



# INUKTUN VT100 VERTICAL CRAWLER™

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## 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.

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## Description and Specifications

The Inuktun VT100 Vertical Crawler™ (VC100) is a portable pipe inspection system based on the Microtrac™ crawler. Three tracks are mounted on an expanding tripod mechanism to fully grip the pipe in any orientation.

### Specifications

Depth Rating	30 m (100 ft)
Weight	8.5 kg (19 lb) (includes all the vehicle's components without tether)
Front Facing Camera	Spectrum 45™ manufactured from aluminum; includes integrated LED lighting, pan, tilt, and remote focus control
Rear Facing Camera	Rear-facing Onyx™ camera
Pick-up Element	1/4in CMOS (NTSC or PAL)
Lens	3.6mm
Resolution	420 TV Lines (Horizontal)
Illumination	0.2 lux
Focus	1/2in to infinity

Image Sensor	1/4in color CMOS NTSC
Sensitivity	0.2 lux
Pixels	640 (H) x 480 (V) @ 30fps
Resolution	420 TVL
Lens	3.4mm, adjustable focus from 1in to infinity (using external tool)
Auxiliary Lights	2x variable intensity LED lights
Expansion Motors	Maxon 24V 20 Watt; 53:1 ratio
Expansion Range	No spacers: 8in – 12in
	2in spacer blocks: 12in – 16in
	3in spacer blocks: 14in – 18in
Control System	Pelican® case-based controller
Auxiliary Control	Control pendant with duplicate controls (optional)
Power Requirements	110/220 VAC 50-60Hz
Operating Temperature	0 ° -50°C (32 ° -122 °F)
Storage Temperature	-4 to 140°F /-20 to 60°C

## 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.
- Under no circumstances should this equipment be used in a potentially explosive atmosphere.
- If the equipment is powered from a source other than an Eddyfi provided controller, the power supplied to the product must have reinforced isolation from the mains with no reference to earth ground.
- Observe all traffic safety requirements in effect in your municipality.
- Never stand on the tether. The vehicle is strong enough to pull it out from under you and cause you to fall. Standing on the tether also increases wear and tear.
- The tether carries 72 VDC for the camera and expansion motor. Follow the guidelines for preventing tether damage. Do not operate with damaged tether.
- Repair any damaged wires before operating the vehicle. A short circuit may damage the controller, cameras, or any attached equipment.

- Never drop the vehicle. Although built tough, the vehicle is heavy, increasing the chance of structural damage when dropped.

**Caution:** Disconnect the power source before servicing the product; otherwise, damage may result.

**Caution: Pinching Hazard.** The track belts and expansion mechanism present a pinching hazard. Do not activate the tracks or expansion mechanism while the vehicle is being handled. Power down the system and disconnect the tether when the vehicle is being worked on or configured. If the vehicle is being tested, do not connect the tether until handling of the vehicle is complete.

## Avoiding Tether Damage

The tether is the most vulnerable part of the VT100 Vertical Crawler™ system. Tether damage is a serious matter but is generally avoidable through proper handling and scheduled maintenance. Unscheduled re-termination will mean lost time, and tether replacement is a significant cost. As a precaution we recommend that anyone using or handling the VT100 Vertical Crawler system read and understand this manual before working with the system.

## System Setup

### Working Environment

#### Controller

The controller is to be used in a **dry, covered** environment only. The controller and its connectors are not waterproof. Keep all cords and cables away from water.

Recommended controller operating temperatures are between 0° and 50° C.

### Tether and Wiring Harnesses

The tether and vehicle wiring harnesses are depth rated to 100 feet (30m) of water. However, the main connector may only be exposed to water when it is plugged in. Keep it capped with a dummy plug when not connected to the vehicle.

#### Vehicle

The Microtracs™, vehicle wiring harnesses and chassis are designed to allow work underwater to a maximum depth of 100 feet. The tracks are tolerant of sandy 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° to 50° C.

Allowable system storage temperatures are between -20° to +60°C.

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## Power Requirements

**Line Voltage** – The controller contains a universal power supply which will accept 110/220 VAC 50-60Hz.

**Power Requirement** – The VT100 Vertical Crawler™ system draws 400 Watts peak and can operate comfortably on a **600W** supply or inverter. This power figure does not include that used by external monitors, recorders and other equipment.

Note that the VT100 Vertical Crawler controller is designed to support Inuktun tracks, cameras, and lights. Powering other devices or equipment using the VT100 Vertical Crawler controller is not recommended.

## Portable Controller Setup

The VT100 Vertical Crawler controller in a Pelican® case is intended for portable applications. All electrical connections are located on the side panel of the controller as below.

To set up the system for operation

1. Unpack the robot from its packing case.
2. Set the controller in a convenient operating location. Remove the protective panel from the side covering the connectors and open the lid. (See illustration) To remove the cover, push in the retaining button and slide the cover back.
3. Set the winch at a convenient operating location and open the lid.

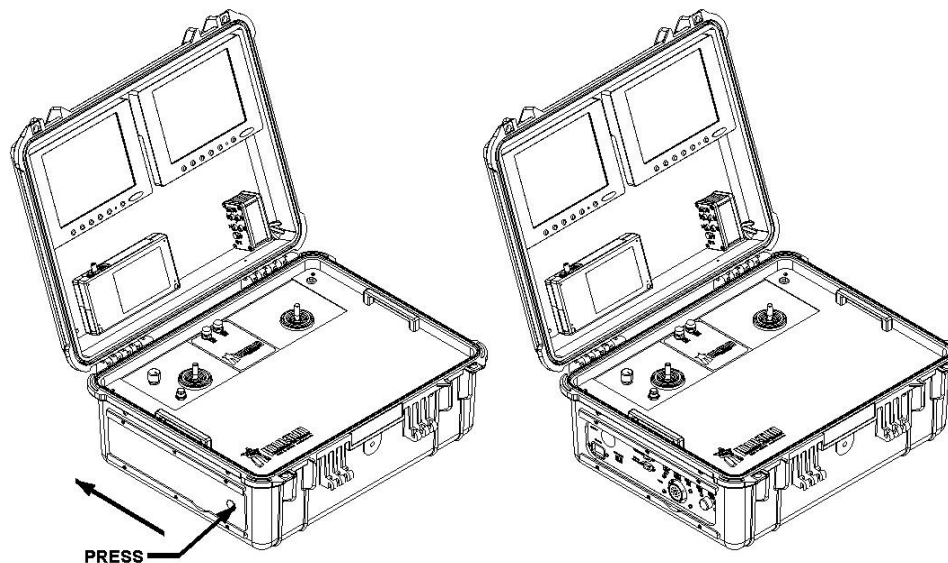


FIGURE 1: CONTROLLER WITH PROTECTIVE SIDE COVER

Three connections must now be made to operate the system:

1. Connect the deck cable from the winch to the TETHER connector bulkhead at the side of the controller.
2. Plug in the AC power cord.

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3. Connect the tether to the main robot connector. Make sure that the connector key is aligned and that the locking collar is screwed on fully. A loose connector may result in electrical damage or loss of the robot. When the tether is not plugged in, it should be capped to prevent dirt and moisture from entering the pins.

**Optional** connections are as follows:

1. An optional PS/2 style keyboard may be connected to the KEYBOARD connector for text overlay and menu shortcuts.
2. There are three video jacks on the controller which may be connected directly to external monitors or recording equipment:
  - a. The AUX video jack provides video from an optional second camera generally installed at the back of the robot.
  - b. The RAW video jack provides front camera video with no text overlay.
  - c. The OVERLAY video jack provides front camera video with on-screen text overlaid with the video signal.
3. Note again that the line voltage switch is disconnected and not used with this controller.
4. Connect the ENCODER cable from the winch to the nine-pin connector labeled ENCODER (optional with manual reel or AC winch).

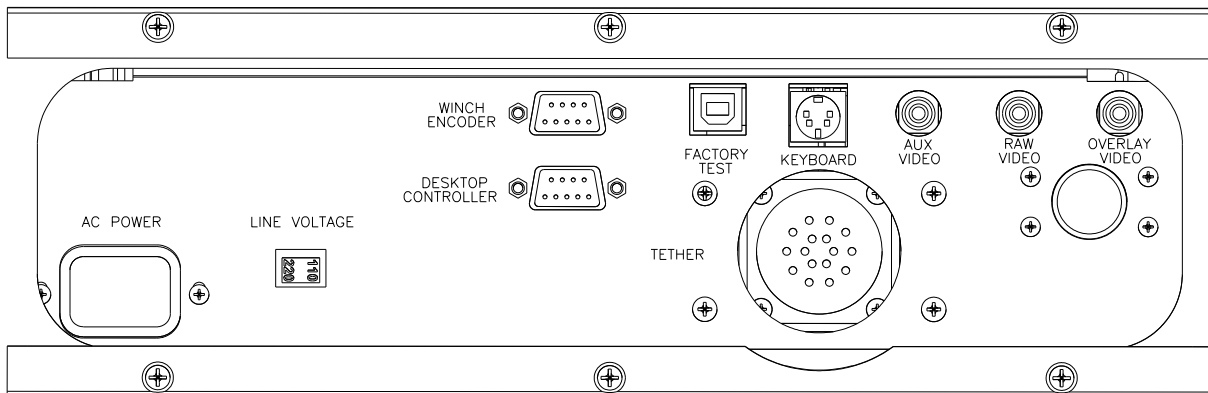


FIGURE 2: CONTROLLER SIDE PANEL CONNECTIONS

## Video Distribution Box

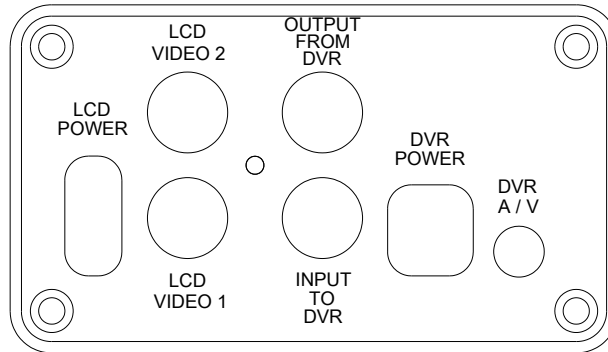


FIGURE 3: VIDEO DISTRIBUTION BOX

The video distribution box is in the lid of the controller. It performs several important functions:

- Provides power for the recorder and LCD monitor(s).
- Switches front and rear video to the monitor and DVR.
- Connects the DVR to the controller and monitor.

### Video Outputs:

LCD Video 2 always displays the Mini Crystal Cam® video from the rear camera.

LCD Video 1 source is controllable:

- When a DVR is detected the video will automatically switch to loop through the DVR before passing to the LCD.
- The LCD / DVR video source can be selected through the controller's main menu ("Camera: Front/Rear").
- Only the main video channel (from the SP90) has text overlay. When a menu or warning screen is displayed the video will automatically switch the LCD to the main video channel so the text will be visible. The display will revert to the selected camera when the menu is cleared.

## Rack Mount Controller Setup

The rack mount controller is intended for permanent installation into an inspection van or portable rack unit.

All electrical connections are located on the rear panel of the controller as below. Typically, recorded video is taken from the “Overlay Video” connector.

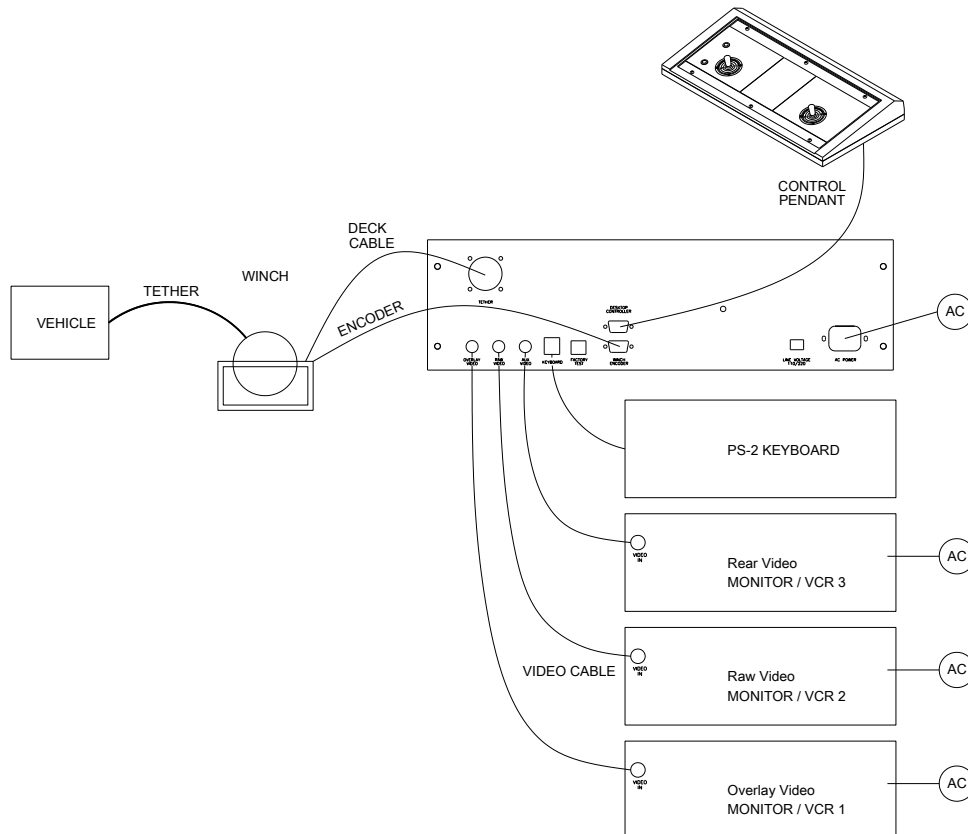


FIGURE 4: RACKMOUNT CABLE HOOK-UP

## Video Hook-Up

The external video connectors on your VT100 Vertical Crawler™ system use RCA style video jacks like most monitors and video equipment. An RCA style video cable has been supplied with the controller. Some industrial monitors may use a BNC style video jack. An RCA to BNC adapter has been supplied for this purpose.

Video from your VT100 Vertical Crawler controller may be connected directly to the video input of a television, VCR, or other recording device. Please refer to your television or recording device owner’s manual.

## Reel Set-Up

The portable reel is ready for use from the factory.

## Distance Encoder

The tether distance encoder on the winch is read and interpreted by the controller. If a winch and controller are sold together the controller will arrive calibrated from the factory. Should re-calibration be necessary this can be done through the controller's on-screen menu system. Refer to the Calibration Menu.

## Connecting the Tether at the Vehicle

It is very important to properly connect the tether to the vehicle. Improper connection may result in costly tether damage or vehicle loss.

1. Plug the connector ALL THE WAY IN and ensure the locking collar is fully screwed down. It is important for the longevity of the connector that it be kept free of dirt, have good o-rings and be mated carefully.
2. When the tether is not plugged in, it should be capped to prevent dirt or moisture from entering the pins.

For more detailed information refer to the, Caring For Connectors, section.

## Vehicle Configuration

### Front Camera Removal / Installation

Camera and lights are held onto the vehicle using a simple clamping fixture. To remove the camera or a light, loosen the clamping screw (M5 Socket Head Cap Screw) and slide the camera or light out of the fixture. When reinstalling, ensure the connectors and locking collars are fully engaged. Ensure polarity on the lights by lining up the dimple on the connector. If the light plug is reversed, the lights will not work.

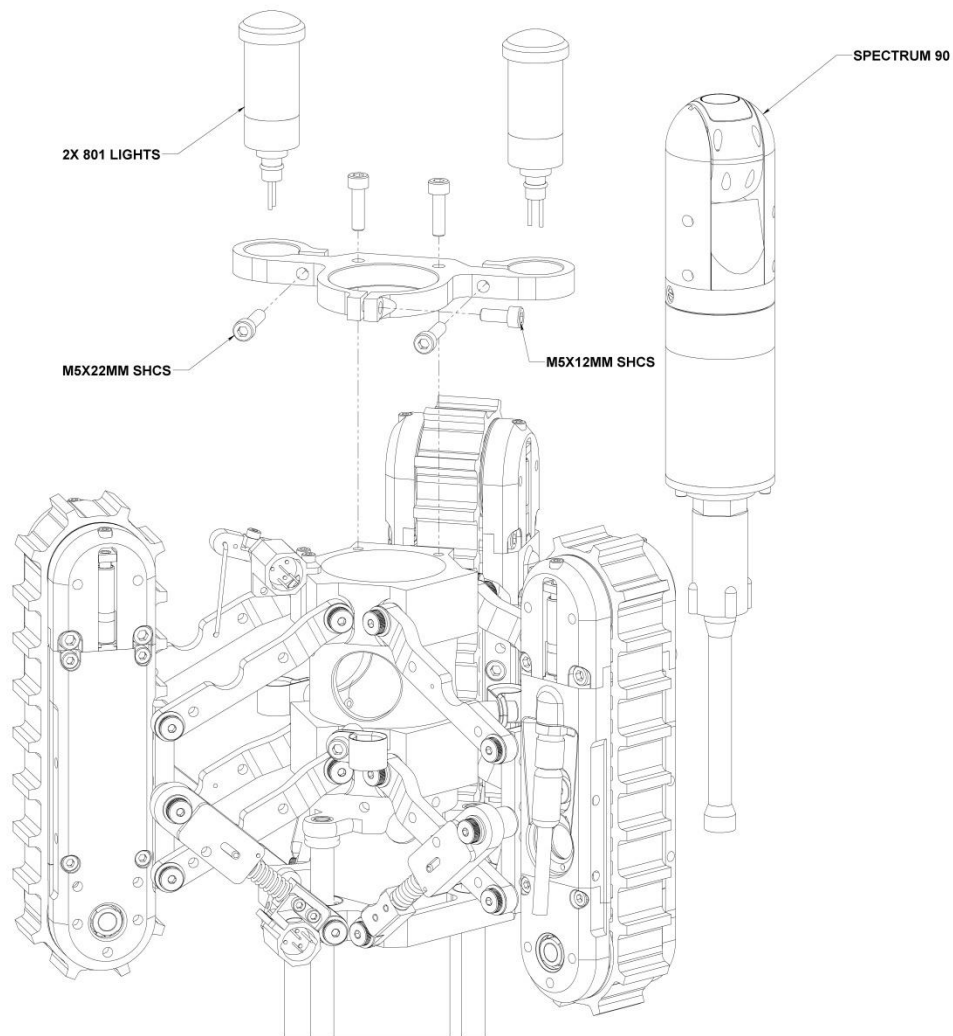


FIGURE 5: FRONT CAMERA AND LIGHT INSTALLATION

## Base Configuration – 8-12in Pipe

When the VT100 Vertical Crawler™ chassis is configured for 8in-12in pipe, the Microtracs™ are connected directly to the expansion linkages as illustrated below using the side mounting holes. Note all tracks are connected to the linkages in the same way, whether right or left.

Referring to the illustration below:

1. Connect the top linkages first using an M6x10mm shoulder screw. The illustration shows the correct placement and orientation of the bushings.
2. Second, connect the lower-most follower linkage as shown.
3. Connect the drive linkage, last, using an M6x20mm shoulder screw.

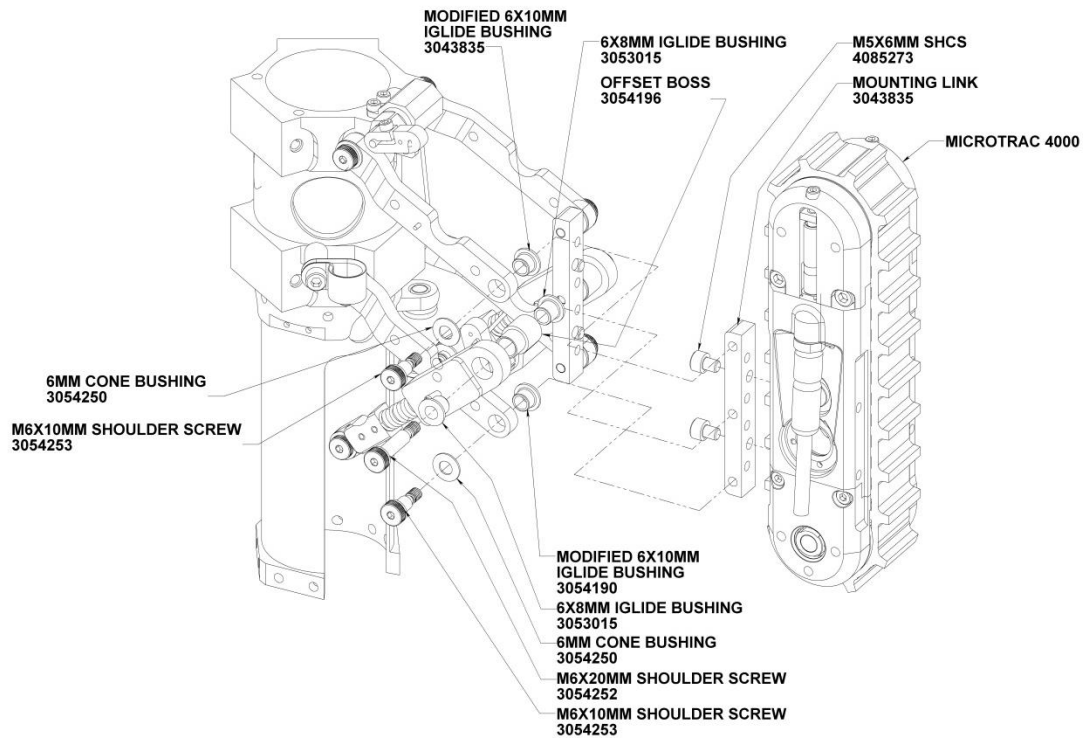


FIGURE 6: TRACK INSTALLATION 8IN TO 12IN

## Extension Brackets for 16 to 18in Pipe

Extension brackets mount to the expansion mechanism directly in place of the Microtracs™. To install the extension brackets:

1. Make sure you have all three of the same extension bracket size. Sizes cannot be mixed.
2. Remove one Microtrac from the expansion mechanism and replace it with the extension bracket using the same spacers and hardware.
3. Attach the Microtrac to the extension bracket using M5x10mm socket cap screws.
4. Ensure there is enough cable fed through the chassis to plug in the track. Wires can generally be secured to the long bushing on the driver linkage.
5. Repeat this procedure for each of the other two tracks.

The process is the same if you are changing between extension bracket sizes.

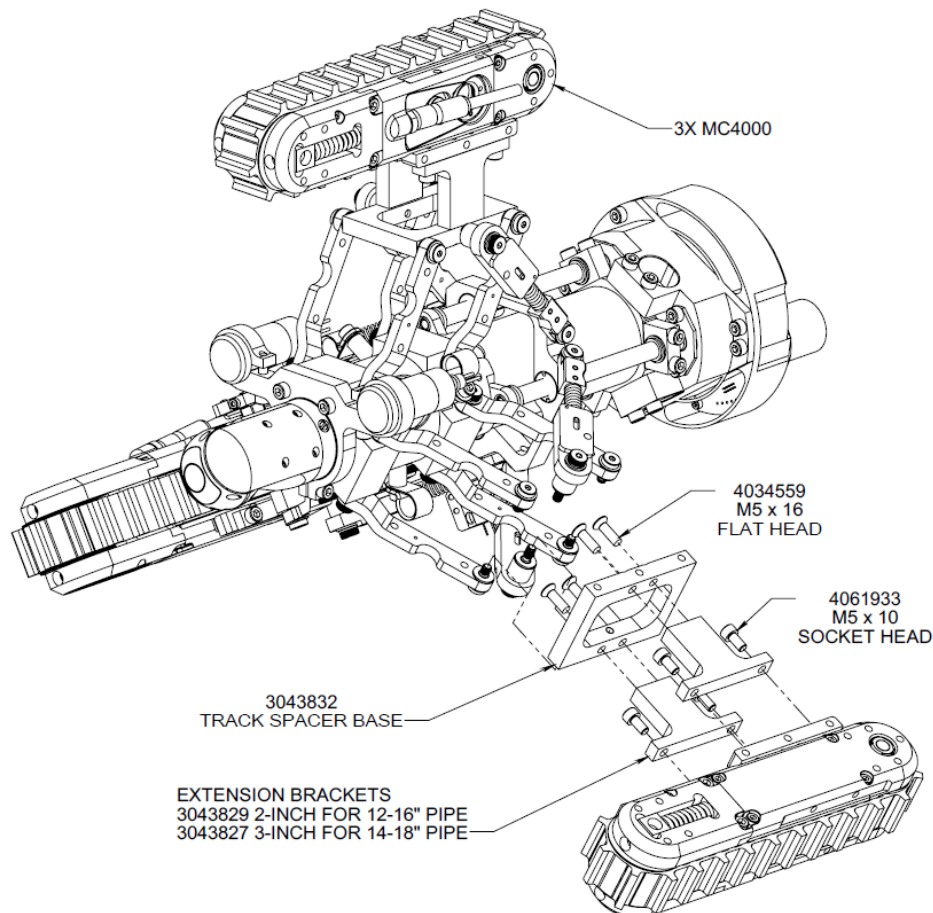


FIGURE 7: TRACK EXTENSION SPACERS: 12IN TO 16IN, 14IN TO 18IN

## Detaching the Drive Housing

On occasion the drive housing may need to be detached from the main chassis for maintenance. The housing attaches using four M5x18mm socket head cap screws as shown below. Because the wiring harness is potted into the drive housing, time must be taken to unthread the wires from the main chassis. Note the lead screws on the chassis plug into slots in the housing. When reinstalling, the screws must be adjusted evenly with respect to each other and in alignment with the slots.

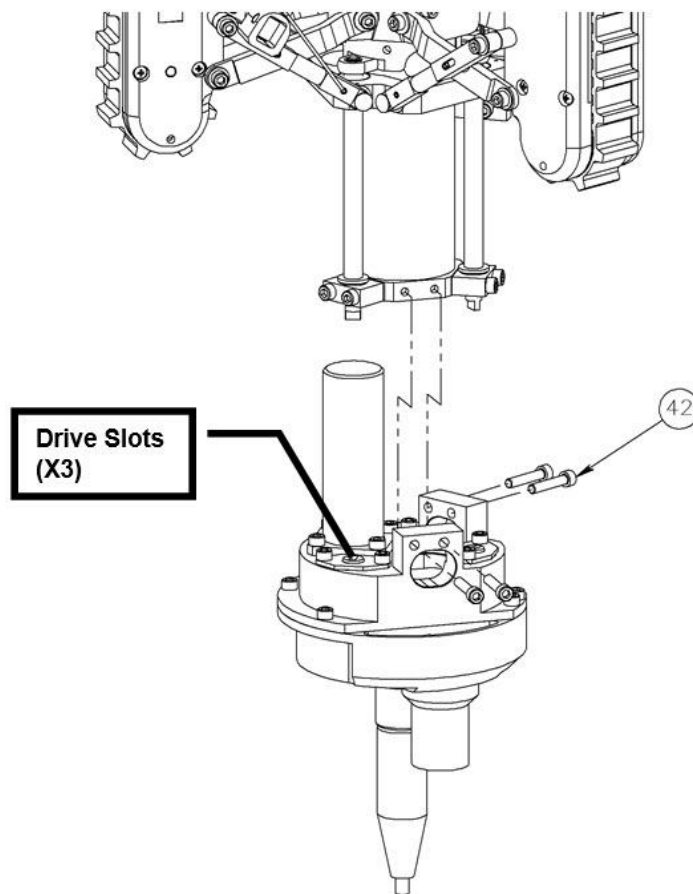


FIGURE 8: DRIVE HOUSING INSTALLATION



## System Operation

### Pre/Post-Operations Inspection

#### Pre-Ops

1. Visually inspect the vehicle and tracks to ensure that the moving parts are free of debris and are functional. Make sure the track belts are free of debris and of the correct tension. See the Microtrac™ maintenance manual for specific tensioning instructions.
2. Ensure that all fasteners are in place and secure. In particular, check the fasteners holding cameras, lights and tracks.
3. Check the vehicle for mechanical damage to the chassis or cable harnesses which could affect its operation.
4. Check all surface cable connections.
5. Power up the system and test each function to ensure proper operation before starting the mission.

#### Post-Ops

After each use of the VT100 Vertical Crawler™:

1. Visually inspect unit for damage or debris in the moving parts.
2. Test each function to ensure proper operation.
3. 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.
4. Store the system properly in a dry environment.

**Note:** Taking time to store the VT100 Vertical Crawler in good working condition will minimize deployment time for future inspections.

### Power Up / Power Down

Make sure all the equipment is properly connected before powering up. Once turned on, the controller will run through a brief power up cycle. A start-up screen (discussed next) will be displayed regarding choice of crawler type and tether length. When this screen is cleared the controller is ready for operations.

Note that if the system power is cycled off and back on quickly the video overlay may not initialize properly. If this occurs, turning the controller off for 5-10 seconds will allow the display to correct itself.

Always power down the system before connecting or disconnecting any equipment. In particular, never connect or disconnect the camera with the power on.

## Startup Screen

Upon startup the following track selection screen will appear:

```
Warning:
Controller is set for:
** Parallel Microtrac **
** 30m Tether **

Wrong vehicle or tether
info may lead to damage
or erratic behavior.

Press SEL to change type
Press MENU to resume.
```

FIGURE 9: SYSTEM START-UP WARNING SCREEN

If the Parallel Microtrac™ mode is selected as shown, press the MENU button to cancel and continue. To prevent runaway, track function will not be enabled until this warning screen is cleared.

If the controller displays a different mode:

- Press SELECT to open the crawler configuration menu where a new crawler or track type may be selected. Press the MENU key again to back out through the menu screens (press the MENU key three times).

```
Menu:Crawler Config
Vehicle Type      VT100
Chassis Type      Parallel
Track Type        Microtrac
Tether Length---  30m
Tether Ohms       2.9 ohm
Track Reverse     Left
Video Compensation None

MENU:Exit  SELECT:Toggle
↑/↓: Move Cursor
```

FIGURE 10: CRAWLER CONFIGURATION SCREEN

- **Vehicle Type** - Choose **VT100**
- **Chassis Type** - Choose **Parallel**
- **Track Type** - Displays **Microtrac**
- **Tether Length** – enter **30m**
- **Tether Ohms** - Default can be overwritten for non-standard tethers.
- **Track Reverse**- Choose **Left**
- **Video Compensation**- Choose **None**

### Vertical Crawler Configuration Screen

The VT100 Vertical Crawler™ expand and contract limits have been set at the factory and should **not** have to be reset by the operator. If required, then expand and contract limits can be reset through the VT100 Vertical Crawler configuration sub-menu. To enter the “Vertical Config” screen, press MENU, select “Configuration”, then select “Vertical Config.”

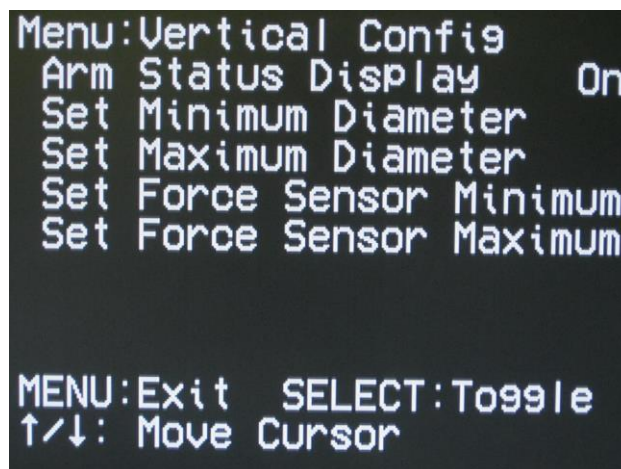


FIGURE 11: VT100 VERTICAL CRAWLER™ CONFIGURATION SCREEN

**Arm Status Display – ON/OFF:** Enables overlay display of the pipe size and the track contact force.

#### Calibration Settings:

This is a tool for calibrating the expansion and force linkages with the potentiometers. This must be done whenever adjustments are made to the wire linkages or if the clamp linkage is ever loosened or removed from the potentiometer.

1. Move the expansion mechanism to its maximum diameter before it reaches the mechanical limits, select the maximum diameter and calibrate.
2. Move the expansion mechanism to its minimum diameter before it reaches the mechanical limits, select the minimum diameter and calibrate.

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3. To clear the calibration settings, set the maximum diameter and minimum diameter without moving the mechanism (vehicle).

The expansion is now calibrated for size readout.

1. Select 'Set Force Sensor Minimum' when there is no load on the spring link.
2. Push down the linkage by hand until the springs are fully compressed.
3. Select 'Set Force Sensor Maximum'.

The force sensors are now calibrated.

## Track Control

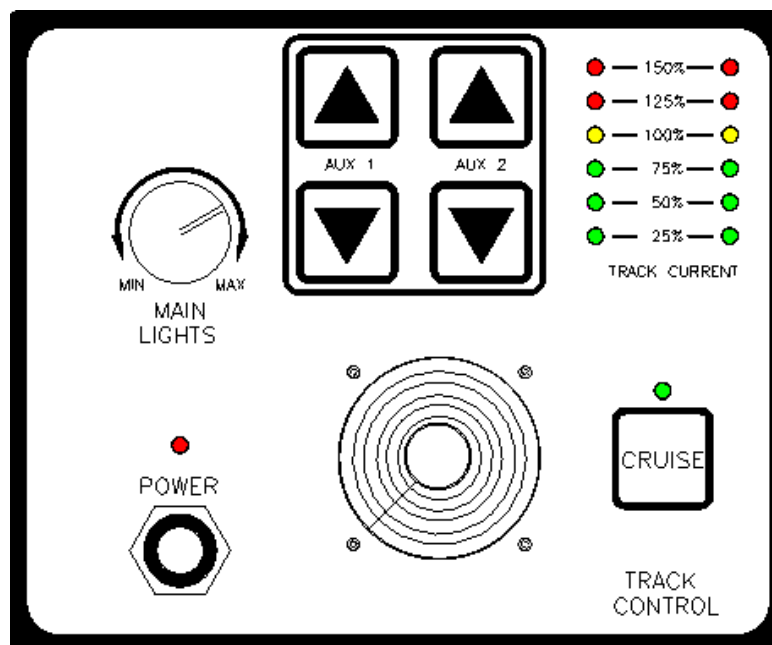


FIGURE 12: TRACK CONTROL JOYSTICK

If this is the first time that you have operated the VT100 Vertical Crawler™, take some time to practice operating the unit within view. This will allow you to become familiar with the speed and turning capabilities of the vehicle as well as develop skills in negotiating obstacles.

## Vertical Operation

The three-track tripod arrangement of the VT100 Vertical Crawler presents a unique control task to the operator. The above diagram shows the typical VT100 Vertical Crawler control panel layout. The bottom two tracks work as an ordinary tractor pair controlled by the left-hand joystick. The joystick is used as with any tractor pair to guide the vehicle forward, backwards and around corners. An averaging circuit inside the controller automatically runs the third track at the average speed of the lower pair. For example, when driving straight forward or straight back, the top track runs forward or backwards at the

same speed as the two lower racks. However, when turning, the top track slows to a speed in between the lower two tracks. When executing a spot-turn, the top track does not move at all.

The VT100 Vertical Crawler must not only negotiate right and left horizontal turns, but also vertical turns, going up and down. To accommodate this, the controller uses the AUX1 buttons to speed up or slow the third track. When negotiating a bend leading down, the top track must travel faster than the lower tracks, thus the operator pushes the AUX1 ▲ button to increase the speed of the top track. Likewise, when negotiating a bend leading upwards, the top track must travel slower than the lower tracks, and the operator must press the AUX1 ▼ button to decrease the speed of the top track. Conversely, when backing the VT100 Vertical Crawler around a corner, the third track will need to be controlled in reverse.

### Pipe Size and Contact Force

The expansion mechanism is operated using the AUX2 ▲/▼ buttons between 8 and 12in pipe sizes and can go slightly smaller or larger to accommodate insertion and maintain full contact in 12in pipe. Contact force is controlled by expanding the mechanism an additional amount after full contact with the pipe. Springs in the linkage will increase the track pressure as the mechanism expands.

Because the springs are pre-compressed, there is a minimum contact force that is displayed at all times, regardless of whether contact is made. Beyond the minimum force, the springs will compress allowing true measurement until they bottom out. To ensure the vehicle is gripping the pipe, the operator must adjust the force beyond the minimum according to the table below. As seen in the table, the maximum contact force decreases with the pipe size. This is because in the smaller pipe sizes, the compression springs are at a mechanical disadvantage.

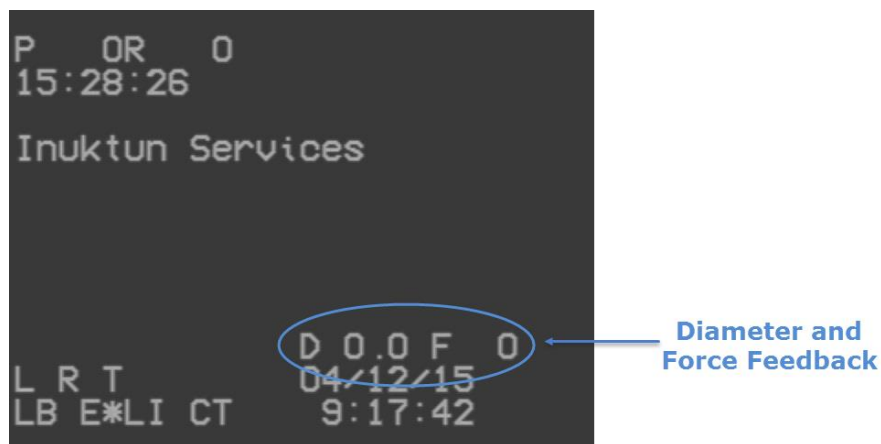


FIGURE 13: DIAMETER AND FORCE FEEDBACK

The diameter and force feedback can be displayed as overlay on the video. The diameter is a guide and maybe up to +/- 1 inch.

When using track extensions, you must add the extension length to the value on screen. For instance, with the four-inch spacers, the total diameter extension is eight inches. When the base is reading 10, add 8 to read 18.

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Pipe Diameter (in)	Minimum Force (lb)	Maximum Force (lb)
12.3	28	43
12.0	27	41
11.0	23	34
10.0	18	25
9.0	14	18
8.0	9	10



**Warning:** Be careful not to allow the contact force to decrease below the minimum or increase beyond the maximum. In these conditions the VT100 Vertical Crawler™ may lose traction and fall or may become jammed or damaged from excessive force.

Some care must be taken during certain transition maneuvers between pipe sizes; for example:

- Crawling upwards, transition from small to large pipe: This is the safest transition with no danger of falling or mechanism overload.
- Crawling upwards, transition from large to small pipe: This is the most dangerous transition, with danger of falling and mechanism overload. We suggest this maneuver be attempted only in smooth pipe transitions and never in large step transitions.
- Crawling downwards, transition from large to small pipe: This is a relatively safe transition but be sure to reduce the size of the mechanism to prevent overload.
- Crawling downwards, transition from small to large pipe: The crawler will fall until it expands to the next pipe size. This maneuver can be dangerous if the next pipe size is too large for the mechanism. If possible, hold the vehicle back by the tether until the mechanism contacts the pipe again.

## Cruise Control

The VT100 Vertical Crawler controller features a cruise function similar to the cruise control in a car. To activate the cruise feature, start by driving the vehicle normally using the joystick. Once a desired speed and direction are reached press the CRUISE button. The vehicle will continue at that course and speed and the joystick can be released.

To drop out of cruise press the CRUISE button a second time and the vehicle will stop.

The last cruise setting may be resumed by pushing the CRUISE button while the vehicle is stopped.

While in cruise mode the track joystick may be used to make adjustments in speed and heading. Momentarily moving the joystick forward will cause the vehicle to accelerate; pulling back will cause it to slow. In the same way, moving the joystick to the side will cause the vehicle to turn.

As a safety precaution the cruise function includes an additional panic feature. Quickly moving the track joystick in any direction will cause the vehicle to drop out of cruise and stop.

NEVER leave the controller unattended while the vehicle is in cruise mode.

## Backing Up / Avoiding Tether Snags

Backing up a tethered vehicle is very different from driving forward. This is because the vehicle cannot push the tether behind it. When backing up, a tether handler must pull the slack tether back from the work area. If the vehicle is allowed to become entangled in the tether, tether damage may result. The vehicle is strong enough to damage the tether by backing over it.

## Camera Control

The VT100 Vertical Crawler™ controller is capable of operating with a Spectrum 45™ camera. This includes pan and tilt, focus and light control.

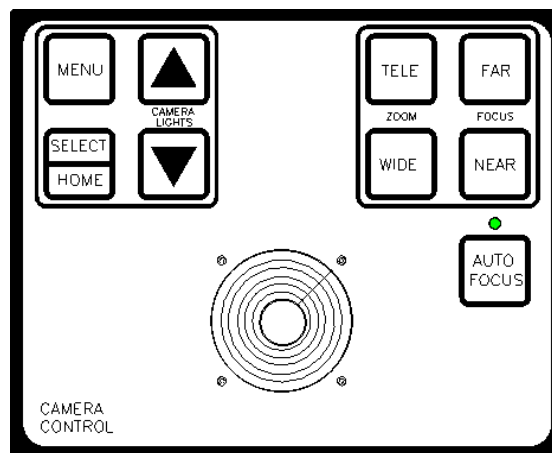


FIGURE 14: CAMERA CONTROL PANEL

The camera control panel includes:

- **Camera Joystick** – Inuktun cameras with pan and tilt capability may be controlled with the camera joystick. As with track control, camera pan and tilt speed are proportional to the joystick movement. Moving the joystick slightly causes the camera to respond slowly. Moving the joystick further causes the camera to pan or tilt more quickly. Controls for customizing joystick handling can be accessed through the controller's on-screen menu system.
- **Zoom** – Not used.
- **Auto Focus** – Not used.
- **Focus** – Use the FAR and NEAR buttons or hot-keys "F" and "Shift + F" to control the focus set point when the camera is in manual focus mode.
- **Home** – Not used.
- **Lights** – Use the Light UP and DOWN arrow buttons to increase or decrease camera light intensity. These functions are also mapped to keyboard keys "B" and "Shift + B". Lights UP and DOWN arrow buttons are used to control the Spectrum 45™ camera lights and the Rear Mini Crystal Cam® lights. The camera lights are independently controlled by accessing the **Main Menu** and changing the **Camera Select Front/Rear**.

## Rear Camera

The rear (AUX) camera powers up with the system. The lights do not and are controlled by selecting the rear camera on the main view screen and pressing the camera light control.

## Main Light Control

Main vehicle light control is located to the upper left of the track joystick. Note that these lights are independent of the camera lights.

## Pendant Control

The VT100 Vertical Crawler™ controller supports the connection of a portable pendant controller. This allows convenient desktop operation or movement away from the main controller for better visibility while deploying the vehicle.

**Track Drive** – To avoid conflicting instructions from multiple operators the system will only listen to one track joystick at a time. If the controller detects multiple joystick instructions from the main controller and a pendant, the vehicle will stop and display a warning on screen. Track control will continue once all joysticks have been centered.

Cruise control can be set from either the main controller or a pendant controller.

**Camera Control** – Full camera control is provided to both the main controller and the pendant. If conflicting joystick commands are received the main controller takes priority and will override any pendant inputs.

## On Screen Display (Video Overlay)

The VT100 Vertical Crawler™ controller is capable of displaying system and camera information overlaid with the video feed. This information can be turned on and off through the Displayed Information menu.

The below screen illustrates how this information will be displayed.

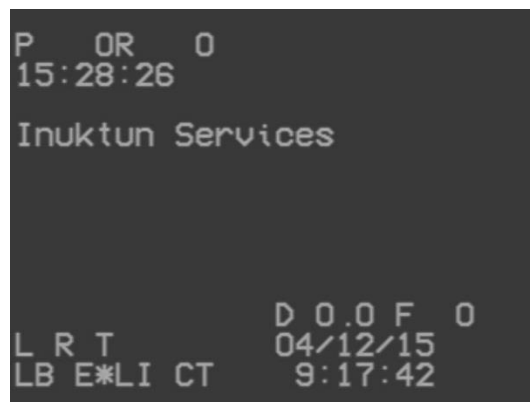


FIGURE 15: TYPICAL VIDEO OVERLAY

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### Top Left Corner

- **Pitch & Roll** – Displays information from a pitch and roll sensor if connected. Angles are displayed in degrees. The Spectrum 45™/90™ have a pitch & roll sensor built into its electronics can. Pitch & roll readings can be useful in tracking pipe travel or monitoring vehicle orientation. (Hot-key “R”)
- **Elapsed Time** – Displays the elapsed time counter. (Hot-key “I”)

### Top Right Corner

- **Pan & Tilt Numeric Data** – Displays camera pan and tilt angles in degrees if supported by the vehicle’s camera. (Hot-key “P”)
- **Pan Indicator** – Displays the camera’s pan position as an indicator bar. (Hot-key “P”)

### Right Side

- **Tilt Indicator** – Displays the camera’s tilt position as an indicator bar along the right side of the screen. (Hot-key “P”)

### Bottom Left Corner

- **Track Current Monitors** – Bar graphs representing the current draw of the left track [LT], right track [RT].
- **Compass / Camera Heading** – Degrees from North (clockwise).
- **Lights Mode [LX]** – The first letter “L” (for Lights) is followed by a letter indicating lighting mode; (S)pot, (F)lood, or (B)oth.
- **Exposure [E]** – An asterisk (\*) indicates auto exposure mode.
- **Lights Current Monitor [LI]** – Bar graph representing the current draw of the lights.
- **Camera Temperature** – Bar graph for camera temperature [CT]. (Hot-key “N”)
- **Distance** – Tether payout distance. (Hot-key “D”)

### Bottom Right Corner

- **Camera Status** – Displays camera operational information if supported by the connected camera (Hot-key “S”):
  - **Focus [F]** – The current focal distance of the camera. This is a value calculated internally by the camera focus mechanism and should not be used as a measure of actual distance.
  - **Zoom [Z]** – The camera’s current zoom factor.
- **Date/Time** – The current date and time. This selection can be toggled between short date format (dd/mm/yy hh:ss) or long date format (example 01-Jan-2006 11:38:24 AM). (Hot-key “T”)

### Center Screen

- **Title Text** – Title and operator comments. (Hot-keys “F1”, “F2”, “F3”, “F4”, and “F5”)

## Title Text Entry

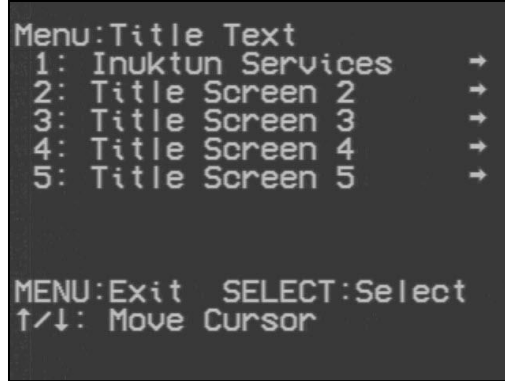


FIGURE 16: OVERLAY TITLE TEXT ENTRY SCREEN

The VT100 Vertical Crawler™ controller allows up to five video overlay title screens to be stored in memory. These screens may be changed at any time or pre-typed and called up on demand. This can be useful for adding comments or site data to an inspection recording.

Each screen can be up to five lines long with 25 characters per line.

A keyboard is required to edit text but once stored in memory the title screens can be called up through the Displayed Information screen in the main menu.

To display or hide any of the five title screens press keyboard keys F1 through F5.

To edit a comment press Shift + F1, Shift + F2, etc., depending on which of the five screens you want to edit.

F1	Show / hide title screen 1
F2	Show / hide title screen 2
F3	Show / hide title screen 3
F4	Show / hide title screen 4
F5	Show / hide title screen 5
Shift + F1	Edit title screen 1
Shift + F2	Edit title screen 2
Shift + F3	Edit title screen 3
Shift + F4	Edit title screen 4

Shift + F5	Edit title screen 5
------------	---------------------

Cursor Control Keys	
←	Move cursor left
→	Move cursor right
↑	Move cursor up
↓	Move cursor down
Tab	Move the cursor and insert space
Home	Move the cursor to the beginning of the line
End	Move cursor to the end of the line
Page up	Move the cursor to the first line
Page down	Move the cursor to the last line
Enter	Moves cursor to the beginning of the next line
Delete	Deletes the character to the right
Backspace	Deletes the character to the left
Insert	Toggles between insert or overwrite text. Flashing characters will be overwritten
Num lock	Enables numeric keypad

## Menu System

The following sections describe the VT100 Vertical Crawler™ controller's on-screen menu system and options.

### Menu Navigation

The on-screen menu system is navigated using the group of four buttons to the upper left of the camera control joystick. The menu can also be navigated using an optional keyboard. Many common items have been mapped to keyboard hot-keys for easy access.

The menu system is organized as a series of sub-menus. General menu navigation is as follows:

- The MENU button (or keyboard key 'M') opens the main menu.

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**Note:** When using a track-only controller the MENU key must be held for four seconds before the menu system will open. This is to prevent accidental changes to settings when operating without a monitor.

- Pressing the MENU button (or keyboard 'ESC') while inside a menu will back out one menu level. Pressing while inside the main menu will exit the menu system.
- Pressing keyboard key 'M' while inside a menu will exit the menu system.
- The light UP and DOWN buttons are used to move between menu options. This can also be accomplished with keyboard arrow keys.
- The SELECT button (or keyboard 'Enter' key) selects or toggles menu items.

Each menu page will also display navigation tips at the bottom of the page to help guide the operator

## Main Menu

Enter the main menu by pressing the MENU key or by pressing "M" on the keyboard.

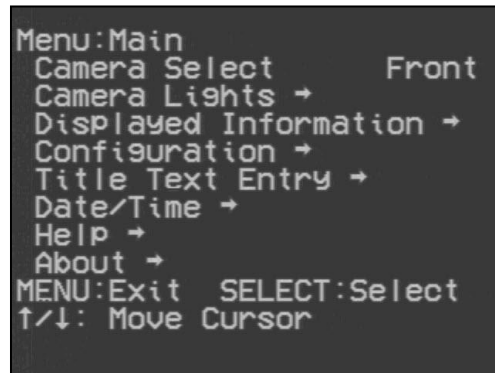


FIGURE 17: MAIN CONFIGURATION MENU

**Camera Select** - Determines which video channel (Front/Rear) is displayed on the built-in monitor. This setting is also used to control the lights on the Spectrum 45™ or Mini Crystal Cam® independently.

**Note:** Pressing the MENU button will switch to Front video with overlay to display the menu. When the menu exits, the rear video will again be display.

**Camera Lights** - Toggle camera lighting between flood/spot/both (hot-key "L").

**Displayed Information** - Video overlay options sub-menu.

**Configuration** - Versatrax™ and camera configuration sub-menu.

**Text Entry** - Text entry screen sub-menu.

**Date / Time** - Date and time settings sub-menu (hot-key "Ctrl + T").

**Help** - Help sub-menu.

**About** - About system information sub-menu

## Displayed Information Menu

This menu allows you to select what information will be displayed by the video overlay. All the visible options are toggled by pressing the SELECT button.

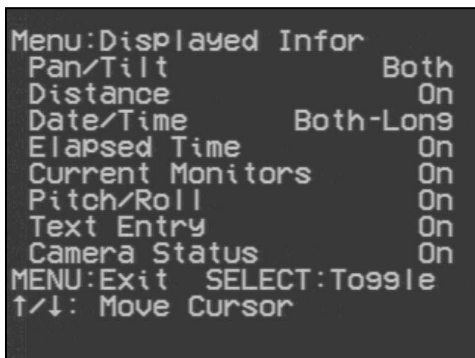


FIGURE 18: DISPLAYED INFORMATION MENU

**Pan/Tilt Indicator** - (Numeric, Indicator, Both, Off) Displays pan and tilt angles numerically in degrees, as a bar graph or both. Numeric angles are considered accurate to  $\pm 2\frac{1}{2}^\circ$ . (Hot-key "P")

**Distance** - (On, Off) Displays the tether payout distance. (Hot-key "D")

**Date/Time** - Display current date and time – hot-key "T". (12hr / 24hr / Long-Date / Short-Date / Both-Long / Both-short / OFF) The short date format is <dd/mm/yy>.

**Elapsed Time** - (On, Off) Displays the elapsed time counter. (Hot-key "I")

**Current Monitors** - (On, Off) Displays a bar graph representing the track current, camera light setting, and camera temperatures. (Hot-key "N")

**Pitch/Roll** - (On, Off) Displays information from the camera's pitch & roll sensor if supported. (Hot-key "R")

**Text Entry** - (On, Off) Displays last title screen. (Hot-key "X")

**Camera Status** - (On, Off) Displays camera operational information including light mode (spot, flood, or both), exposure mode (manual or auto), focus distance, and zoom factor. (Hot-key "S")

## Configuration Menu

This menu provides access to configuration settings and system information.

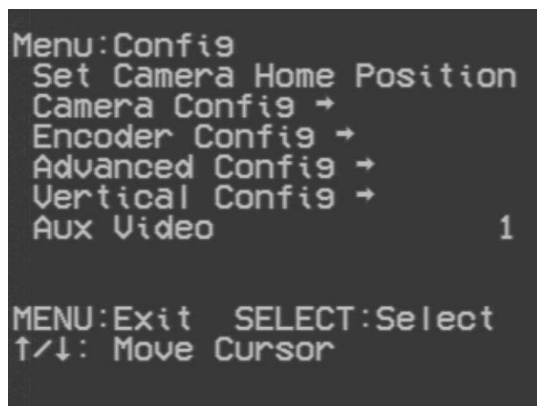


FIGURE 19: CONFIGURATION MENU SCREEN

**Set Camera Home Position** - Press the SELECT button to set the camera home position. (Hot-key “Ctrl + H”). The VT100 Vertical Crawler™ system does not support this function.

**Camera Config** - Camera configuration sub-menu.

**Encoder Config** - Encoder configuration sub-menu.

**Advanced Config** – Advanced configuration sub-menu.

**Vertical Config** – Vertical Crawler configuration sub-menu.

**Aux Video** – Press the SELECT button to switch between the Crystal Cam® video and the Spectrum 45™ video for the main (right) monitor.

## VT100 Vertical Crawler™ Configuration Screen

See section above describing the VT100 Vertical Crawler™ Configuration Screen.

## Camera Configuration

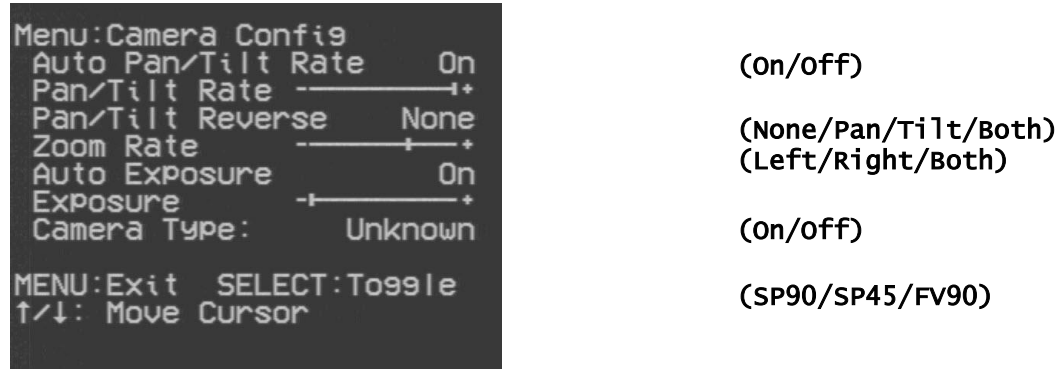


FIGURE 20: CAMERA CONFIGURATION SCREEN

**Auto Pan/Tilt Rate** - When this option is selected the pan and tilt speed will automatically adjust with the zoom factor; the controller will slow the pan and tilt speeds as the zoom position increases.

**Pan/Tilt Rate** - Increase or decrease the pan / tilt speed with the arrow keys. Press the SELECT to store the value. This setting can only be changed if the Auto Pan/Tilt Speed is set to OFF.

**Pan/Tilt Reverse** - Reverse joystick directions of pan, tilt or both. Set according to operator preference.

**Zoom Rate** - Sets the camera zoom speed.

**Auto Exposure** - Toggles the camera's auto exposure function on/off.

**Exposure Level** - Manually set the camera exposure level. Set by selecting this menu option and adjusting with the arrow keys. Press SELECT again to store the setting. The option is only enabled if the Auto Exposure option is set to OFF.

**Camera Type** - Informative only.

## Advanced Configuration

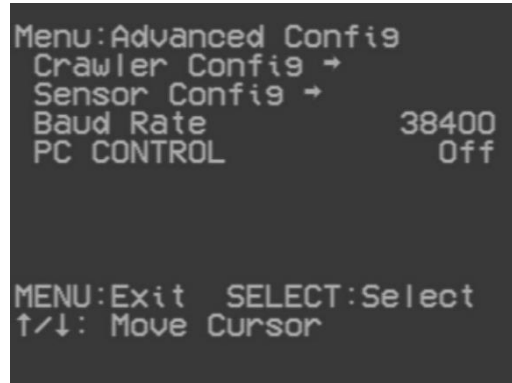


FIGURE 21: ADVANCED CONFIGURATION SCREEN

**Crawler Config** – Crawler configuration sub-menu.

**Sensor Config** – Sensor configuration sub-menu.

**Baud Rate** – Choose **38400**. Important: Required communication baud rate for this vehicle.

**PC CONTROL** – Choose **OFF**.

**Warning:** Failure to set the baud rate to 38400bps for vehicle communication may result in loss of camera, video control and expand control.

## Crawler Configuration Menu

**Warning:** Incorrect crawler and chassis setting may result in loss of vehicle control. Incorrect track setting may result in track damage.

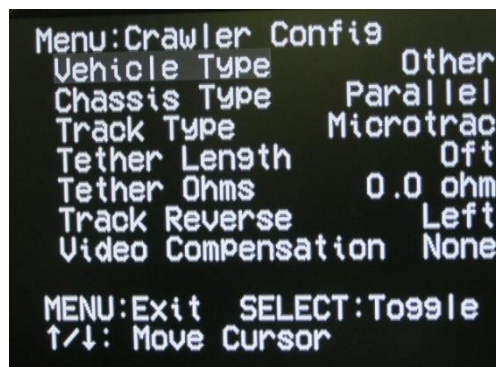


FIGURE 22: CRAWLER CONFIGURATION SCREEN



Notes for the VT100 Vertical Crawler™ vehicle:

- **Vehicle Type** - Choose Other.
- **Chassis Type**- Choose Parallel chassis type.
- **Track Type** – Choose Microtrac™. (Choosing MINITRAC™ may damage the vehicle.)
- **Tether Length** - Input your tether length (calculates a default tether ohms).
- **Tether Ohms** - Internally calculated value can be overwritten for non-standard tethers.
- **Track Reverse** - Reverse left, right, both or none options dependent on vehicle type.
- **Video Compensation** - None, Low, Med, or High - choose which ever looks best. NONE is recommended for the VT100 Vertical Crawler.

### To set tether resistance

Enter the round-trip resistance of the tether. The VT100 Vertical Crawler controller will adjust its output power to compensate for electrical losses in the tether. Tether losses are dependent on length and type of tether. This menu selection allows the user to enter the tether resistance into the controller.

It is important that this value be set carefully. Too low a value may leave the tracks underpowered. Too high a value may cause the vehicle to creep forward unable to stop or in extreme cases become unstable resulting in loss of control.

The resistance value may be entered using a keyboard or by using the UP / DOWN and SELECT buttons to enter each digit.

To determine the correct resistance value either:

1. Connect the vehicle (complete with tracks) and, with a multi-meter, measure the resistance between Track+ and Track- (pins C and D) at the top-end tether connector, or
2. Measure the end-to-end resistance of one of the track tether conductors using a multi-meter. Double this value and add 3, or
3. Standard VT100 Vertical Crawler tether only: Use the table below, choosing the value closest to your tether length. You may interpolate between values.

Tether Length	Resistance Setting
250	5.1
500	7.3
750	9.5
1000	11.6
1250	13.7
1500	15.8

## Sensor Config Menu

```
Menu:Sensor Config
Sonar String Output Off
Compass Off
Heading Display Compass
MAG Declination 0.00°
Compass Direction Front
MAG Dec Input Degree

MENU:Exit SELECT:Toggle
↑/↓: Move Cursor
```

FIGURE 23: SENSOR CONFIGURATION MENU

**Sonar String Output** - Toggle on/off. Any sensor that requires information on pitch and roll and tether out can read that information on the USB serial port. The format of the output string is:

\$PITCH±DD.D,ROLL±DDD.D,DIST±DDDD.DD<CR><LF>

**Compass** - Toggle on/off to enable and display.

**Heading Display** - Choose either camera or compass.

**MAG Declination** - Enter your geographic offset from true north to magnetic north

**Compass Direction** - Choose front or back.

**MAG Dec Input** - Select degrees or minutes.

## Date/Time

```
Menu:Date/Time
Set Date 14-May-2014
Set Time 7:31:47 AM
Zero Elapsed 15:32:13

MENU:Exit SELECT:Toggle
↑/↓: Move Cursor
```

FIGURE 24: DATE / TIME SET SCREEN

**Set Date** - The date can be set by using SELECT button to advance through the fields. The arrow keys will increment and decrement the fields. The value is saved when the last field is entered.

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**Set Time** - Set using the same method as the date.

**Zero Elapsed Time** - Zeroes the elapsed time counter.

## Help

```
Menu:Help
Overlay Display Hotkeys→
Vehicle Control Hotkeys→
Camera Control Hotkeys→
Video and Light Hotkeys→
Menu Hotkeys→
Title Screen Hotkeys→
Title Editor Hotkeys→

MENU:Exit  SELECT:Select
↑/↓: Move Cursor
```

FIGURE 25: HELP SCREEN

**Overlay Display Hotkeys** - Overlay display hotkeys sub-menu.

**Vehicle Control Hotkeys** - Vehicle control hotkeys sub-menu.

**Camera Control Hotkeys** - Camera control hotkeys sub-menu.

**Video and Light Hotkeys** - Video and light hotkeys sub-menu.

**Menu Hotkeys** - Menu hotkeys sub-menu.

**Title Screen Hotkeys** - Title screen hotkeys sub-menu.

**Title Editor Hotkeys** - Title editor hotkeys sub-menu.

Refer to the full table of keyboard shortcuts in this manual.

## About

```
About:
Versatrax Controller
SW Version      S0054-59-26
Video           NTSC
Build ID:       M20140505
Inuktun Services Ltd.
All rights reserved.
Visit:          www.inuktun.com
Email:          info@inuktun.com
MENU:Exit ESC:Return
```

FIGURE 26: ABOUT SCREEN

**Software Version** - The software version of the controller. Informative only.

**Video** - The video format is informative only.

## Zero Encoder

```
Menu:Encoder Config
Zero Encoder
Encoder Offset  9999.3m
Units           Metric

MENU:Exit  SELECT:Select
↑/↓: Move Cursor
```

FIGURE 27: ZERO ENCODER SCREEN

Zero the encoder by pressing “Ctrl+F11” on the keyboard. Press “Y” to confirm or “ESC” to cancel.

## Encoder Offset

```
Menu:Encoder Config
Zero Encoder
Encoder Offset 9999.3m
Units Metric

MENU:Exit SELECT:Select
↑/↓: Move Cursor
```

FIGURE 28: ENCODER OFFSET SCREEN

Press “Ctrl+F12” on the keyboard to enter an encoder offset.

Press “Enter” or “→” to select digit and “↑”/“↓” to change the number.

## Calibration Menu

**Warning:** This menu allows the operator to change system settings which could cause malfunction or erratic behavior. For this reason, access is gained only through special key strokes noted below.

```
Menu:Calibration
Video Compensation None
Video Type Auto
Calibrate Pan/Tilt →
Zero Joysticks
Calibrate Encoder
Calibrate Sensors →
Master Mode →

MENU:Exit SELECT:Toggle
↑/↓: Move Cursor
```

FIGURE 29: CALIBRATION MENU SCREEN

**Note:** The calibration menu can only be entered by pressing CTRL+ALT+C on the keyboard or by pressing front panel buttons MENU+SELECT+UP+DOWN simultaneously. It cannot be found through the main menu.

**Video Compensation** - Video compensation is used to correct for video signal losses over longer tethers. If the compensation is set too low the video may not appear crisp or the color may appear washed out. If compensation is set too high the picture may appear jumbled or may flicker. Generally, longer tethers need a higher compensation setting. Select the setting which provides the best picture.

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**Calibrate Pan/Tilt** - Enters the camera pan/tilt calibration sub-menu. Inuktun pan and tilt cameras store these calibration settings within camera memory. Cameras may then be freely swapped without affecting their calibration.

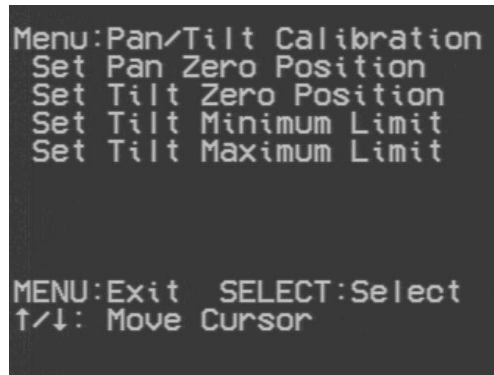


FIGURE 30: CAMERA CALIBRATION SCREEN

**Set Pan Zero Position** - Because camera pan rotation is continuous it only requires one zero point for reference. Position the camera in the desired orientation and press the SELECT button. The camera will now refer to this pan position as 0°.

**Set Tilt Zero Position** - Position the camera in the desired orientation and press the SELECT button. The camera will now refer to this tilt position as 0°.

**Set Tilt Minimum Position** - Tilt the camera all the way in one direction and press SELECT. This sets the maximum travel in this direction. It is good practice to back the head off a little bit from the mechanical stop before storing the position. This will allow the software limit to stop the camera before it reaches the mechanical stop, increasing the life of the tilt clutch.

**Set Tilt Maximum Position** - Tilt the camera all the way in the other direction and press SELECT. As before, it is good practice to back the head off from the mechanical stop before storing the position.

**Zero Joystick** - This menu option will store the current joystick positions as their new center or zero position.

**Calibrate Encoder** - This option will recalibrate the tether distance counter. Instructions appear at the bottom of the screen to assist the operator through the sequence of events. Pressing the SELECT button or 'Enter' on the keyboard will advance to the next stage.

When "Calibrate Encoder" is selected the calibration routine enters its first stage. A number is displayed on the right showing the number of encoder counts. This is the raw data from the encoder.

The operator is asked to pull out a known length of tether. This can be any known length but between 10 and 30 feet is recommended. The longer the length the more accurate the calibration will be. Pressing SELECT will move to the next stage.

The operator will then be asked to enter the length of the tether that was pulled through. It is important the measurement units match those on screen. The units of measurement can be changed by pressing

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“U” on the keyboard. The length may be entered on the keyboard or by using the UP / DOWN and SELECT buttons to enter each digit.

**Cal Sensors** - Enters the Calibrate sensors sub menu.

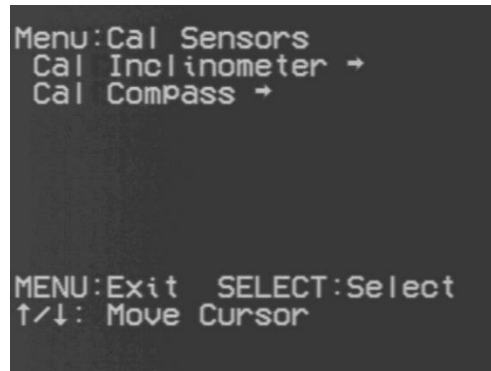


FIGURE 31: CALIBRATE SENSORS MENU

**Cal Inclinometer** - Calibrates the camera's inclinometer (if supported by the camera model connected). This setting is stored by the camera itself.

**Cal Compass** - Sub menu to set magnetometer, set deviation, zero variation and zero deviation.

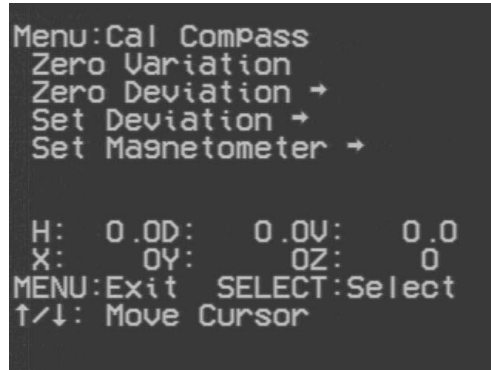


FIGURE 32: CAL COMPASS MENU

**Zero Variation (also called MAG Declination)** - This removes the geographic offset at your location between true and magnetic north as entered in the Sensor Configuration section.

**Zero Deviation** - Removes the deviation set below.

**Set Deviation** - Allows for mounting misalignment between the compass and the vehicle.

**Set Magnetometer** - Aligns compass with magnetic north.

**Master Mode** - Opens the Master Mode sub-menu. Two standard Versatrax™ controllers may be linked together to power a four-track crawler. The two controllers will automatically coordinate track speeds and turn handling. This menu is used to assign control values.

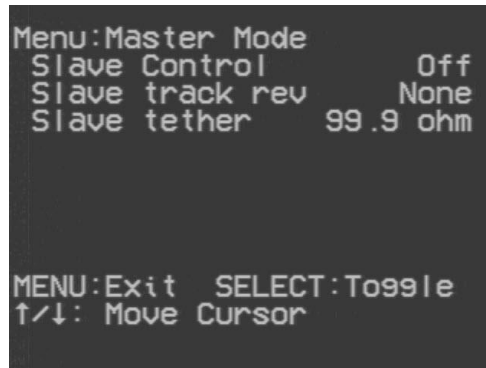


FIGURE 33: MASTER / SLAVE CONTROL SCREEN

**Slave Control** - Setting to ON assigns the current controller as the master controller. Any controller not configured as master will automatically switch to slave mode when linked with a master controller.

**Slave Track Reverse** - Sets the polarity of the slave.

**Slave Tether** - The resistance value of the slave track tether conductors. Tether resistance may be determined as described above.

A special cable can be obtained from us to link the two controllers through their WINCH ENCODER ports. Control instructions will be transmitted from the master controller to the connected slave. These instructions will allow the two controllers to coordinate vehicle movements to the master controller's track joystick. For advanced maneuvering the slave controls can still be used to direct the slave tracks independently.

Each controller will power a pair of tracks through its tether output. The system designer has a choice to run two standard tethers to the vehicle or combine functions into a larger single tether.

Regardless of menu settings, the two controllers will revert to normal operation if the control link is disconnected.

**Tether Resistance** - Enter the round-trip resistance of the tether. The Versatrax™ controller will adjust its output power to compensate for electrical losses in the tether. Tether losses are dependent on length and type of tether. This menu selection allows the user to enter the tether resistance into the controller.

It is important that this value be set carefully. Too low a value may leave the tracks underpowered. Too high a value may cause the vehicle to creep forward unable to stop or in extreme cases become unstable resulting in loss of control.

The resistance value may be entered using a keyboard or by using the UP / DOWN and SELECT buttons to enter each digit.



To determine the correct resistance value either:

Connect the vehicle (complete with tracks) and, with a multi-meter, measure the resistance between Track+ and Track- (pins C and D) at the top-end tether connector.

or

Measure the end-to-end resistance of one of the track tether conductors using a multi-meter. Double this value and add 3.

or

Standard Versatrax™ Tether Only: Use the table below, choosing the value closest to your tether length. You may interpolate between values.

Tether Length	Resistance Setting
250	5.1
500	7.3
750	9.5
1000	11.6
1250	13.7
1500	15.8

## Keyboard Shortcuts

The following hot keys can be used to control the VT100 Vertical Crawler™ system and navigate the menu system:

Key	Function
<b>Overlay Display</b>	
D	Toggle the display mode of the distance encoder.
P	Toggle the pan/tilt display mode.
R	Toggle the pitch/roll display mode.
S	Toggle the camera status display mode.
T	Toggle the date/time display mode.
U	Toggle the display unit's mode (metric/imperial).

X	Toggle the text entry display mode.
G	Toggle auxiliary sensor display.
<b>Vehicle Control</b>	
C	Toggle to Cruise Control mode.
I	Toggle elapsed timer display.
Ctrl + I	Zero elapsed timer.
Ctrl+F11	Display the zero-encoder confirmation screen.
Ctrl+F12	Display the encoder offset confirmation screen.
<b>Camera Control</b>	
A	Toggle the Auto Focus mode.
F	Focus the camera near.
Shift + F	Focus the camera far.
Z	Zoom telephoto.
Shift + Z	Zoom wide.
H, Home	Send the camera to the Home position.
Ctrl + H, Ctrl + Home	Store the camera Home position.
<b>Camera Video / Light / Control Settings</b>	
Shift + B	Decrease the camera light set point.
B	Increase the camera light set point.
E	Increase the camera exposure level.
Shift + E	Decrease the camera exposure level.
Ctrl + E	Toggle the camera exposure mode between automatic and manual.
L	Toggle the camera light mode between spot/flood/both.
<b>Menu Shortcuts</b>	
Ctrl + T	Display the date/time menu.

Ctrl + Alt + C	Display the Calibration menu.
Ctrl + Alt + D	Display the Diagnostics menu.
M	Display the main menu.
Alt	Display the main menu (also displays menu short cut keys for the while the Alt key is held down).
<b>Title Screen &amp; Comments Shortcuts</b>	
X	Show / hide the last title screen.
F1 Key	Select Title Screen 1.
F2 Key	Select Title Screen 2.
F3 Key	Select Title Screen 3.
F4 Key	Select Title Screen 4.
F5 Key	Select Title Screen 5.
F6 Key	Display PIPELOGIX overlay.
Shift + F1 Key	Edit Title Screen 1.
Shift + F2 Key	Edit Title Screen 2.
Shift + F3 Key	Edit Title Screen 3.
Shift + F4 Key	Edit Title Screen 4.
Shift + F5 Key	Edit Title Screen 5.

## Maintenance

## Troubleshooting

### Camera Control Problems

Not all the camera lights are on.

- Spectrum 45™ lights are controlled together. A missing light indicates a faulty LED.

Camera tilt does not function in one or both directions.

- Re-zero the joystick calibration. See 'Zero Joystick' in the index.
- Check if the camera is jammed by debris.

Camera is moving very slowly.

- Check the pan & tilt speed. See 'Camera Configuration' in the index.
- There may be a problem with the camera clutch.

Camera does not stop moving.

- Re-zero the joystick calibration. See 'Zero Joystick' in the index.

Cannot adjust camera pan & tilt speed.

- Camera pan and tilt are proportional to joystick position.
- Pan and tilt max speed may not be manually set while in auto pan/tilt mode. Turn off auto pan/tilt mode. See 'Camera Configuration' in the index.

Camera Joystick is backwards.

- Pan and tilt joystick may be reversed in the Camera Configuration menu. See 'Camera Configuration' in the index.

Pitch or Roll angle is not displaying correctly.

- Re-calibrate the inclinometer. An inclinometer error of up to  $\pm 2\frac{1}{2}^\circ$  is normal. See 'Calibrate the Inclinometer' in the index.

Date / Time shows random text or clock does not work.

- Reset date & time. See 'Date/Time' in the index.

### Video Problems

No video (black or blue background).

- Controller power is not on.
- Check monitor input settings.
- Video cables are not hooked up.

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- Check for problems with other video components between the controller and your monitor.
- Try a different monitor.

No video (purple background on screen).

- Tether is unplugged at the vehicle or controller.
- Camera is unplugged.

Picture is very dark or very bright.

- Check the light levels of both the camera and main lights.
- Check for dirt on the camera lens.

Intermittent picture.

- Check and replace the video cables. It is our experience that many video problems can be traced to faulty video cables.
- Check the monitor is working properly – try a different monitor.
- Check the tether connectors at both controller and vehicle.
- Check that the camera is fully plugged in.

Picture is blurry or has poor color.

- Video compensation set too low. See 'Video Compensation' in the index.

Flickering or jumbled image, text overlay will not settle.

- System was turned on too quickly after power down. Turn off the controller and wait five seconds before turning it back on.
- Video compensation set too high. See 'Video Compensation' in the index.

No video overlay.

- Verify connection to the OVERLAY video output (not the RAW video output).
- Turn off controller for 5-10 seconds to reset overlay chip.
- Verify overlay display settings. See 'Overlay Display' in the index.

No Rear Video.

- Check that the rear-view monitor is plugged into the AUX video output.

## Vehicle Problems

Vehicle won't steer or runs backward.

- Chassis type is set incorrectly. See 'Chassis Type' in the index.
- One or more track reversals are set. See 'Track Reverse' in the index.

Tracks are running too fast or too slow.

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- Re-zero the joystick calibration. See 'Zero Joystick' in the index.
- Verify tether resistance settings. See 'Set Tether Resistance' in the index.
- Verify track type. See 'Track Type' in the index.

Tracks running or creeping even with joystick centered.

- Re-zero the joystick calibration. See 'Zero Joystick' in the index.
- Tether resistance is set incorrectly. See 'Set Tether Resistance' in the index.

Tracks slow down excessively when under load.

- Tether resistance is set incorrectly. See 'Set Tether Resistance' in the index.

Tracks run out of control or speed up when under load.

- Tether resistance is set incorrectly. See 'Set Tether Resistance' in the index.

Tracks will not run.

- Check the current meters.
  - If current is at 100% then the tracks may be stalled. They could be wedged on an object or jammed with sand. Try reversing the tracks to clear any debris. If a jam will not clear you will have to recover the vehicle by pulling it out with the tether.
  - If no current is registered, then power is not getting to the tracks. Check all the cable connections.
- Try changing tracks.
- Inspect the vehicle wiring for damage.
- Check all the system connectors.
- Listen for the track motors. If the motors run but the track doesn't turn suspect a mechanical fault in the drive train. Refer to the assembly diagram in the track manual.

Main lights don't function even with dial is turned to maximum.

- Check all the cable connections.
- Verify both light whips are fully plugged in.

## 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 in which vehicle may need to be recovered. Loading the tether beyond its maximum safe capacity of 100 pounds is to 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.

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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 which 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 can't work itself free from a snag, try using light tether tension and tractor power simultaneously.
3. If still stuck, try a stronger tether tension – up to 200 pounds. The tether will handle this as a temporary load.
4. If the vehicle seems to be permanently stuck in the pipe, the supervisor must decide whether to sacrifice the tether in an attempt to pull harder (over 200 pounds), or to dig the vehicle out.

### Microtrac™ Maintenance

Refer to the Microtrac™ manual for Microtrac™ maintenance and servicing instructions.

### Camera Maintenance

Refer to the Spectrum 45™ camera manual for operating and maintenance instructions.

### Tether Re-termination

Re-termination is beyond the scope of this manual. Contact us to obtain a tether re-termination kit. Tether wiring diagrams are available upon request.

### Tether Handling

#### Caring For the Tether

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 underfoot 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 radius. For standard VT100 Vertical Crawler™ cable this is 3in for continuous flex and 2in for occasional occurrence. If the tether has difficulty bending, you

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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 a winch drum and any pulleys or tackle supports the tether beyond its minimum bend diameter. For an extended fatigue life, the minimum bend diameter should be considered larger. The minimum radius for permanent installation is 5/8-inch.

Never kink the tether. A tight kink causes local but permanent deformation in the tether. This can be serious because accelerated wire fatigue is subsequently concentrated at the kink location. 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 load capacity of 360-pound 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 transport device is suspended from a swinging deployment crane.

Avoid loading the tether unnecessarily. Unnecessary large loads will only shorten the fatigue life of the tether.

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 will be damaged.

## Caring For Connectors

With regards to system reliability, connectors come next after the tether in terms of importance. Though not quite as expensive to replace as a whole 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.
  - Inspect for bent or burnt pins.
  - Make sure any o-rings are present (where applicable).
  - All connectors - 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 or burn-out. In general, locking collars need only be screwed on finger tight.
- Do not plug in dirty or damaged connectors.
- The tether connector is not wet pluggable. The contacts must be dry when plugging into the vehicle.
- The camera, light, and track connectors are wet pluggable.
- Cap any unused connectors. System shorts may result from open connectors in water.
- Use silicone grease on the wet pluggable (rubber) connectors to ease insertion and removal.

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## 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.

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## 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.

## 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.

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## 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.

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