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User Manual

Motorized Tank & Vessel Scanner

KEEP THIS MANUAL – DO NOT LOSE

THIS MANUAL IS PART OF THE TRIPOD SYSTEM AND MUST BE KEPT FOR THE LIFE OF THE PRODUCT. PASS ON TO SUBSEQUENT OWNERS.
Ensure any amendments are incorporated with this document.

SAFETY WARNINGS / PRECAUTIONS

DANGER! The TriPod is designed for a specific use. Using the TriPod outside of its intended use is dangerous. Severe injury or death could result. Read and understand this manual before using.

DANGER! FALLING OBJECT HAZARD. Failure to comply with the warnings, instructions, and specifications in this manual could result in **SEVERE INJURY** or **DEATH**.

DANGER! FALLING OBJECT HAZARD. The area below an operating crawler must be kept clear at all times. A clearly marked NO ENTRY ZONE must be cordoned off directly below the area of crawler operation, in accordance with Section 2.5 “No Entry Fall Zone.”

DANGER! Do NOT operate or place crawler on a surface higher than 2m (6’) without a proper tether held taut at all times. Refer to Section 2.6 “Tether Requirements and Attachment.”

DANGER! Hook the tether hook to the provided lifting sling BEFORE placing the crawler on the surface to be inspected (i.e. tank). IMPORTANT: Tether hook must have a safety latch to prevent accidental disconnection.

WARNING! MAGNETIC MATERIAL. The wheels on the crawler produce an extremely strong magnetic field which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, medical devices, or other electronics. Tools, magnets, and metal objects can cut, pinch, or entrap hands and fingers. HANDLE WITH CARE. People with pacemakers or ICD’s must stay at least 2m (79’’) away.

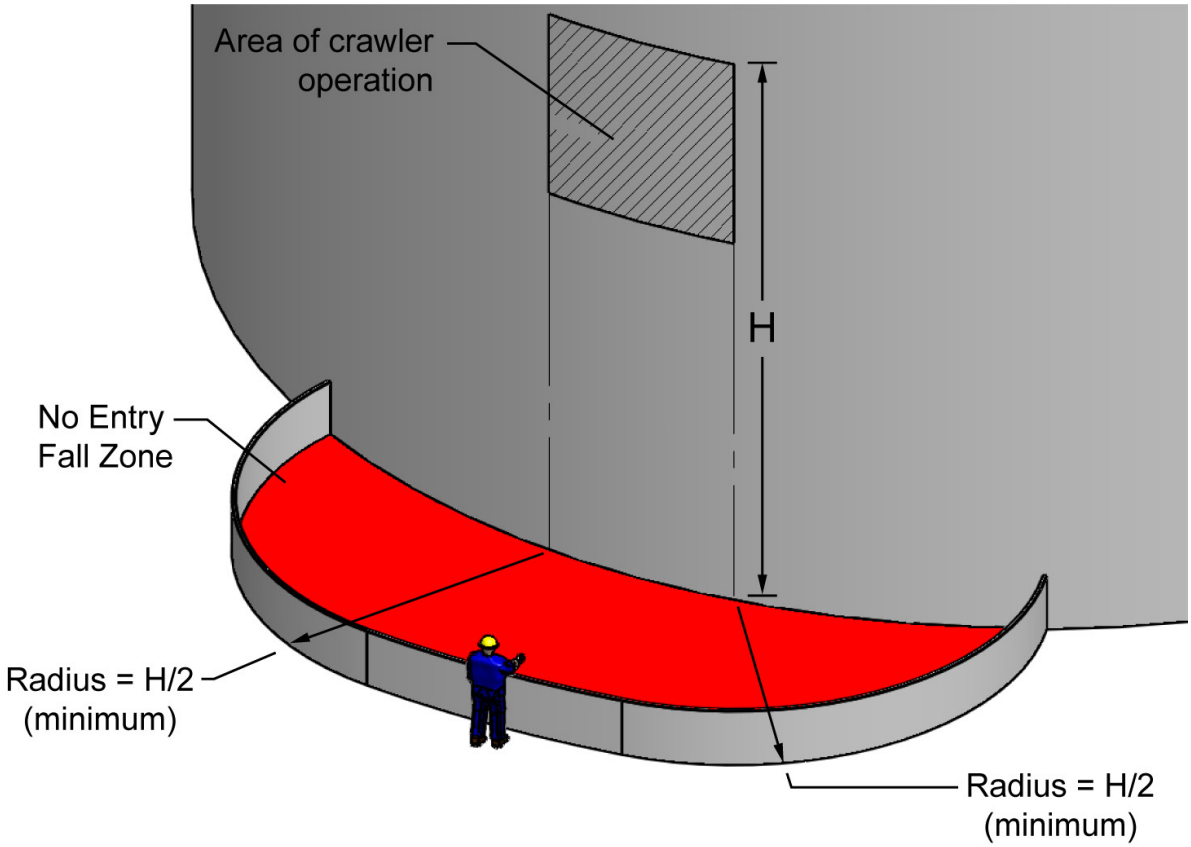
CAUTION! MAGNETIC MATERIAL. Due to magnetic material, consult IATA documentation before air shipping.

WARNING! Do NOT operate crawler in an explosive environment. Do NOT operate crawler in the presence of volatile substances.

The WEEE symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately.

DANGER! FALLING OBJECT HAZARD. The area below an operating crawler must be kept clear at all times. A clearly marked NO ENTRY FALL ZONE must be cordoned off directly below the area of crawler operation.

The area below an operating crawler must be kept clear at all times. A clearly marked NO ENTRY FALL ZONE must be cordoned off directly below the area of crawler operation, according to the dimensions shown below.



Example: If inspecting a tank that is 6m (20ft) tall, the No Entry Fall Zone radii must be no smaller than 3m (10ft) from the area below the area of crawler operation.

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DISTRIBUTOR:

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1. TriPod Specifications

1.1. Intended Use

The TriPod is a remote operated vehicle with magnetic wheels suitable for driving on ferrous material. Its primary purpose is to move inspection equipment over areas of structures, such as tanks or pipes, made from ferrous materials.

The intended ferrous surface is to:

- be bare metal for up-side-down surfaces, or
- be coated to a thickness no greater than:
  - o 0.5mm (.020”) for vertical surfaces
  - o 1mm (.040”) for horizontal surfaces on which the crawler is right-side-up
- be free of excess rust, scale, ferrous debris, ice, frost
- have a minimum thickness of 5mm (0.200”)
- have a minimum radius of curvature of 2m (6’) for inside a tank
- have a minimum radius of curvature of 1m (3’) for outside a tank or pipe

The TriPod is intended to:

- be used by trained personnel. See 1.2 “Intended User”;
- operate in an environment as described in 1.6 “Operating Environment”;
- operate with a proper tether system. See 2.5 “Tether Requirements and Attachment”.

1.2. Intended User

For operating at a height greater than 2m (6’), the TriPod is intended to be used by two people:

- a person who is trained in rigging and fall protection and is able to effectively apply the same safety principals to the crawler.
- a person who is trained to control the crawler.

The TriPod is intended to be used by persons without limitations in the physical abilities of the upper and lower limbs, sight, hearing, and anyone with a pacemaker or ICD.

1.3. Dimensions and Weight

Crawler Weight*:	13.6 kg	30 lbs
Crawler Dimensions*:	46 x 40 x 19cm	18” x 15.5” x 7.5”
Shipping Weight, Crawler case:	33.5 kg	74 lbs
Shipping Dimensions, Crawler case:	66 x 54 x 33cm	26” x 21” x 13”
Shipping Weight, Power Supply case:	11.4 kg	25 lbs
Shipping Dimensions, Power Supply case:	51 x 41 x 21cm	20” x 16” x 8”
Shipping Weight, Pump case**:	5.9 kg	24 lbs
Shipping Dimensions, Pump case**	64 x 54 x 23 cm	25” x 21” x 9”

*excluding case, attachments, umbilical, power supply, and control pendant

** excluding umbilical

1.4. Performance Specifications

Vertical Payload*:	10 kg	23 lbs
Umbilical Length**:	30 m	100 ft
Max Controller Cable Length**:	30 m	100 ft
Travel Speed:	0 - 18 m/min.	0 - 60 ft/min.

*attachments and umbilical are considered part of payload

**contact Jireh Industries for custom cable lengths

1.5. Power Requirements

WARNING! A reliable power source must be used for powering the crawler. Connections must be secured to prevent accidental disconnection. Power failure may cause the crawler to freewheel down if operating in a vertical orientation. Portable generator usage is not recommended unless accompanied by the use of an uninterruptible power supply system.

WARNING! Proper grounding of the power supply is important for safe operation. If a generator is being used to supply power to the system (not recommended), the generator must be properly grounded (see the generator manual).

Power Requirements: 85-264VAC, 45-65Hz, 5 Amps

NOTE: The TriPod power supply automatically adjusts to the supplied voltage.

1.6. Operating Environment

The TriPod is designed for use in an industrial environment that is:

- dry or damp (the crawler its self is rated to IP67);
- between -20°C and 50°C;
- free of explosion or fire hazards.

1.7. Unintended Use

DANGER! FALLING OBJECT HAZARD. Using the TriPod outside of its intended use is dangerous. Severe injury or death could result. Do NOT use the TriPod as listed below!

The TriPod is NOT intended for:

- operation on surfaces that are not clean. (e.g. excess rust, scale, ferrous debris, ice, frost);
- lifting / lowering objects or people (I.e. using the crawler as a crane / elevator);
- driving into obstructions;
- operating in ambient temperatures below -20°C or above 50°C;

In addition to the above points, for operating at a height greater than 2m (6'), the crawler is not intended for:

- operation without a proper tether system;
- operating up-side-down;
- operating while oriented such that the umbilical strain relief points upwards, or at worst, horizontal (front of the TriPod is lower than the umbilical connection).

2. Preparation for Use

2.1. Transportation

> ⚠ **CAUTION!** MAGNETIC MATERIAL. Due to magnetic material, consult IATA documentation before air shipping.

> ⚠ **CAUTION!** PINCH / CRUSH HAZARD. BE CAREFUL when passing the TriPod crawler through narrow ferrous (magnetic) openings, such as man-holes. The magnetic Drive Wheels can cause bodily harm if allowed to slam onto the walls of the opening.

2.2. Scanner Component Identification

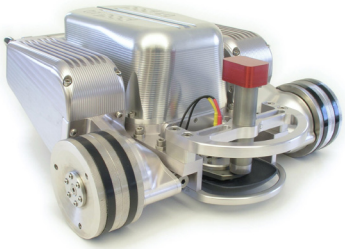

Figure 1 - TriPod (crawler)

Figure 2 - Power Supply

Figure 3 - Umbilical

Figure 4 - Controller

Figure 5 - Controller Cable

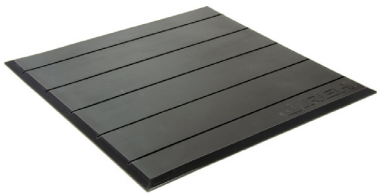

Figure 6 - Scanner Installation Mat

Figure 7 - Pump System

2.3. Connecting the Components

⚠ WARNING! MAGNETIC MATERIAL. The wheels on the crawler produce an extremely strong magnetic field which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, medical devices, or other electronics. Tools, magnets, and metal objects can cut, pinch, or entrap hands and fingers. HANDLE WITH CARE. People with pacemakers or ICD's must stay at least 2m (79'') away.

⚠ WARNING! ELECTRICAL CORDS CAN BE HAZARDOUS. Misuse can result in fire or death by electrical shock. Inspect thoroughly before each use. Do NOT use if damaged. Do NOT use when wet. Keep away from water. Do NOT drive, drag, or place objects over cord.

⚠ WARNING! POWER MUST BE DISCONNECTED. Ensure that the power supply is disconnected from the power source when connecting components. If powered, a spark could occur resulting in explosion and/or fire.

Power Supply to Umbilical

The power supply is to be connected to a 85-264VAC, 45-65Hz, 5A power source using the standard three prong plug. The umbilical is connected to the receptacle located on top of the power supply via the twelve pin bayonet connector (see Fig. 8). Output of the power supply is 24VDC, 20A.

Figure 8 - P/S to Umbilical

Crawler to Umbilical

Power and control signals are supplied to the crawler by connecting the 19 pin military style plug connector to the corresponding receptacle on the umbilical. Secure this connection by threading the outer ring on the umbilical side to the connector on the crawler. (1) quick connect hose and (4) BNC connectors coming from the umbilical are also to be connected to the Tri Pod. The BNC jacks located on the rear bulkhead are stamped Y, W, R, G. These correspond to the colored cables of the umbilical (Y is yellow etc.).

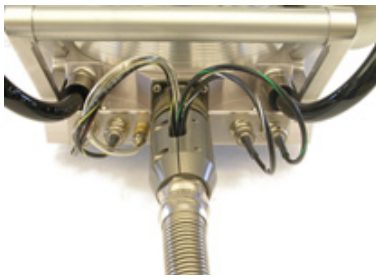

Figure 9 - Crawler Connected

Figure 10 - Hose & BNC Connectors

Controller to Umbilical

The controller is connected via a control cable with a six pin quick connector on each end. One end is to be connected to the plug on the top of the controller (see Fig. 11) while the other end is connected to the plug on the umbilical labeled 'CTRL' (see Fig.12). Both ends of the control cable are identical; therefore, either end can be connected to either component. Standard length for the control cable is 20ft, although longer lengths are available.

Figure 11 - Hand Held Controller

Umbilical Bell Explained

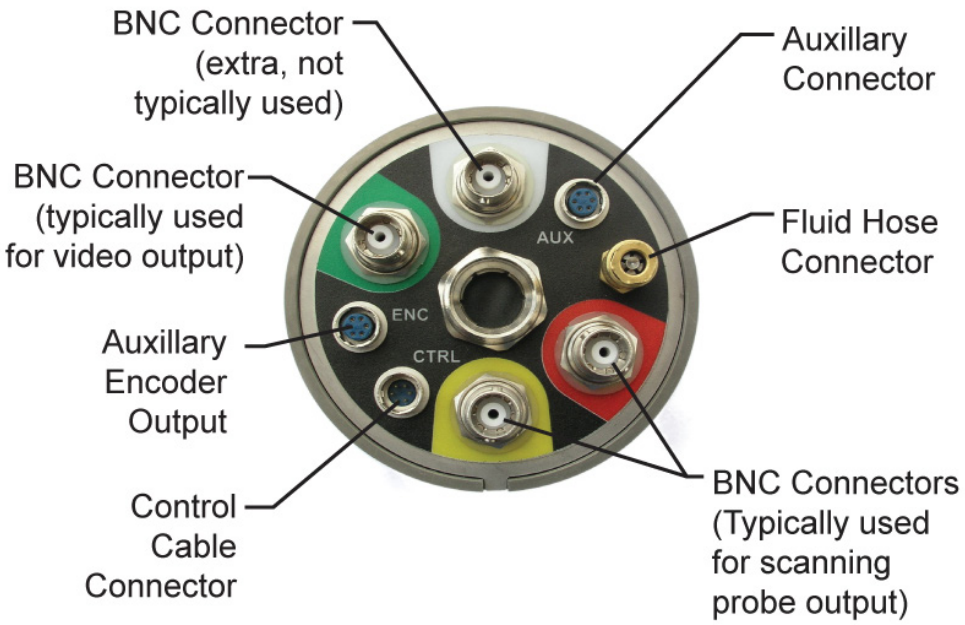

Figure 12 - Umbilical Bell

2.4. Additional Components

2.4.1. Encoder

The standard encoder provides 88.26925 pulses/inch (3.4752pulses/mm) or 353.077counts/inch (13.9007counts/mm) with 4x quadrature decode. The output is a RS422 compatible line driver.

Note: the type of output is factory configured and cannot be changed by the user.

Encoder readout can be viewed on the hand held controller or through the encoder output located on the umbilical.

Wiring

Connections to the encoder are done through a six pin circular connector located in the umbilical end bell.

Pin #	RS422 Line Driver
1	
2	Enc B
3	Enc B’
4	Enc A
5	Enc A’
6	Common

2.4.2. Probe Lift

Installing the Probe

To install the probe (not included) in the holder, loosen the clamp screw (see Fig. 19; item #21) and the clamp mount screw adjacent to it (to allow the clamp to open up). Slide the probe in through the hole and set the height appropriately. Tighten the clamp screw and clamp mount screw.

Note: different sizes of probe holders are available.

Lifting / Lowering the Probe

The probe lift actuator is controlled by the 'A' push button on the controller (see Fig. 17). This button will both lower and raise the probe accordingly.

Connecting the Probe

Connect the probe (not included) by threading the yellow and red connector leads onto the top of the probe. The outputs of these leads are located on the umbilical (see Fig. 12).

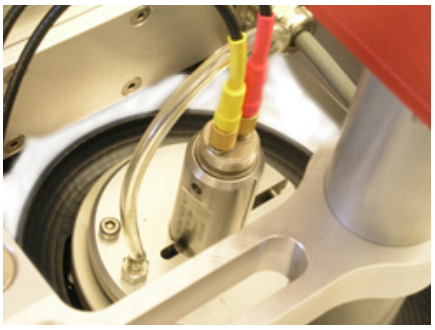

Figure 13 - Probe Connection

2.4.3. Pump System

The pump system is used to feed couplant fluid through the umbilical to the probe on the crawler.

Note: Do not assume fluid compatibility. Check with pump manufacturer to ensure the fluid to be pumped is suitable for this particular pump. E.g. do not use windshield washer fluid (it is very corrosive and may void the manufacturer's warranty).

Connecting the Pump System

To connect the pump system to the Tri Pod, simply connect the hose from the pump to the fluid hose connector on the umbilical. The pump system is required to be plugged into a GFCI 120VAC 60Hz power source.

2.5. Optional Equipment

2.5.1. Video Camera

The integrated video option includes an industrially rugged, sealed, colour, solid state, wide angle video camera complete with adjustable LED lighting.

Mounting

Mount the camera to the Tripod using the provided quick-connect STIX components (see Fig 19; items #3, #4, #5).

Connection

Connect the camera connector to the back of the camera. Connect the power connector to the connector in the front of the Tripod. Ensure the green flying lead BNC connector on the umbilical is connected to the BNC connector on the camera (see 2.3 – connecting the components).

Connect the BNC-to-RCA adapter to the Green connection on the umbilical (see Fig. 12). Connect the RCA cable to the adapter.

Connect the RCA cable to a suitable display or converter. Output from the camera is standard NTSC video which is compatible with standard line input video devices such as televisions, video recorders, etc.

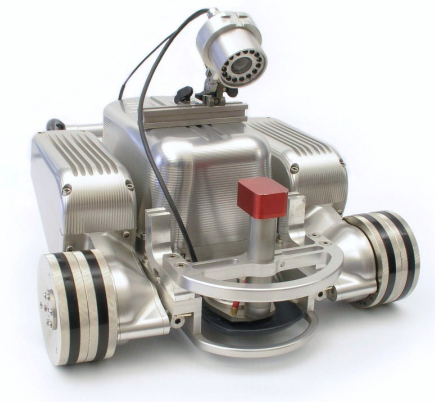

Figure 14 - Camera Mounted

Light Brightness Adjustment

Adjustment of the video light brightness is done through the “User Settings”. 36 levels of brightness are available. For further information see the “User Settings” section of this manual.

Video Converter

For ease of use, a USB converter is normally provided with the Camera Option to view the camera output on a standard computer (or Laptop). For further information, see the instructions and software included with the converter. If further support is necessary, please contact the converter manufacturer.

Figure 15 - Video Converter

2.6. Tether Requirements and Attachment

DANGER! FALLING OBJECT HAZARD. Failure to comply with the warnings, instructions, and specifications in this manual could result in **SEVERE INJURY** or **DEATH**.

DANGER! Do NOT operate or place crawler on a surface higher than 2m (6’) without a proper tether held taut at all times.

DANGER! Hook the tether hook to the provided lifting sling BEFORE placing the crawler on the surface to be inspected (i.e. tank). IMPORTANT: Tether hook must have a safety latch to prevent accidental disconnection.

During use at a height greater than 2m (6’), the Tri Pod crawler MUST be tethered with a proper tether system to prevent the crawler from falling. The tether system must:

- be capable of safely suspending the crawler from above in case the crawler detaches from the inspection surface;

CAUTION! The overhead attachment point for the tether must be located as close as possible to a location directly above the crawler to minimize dangerous swinging of the crawler should it detach from the inspection surface.

- have sufficient capacity to catch and hold a 70 kg (150 lb) load;
- include a mechanism or person to continuously take up slack in the tether as the crawler moves;
- include a lifting hook with a safety latch to prevent accidental disconnection. The hook must be free of sharp edges that may cut or abrade the provided lifting sling.

Before placing the Crawler on the surface to be inspected (i.e. tank) attach the provided lifting sling to the Tri Pod (can be done by forming a girth hitch around the front handle) and then hook the tether hook to the lifting sling.

IMPORTANT! Carefully inspect the lifting sling for damage prior to each use. Ensure the tether hook does not have sharp edges that may cut the lifting sling.

2.7. No Entry Fall Zone

DANGER! FALLING OBJECT HAZARD. The area below an operating crawler must be kept clear at all times. A clearly marked NO ENTRY FALL ZONE must be cordoned off directly below the area of crawler operation.

The area below an operating crawler must be kept clear at all times. A clearly marked NO ENTRY FALL ZONE must be cordoned off directly below the area of crawler operation, according to the dimensions shown in Figure 16 (below).

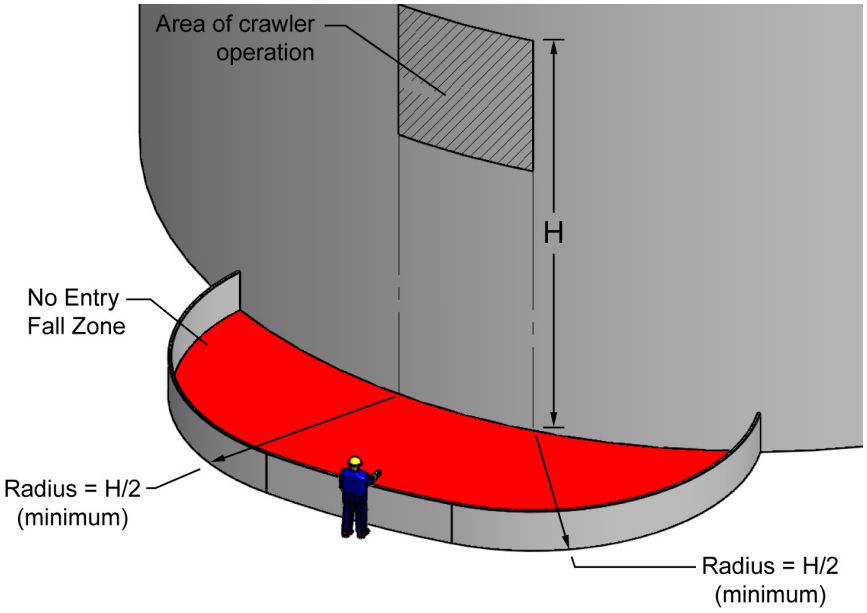

Figure 16 - No Entry Fall Zone

Example: If inspecting a tank that is 6m (20ft) tall, the No Entry Fall Zone radii must be no smaller than 3m (10ft) from the area below the area of crawler operation.

2.8. Preparation of Inspection Surface

- Remove build-up of scale, soot, and other debris (i.e. dirt, ice) from surface on which the crawler is to drive. Excessive build-up will cause the wheels to lose magnetic attraction which may lead to wheel slippage or crawler detachment.
- Ensure there are no obstructions (other than standard butt welds) or voids in the drive path. Obstructions and voids, if driven into or over, could cause the crawler to fall.
- Ensure there are no patches of non-ferrous material in the drive path of the crawler. If the crawler drives over a non-ferrous patch, it will lose magnetic attraction and will cause the crawler to fall.

3. Operating Instructions

3.1. Controller Layout

Figure 17 - Controller

3.1.1. Main Menu

The main menu allows the operator to switch between modes of operation. Four modes are currently supported. To navigate to 'Main Menu' from 'Manual Drive Mode', press button 'B'.

1) User Settings – Contains settings that an operator may normally change.
2) System Parameters – Contains system settings that should never be changed.
3) Diagnostics – Allows various systems of the crawler to be individually monitored and tested.
4) Manual Drive Mode – The normal mode for driving operation of the crawler.

Controls

Left Joystick – Scrolls up and down the available menu selections.

Right Joystick – Inactive in this mode.

Left Pushbutton click – Inactive in this mode.

Right Pushbutton click – Selects menu item.

Right Pushbutton hold – Exits to "Manual Drive" mode.

3.1.2. User Settings

This menu contains settings that an operator may normally change.

Controls

Left Joystick – Scrolls up and down in the setting list. Last menu item is always exit to “Main Menu”.

Right Pushbutton click – Selects displayed item for editing. (See “Setting Edit Mode” below.)

Right Pushbutton hold – Exits to “Main Menu”.

User Settings					
No.	**Description**		**Min**	**Max**	**Default**
0	Auto Home	When set, the system automatically homes on power-up. If not set, the system will prompt for operator input before homing.	0	1	1
1	Idle Timeout (s)	The time in seconds before the system will enter the idle sleep mode.	0	32767	30
2	Units (0=in, 1=mm)	Switches between imperial and metric units.	0	1	0
3	Auto: Dist*1000 (in)	Not Currently Active	0	999999999	12
4	Scan Speed %of Max	Sets scan speed as a percentage of the maximum crawler speed. Typically used for setting a slow speed for scanning while driving.	1	100	10
5	Scan Steer %of Max	Limits the steering angle as a percentage of the maximum steering angle (90deg). Typically used to reduce the sensitivity of the steering when scanning or visually tracking a line.	1	100	10
6	Video Light	Sets the brightness of the video camera lighting system.	0	36	1
7	Display Type	Sets the display order of the middle two lines of the display.	0	1	1

3.1.3. Setting Edit Mode

When a setting has been selected for editing the number enclosed within the ‘*’ character and a blinking cursor is displayed to indicate which digit is currently selected to be changed.

Controls

Left Joystick – Scrolls currently selected numerical digit from 0..9.

Right Joystick – Moves cursor left or right to select numerical digit to change.

Right Pushbutton click – Enters new value and exits edit mode. When entered, the limits of the entry are checked. If the entered value is below the minimum allowed, the minimum value will be set. If the entered value is above the maximum allowed, the maximum value will be set.

Right Pushbutton hold – Cancels editing and restores value to previous setting.

3.1.4. Diagnostic Mode

⚠ **WARNING!** DO NOT USE ON INSPECTION SURFACE. Do NOT use this mode when the crawler in placed on an inspection surface that is anything other than horizontal and flat.

A diagnostic mode allows various systems of the crawler to be individually monitored and tested. Extreme care must be taken. Improper use may cause system damage.

Name	Description
LdriveEnc	Left Drive Wheel Encoder Feedback
LdriveEnable	Left Drive Wheel Amplifier Enable=1, Disable=0 (Right click toggles)
RdriveEnc	Right Drive Wheel Encoder Feedback
RdriveEnable	Right Drive Wheel Amplifier Enable=1, Disable=0 (Right click toggles)
SteerEnc	Steering Wheel Encoder Feedback
SteerEnable	Steering Wheel Amplifier Enable=1, Disable=0 (Right click toggles)
InclinoEnc	Inclinometer Encoder Position (Optional)
IdlerEnc	Read Idler Encoder Position (Optional)
XjoyVal	Right Joystick Value
YjoyVal	Left Joystick Value (Right click toggles menu scrolling so real values can be read.)
SteerHomeSw	Status of steering home switch (1=on, 0=off)
SteerLimitSw	Status of steering limit switch (1=on, 0=off)
CommErrors	Count of communications errors between crawler and operator display
DriveStatus	Shows the status of the three motor drives as a single digit. Steer-Left-Right 1 – Commutation failure 3 – Over temperature 4 – Drive externally disabled 5 – Short in wiring 6 – Current limiting active 9 – Internal supply protection mode A – Shunt active B – Over voltage D – Under voltage E – Amplifier OK F – Power up reset
DriveRelays	Toggles drive brake relays on and off. Note, if the relays are ON, than the brakes are OFF. Care must be taken when using this as the crawler may back drive rapidly. 0=On, 1=Off.
LDriveCommand RDriveCommand SteerCommand	Applies a simple continuous torque command to the selected motor.
LDriveMonitor RDriveMonitor SDriveMonitor	Monitors the drive status and command value to each motor drive. Status codes are as described in DriveStatus above.
DriveCommand	Applies a simple continuous torque command to both drive motors simultaneously.
SoftwareVersion	Shows the current software version.

Controls

Left Joystick – Scrolls up and down in the setting list. Last menu item is always exit to “Main Menu”.

Right Pushbutton click – Depends on current item being displayed. See diagnostic item list.

Right Pushbutton hold – Exits to “Main Menu”.

3.2. System Start-up

To start the system, follow these steps:

1. Plug-in the Power Supply to the appropriate power source (see 1.5 “Power Requirements”).
2. Connect the components properly (see 2.3 – Connecting the components)
3. Rotate the red E-Stop Pushbutton clockwise to unlatch.

On power up, the system does a series of safety checks to ensure that the operator interface (controller) is in a neutral position. If the joysticks are not centered, the system will display an error message. If the joysticks are centered, the system locks the drive wheels and aligns the steering wheel in preparation for the “Manual Drive” mode.

3.2.1. System Start-up Overrides

On start-up, three different start-up modes can be forced by applying power and simultaneously holding combinations of the two pushbuttons as follows:

Left Pushbutton Hold On Power-up

Holding the left pushbutton on power-up will force the system to go directly to the “Diagnostic” mode of operation.

Right Pushbutton Hold On Power-up

Holding the right pushbutton on power-up will force a recalibration of the joysticks. Joystick calibration is performed by making sure that both joysticks are released while pressing the left pushbutton when prompted. If the normal system start-up fails with a joystick problem, recalibrating the joysticks may solve the problem.

Left & Right Pushbutton Hold On Power-up

Holding both the right and left pushbuttons on power up will force the current position of the rear steering wheel to become the new straight driving position. If the crawler does not track straight ahead when no steering is being applied, re-aligning the steering wheel may be done using this start-up option.

3.3. Placement of Crawler on Inspection Surface

IMPORTANT! To place the crawler on the surface to be inspected, use the flux breaker mat (see Fig. 6) as a spacer between the wheels and the surface on which the crawler is to drive. This is necessary to protect the electronic components within the crawler from damaging shock, should the crawler be slammed directly onto the surface.

CAUTION! Do NOT handle the crawler using the umbilical cable. Use the provided handles.

To place the crawler on the inspection surface:

1. Connect the crawler to the electrical system and turn on the power. The crawler will home and enter the *Manual Drive* mode.
2. Place the mat on the surface.
3. Place the crawler on the mat with the umbilical connection down. Ensure that the drive wheels are flat on the mat.
4. Back the crawler down off of the mat. Do not drive forward.
5. Remove the mat.

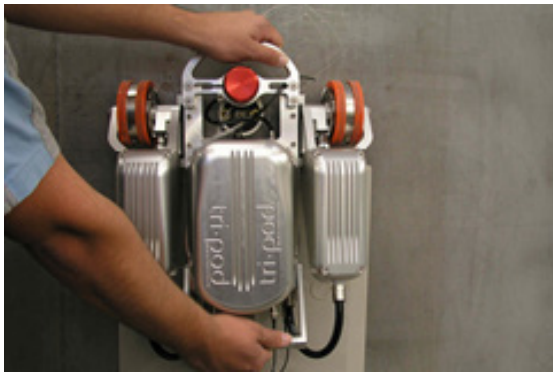

Figure 18 - Placement

3.4. Operating

DANGER! FALLING OBJECT / ELECTRICAL SHOCK HAZARD. Do NOT stand on or place objects on the Umbilical Cable. Ensure the Umbilical Cable is free to uncoil without snagging anything as the crawler moves upwards.

DANGER! FALLING OBJECT / ELECTRICAL SHOCK HAZARD. Do NOT drive over the umbilical cable with the crawler. PAY ATTENTION as the crawler drives to avoid this hazard.

On startup, the system enters manual drive mode. This is the normal mode of operation.

Display

Top Left Corner – Current linear position as calculated from front two drive wheels.

Top Right Corner – Current temperature within the main crawler enclosure.

Middle Right Corner – Optional idler wheel encoder position.

Controls

Left Joystick – Moves the scanner forward and reverse at a speed proportional to joystick movement. When released, the crawler will maintain it's current position without operator input.

Right Joystick – Steers crawler proportionally left or right. When fully left or fully right, the crawler will pivot around the probe.

Left pushbutton click – Raises and lowers the probe.

Right pushbutton click – Exits manual drive mode and enters the "Main Menu".

Left pushbutton hold – Allows the current crawler position to be reset to zero.

Right pushbutton hold – Toggles drive speed from rapid to scan speed. (See "User Settings".)

High Temperature Shutdown

Internal temperature of the crawler is monitored at all times during manual driving. Maximum recommended internal operating temperature is 50°C. If the internal temperature exceeds 50°C, the system will automatically disable all motors and a warning message will be displayed. Once the warning has been acknowledged, operation is allowed to continue but is not recommended. Permanent damage can result from operation at extremely high temperatures.

3.5. Removal of Crawler from Inspection Surface

CAUTION! Do NOT handle the crawler using the umbilical cable. Use the provided handles.

To remove the crawler from the inspection surface:

1. Place the mat on the surface.
2. Move the probe to the lifted position.
3. Back the crawler onto the mat. (Umbilical end moving onto the mat first.) Do not drive forward.
4. Pull the crawler off of the mat.
5. Remove the mat.

4. Maintenance

4.1. Safety Precautions before Maintenance

⚠ WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the Power Supply when servicing the equipment. The Power Supply Box is powered even when the E-Stop Pushbutton is latched in off position.

⚠ WARNING! MAGNETIC MATERIAL. The wheels on the crawler produce an extremely strong magnetic field which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, medical devices, or other electronics. Tools, magnets, and metal objects can cut, pinch, or entrap hands and fingers. HANDLE WITH CARE. People with pacemakers or ICD's must stay at least 2m (79'') away.

4.2. Maintenance Schedule

The Tri Pod system must be maintained according to the following schedule:

Maintenance Item	Frequency
Inspect Safety Apparatus This includes: • All components of Tether System. Replace damaged components as necessary. • Lifting Sling on crawler. If the Lifting Sling shows signs of damage (i.e cuts, abrasion, etc), do NOT use.	Every Use
Clean the Drive Wheels Since the Drive Wheels are magnetic, debris will build up on them. This debris must be cleaned off before every use. An effective cleaning method is to use adhesive-backed tape (i.e. duct tape) to 'pull' the debris off the wheels.	
Inspect Cables and Connectors Inspect the Umbilical Cable, the Control Cable, and the Power Supply Cable for damage. Repair by a qualified person or replace the cable assembly as necessary. Inspect all connectors for damage or moisture. Straighten bent pins. Dry connectors before using.	Every Use
General Cleaning Ensure that the scanner stays relatively clean by wiping off any excess dirt or other contaminants after every use.	
Check Drive Wheel Backlash Check each Drive Wheel individually for free-play by rotating back and forth by hand. If the free-play allows the wheel to move more than 2 teeth (if you see more than 2 teeth on the outer diameter of the wheel move past a stationary point), check to see that the M6x16 Screw (see Fig. 19; item #28) is tight. If the screw is tight, the crawler must be serviced. Contact the manufacturer before further use (see page 3).	Every 40 hours

5. Troubleshooting

#	Problem	Possible Cause	Solution
1.	Display does not turn on.	Input power requirements not met.	Ensure input power meets requirements (see Section 1.7 “Power Requirements”).
		Controller not plugged into Umbilical.	Plug Controller into Umbilical. Ensure connectors are dry and clean and pins in connector are not bent.
		Umbilical Cable not properly connected.	Check Umbilical Cable connections at both ends. Ensure connectors are dry and clean and pins in connectors are not bent.
		TriPod system not started.	Start the TriPod system (see Section 3.2 “System Start Up”)
		Damaged components in Controller, Crawler, Power Supply, or cabling.	Call manufacturer (see page 4).
2.	Display is on but crawler doesn’t home or drive.	Damaged components in Controller, Crawler, Power Supply, or cabling.	Call manufacturer (see page 4).
3.	Crawler does not drive and is unreachable.	See Possible Causes for Problem 1.	See Solutions for Problem 1. If crawler still unresponsive, see Section 5.1 “Retrieval of a Stranded Crawler”.
4.	Steering wheel does not home.	Steering assembly is dirty, or slipping/seizing of steering components.	Call manufacturer (see page 4).

For technical assistance, see Section 6.2 “Technical Support”.

5.1. Retrieval of a Stranded Crawler

DANGER! FALLING OBJECT HAZARD. The tether system must remain active while retrieving the crawler (i.e. a mechanism or person must be continuously taking up slack in the tether).

Should the Tri Pod crawler become inoperative while out of reach, and after the solutions to the problems described in the troubleshooting chart are proven ineffective (see 5. “Troubleshooting”), it may be necessary to retrieve the crawler manually. To do so:

1. Press the E-Stop Pushbutton to turn off power to crawler. NOTE: Under normal conditions, the crawler should start descending slowly.
2. If the crawler stops descending, possibly from running into a standard butt weld bead, VERY CAREFULLY and smoothly pull downwards on the umbilical to overcome the obstacle.

NOTE: FALLING OBJECT HAZARD. It is CRUCIAL that the tether system remains active while retrieving the crawler (i.e. a mechanism or person must be continuously taking up slack in the tether).

6. Service and Repair

⚠ WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the Power Supply when servicing the equipment. The Power Supply Box is powered even when the E-Stop Pushbutton is latched in off position.

⚠ WARNING! MAGNETIC MATERIAL. The wheels on the crawler produce an extremely strong magnetic field which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, medical devices, or other electronics. Tools, magnets, and metal objects can cut, pinch, or entrap hands and fingers. HANDLE WITH CARE. People with pacemakers or ICD's must stay at least 2m (79'') away.

6.1. Drive Wheel Removal / Installation

NOTE: Remove / install one Drive Wheel #17 at a time. Keep the wheels at least 2m (6ft) apart to keep them from slamming into each other. BEWARE of all ferrous (magnetic) metal objects or surfaces in your work area (tools, tool boxes, workbenches, cabinets, etc.) and keep the wheels away!

NOTE: To help identify the parts described below, refer to Figure 9 (see section 7, "Spare Parts").

To remove the Drive Wheels:

1. Obtain / prepare two containers suitable for holding one Drive Wheel #27 each. The containers must:
   - be non-ferrous (non-magnetic)
   - have an effective wall thickness of 5cm (2") on all six sides
     For example: a wooden box lined on all sides, including the lid, with 5cm (2") thick rigid foam.
2. Remove the M6x16 Screw #28 that retains the rear Drive Wheel #27.
3. Have a helper firmly hold the crawler. With a firm grip on the wheel, VERY CAREFULLY slide the Drive Wheel #27 off its axle.
4. Place the loose Drive Wheel #27 in the first container and securely close the lid.
5. Repeat these steps for the second drive wheel.

To install the Drive Wheels:

1. Slide the Drive Wheel #27 onto its axle. Rotate the wheel until the drive dogs fully engage.
2. Insert and tighten the M6x16 Screw #28 to 8 Nm (75 in.lbs)

6.2. Technical Support

For technical support contact Jireh Industries (see page 4).

7. Spare Parts

ITEM	PART NUMBER	DESCRIPTION
1	AA0239	CAMERA MOUNTING RING
2	MD049-016	M3 X 16mm SCREW
3	BGS004	PIVOT BLOCK
4	BGS016-12	DOVETAIL STICK
5	BGS001	CROSS BLOCK
6	AAS073	REAR HANDLE
7	MD031-040	M6 X 40mm SCREW
8	AAS047	PROBE LIFT ACTUATOR
9	MD051-020	M5 X 20mm SCREW
10	AA0237	CAMERA
11	AA0207	FRONT HANDLE
12	AA0062	FRONT HANDLE MOUNTING BLOCK
13	LA004	TUBE BARB, 10-32 TO 3/32"ID
14	AA0214	PROBE CLAMP PLATE
15	AA0209	PROBE HOLDER HOUSING
16	MD028-006	M3 X 6mm SCREW
17	AA0219	ANTI-ROTATE TAB
18	MD030-010	M5 X 10mm SCREW
19	AA0212	PROBE SKI
20	MD049-012	M3 X 12mm SCREW
21	MD049-020	M3 X 20mm SCREW
22	AA0213	PROBE HOLDER
23	MD048-006	M2.5 X 6mm SCREW
24	AA0215	BUMPER
25	MD050-012	M4 X 12mm SCREW
26	MD072-008	M3 X 8mm SCREW
27	AAS076	DRIVE WHEEL
28	MD031-016	M6 X 16mm SCREW
29	AA0067	UNDERSIDE COVER
30	MD052-025	M5 X 25mm SCREW

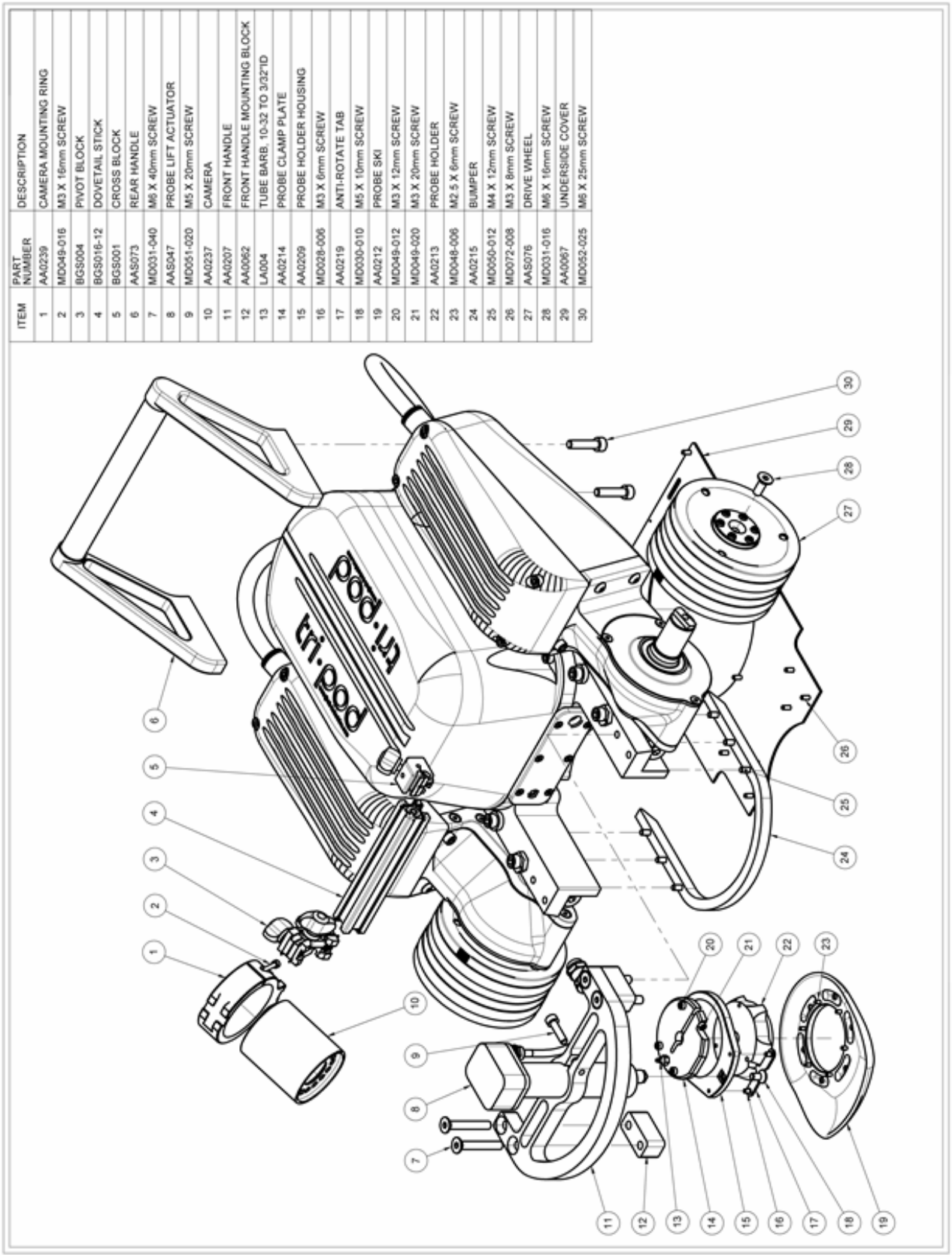

Figure 19 - Spare Parts