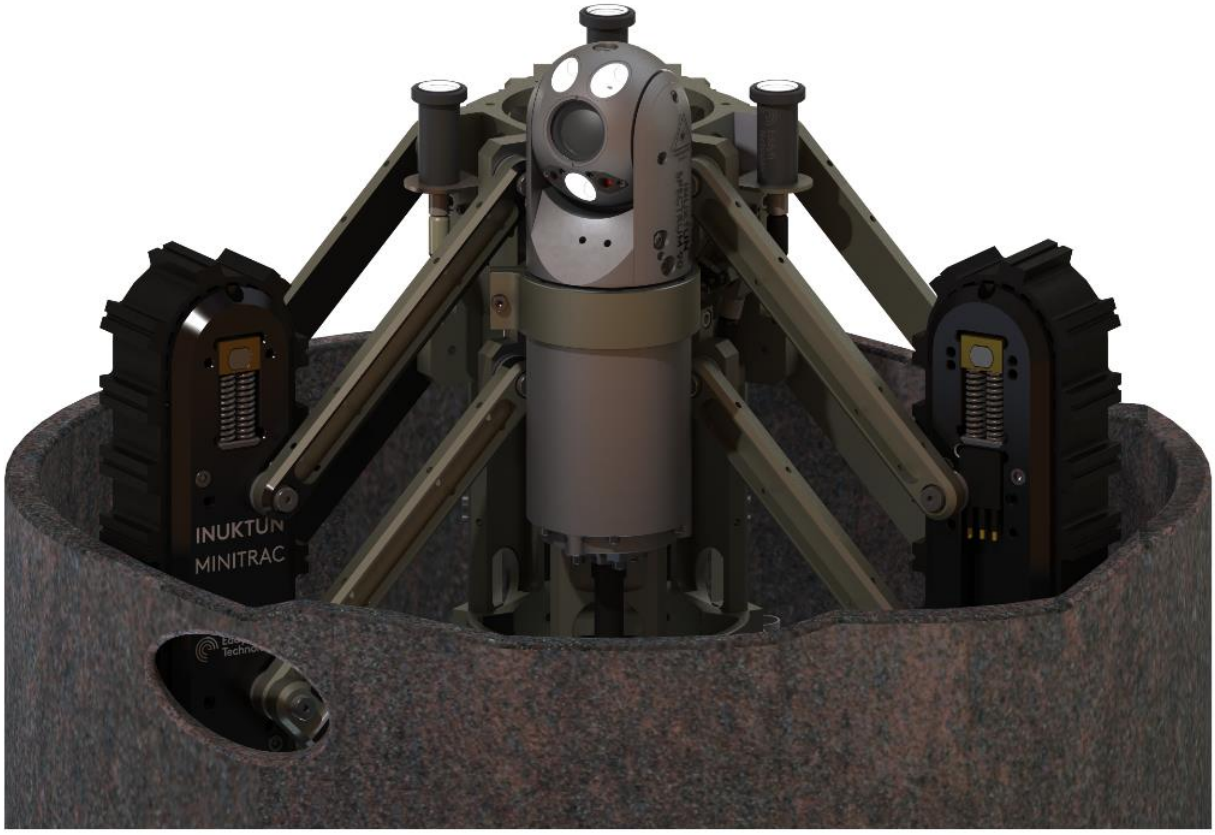


INUKTUN VT150 VERTICAL CRAWLER™

Table of Contents

About This Manual

This manual has been prepared to assist you in the operation and maintenance of your Eddyfi Technologies Inuktun equipment. Correct and prudent operation rests with the operator who must thoroughly understand the operation, maintenance, service and job requirements. The specifications and information in this manual are current at the time of printing.

This product is continually being updated and improved. Therefore, this manual is meant to explain and define the functionality of the product. Furthermore, schematics or pictorials and detailed functionality may differ slightly from what is described in this manual.

Eddyfi Technologies reserves the right to change and/or amend these specifications at any time without notice. Customers will be notified of any changes to their equipment.

Information in this manual does not necessarily replace specific regulations, codes, standards, or requirements of others such as government regulations.

System Description

The Inuktun VT150 Vertical Crawler™ system is a Minitrac™ based vehicle used for navigating pipelines ranging from 380mm to 915mm (15 inches to 36 inches) internal diameter. A minimized vehicle profile provides maximum clearance for passage of service intrusions in the pipe.

The inspection system has been manufactured with the hazards and demands of pipe inspection in mind.

All Versatrax™ hardware can be used dry, underwater, or in dirty, muddy conditions. The rugged design ensures a long service life and helps protect the vehicle from damage during normal use.

Typical applications include inspection of:

- Sewer and storm drains
- Hydroelectric pipe and infrastructure
- Steam headers
- Tanks and pressure vessels
- Oil and gas refineries and pipelines
- Pulp and paper mills

Specifications

*Pipe Size Range	
Standard Link, Track Inner Position	Minimum: Ø381mm / Ø15in Maximum: Ø559mm / Ø22in
Standard Link, Track Outer Position	Minimum: Ø457mm / Ø18in Maximum: Ø660mm / Ø26in
Longer Link, Track Outer Position	Minimum: Ø559mm / Ø22in Maximum: Ø914mm / Ø36in
Camera	Spectrum 90™ Pan, Tilt, Zoom Camera in Aluminum
Tracks	8000 Series Aluminum Minitracs™
Operating Temperature	0 - 40˚C / 32 - 104˚F
Storage Temperature	-20 - 60˚C / 4 - 140˚F
Depth Rating (for chassis, tracks, cameras, lights)	60m/200ft
Vehicle Weight	**kg/***lb (weight may vary depending on configuration)
Power Input	Switchable between 120VAC/50-60Hz and 220VAC/50-60Hz, 3080 Watts Peak

*Specified diameters are internal diameters of pipe

Certification

The Versatrax 150™ system is built in accordance with the Low Voltage Directive 2006/95/EC, Machinery Directive 2006/42/EC, and Electromagnetic Compatibility Directive 2004/108/EC.

CE

Safety

Personal Safety Equipment

Observe all safety regulations required by law in your place of work. These typically include:

- Traffic safety protocols
- Standard personal safety equipment including:
  - Steel Toed Boots
  - Safety Vests
  - Hard Hats
  - Gloves
- Heavy lifting procedures
- Overhead lifting protocols

Equipment Safety

Some precautions should be taken to protect the Versatrax™ system from damage:

- Repair damaged wires before operating the vehicle. A short circuit may damage the power system, telemetry system, cameras, or any attached equipment.
- Never drop the vehicle. Although built tough, the vehicle is heavy and can suffer structural damage when dropped.
- Prevent impact to the front of the 801 lights, Spectrum 90/120™ camera and Crystal Cam® camera as they can suffer damage.

Operational Safety

- All personnel operating or maintaining this equipment must read and understand the operations and maintenance manual prior to system operation.
- All personnel operating or maintaining this equipment must be competently trained.
- Appropriate personal protective equipment (PPE) must be worn while operating and maintaining the equipment.
- The power supply is equipped with a ground fault interrupt circuit. Do not cheat or bypass the ground fault interrupt circuit. Do not power the equipment from a source other than the provided power supply.
- ***Caution*: Spark Hazard** - Under no circumstances should this equipment be used in a potentially explosive atmosphere.
- ***Caution*: High Voltage** - The tether carries 400VDC to the rear harness block, and the Minitrac™ whips carry 400VDC from the harness block to the tracks. Keep the tether capped at all times when not installed on the vehicle. Follow the guidelines for preventing tether damage. Do not operate with a damaged tether or Minitrac™ whip. 400VDC can cause serious injury or death. Repair damaged wires before operating the vehicle. A short circuit may damage the controller, cameras, or any attached equipment.
- Disconnect the power source before servicing the product; otherwise, damage or fatal injury may result.
- ***Caution*: Trip Hazard** - Never stand on the tether. The vehicle and winch are strong enough to pull it out from underneath you and cause you to fall. Standing on the tether may also cause damage to the internal conductors and decrease the life of the protective jacket.

- ***Caution:*** **High Temperature** - Both the integrated harness block and the 801 lights may become extremely hot during operation. Always wear protective gloves when handling these parts of the vehicle after they have been in use.

- ***Caution*****: Intense Optical Radiation** - The 801 lights and Spectrum™ camera lights are extremely bright. Never look directly at the lights or even from a shallow angle. Always use a welding filter (shade #8 or higher) when inspecting the LEDs.

- ***Caution*****: Pinching Hazard** - There is a possibility that one's fingers could be drawn into the tracks should they be activated when the vehicle is being handled, or they may be pinched or severed by the expand mechanism. To avoid this hazard do not connect the tether to the portable controller until the vehicle is configured, placed, and ready to use. If the vehicle is being tested, do not connect the tether until handling of the vehicle is complete. If the vehicle is permanently installed onto a van or trailer and the tether cannot be disconnected, turn off the power.
- Establish a communication protocol between the person handling the vehicle and the operator at the computer. It is the operator's responsibility to check and ask if it is safe to power up the vehicle or initiate movement.

System Setup

Working Environment

The **control rack** (computer, power supply, interface box) are to be used in a **dry, covered** environment only. These components are not waterproof. Keep all cords and cables away from water. The recommended controller and power supply operating temperatures are between 0˚C - 40˚C (32˚F - 104˚F).

The **tether and vehicle** are depth rated to 60 meters (200 feet) of water. The tether connector is a dry-mate type which must be dry when connected to the vehicle. Keep the tether connector capped with a dummy plug when not connected to the vehicle to help keep out dirt. The tracks are tolerant to sand and muddy conditions, although this decreases seal life. The vehicle may also be operated in dry or dusty environments in the recommended operating temperature range of 0°C - 40°C (32°F - 104°F).

The **winch** and portable reel are splash resistant only. Refer to the winch or reel manual.

System **storage temperatures** are between -20˚C - 60˚C (-4˚F - 140˚F).

System Power & Line Voltage Set

Power Requirements

The power requirements given below are maximums for a fully configured system with cable reel. For use with 110VAC source, a fully configured Versatrax™ system requires three independent standard 15-Amp circuits for power, or one 20-Amp and one 15-Amp circuits as follows.

Control Computer	500W	15-Amp 110VAC Circuit #1	

Monitor	80W		20-Amp 110VAC Circuit #1
Power Supply and Vehicle	1300W	15-Amp 110VAC Circuit #2	
Powered Winch	1200W	15-Amp 110VAC Circuit #3	15-Amp 110VAC Circuit #2
System Total	**3080W**		

Set the Line Voltage

Before powering on the Versatrax™ system, it is important to check that the input voltage settings are correct - an incorrect voltage setting will damage the system power supply and the winch controller. When installing the system in a new location always check the line voltage.

- **Monitor:** Universal - no action required.
- **Computer:** Universal - no action required.
- **Interface Box:** Universal - no action required.
- **Power Supply:** Set the line voltage switch to 115/230VAC and change fuse.
  - For 115VAC use 15A MDA type fuse.
  - For 230VAC use 10A MDA type fuse.
- **Winch:** Jumpers must be set inside the hand-held controller. Refer to the winch manual for instructions.

Generators / Inverters

If powering the system from a generator or inverter, refer to that unit's operating manual for recommendations on continuous and peak load ratings. These power sources may apply a reduced output rating based on electrical load and environmental temperature. Remember to include the power needs of any other connected devices (external monitors, recording devices, lighting, etc.) when selecting a generator or inverter.

Connections - Preconfigured Control Rack

Pre-Configured Control Rack

The monitor, computer, interface box and power supply are installed and connected in a shock-mount portable 19-inch rack case. Systems pre-configured in a control rack will only need the tether, winch and vehicle connections to be made before operations as described below.

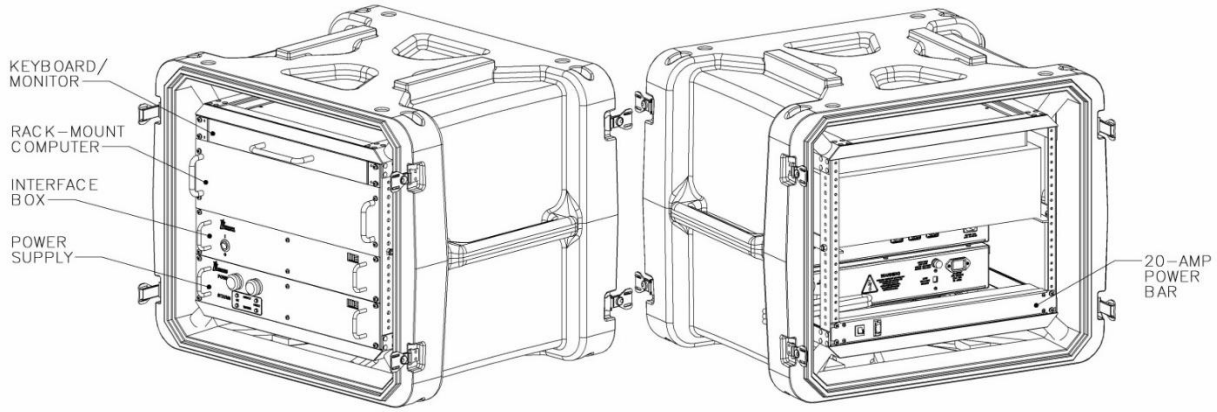


FIGURE 1: CONTROL RACK CONFIGURATION

Control System Connections – Copper Tether

1. Connect the power supply to the interface box using the supplied interface cable. Ensure the locking collars are screwed on all the way.
2. Connect the keyboard/monitor/mouse/system speakers to the computer. These are standard computer connections.
3. Using equipment power cords, connect the monitor, computer, interface box and system power supply to the 20-Amp power bar. Note that the power bar will only accept equipment power cords. The input cord on the power bar can be changed depending on the input voltage and location.
4. Connect the tether (or deck cable from the winch or reel) to the interface box as illustrated below.

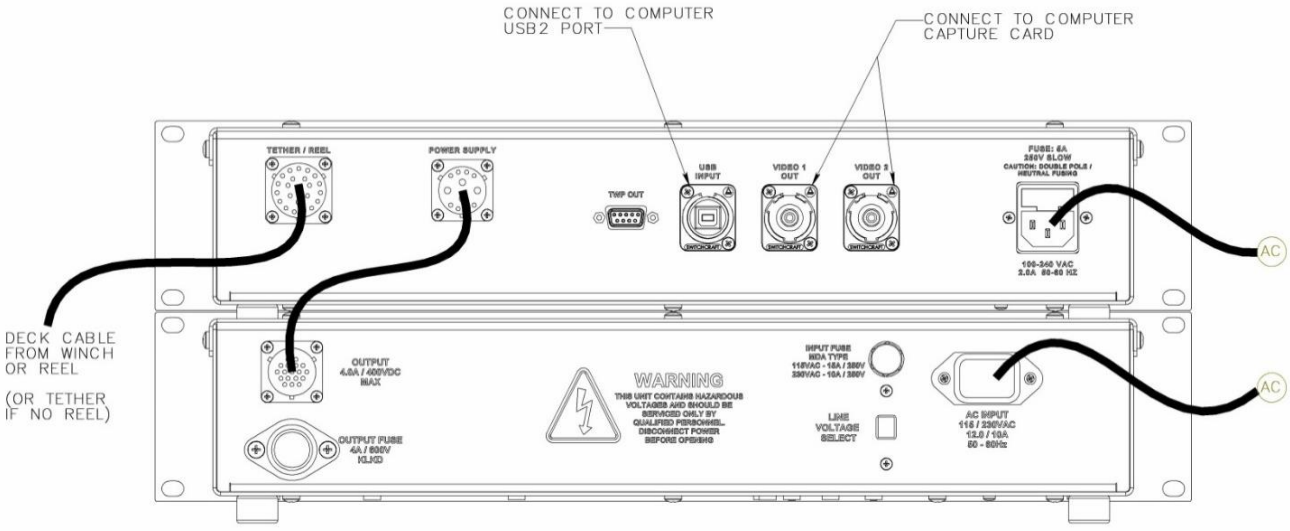


FIGURE 2: POWER SUPPLY & INTERFACE BOX

Control System Connections – fiber optic tether

Systems equipped with a fiber optic tether employ a fiber bundle running down the middle of the tether to transmit communications and video to and from the vehicle. The fiber bundle is typically terminated inside the winch and comes out as two fiber connectors (which look like small BNC connectors) underneath the bearing box.

Here are some basic rules for handling fiber optic cables and connectors to ensure system performance:

- When not connected, always keep the fiber optic patch cables capped to protect the ends from dirt and contamination. Keep the connectors on the interface box and winch capped for the same reason.
- When caps are removed, immediately place them in a clean zip-lock bag to keep the caps free from dirt and contamination.
- Don't let the ends of the patch cable contact or strike any surfaces. Contact may scratch or chip the end.
- Avoid touching the exposed end with your fingers. This will leave oil residue and may cause a decrease in signal strength.
- The minimum bend radius for a fiber optic cable is about 2 inches [50mm]. Sharper bends may degrade the signal. If a very sharp bend or kink occurs – don't worry – these typically don't break the cable; they just cause signal loss until the bend or kink is straightened out.
- If tie-wraps are used to constrain a fiber patch cable, leave them loose – do not overtighten. Tie-wraps can cause sharp local bends which degrade the signal.
- If you regularly connect and disconnect fiber optic cables, we strongly suggest you obtain a fiber connector cleaning kit.

Top – End cable connections for a fiber optic system:

1. Connect the power supply to the interface box using the supplied interface cable. Ensure the locking collars are screwed on all the way.
2. Connect the keyboard/monitor/mouse/system speakers to the computer. These are standard computer connections.
3. Using equipment power cords, connect the monitor, computer, interface box and system power supply to the 20-Amp power bar. Note that the power bar will only accept equipment power cords. The input cord on the power bar can be changed depending on the input voltage and location.
4. Connect the tether (or deck cable from the winch or reel) to the interface box as illustrated below.
5. Connect the fiber optic cables from the winch to the interface box. Match connectors 1 & 2 on the winch to the same connector number on the interface box. Follow the fiber optic handling guidelines given above.
6. Connect the SD-1 (standard definition #1) output to the video capture card in the computer. This is the system Rear Video.
7. Connect the HD-SDI output to the computer HD-SDI video capture card. This is the system front High Definition Camera.
8. Connect the USB to a computer USB-2 port. This is vehicle communications.

9. Connect the Ethernet port to the Ethernet jack on the computer. This is Ethernet communication to the vehicle for devices which require Ethernet.
10. There are spare front and rear video outputs which can be connected to external monitors. This is often useful in a permanent installation such as a trailer or van to feed auxiliary monitors.

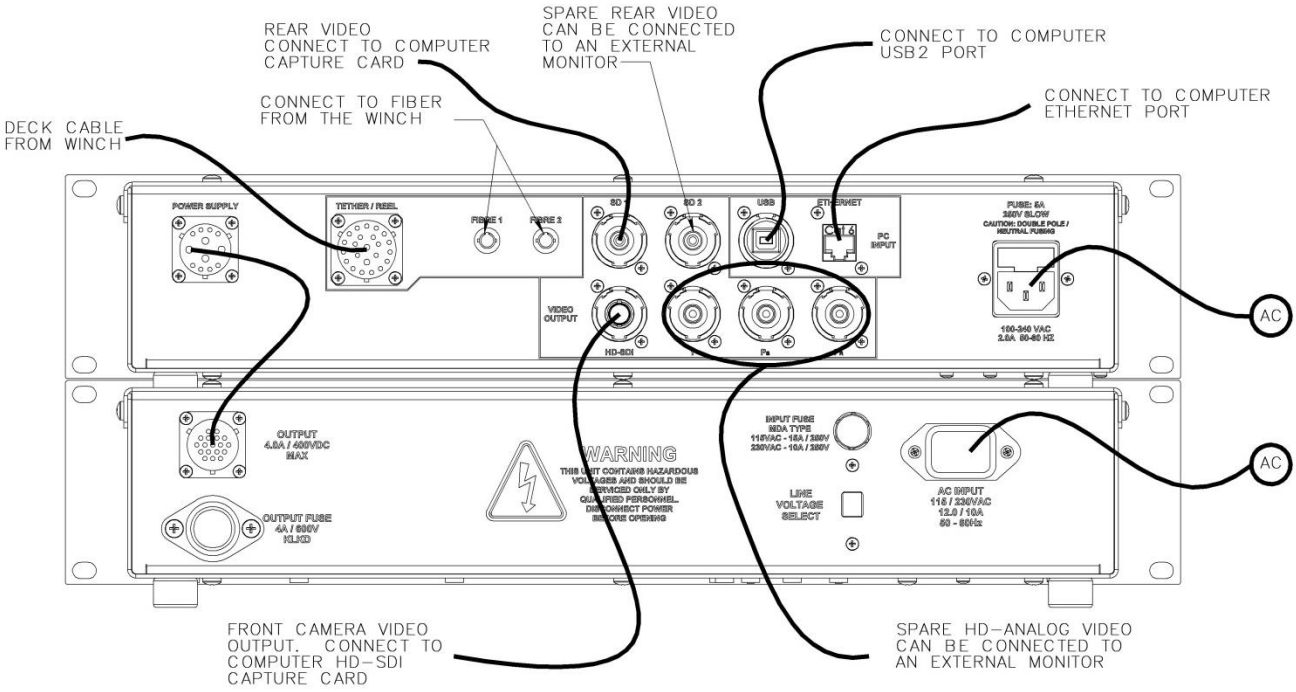


FIGURE 3: POWER SUPPLY & INTERFACE BOX CONNECTIONS

FIGURE 4: WINCH FIBER OPTIC CONNECTIONS

Client Configured Rack

If you are installing the power supply and interface box into your own 19-inch rack installation, consideration must be given to adequate air flow for cooling the power supply. In any installation, ensure that the air inlet and outlet at the sides of the power supply are free of obstructions. The system could overheat if airflow is restricted.

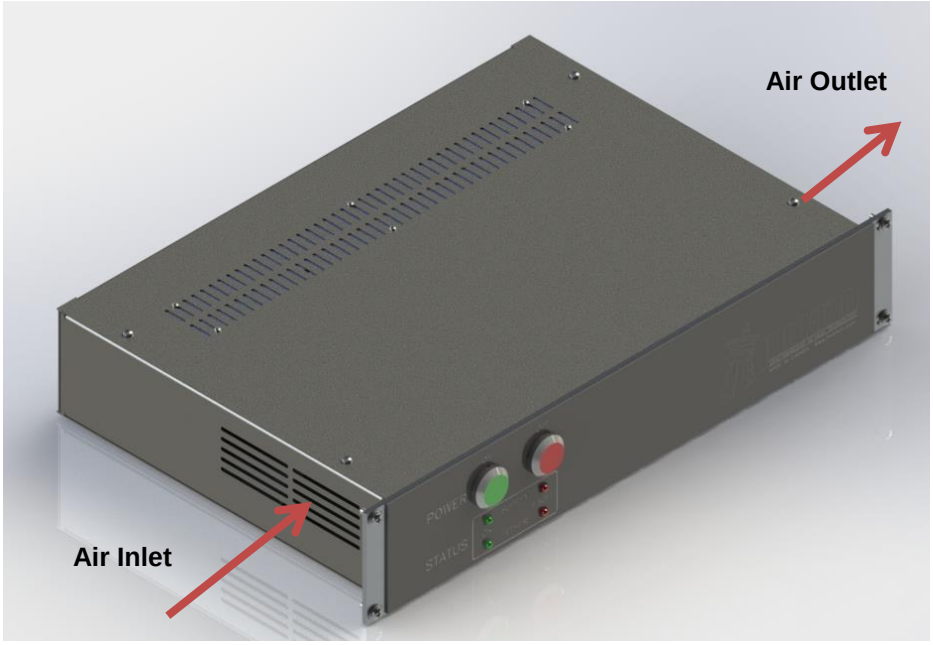


FIGURE 5: AIR FLOW - POWER SUPPLY COOLING

Connections - Vehicle & Tether

It is important that the tether be properly connected to the vehicle; otherwise, damage to the system may result.

1. Connect the vehicle end of tether to the back of the integrated harness block. Visually line up the key in the connector before mating. Fully screw down and hand tighten the locking collar.
2. Secure the tow cable to the Kellems grip on the tether using the quick-link. Adjust the grip so that there is tether slack between the grip and the vehicle no matter which way the tether approaches the harness block from as illustrated below.
3. Verify all device whips from the harness block to their respective components are securely connected, and the whips are free from damage.
4. Ensure any unused connectors are capped with dummy plugs to insulate and protect their electrical contacts.

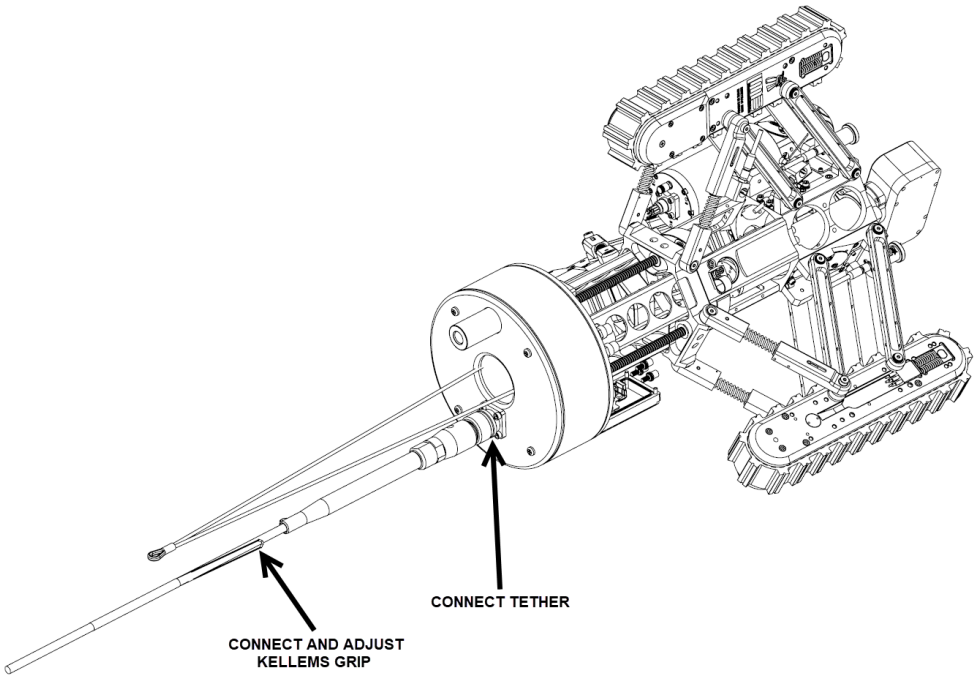


FIGURE 6: TETHER CONNECTION TO THE VEHICLE

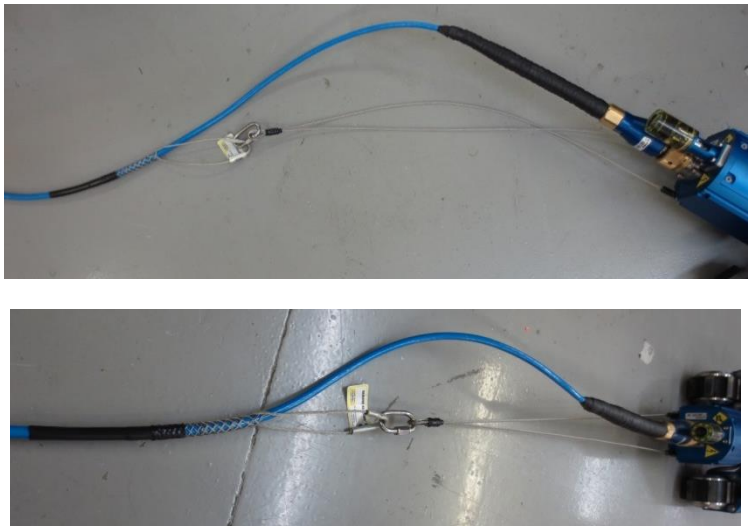


FIGURE 7: KELLEMS GRIP ADJUSTMENT FOR TETHER SLACK

Winch Installation

If your system includes an AC powered winch refer to the winch manual for setup and installation instructions.

Portable Reel Setup

If your system includes a portable reel, follow these steps to operate:

1. Remove the shipping cap from the front of the case and insert the crank handle.
2. Connect the deck cable from the reel to the controller.
3. Disengage the packing brake (pull back and turn on the locking pin).
4. Make sure the friction brake is **engaged** - disengaging the friction brake can result in slack tether resulting in potentially jamming the reel.
5. Unwind some tether and connect the tether to the vehicle.

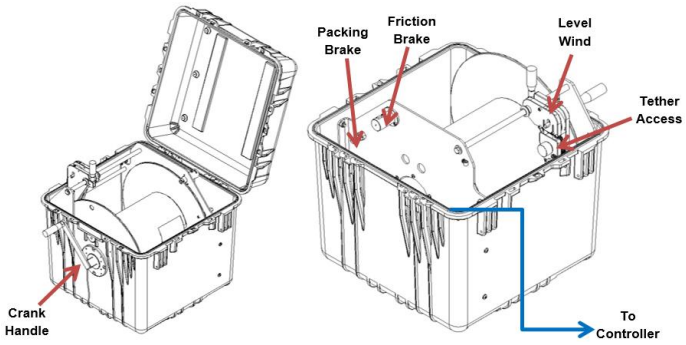


FIGURE 8: PORTABLE REEL SETUP

6. Run the tether through the level wind as follows:
    a. There is an access slot which must be opened by lifting up on the two exposed screw heads to raise the tether support shafts.
    b. Pull up on both sides of the axle on the top wheel and slide the tether beneath it - failing to lift up on the wheel can scuff and damage the tether.
    c. Make sure that the two wheels that sandwich the tether top and bottom in the level wind are tracking properly as the tether is paid out - this tells the controller how much tether the reel has unwound and how far your vehicle has travelled.

Tether Handling

The tether should be considered the most important part of the vehicle system. It feeds power and control signals to the vehicle and returns data from the sensors. If the tether becomes damaged from improper use, poor handling or an accident, the vehicle may become crippled or inoperable. This is a serious situation because of the cost for tether repairs, as well as significant downtime and loss of production. For maximum tether life and reliability, we offer the following tether handling tips:

- **Never step on the tether.** Trampling the tether may crush conductors, leading to premature failure. Trampling is also abrasive to the tether jacket. Trampling fosters the wrong attitude toward the tether. Remember, this is an expensive multi-conductor tether, not a common electrical extension cord.
- **Never allow vehicles, trucks, cars, etc. to drive over the tether.** This will do concentrated, immediate and permanent damage. Set up cones or blockades to keep vehicles away.
- **Do not bend the tether beyond its minimum bend diameter.** If the tether has difficulty bending, you have bent it too far. If the tether is bent beyond its minimum diameter on pulleys or around corners, wire fatigue will be accelerated. It is important that any pulleys or tackle support the tether at or beyond its minimum bend diameter. For an extended fatigue life, the minimum bend diameter should be considered larger.

  NOTE: For a standard Versatrax™ system, the minimum tether bend diameter six (6) inches.
- **Never kink the tether.** A kink will permanently bend a cable and may break a wire internally. Take precautions to never allow the tether to kink. Kink situations may occur when there is slack tether with closing loops, or when coils slip off a full drum.
- **Do not snap load the tether.** Your tether has a maximum safe working load of 400 pounds of tension. Loads may peak at a very high value when the tether snaps taut. Snap loading may easily occur when a slack tether is reeled onto a motorized spool, or when the vehicle is suspended from a swinging deployment crane.
- **Avoid loading the tether unnecessarily.** Unnecessary large loads will only shorten the fatigue life of the tether.
- **Always use the Kellems grip strain relief on the vehicle.** The Versatrax 150™ is powerful and can generate a lot of pulling force. Even though the tether termination is designed to withstand full tension, it is best to protect it with a strain relief.

- **Never fully un-spool the tether.** The surface end of the tether is anchored to the spool drum. If the spool is turned past the anchor point, the tether may be kinked or broken and require re-termination. To help prevent this, a band of tape is typically wrapped around the last few coils to act as a visible and audible warning that the tether is fully paid out.

Connector Handling

With regards to system reliability, connectors come next after the tether in terms of importance, though not quite as expensive to replace as a tether; a damaged connector can still represent significant cost in downtime and re-termination which could easily have been prevented. To this end, we recommend the following steps to help prevent damage to connectors.

When plugging in a connector:

- Inspect for dirt in both sides of the connectors. Do not plug in a dirty or damaged connector.
- Inspect for bent or burnt pins.
- Visually align the key-way or locating pin first before plugging in. **Do not** blindly jam and twist.
- Fully tighten or engage a connector. Never use a connector partly plugged or screwed in. Contacts left partly open may be subject to leaking, arcing, and burn-out.
- Use locking collars where available. In general, locking collars need only be screwed on finger tight.
- In general, all connectors on the vehicle are wet pluggable.
- Install dummy plugs on unused connectors.
- Regularly apply silicone grease to the connectors to keep them from seizing.
- Never use WD-40 or similar solvent-based fluids as this can cause serious damage to connectors.

Camera Installation

The Versatrax 150™ can mount any Spectrum 90™ camera. Installation is as follows:

1. **ALWAYS** turn off the system before working around the expand mechanism; pinch points may cause injury to fingers and hands.
2. Loosen the M5x14 socket head cap screw on the camera mount ring.

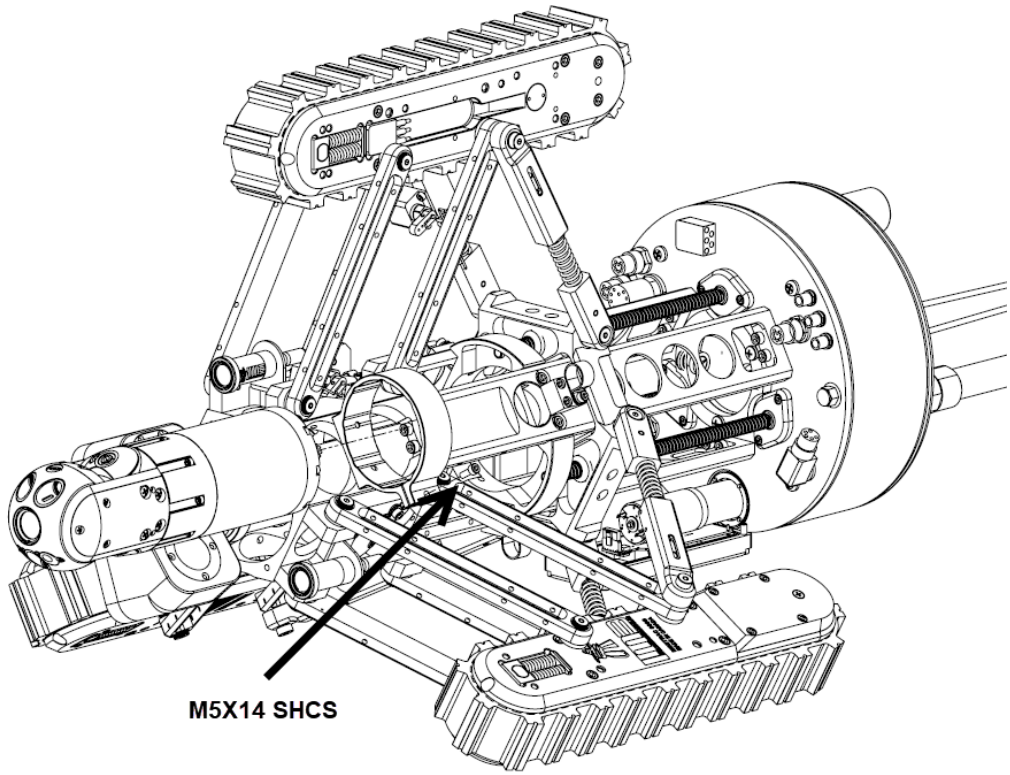


FIGURE 9: POSITION FOR CAMERA INSTALLATION

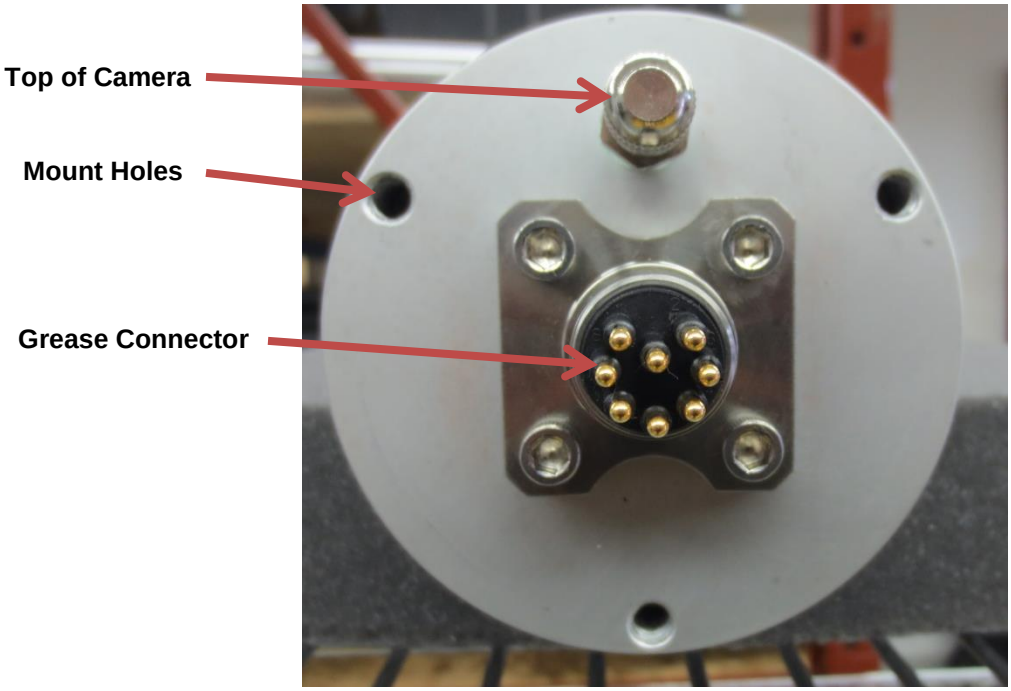


FIGURE 10: CAMERA ORIENTATION

3. The purge valve indicates the top of the camera, as shown in Figure 10. Mount the camera with the valve on top.
4. Slide the camera into the desired position from the front of the camera mount. Make sure not to clamp on the rotating section of the camera.
5. Tighten the mounting screw.

Minitrac™ Installation/Removal

The following procedure is the preferred method for installing the Minitracs™ onto the Versatrax 150™ Vertical chassis.

Note: Ensure that the system is powered down when connecting or disconnecting track whips. Track whips carry 400VDC. 400VDC can cause serious injury or death.

To install the Minitracs™, do the following:

1. Unscrew the shoulder bolts that mount the track to the expand linkages.
2. Remove the track.

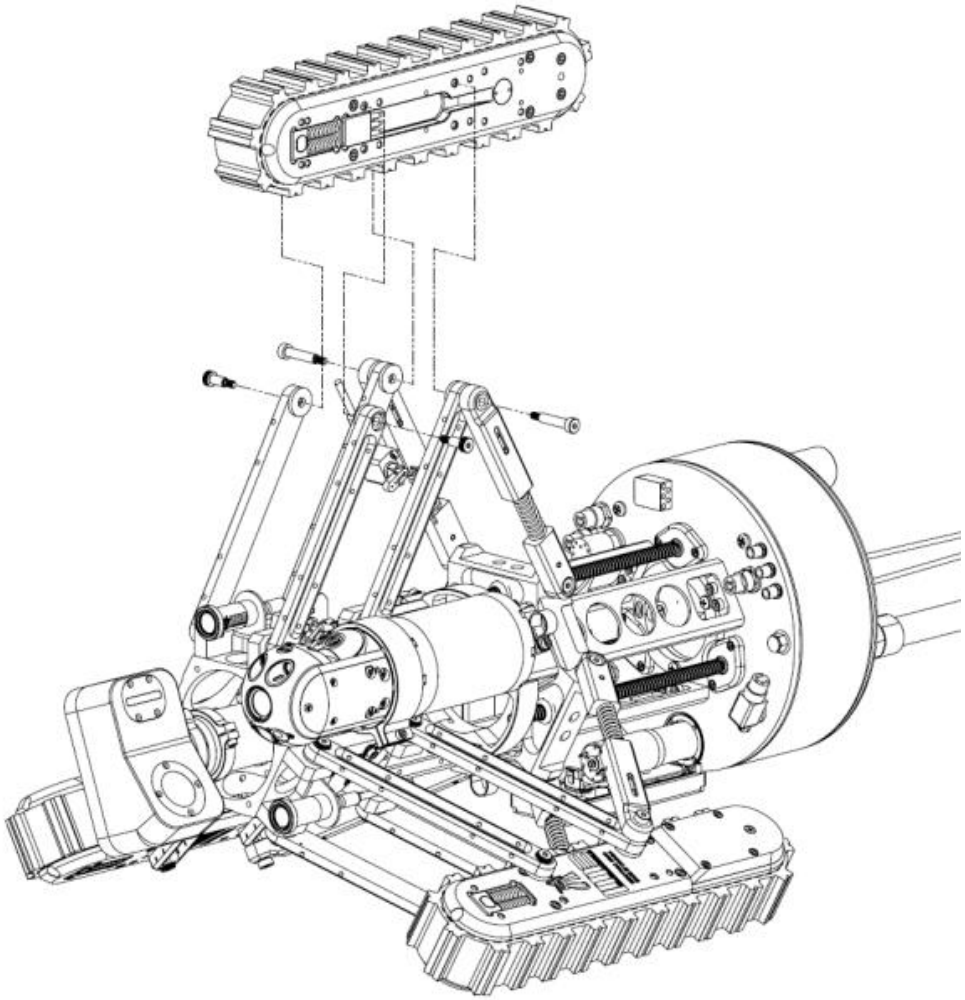


FIGURE 11: MINITRAC INSTALLATION

Track Extensions

To install the track extensions, do the following:

1. Screw the shoulder bolts into the track extension frame.
2. Attach the track mount plates to the extension frame.
3. Mount the track to the extension plates as shown below.

It is recommended that extended length Minitracs™ be used when operating in larger diameter pipes.

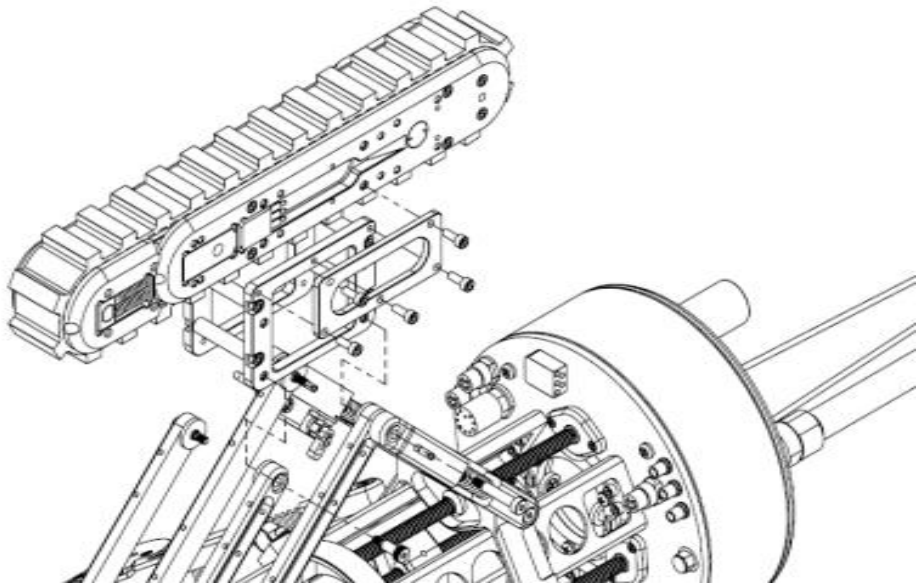


FIGURE 12: TRACK EXTENSION INSTALLATION

System Operation

Pre-Operations Check

Before each deployment of the Versatrax™ system, ensure everything is completed on the following checklist:

- ❑ Check that the work area has been safely set up.
- ❑ Check that the line voltage available at the worksite matches the equipment setup.
- ❑ Check that power and deck cable connections are correct.
- ❑ Check the vehicle for the following:
  - ❍ Check that the vehicle is in the correct configuration for the deployment.
  - ❍ Check the vehicle for mechanical damage to the chassis or cable harnesses which could affect its operation.
  - ❍ Ensure that all fasteners are in place and secure. In particular, check the fasteners holding on cameras, lights, tracks and tow cable.
  - ❍ Visually inspect the vehicle and Minitracs™ to ensure that the moving parts are free of debris and functional. Make sure the track belt is free of debris and turns freely.
  - ❍ Check the tether and vehicle whips for damage.
  - ❍ Ensure camera viewports are clean.
  - ❍ Check the 801 are clean and operational
  - ❍ **Optional Components** - Check that the screw on the automatic camera raise has been well lubricated.
- ❑ Check the winch/reel for the following:
  - ❍ Check that nothing will block movement of the level wind shuttle.
  - ❍ Check that the tether has no loose, dangling coils. Dangling coils can propagate as the drum rotates and have the potential to jump the drum. Take care of these before deploying the tether.
  - ❍ WINCH - Check that no objects, tools, etc., have fallen into the winch mechanism around the chain and drum.
  - ❍ WINCH - Check that the drum lock is disengaged and latched open.
  - ❍ WINCH - Ensure that the drive clutch moves freely and is operational.
- ❑ Power up the system and check the following:
  - ❍ Check for enough SSD drive space for recording.
  - ❍ Check record directories are set.
  - ❍ Check video quality and camera control functions.
  - ❍ Test video recording.
  - ❍ Test main lights.
  - ❍ Test track control.

Post-Operations Check

A Post-Ops inspection should be carried out after every deployment using the following checklist:

- ❑ Inspect the tether for damage as it is reeled in.
- ❑ Visually inspect vehicle for entrained debris or mechanical damage.
- ❑ Test each function to ensure proper operation.
- ❑ Clean the system by hosing it down with water at regular line pressure. Do not pressure wash. The tracks may be cleaned off by hosing them down while running. If the system has been used in salt water, thoroughly rinse the vehicle with fresh water right away.
- ❑ **Optional Components** - Locate the automatic camera raise height at 80mm (3.1 inches) from its home position for packing into the plastic shipping case.
- ❑ Take time to pack the system properly for transport away from the worksite.
- ❑ Store the system in a dry environment.

Note: Ensuring the Versatrax™ system is always stored in good working condition will minimize deployment time for future inspections.

***Caution*:** Use regular water line pressure to rinse. Do not use a pressure washer. The high-pressure water jet can push past the seals.

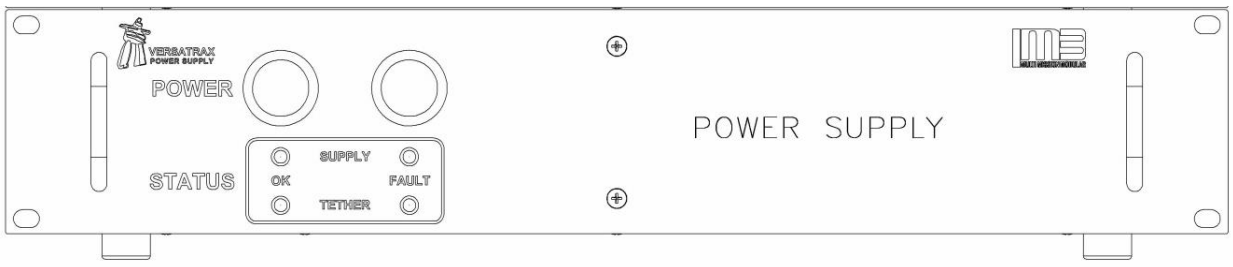
Power-Up Sequence

After all wiring connections have been made, the system may be powered up. The recommended sequence for power-up is as follows:

1. Power up the control computer and allow time for it to fully boot.
2. Switch on the Interface Box.
3. Turn on the Vehicle Power Supply.
4. Start the ICON (Inuktun Control) control program.

ICON always begins with identification of attached system components (cameras, tracks, etc.). If vehicle power is turned on after ICON is started, the system will not function until ICON is closed and restarted.

Ground Fault Detection & Alarms



The front of the power supply includes power on and off buttons as well as status indicators. The ON button and status indicators will light green during normal operation. The two red fault indicators may light momentarily during startup and shut down; this is normal.

There are two status indicators:

1. **Supply:** This is the main power supply providing 400VDC to the tether. A “supply” fault warning will trigger if the AC power input drops below 85VAC or if the power supply reaches over-temperature levels. The power supply will be automatically shut down.
2. **Tether:** The power supply is also equipped with fault detection which monitors potential current leakage from the high voltage power feed to the tether and vehicle. A “tether” fault warning may indicate possible damage to the tether cable or water leakage inside the harness block or Minitracs™. This fault will also be triggered if the output fuse has blown due to a short circuit.

Tether faults should not be triggered under normal operation and may be an indication of a major device malfunction or a potential safety hazard. If a tether fault is announced, the power supply should be disconnected and the reel, deck cable, tether, and vehicle harness whips should be inspected for damage. If all cabling looks good, the Minitracs™ and integrated harness block should be examined.

If either of the fault indicators trip, the power supply will automatically disable power to the tether and vehicle. The corresponding status indicator will light red and the ON button will flash to indicate external power has been disabled. The power supply will not re-enable vehicle power until it has been reset by pushing the OFF button.

***Warning*:** A ground fault alarm may be an indication of a safety risk. The system should be turned off and carefully examined before powering back up.

Note: The GFI fault detector monitors the high voltage DC power feed only and is not a replacement for a proper GFCI protected AC power outlet.

Inuktun Control - ICON & InPro

Vehicle control and video recording are accomplished using Inuktun’s ICON graphical interface controller software. Video playback and reporting is conducted through InPRO. **Manuals for these two software packages are included separately.** Controls for recording and snapshot functions are kept on-screen with the camera controls.

- ICON Manual: Control Interface & Recording
- InPRO V2 Manual: Reporting, Playback, Video Export

Dealing With Obstacles

The operator will invariably encounter a range of obstacles in a pipe. Each time the operator must decide if the vehicle can safely pass or if there is risk of getting stuck. Common obstacles include but are not limited to:

- Crushed pipe
- Sand
- Rocks and/or debris
- Roots
- Intersecting service pipes
- Animals and their nests

If the operator is unsure about pipe navigability, he or she should consult with the site supervisor before moving forward.

Inspection Guidelines

The objective of an inspection is to obtain a recording of video and other data for review by the customer or pipe owner. If a recording is lost, fails to record, or is of poor quality the inspection will likely have to be re-done at the operator's expense. Therefore, it is in the operator's best interest to verify vehicle operation, video quality and recorder function before beginning each inspection.

A set of video overlay comments and data are usually required depending on the contract or client. Initial comments will usually include the location, pipe number and date. During the inspection the contractor may require certain pipe features or faults to be pointed out along with the distance from the pipe entry.

Conduct a complete inspection of pipe features and faults. For any feature or situation of interest, stop the vehicle and make a complete video survey using the continuous pan feature of the camera. Ultimately, the inspection is conducted for the benefit of the client who is reviewing the footage later on.

Powered Winch Operation

Refer to the winch manual for winch installation and operating instructions.

Vehicle Recovery

In the event the vehicle becomes disabled while on a mission in a pipe, provision has been made for recovery of the vehicle by pulling it out with the tether. Recovering the vehicle by pulling is a serious operation and can put great demand on the tether system. Listed below are three scenarios where the vehicle may need to be recovered. Loading the tether beyond its maximum safe capacity of 400 pounds should be considered only as a last resort.

Note: Prevention is always the best policy. When traveling through a pipe or in any unknown area, carefully watch your monitor.

The vehicle may become stuck if it is traveling through a damaged pipe section or improperly steered around a corner. If the vehicle does become stuck:

1. Determine if it is the vehicle or the tether that is stuck. Look back at the tether with the camera if possible. If the vehicle can back up but the tether will not reel in, the tether is caught on something. Try to look for and fix the cause of the catch *before* putting any more strain on the tether. The operator should use any dexterity available first to free the vehicle without resorting to force.
2. If the vehicle cannot work itself free from a snag, try using *light* tether tension and tractor power simultaneously.
3. If still stuck, try a stronger tether tension. When cranked by hand, the winch can pull up to 500 pounds of force. The tether will handle this as a temporary load (if using the portable reel, the tether will have to be pulled on directly; be careful not to kink it).
4. If the vehicle seems to be permanently stuck in the pipe, the supervisor must decide whether to sacrifice the tether in order to pull harder (over 500 pounds), or to dig the vehicle out.

Troubleshooting

Camera Control Problems

- Not all the auxiliary lights are on.
  - The ICON software allows the lights to be controlled independently. Ensure all lights are enabled. Refer to the ICON interface manual.
  - Inspect for blown LEDs.
- Warning: High Intensity. Do not look directly into the lights. Use a welding filter (shade #8) to observe the light elements.
- Camera pan or tilt does not function in one or both directions.
  - Check that the camera is not jammed.
  - If you can hear a motor running but see no movement, there is a mechanical or clutch problem inside the camera. Contact us.
- Camera is moving very slowly.
  - Check the pan & tilt speed in the camera control window. Refer to the ICON user interface manual.

Video Problems

- No video (black or blue background)
  - Interface box is not turned on.
  - Video cables are not hooked up between interface box and computer.
  - Camera connector on vehicle is loose (turn power off first before plugging in camera).
  - Check that the camera harness whip is plugged into the correct socket on the telemetry can.
  - Check monitor input settings.
- Vehicle power is not on.
  - Check for problems with other video components between the computer and monitor.
  - Try a different monitor. Whole days have been spent on field maintenance trips only to discover a faulty monitor.
- Picture is very dark or very bright.
  - Check the light levels of both the camera and main lights.
- Intermittent picture.
  - Check and replace the video cables.
  - Check the monitor is working properly.
  - Check that the camera harness whip is fully plugged in.
  - Check for intermittent breaks in the camera harness cable.
  - Check the tether connectors at both controller and vehicle.
  - Check for tether or slip ring damage by testing tether continuity.
- Picture is blurry, will not focus, or has poor color.
  - This may be a dirty camera view port, or a narrow object lying in front of the view port.
  - Object may be too close to the camera.
- No Rear Video
  - Verify the video connection from the interface box to the computer.
  - This may be a dirty camera view port, or a narrow object lying in front of the view port.

Vehicle Problems

- Vehicle won't steer or vehicle runs backward.
  - Tracks set to the wrong positions.
  - Track reverse setting incorrect in control software.
  - Node ID conflict between one or more devices on the vehicle.

- Tracks will not run.
  - Check the track current feedback (See ICON manual).
    - If current is at 100% and the vehicle doesn't move, then the tracks may be jammed. They could be wedged on an object or jammed with sand. Try reversing the tracks to clear debris. If a jam will not clear you will have to recover the vehicle by pulling it out with the tether.
    - If no current registers, then power or communication is not getting to the tracks. Check all the cable connections.
  - Try power cycling the system.
  - Inspect the vehicle wiring for damage.

  - Check all the system connectors.
  - Try restarting ICON
  - Listen for the track motors. If the motors run but the track doesn't turn there is a problem with the gearing or shaft pins.
  - Try changing tracks. (ICON will require a restart.)
- Camera Raise will not move.
  - For each time the system is turned on, the camera raise will not move until it is zeroed. Click the CALIBRATE button on the ICON interface after system startup. The mechanism will lower itself automatically to its lowest position until the limit switch is detected.
  - Check the connector to the camera raise motor.
  - Try restarting ICON.

Winch Problems

- Tether distance does not read correctly.
  - Check that the pressure wheel is pressing the tether against the payout sheave. If the tether is being pulled up from the sheave instead of down, it may be disengaged from the sheave.
  - Check that the units are set properly in the graphical overlay.
  - Recalibrate distance encoder.
  - Ensure that the correct COM port is selected in the control software.
- Winch is very noisy.
  - The short chain directly off the motor is too tight. This chain must run with some slack. Refer to the winch manual.
- Winch does not run.
  - Check that the winch has AC power.
  - Check that the Emergency STOP button has not been pressed. (Twist to reset).
  - After a power failure the run/stop switch must be reset.
  - If there are no lights on the controller, check the fuse on the winch and in the motor control box. Refer to the winch manual.
- Intermittent problems with vehicle or camera only when the winch is running.
  - This may be caused by loose connectors.
  - Slip ring may be damaged. Pin out the tether to check continuity with the winch drum turning.

Parts and Repairs

Ordering Parts/Customer Service

Spare and/or replacement parts are available for your product and can be ordered directly from your local office.

When ordering parts, always make sure to quote the sales order acknowledgement (SOA) number and/or the serial number of the system component in question.

Inuktun Services Ltd. (Canadian Headquarters and Manufacturing Location)
2569 Kenworth Road, Suite C
Nanaimo, BC, V9T 3M4
CANADA
TF 1.877.468.5886
T +1.250.729.8080
info@eddyfi.com
www.eddyfitechnologies.com

Eddyfi Technologies – US (American Authorized Distributor and Service Centre)
812 W 13th Street
Deer Park, TX, 77536
USA
T +1.281.542.3292
info@eddyfi.com
www.eddyfitechnologies.com

Warranty Repairs

Warranty conditions are specified in the Warranty section. Should any conditions of the manufacturer's warranty be breached, the warranty may be considered void. All returned items must be sent prepaid to Eddyfi technologies at the above address.

Factory Returns to Canada

Some sub-assemblies of your Eddyfi Technologies product are not field-serviceable and may need to return to the factory for repair. Warranty claims must return to the factory for evaluation.

To return an item for evaluation or repair, first contact Eddyfi Technologies at our toll-free number or e-mail address. Eddyfi Technologies will supply a Return Merchandise Authorization (RMA) number with detailed shipping and customs instructions. Items shipped without an RMA number will be held at Eddyfi Technologies until the correct paperwork is completed. If cross-border shipments are not labelled as per the instructions, the items may be held by customs and issued additional fees.

All returned items must be sent prepaid unless other specific arrangements have been made.

When the product or system is being shipped anywhere by courier or shipping company, it must be packaged in the original packaging it was received in. This measure greatly reduces the consequences of rough handling and subsequent shipping damage.

Eddyfi Technologies cannot be held responsible for damages due to improper packaging. Shipping damage may have significant impact on repair turnaround times.

Eddyfi cannot be held responsible for damages due to improper packaging. Shipping damage may have significant impact on repair turnaround times.

Product/System Drawing Package Availability

Mechanical assembly and electrical wiring diagram drawing packages for your equipment are available in PDF format upon request. Printed copies may also be purchased from Eddyfi Technologies. Contact your local sales contact for more information.

Fuse Replacement

Fuses are located on the rear panels of the power supply and interface rack-mount boxes. Fuses must only be replaced with ones of equivalent type and rating.

Interface Box Fuse - 5 Amp, 250VAC SLOW

High Voltage Fuse (Power Supply Rack) - 4 Amp, 600AC fuse (Littlefuse KLKD Midget Series, part# KLKD004).

Input Fuse (**Power Supply Rack)** - This fuse must be selected depending on the input voltage.

- For 115 Volt input: 15 Amp 250 VAC slow
- For 220 Volt input: 10 Amp, 250 VAC slow

Fuse Diagnostics

Interface Box Fuse

This fuse provides protection for the interface box's internal power supplies for the video receivers and communications circuitry. If triggered, this fuse will disable video receivers and vehicle communications.

Vehicle Power Fuse

This fuse is located in line with the 350VDC output to the tether. If triggered, this fuse will disable the 400VDC output but not the power supplies themselves. *This is a high voltage fuse and must only be replaced with an identically rated fuse type.*

Input Fuse (Power Supply Rack)

This fuse protects the high voltage power supply and all auxiliary power supplies within the power supply rack. If tripped, this breaker will cut power to the supplies and, as a result, all power delivery to the vehicle. A tripped main power breaker is a sign of a significant and sustained short-circuit either at the power supplies or within the interface box. This equipment should be carefully evaluated before attempting to re-power.

Tether Re-termination

Tether termination is a specialized service beyond the scope of this manual. Contact Eddyfi Technologies if the tether is damaged or requires re-termination.

Limited Warranty Policy

Eddyfi Technologies will repair or replace, at its expense and at its option, any system or component, subject to the limitations and / or exclusions specified herein, which in normal use has proven to be defective in workmanship or material provided that, within one (1) year of the purchase date, the original purchaser returns the product prepaid, accompanied by proof of purchase, from a sales agent authorized by Eddyfi Technologies, and provides Eddyfi Technologies with reasonable opportunity to verify the alleged defect by inspection.

Warranty Limitations and/or Exclusions:

1. This warranty does not apply to light bulbs.
2. Batteries, fuses, transistors, integrated circuit modules (IC's), voltage regulating devices and electrical plugs and / or connectors are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
3. Any article purchased from, but not manufactured by, Eddyfi Technologies is sold with only such warranties as are made by the manufacturer therein. Eddyfi Technologies only warrants that it has title thereto, free of all liens or encumbrances.
4. This warranty does not apply to units which are damaged by connection to improperly wired AC receptacles.
5. Track belts, tethers, view ports and other components subject to wear through abrasion are warranted to be free from defects in material and workmanship for a period of ninety (90) days from the date of shipment to the original purchaser.
6. Any damage caused by failure to observe proper packing or to observe instructions for operation and maintenance as contained in the Instruction Manual furnished with the equipment, by accident in transit or elsewhere, will not be covered by the warranty.
7. Repairs are warranted for 90 days.

Eddyfi Technologies may require that certain components may be returned, prepaid, to a manufacturer's authorized station for inspection and repair or replacement.

Eddyfi Technologies will not be responsible for any asserted defect which has resulted from Acts of God, normal wear, misuse, abuse, improper configuration, repair, or alteration made, or specifically authorized by, anyone other than a representative of Eddyfi Technologies authorized to do so. The giving of, or failure to give, any advice or recommendation by Eddyfi Technologies shall not constitute any warranty by, or impose any liability on, Eddyfi Technologies.

The foregoing constitutes the sole and exclusive remedy of the purchaser and the exclusive liability of Eddyfi Technologies and is in lieu of any and all other warranties, express, implied or statutory as to merchantability, fitness for purpose sold, description, quality productiveness, or any other matter. Under no circumstances shall Eddyfi Technologies be liable for special, incidental or consequential damages, or for delay in performance of this warranty.