NAVIC 2

CX0344 Rev 05.3

Automated Steerable Scanner

JIREH

SAFETY WARNINGS / PRECAUTIONS

KEEP THIS MANUAL – DO NOT LOSE

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

WARNING! The **NAVIC** is designed for a specific use. Using the **NAVIC** outside of its intended use is dangerous. Failure to comply with the warnings, instructions, and specifications in this manual could result in **SEVERE INJURY** or **DEATH**. Read and understand this manual before using.

WARNING! FALLING OBJECT HAZARD. The area below a 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.

(see "Preparation for Safe Use" on page 39 for additional details)

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

(see "Tether Requirements and Attachment" on page 40 for additional details)

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! Do **NOT** operate scanner in an explosive environment. Do **NOT** operate scanner in the presence of volatile substances.

WARNING! MAGNETIC MATERIAL. The wheels of 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 75 cm *(30 in)* away.

WARNING! MAGNETIC MATERIAL. When the carrying case contains the crawler, a magnetic field exists outside the case which may cause failure or permanent damage to items such as watches, memory devices, CRT monitors, medical devices or other electronics.

People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away from the carrying case when it contains the crawler.

WARNING! MAGNETIC MATERIAL. The installation/removal mat *(see "Scanner Installation/Removal Mat Use" on page 130)* contains magnetic material.

People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

WARNING! LASER RADIATION. The battery powered optical guide contains a Class 1M laser. Do not view directly with optical instruments.

WARNING! If this product is to be used with any Child Products listed in *(Chaper 2.3)*, be sure to read and comply with the warnings, instructions, and specifications in the Child Product's User Manual*(s)*.

CAUTION! Pinch points exist with this product. Keep fingers and hands clear of pinch points.

CAUTION! Do **NOT** operate the **NAVIC** crawler on an inspection surface which is electrically connected to a component that is being welded.

CAUTION! **DO NOT DISCONNECT UNDER LOAD**. Shut off power before connecting or disconnecting. Permanent damage to electronics could occur.

EMERGENCY STOP. This symbol indicates emergency stop button.

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

(see "Disposal" on page 175 for additional details)

TABLE OF CONTENTS

IDENTIFICATION

1.1. Product Brand

This user manual describes the proper safety precautions, setup and use of the **NAVIC** system.

1.2. Manufacturer

Distributor:

Manufacturer:

Jireh Industries Ltd.
53158 Range Road 224
Ardrossan, Alberta, Canada
T8E 2K4
Phone: 780.922.4534
jireh.com

1.3. Compliance Declarations

1.3.1. ISED Emissions Compliance (Canada)

CAN ICES-003(A) / NMB-003(A)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

1.3.2. FCC Suppliers Declaration of Conformity (United States)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: *(1)* this device may not cause harmful interference, and *(2)* this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RESPONSIBLE PARTY NAME:	Jireh Industries
ADDRESS:	2955 S Sam Houston Pkwy E Suite 300 Houston, Texas United States 77047
TELEPHONE:	832-564-0626

1.3.3. European Union CE Declarations

Jireh Industries hereby declares that the **NAVIC** product complies with the essential requirements and other relevant provisions of the following European Union directives:

2014/30/EU	EMC Directive
2014/35/EU	Low Voltage Directive
2012/19/EU	Directive on Waste Electrical and Electronic Equipment
2011/65/EU	Directive on Restriction of Hazardous Substances (RoHS)

PRODUCT SPECIFICATIONS

2.1. Base NAVIC System

This section outlines the product specifications of the base system. When the base system is used together with compatible components *(Chaper 2.2)* or child products *(Chaper 2.3)*, the product specifications of the base system may be superseded. See *(see "Compatible Components" on page 10)* and *(see "Child Products" on page 16)*.

2.1.1. Intended Use

WARNING! FALLING OBJECT HAZARD. The **NAVIC** is intended for a specific use. Read and understand the intended and unintended use limits below. Using the **NAVIC** outside of its intended use is dangerous and could result in **SEVERE INJURY** or **DEATH**.

The **NAVIC**'s primary purpose is to perform inspections of ferrous assets such as pipes, vessels, or storage tanks by moving an inspection tool over a ferrous surface. It is intended for industrial use only.

2.1.1.1 Operating Limits

Category	Parameter	Specification
Inspection Surface	Maximum coating thickness:	
	Up-side-down orientation	Bare metal only
	Vertical orientation	0.5 mm *(0.020 in)*
	Horizontal, Right-side-up orientation	1 mm *(0.040 in)*
	Condition	Clean, free of excess rust, scale, debris *(i.e. dirt, sand, etc.)*, ice, frost
	Minimum thickness	3 mm *(0.120 in)*
	Minimum ID, internal circumferential driving	610 mm *(24 in)*
	Minimum OD, external Circumferential driving	70 mm *(2.75 in)*
	Minimum OD, longitudinal driving	305 mm *(12 in)*
	Maximum surface temperature	50°C *(122°F)*

Category	Parameter	Specification
Scanner	Maximum umbilical length	30 m *(100 ft)*
	Maximum payload *(performance may vary with surface condition)*	10 kg (23 lb) *(Umbilical and attachments are considered payload)*
	Attachments	Restricted to those listed in compatible components or child products
	Orientation while driving at height >2 m *(6 ft)* on vertical surface	Umbilical strain relief to point downwards, or at worst, horizontal. It is not to point upwards
	Required radial clearance *(handles removed, circumferential driving)*	70 mm *(2.75 in)* on outer diameters <200 mm *(8 in)* 81.5 mm *(3.2 in)* on outer diameters >200 mm *(8 in)*

2.1.1.2 Operating Environment

The NAVIC is for use in dry industrial environments having ambient temperatures shown below. It is NOT intended for use in explosive environments.

Category	Parameter	Specification
Environment	Minimum ambient temperature	-20°C *(-4°F)*
	Maximum ambient temperature	50°C *(122°F)*

2.1.1.3 User

The NAVIC is intended to be used by persons who have read and understand the user manual. The intended user is to be a person without limitations in the physical abilities of the upper and lower limbs, sight, hearing, or anyone with a pacemaker.

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

1. a person who is trained in rigging and fall protection and is able to effectively apply the same safety principles to the crawler, and
2. a person who is trained to operate the Navic

2.1.2. Unintended Use

The NAVIC is NOT intended for:

- use outside of its intended use
- lifting / lowering objects or people *(i.e. using the Navic as a crane / elevator)*
- driving into / over obstructions, excluding standard weld caps
- installation on a surface on which welding is actively occurring

In addition to the above points, for operating at a height greater than 2 m *(6 in)*, 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 upward *(front for the Navic is lower than the umbilical connection)*.

2.1.3. Dimensions and Weight

Crawler height:	12.5 cm	4.9 in
Crawler width:	28.2 cm	11.1 in
Crawler depth:	30.8 cm	12.1 in
Crawler height *(handles removed)*:	81. cm	3.2 in
Crawler width *(right drive module)*:	16.1 cm	6.3 in
Crawler weight: *	7.7 kg	17 lb
Crawler weight *(right drive module)*:	4.2 kg	9.3 lb

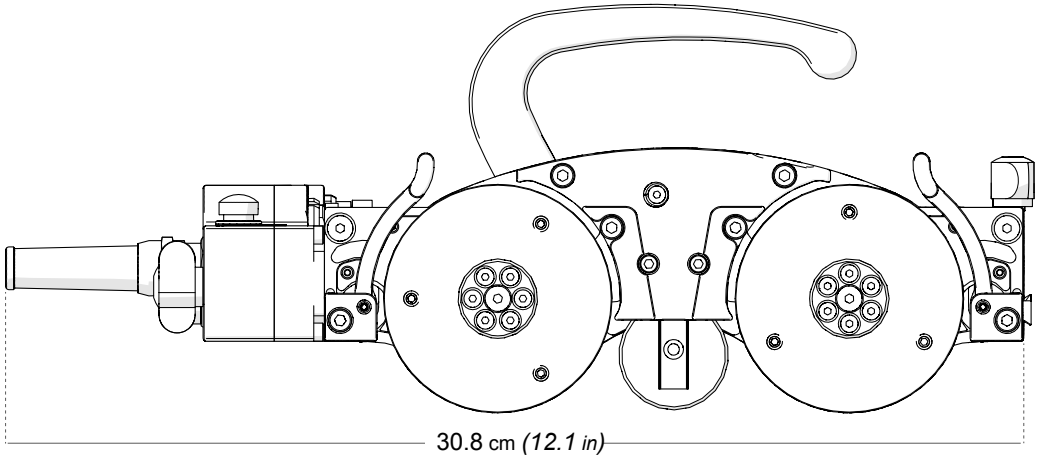


Fig. 1 - Crawler dimensions

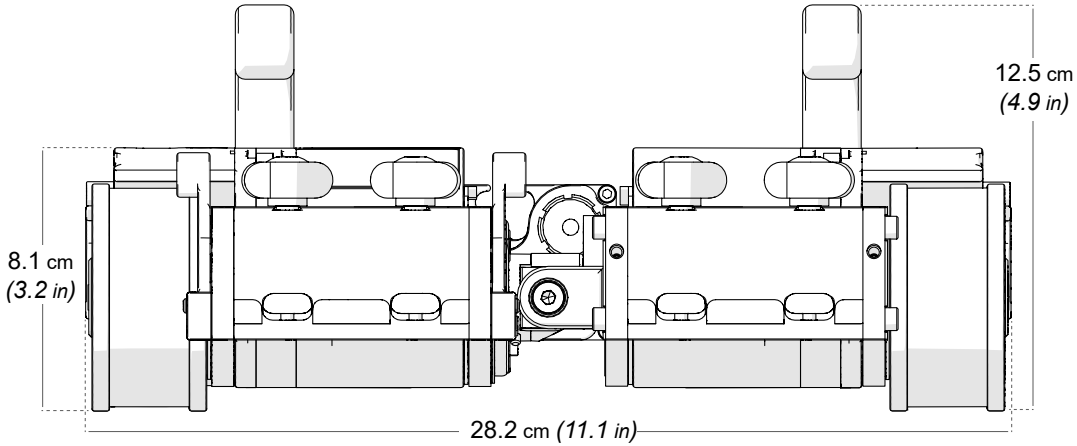


Fig. 2 - Dual module dimensions

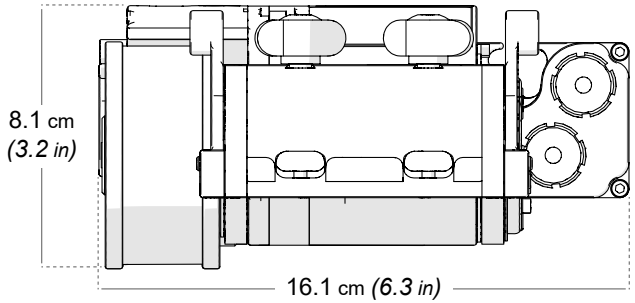


Fig. 3 - Single module dimensions

** Dual module configuration excluding case, attachments, umbilical, power controller and handheld controller.*

2.1.4. Power Requirements

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

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

CAUTION! Do not disconnect under load. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

Power Requirements: 100-240 VAC, 50/60 Hz, 3.5A

2.1.5. Environmental Sealing

Dust-tight, watertight *(not submersible)*.

2.1.6. Performance Specifications

Category	Parameter	Specification
Crawler	Maximum speed	25 cm/sec *(10 in/sec)*
	Encoder resolution, right module *(idler encoder)*	13.78 counts/mm *(349.9 counts/in)*
	Encoder resolution, left module *(motor encoder)*	872.5 counts/mm *(22161.8 counts/in)*

2.1.7. Encoder Interface Specifications

Output type: 4 channel quadrature 5VDC RS422 compatible.

Power: Power must be supplied to the interface.
5VDC +/-10% power limited to < 15w.

1	Enc B
2	Enc B’
3	Enc A
4	Enc A’
5	Aux Enc A’
6	Aux Enc A
7	Aux Enc B’
8	Aux Enc B
9	Enc +5V
10	Enc Com
H	Shield

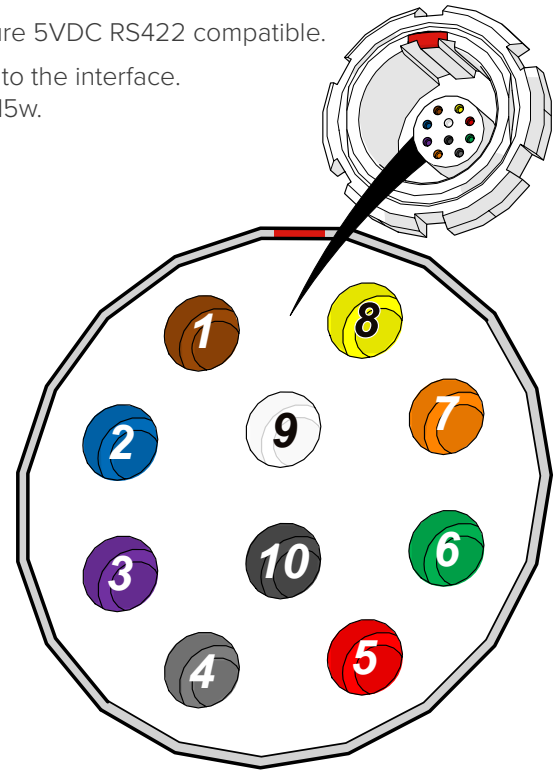


Fig. 4 - JIREH Industries pin out configuration

2.2. Compatible Components

The components listed in this section integrate with the base system to perform certain tasks. Their use may modify the product specifications *(i.e. intended use, power requirements, etc.)* from those of the base system. The specifications listed here supersede those of the base system. If no specifications are listed here, the specifications of the base system remain effective.

2.2.1. Low Profile Probe Holder Frame
CXG004-

2.2.1.1 Intended Use

The Low Profile Probe Holder Frame is intended to be mounted in the NAVIC's swivel mount to provide mounting of multiple probe holders. Its use limits the NAVIC's operation to inspection surfaces that a lat or driven on in the circumferential direction.

2.2.1.2 Operating Limits

Category	Parameter	Specification
Inspection Surface	Minimum OD, longitudinal driving	Not recommended
Maximum number of probe holders	Slip joint probe holders	4

2.2.2. Vertical Probe Holder Frame
CXG007-

2.2.2.1 Intended Use

The Vertical Probe Holder Frame is intended to be mounted in the NAVIC's swivel mount to provide mounting of multiple probe holders. Its use limits the NAVIC's operation to inspection surfaces that are either flat or driven on in the circumferential direction.

Category	Parameter	Specification
Inspection Surface	Minimum OD, longitudinal driving	Not recommended
Maximum number of probe holders	Vertical probe holders	6

2.2.3. Pivoting Probe Holder Frame
CXG013-

The Pivoting Probe Holder Frame is intended to be mounted in the NAVIC's swivel mount to provide mounting of multiple probe holders. Its use limits the NAVIC's operation to the operating limits shown below.

2.2.3.1 Operating Limits

Category	Parameter	Specification
Inspection Surface	Minimum OD, longitudinal driving	305 mm *(12 in)*
Maximum number of probe holders	Vertical probe holders	6

2.2.4. Frame Bar
BG0038-

The Frame Bar is intended to be mounted in the NAVIC's swivel mount to provide mounting of multiple probe holders. Its use limits the NAVIC's operation to inspection surfaces that are either flat or driven on in the circumferential direction.

2.2.4.1 Intended Use

Category	Parameter	Specification
Inspection Surface	Minimum OD, longitudinal driving	Not recommended
Maximum number of probe holders	Slip joint probe holders	2
	Vertical probe holders	2
	Heavy duty vertical probe holders	2

2.2.5. Slip Joint Probe Holder
PHA012-

The Slip Joint Probe Holder is intended to a provide probe holding solution for probes and wedges with pivot button holes. It is useful for situations requiring lower profile. It is mounted in the dovetail groove of any probe holder frame or frame bar.

2.2.6. Vertical Probe Holder
PHA015-

The Vertical Probe Holder is intended to a provide probe holding solution for probes and wedges with pivot button holes. It is mounted in the dovetail groove of any probe holder frame or frame bar.

2.2.7. Heavy Duty Vertical Probe Holder
PHS043-

The Heavy Duty Vertical Probe Holder is intended to a provide probe holding solution for larger, heavier probes. It is mounted in the dovetail groove of any probe holder frame or frame bar.

2.2.8. Corrosion Thickness Probe Holder
PHS046- / PHS056-

The Corrosion Thickness Probe Holder is intended to a provide probe holding solution for specific probes or wedges that do not have pivot button holes. It is mounted in the dovetail groove of any probe holder frame or frame bar.

2.2.9. HydroFORM Cart with Wheels
PHS044

The HydroFORM Cart with Wheels is intended to a provide solution for holding the Olympus HydroFORM probe. It is used in conjunction with the heavy duty vertical probe holder.

2.2.10. Preamp Bracket
CES029-

2.2.10.1 Intended Use

The Preamp Bracket is intended to mount objects such as preamps, splitters, etc. on a rack or dovetail bar that is mounted to the NAVIC crawler. The mounted object is attached to the NAVIC with a lanyard or probe cables strong enough to prevent the object from falling, should the straps or screws that hold it to the bracket fail. Also, if the object is mounted with straps, it is to have smooth edges so as not to cut the straps.

2.2.10.2 Operating Limits

Category	Parameter	Specification
Preamp Bracket	Maximum weight of mounted object	1.36 kg *(3 lb)*
Scanner	Required radial clearance (handles removed, circumferential driving)	Dependent on object mounted on Preamp Bracket

2.2.11. NAVIC Backpack
CXS077

2.2.11.1 Intended Use

The NAVIC Backpack is intended to mount objects such as preamps, splitters, etc. on the NAVIC crawler. The mounted object is to be attached to the NAVIC with a lanyard or probe cables strong enough to prevent the object from falling, should the straps fail. Also, the object is to have smooth edges so as not to cut the strap.

2.2.11.2 Operating Limits

Category	Parameter	Specification
NAVIC Backpack	Maximum weight of mounted object	1.36 kg *(3 lb)*
Scanner	Required radial clearance	Dependent on object mounted to Backpack

2.2.12. NAVIC Camera Mount CXG067

2.2.12.1 Intended Use

The Navic Camera Mount is intended to mount any small action camera on the Navic crawler.

2.2.12.2 Operating Limits

Category	Parameter	Specification
Camera	Maximum weight	0.5 kg *(1.1 lb)*
	Required mounting hole	1/4 in - 20 thread
Scanner	Required radial clearance	Dependent on camera size

2.2.13. Battery Powered Optical Guide CXS080

2.2.13.1 Intended Use

The Battery Powered Optical Guide is intended to provide a point of reference useful for guiding the NAVIC along a given path *(i.e. a weld cap)*. It is intended to be mounted in the dovetail groove of any probe holder frame or frame bar.

2.2.13.2 Operating Environment

Category	Parameter	Specification
Scanner	Required radial clearance	Dependent on mounted orientation of Battery Powered Optical Guide

2.2.13.3 Power Requirements

Power requirements: 1 AA battery

2.2.13.4 Environmental Sealing

IP64

2.2.14. Medium Temperature Add-On Kit
CXG031-

2.2.14.1 Intended Use

The Medium Temperature Add-On Kit allows the NAVIC to operate on inspection surfaces that are hotter.

2.2.14.2 Operating Limits

Category	Parameter	Specification
Inspection surface	Maximum surface temperature	150°C *(302°F)*
Scanner	Required radial clearance	Dependent on object mounted to Backpack

2.2.15. Encoder Adapter
UMA010-

2.2.15.1 Intended Use

The Encoder Adapter adapts a scanner's existing encoder cable connector to a different instrument's encoder input.

2.2.16. 3-Axis Nozzle Scanner Add-On Kit
CXG028-

Mounted on a single NAVIC pod, the 3-axis nozzle scanner add-on kit includes a specialized probe holding system for inspection of nozzle and fitting welds.

2.3. Child Products

The products listed in this section integrate with the base system to perform certain tasks. Their use may modify the product specifications *(i.e. intended use, power requirements, etc.)* from those of the base system. These products have a user manual of their own, and shall be referred to for their product specifications as well as how their use modifies the product specifications of the base system.

2.3.1. Motorized Couplant Pump
CMA015

The Motorized Couplant Pump is a powered pumping unit used to supply couplant fluid to scanning equipment.

2.3.2. Motorized Raster Arm
CWG002-

Available in various lengths, the Motorized Raster Arm can carry many different probes for various types of corrosion scans. The Motorized Raster Arm is intended to be mounted in the NAVIC's swivel mount.

2.3.3. Actuated Probe Lift
CXG030-

The Actuated Probe Lift allows the user to raise and lower a corrosion thickness probe holder remotely from the handheld controller. This allows the probe to avoid obstacles and large welds preventing damage and unnecessary wear to the probe. The Actuated Probe Lift is intended to be mounted in the NAVIC's swivel mount.

2.3.4. Optical Guide
CXG035

The Optical Guide mount's to any dovetail attached to a motorized crawler. The Optical Guide provides a green colour, point of reference for guiding scanners along a given path *(i.e. a weld)*.

2.3.5. Tracker
DRG001

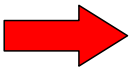
The Tracker uses advanced laser guidance to follow elevated profiles *(i.e. a weld)* on a ferrous surface. It intended to be mounted in the dovetail groove of any probe holder frame or frame bar.

2.3.6. Preamp
CXG032

The Preamp is used to amplify the return signal from an ultrasonic transducer and improve the signal-to-noise ratio for transmission over long cables.

DEFINITIONS

3.1. Definition of Symbols

	Instructions to ‘look here’ or to ‘see this part’
	Denotes movement. Instructing user to carry out action in a specified direction.
	Indicates alignment axis
	Alerts user that view has changed to a reverse angle

3.2. Definitions of Terms

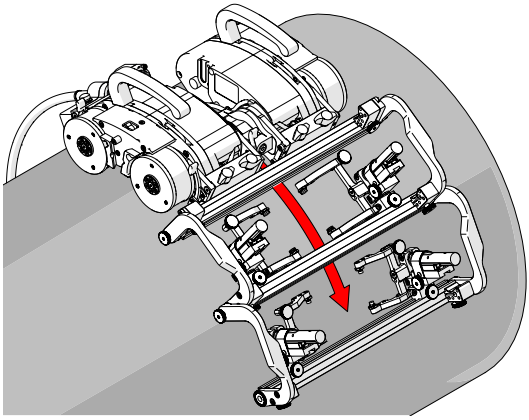


Fig. 5 - Circumferential scanning

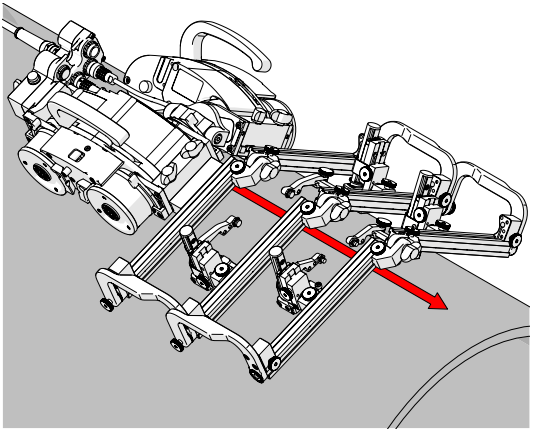


Fig. 6 - Longitudinal scanning

Circumferential	Direction of scan travel is around the circumference of the pipe/tube *(Fig. 5)*.
Longitudinal	Direction of scan travel is lengthwise of the pipe/tube *(Fig. 6)*.

3.3. Safety Symbols

The following safety symbols might appear on the product and in this document. Read and understand their meaning below:

	General warning symbol	This symbol is used to alert the user to potential hazards. All safety messages that follow this symbol shall be obeyed to avoid possible ham or material damage.
	Shock hazard caution symbol	This symbol is used to alert the user to potential electric shock hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm.
	Laser warning symbol	This symbol is used to alert the user to potential laser hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm or material damage.

3.4. Safety Signal Words

The following safety signal words might appear in this document. Read and understand their meaning below:

DANGER!	The DANGER signal word indicates an imminently hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to will result in death or serious personal injury. Do not proceed beyond a DANGER signal word until the indicated conditions are fully understood and met.
WARNING!	The WARNING signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to could result in death or serious personal injury. Do not proceed beyond a WARNING signal word until the indicated conditions are fully understood and met.
CAUTION!	The CAUTION signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like that if not correctly performed or adhered to may result in minor or moderate personal injury, material damage, particularly to the product, destruction of part or all of the product, or loss of data. Do not proceed beyond a CAUTION signal word until the indicated conditions are fully understood and met.

4.1. Component Identification

4.1.1. Base System

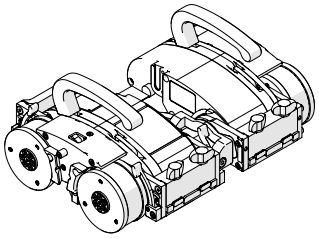


Fig. 7 - NAVIC (crawler)
CXA016-

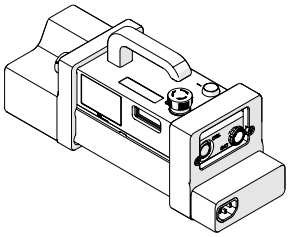


Fig. 8 - Power controller
CXA019-

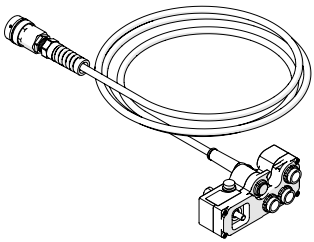


Fig. 9 - Umbilical
UMA030-

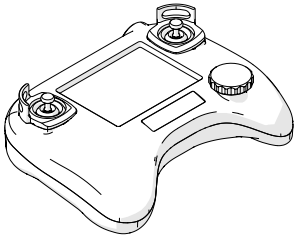


Fig. 10 - Handheld controller
CXA008

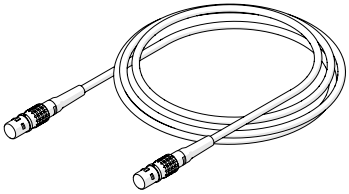


Fig. 11 - Auxiliary cable
UMA017-06

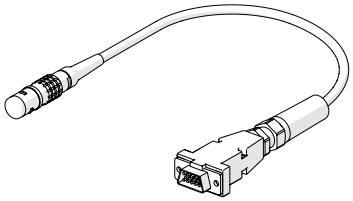


Fig. 12 - Encoder cable
UMA025-

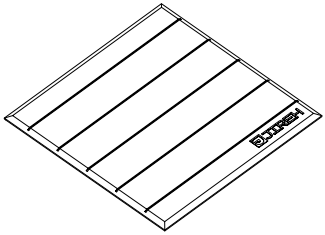


Fig. 13 - Installation/removal mat
AAS061

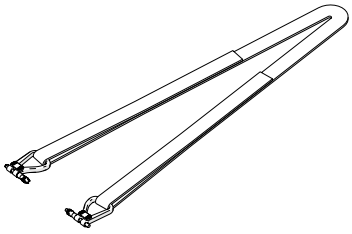


Fig. 14 - Lifting sling
CXA009

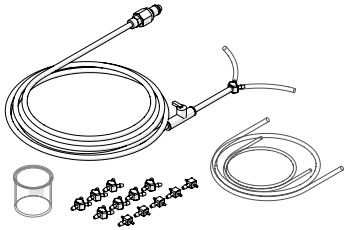


Fig. 15 - Irrigation kit
CMG009-

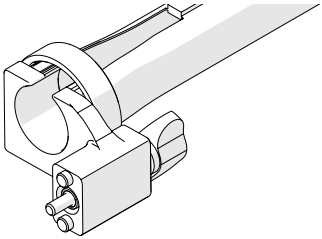


Fig. 16 - Cable management
CXS046-

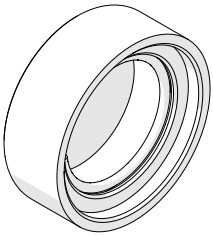


Fig. 17 - Cap
CXS066

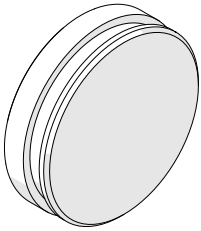


Fig. 18 - Cap
CX0174

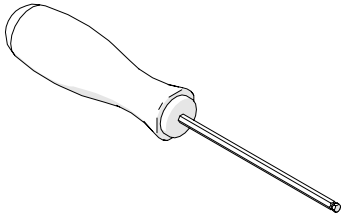


Fig. 19 - 3 mm hex driver
EA414

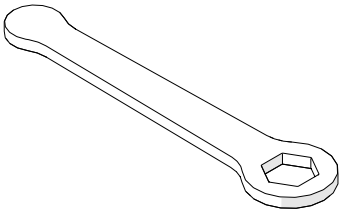


Fig. 20 - 3/8 in wrench
EA470

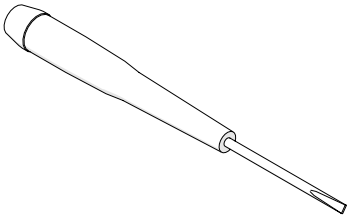


Fig. 21 - 3 mm flat driver
EA480

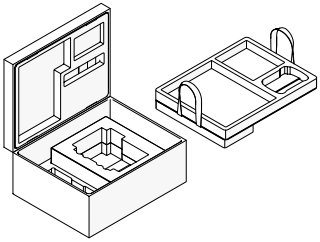


Fig. 22 - Case, NAVIC crawler
CXA037

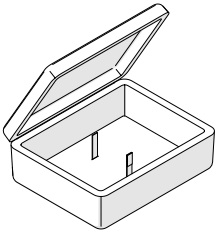


Fig. 23 - Umbilical/probe holder frame case
CXA023

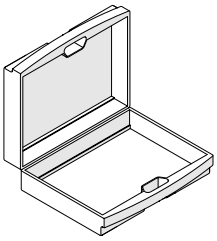


Fig. 24 - Umbilical case
EA421

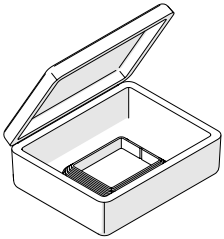


Fig. 25 - Motorized pump / umbilical case
CMA016

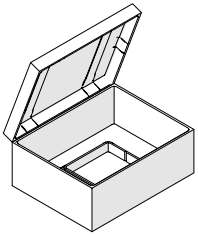


Fig. 26 - Motorized pump / umbilical case
CXA042

4.1.2. Compatible Components

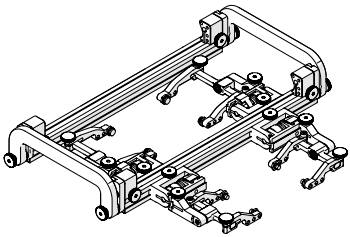


Fig. 27 - Low profile probe holder frame
CXG004-

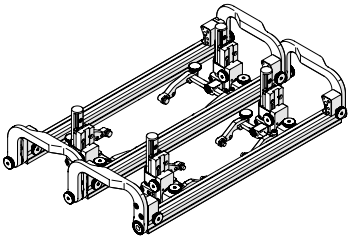


Fig. 28 - Vertical probe holder
CXG007-

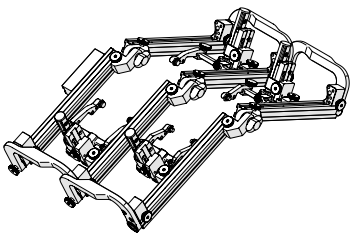


Fig. 29 - Pivoting probe holder frame
CXG013-

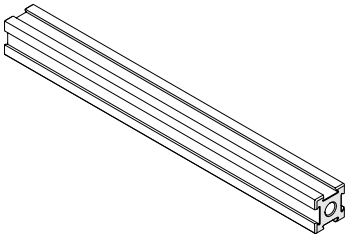


Fig. 30 - Frame bar
BG0038-

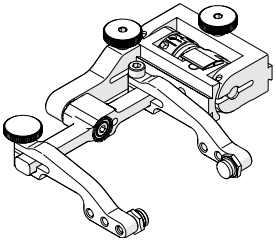


Fig. 31 - Slip joint probe holder
PHA012-

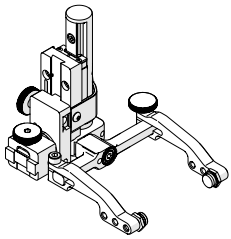


Fig. 32 - Vertical probe holder
PHA015-

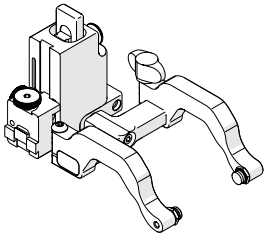


Fig. 33 - Heavy duty vertical probe holder
PHS043-

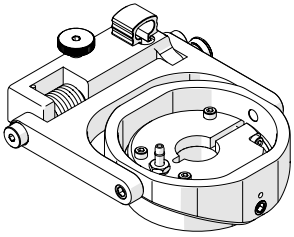


Fig. 34 - Corrosion thickness probe holder
PHS046-

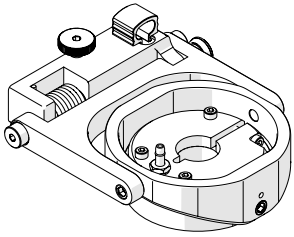


Fig. 35 - Corrosion thickness probe holder
PHS056-

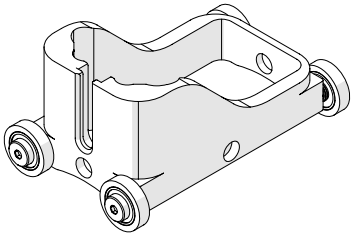


Fig. 36 - HydroFORM cart
PHS044

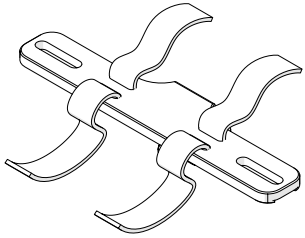


Fig. 37 - Preamp bracket
CES029-

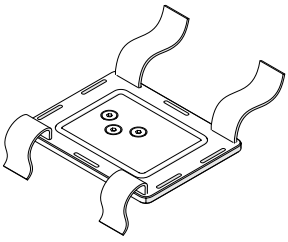


Fig. 38 - Backpack
CXS077

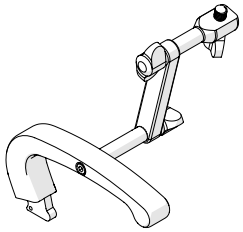


Fig. 39 - NAVIC camera mount
CXS067

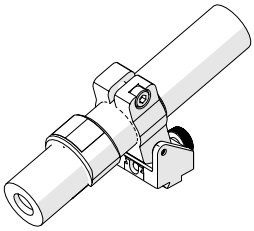


Fig. 40 - Battery powered optical guide
CXS080

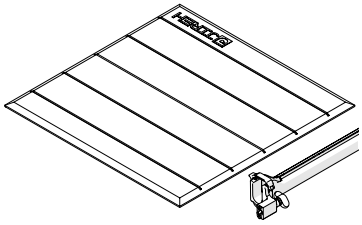


Fig. 41 - Automated crawler medium temperature add-on kit
CXG031-

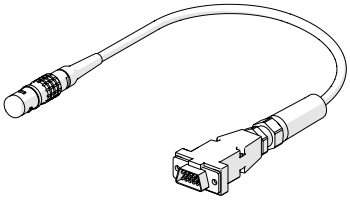


Fig. 42 - Encoder adpater
UMA010-

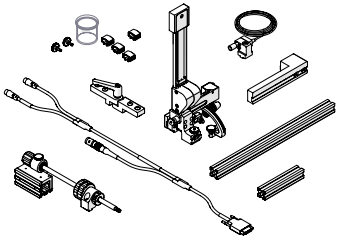


Fig. 43 - 3-axis nozzle scanner add-on kit
CXG028-

4.1.3. Child Products

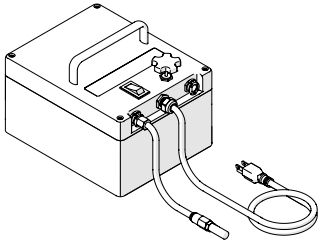


Fig. 44 - Motorized Couplant Pump
CMA015

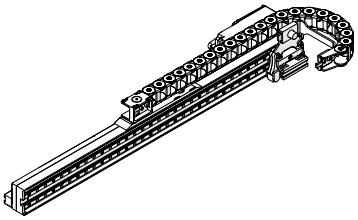


Fig. 45 - Motorized raster arm
CWG002-

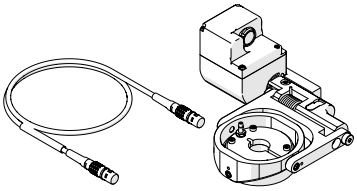


Fig. 46 - Actuated probe lift
CXG030-

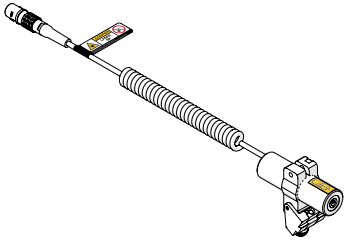


Fig. 47 - Optical guide
CXG035

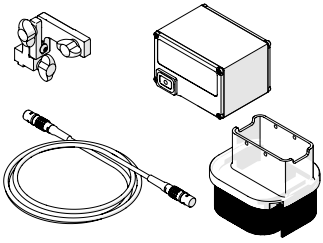


Fig. 48 - Tracker
DRG001

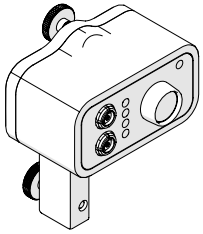


Fig. 49 - Preamp
CXG032

4.2. Tools

4.2.1. Included Tools

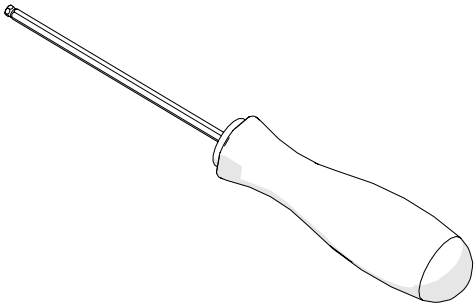


Fig. 50 - 3 mm hex driver

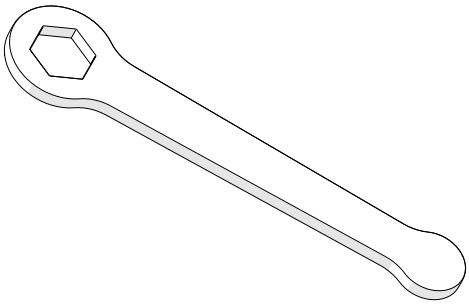


Fig. 51 - 3/8 in wrench

The included 3 mm hex driver *(Fig. 50)* is suitable for most typical adjustments within the **NAVIC** system.

Also included in this kit is a 3/8 in wrench *(Fig. 51)* which is used to remove and install probe holder pivot buttons.

The included 3 mm flat driver *(Fig. 52)* is useful for releasing the flaps of the raster arm's cable tray.

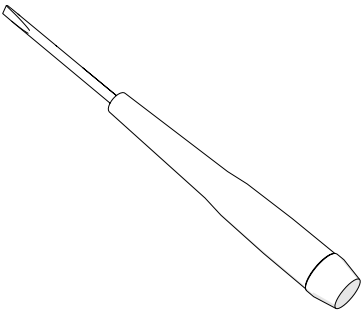


Fig. 52 - 3 mm flat driver

4.2.2. Optional Tools

Some specialized adjustments require tools that are not included with this kit.

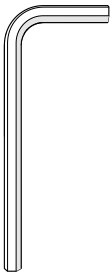


Fig. 53 - 1.5 mm hex wrench

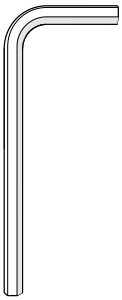


Fig. 54 - 2 mm hex wrench

Fig. 55 - 2.5 mm hex wrench

Fig. 56 - 3 mm hex wrench

4.3. Base System Components

4.3.1. Crawler

4.3.1.1 Right Drive Module

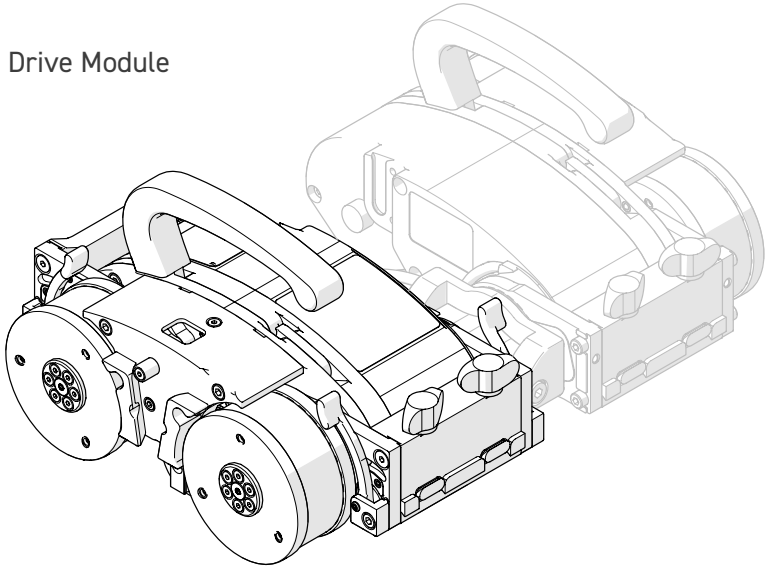


Fig. 57 - Right drive module

The right drive module includes the encoder, umbilical connections and accessory mounting point. When connected with the left drive module the **NAVIC** scanner is able to steer on an inspection surface.

> ***NOTE:*** *The ability to effectively steer the crawler in the circumferential direction decreases as pipe diameters decrease below 300 mm (12 in).*

It is possible to use the right drive module independently to carry out weld scanning when steering is not required and/or overall scanner size is a concern.

4.3.1.1.1 Encoder

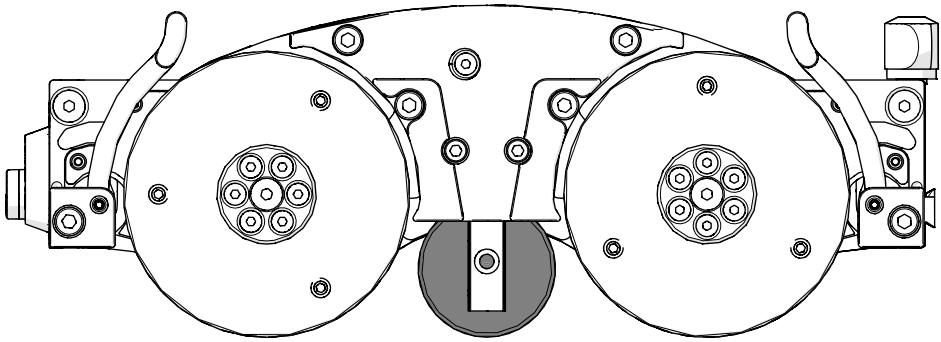


Fig. 58 - Encoder wheel

The right drive module includes an independent encoder wheel. This encoder wheel provides accurate encoding even in the event of drive wheel slip.

The spring-loaded encoder wheel maintains scan surface contact through all listed scan diameter sizes *(see "Operating Limits" on page 5)*. Adjustment of the encoder wheel is not required.

4.3.1.2 Left Drive Module

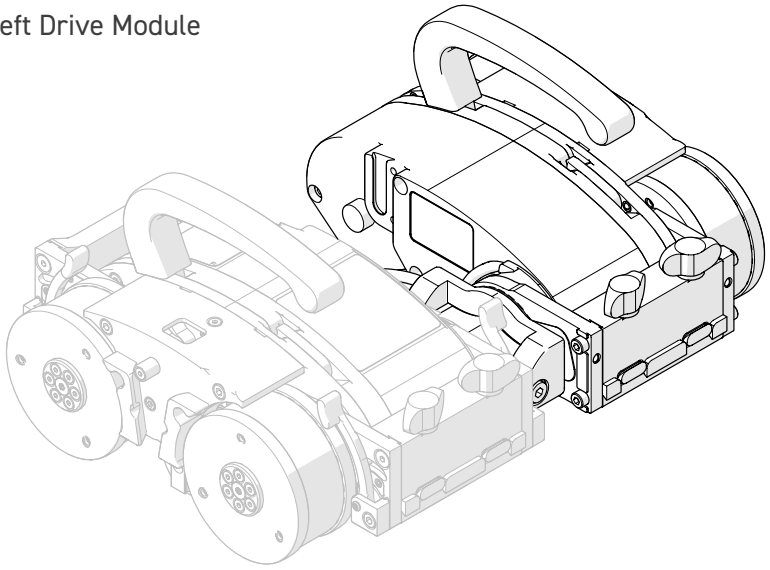


Fig. 59 - Left drive module

The left drive module is only used in conjunction with the right drive module. Combining both modules allows the **NAVIC** scanner to steer on an inspection surface.

> ***NOTE:*** *Steering is limited on smaller diameter inspection surfaces.*

4.3.2. Power Controller

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

WARNING! There are no user serviceable components inside the power controller. Dangerous voltages can be present inside the case. Do **NOT** open. Return to manufacturer for repair.

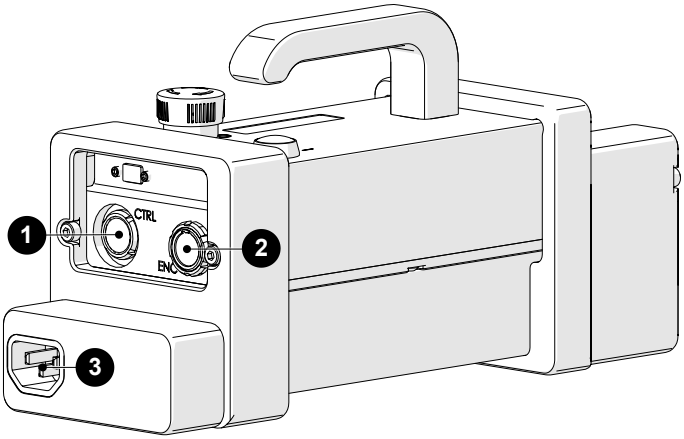


Fig. 60 - Power controller

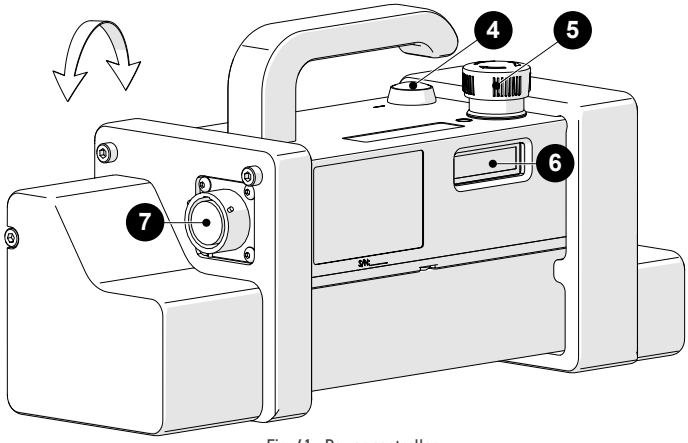


Fig. 61 - Power controller

The **NAVIC** power controller converts power from a 100-240 VAC, 50/60Hz, 3.5A power source to 36VDC, 8.9A. A start/stop safety circuit and physical **ON** and

OFF push-buttons are integrated into the supply.

1	CTRL socket *(Fig. 60)*	Connection for the auxiliary cable.
2	ENC socket *(Fig. 60)*	Connection for the encoder cable.
3	Power connection *(Fig. 60)*	Connect plug from a properly grounded source. Use IEC320 cord approved for AC supply.
4	Power button *(Fig. 61)*	Activate system power by pressing *(and releasing)* the green button.
5	Stop button *(Fig. 61)*	The red stop button latches down when pressed, this stop button shuts down the system. Twist the stop button clockwise to return to the released position. This must be done before power can be activated.
6	Status LCD *(Fig. 61)*	Displays the power controller's status.
7	Umbilical connection *(Fig. 61)*	Connection for the umbilical.

In the event of a break in the stop circuit *(the stop circuit runs through the power controller cable, umbilical and the crawler's emergency stop button)* power will shut off.

NOTE: *Before use, always inspect the power cable and plug for damage. The power controller should not be used if visible damage is present. Use of damaged components may be a safety hazard.*

4.3.2.1 Power Connection

The 3 power connection *(Fig. 60)* of the power controller is used to connect the power controller to a suitable 100-240VAC, 50/60Hz grounded power source capable of supplying a minimum of 5 amps.

The safety of the power controller relies on the provision of a proper ground connection.

In environments with moisture present, a GFCI (Ground Fault Circuit Interrupter) must be used to ensure operator safety.

NOTE: *Some generators or DC-AC inverters may introduce significant levels of noise to the system. This may degrade overall system performance or reduce the system life expectancy. Use of generators or DC-AC inverters is not recommended and are used at the operator's risk.*

4.3.3. Umbilical

WARNING! FALLING OBJECT HAZARD.
Ensure the umbilical can freely uncoil during operation and does not become snagged. If umbilical becomes snagged, the crawler may fall and **SEVERE INJURY** or **DEATH** could result.

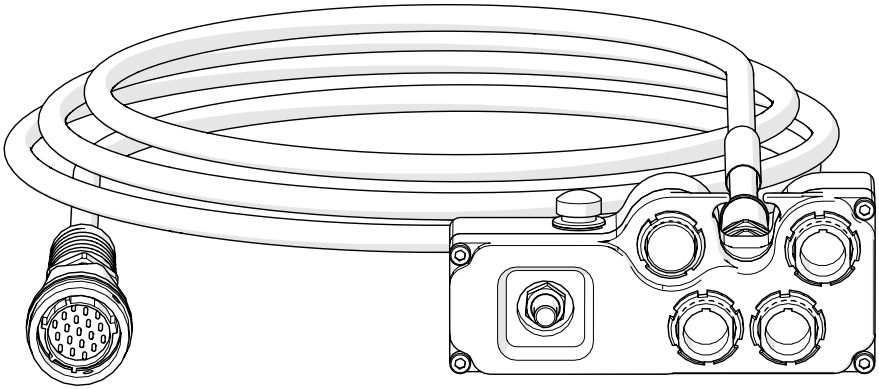


Fig. 62 - Umbilical

The umbilical is the backbone of the **NAVIC** system. It provides all power, network distribution as well as encoder signal transmission. Circuitry is incorporated into the umbilical to protect or isolate all signals. The umbilical provides separation between the power controller and the crawler. Various umbilical lengths are available from 5 m to 30 m *(16.4 ft to 98.4 ft)* long.

NOTE: *Before use, inspect the cable and connectors for damage. When any damage is evident, the cable must* ***NOT*** *be used. Using a damaged cable may be a safety hazard and could also put other system components at risk.*

4.3.3.1 Umbilical Connections

Multiple 4-pin and 8-pin Lemo® receptacles are located on both ends of the umbilical. Any 4-pin connector can be plugged into any 4-pin receptacle. Any 8-pin connector can be plugged into any 8-pin receptacle.

System power and network wiring are identical on each type of plug. The only difference being, the 8-pin receptacle encoder pin wiring is unique to either the primary 4 **X ENC** *(Fig. 63)* or secondary 2 **Y ENC** *(Fig. 63)* encoder axis. The 3 unlabeled receptacle *(Fig. 63)* contains no encoder wiring.

TIP: *Cables may be plugged into any 8-pin receptacle. This only affects which encoder signal is transmitted to the umbilical's 10-pin encoder output connector plug.*

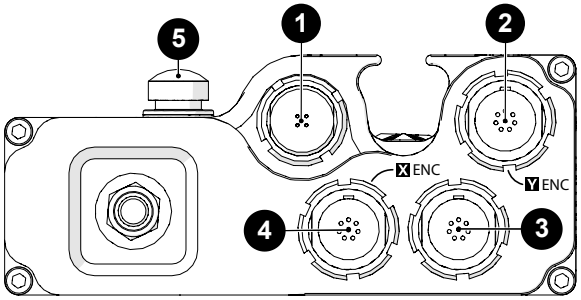


Fig. 63 - Umbilical (crawler side)

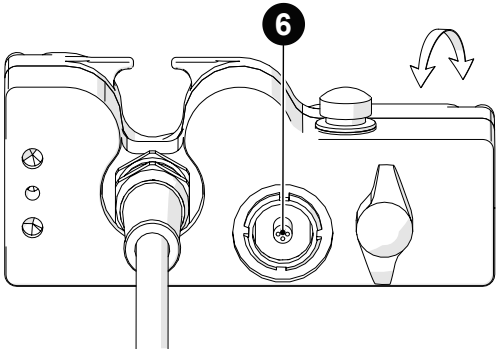


Fig. 64 - Umbilical (cable side)

1/6	4-pin accessory connector	Typical usage: Optical guide, Tracker, Actuated probe lift, Handheld controller
2	8-pin expansion connector	The module connected to the **Y-ENC** 8-pin Lemo® will transmit encoder signals through the umbilical as the 2nd encoder axis. Typical usage: Optional raster arm
3	8-pin connector	The unlabeled 8-pin Lemo® does not support encoder signals. Typical usage: Left drive module
4	8-pin expansion connector	The module that is connected to the **X-ENC** 8-pin Lemo® transmits encoder signals through the umbilical as the 1st encoder axis. Typical usage: Right drive module
5	Emergency stop button	*(see "Emergency Stop Button" on page 30).*

4.3.3.2 Emergency Stop Button

Fig. 65 - Emergency off

The 5 red button *(Fig. 63)* located on the umbilical provides an emergency off button to the entire system. When pressed, all power to the **NAVIC** system will disengage.

To restore system power, it is necessary to press the green power button located on the power controller *(see "Power Controller" on page 27)*.

NOTE: *Terminating system power may cause the crawler to freewheel down when operating in a vertical orientation.*

4.3.3.3 Encoder Signal Isolation

The umbilical contains a built-in circuit which buffers encoder signals in addition to providing isolation and protection to user instrumentation. The isolator requires 5VDC from the user's instrument and this is built into the supplied encoder cables.

4.3.4. Handheld Controller

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

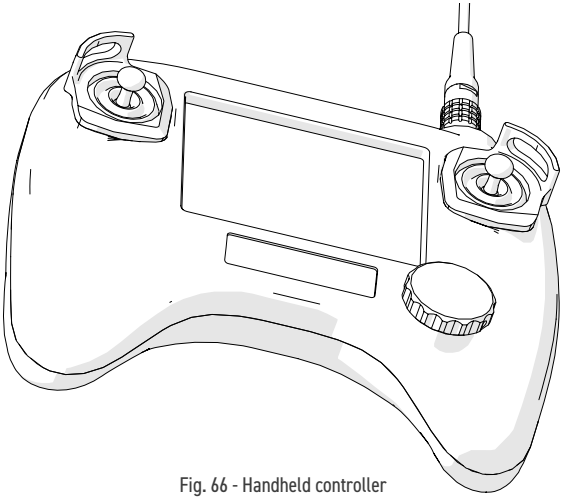


Fig. 66 - Handheld controller

The handheld controller is used to manipulate a scanner installed on an inspection surface. User settings and scan information are edited using the handheld controller. The handheld controller is connected to the power controller or umbilical with the auxiliary cable.

The handheld controller contains the complete system program and must be connected for the system to operate. When a software upgrade is necessary, the handheld controller is the only component required.

The handheld controller is not watertight and is not intended to be used in extremely wet environments. The handheld controller utilizes a resistive touch screen, care should be taken to not use sharp or gritty objects on the screen as the touch membrane can scratch. If the screen is damaged, all programmed functions can still be accessed using the click wheel.

NOTE: *Do* ***NOT*** *connect the handheld controller while system activated.*

4.3.5. Auxiliary Cable

The auxiliary cable connects the handheld controller to the power controller. 36VDC and network signals are used in the cable.

Both auxiliary cable connectors are identical and interchangeable. The cable may be plugged into the 4-pin receptacle on the power controller or the crawler's umbilical.

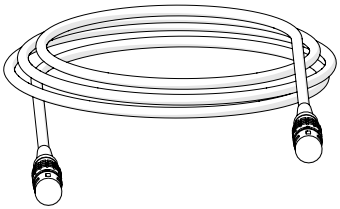


Fig. 67 - Auxiliary cable

> ***NOTE:*** *Inspect the cable and connectors for damage before use. When any damage is evident, the cable must* ***NOT*** *be utilized. Use of a damaged cable may be a safety hazard and could also put other system components at risk.*

4.3.6. Encoder Cable

The encoder cable connects the **NAVIC** system to the user's instrument. This cable allows transmission of two-axis position signals from the **NAVIC** to the instrument. The encoder cable also provides 5VDC from the user's instrument to the encoder isolation circuitry.

Various encoder styles are available for various instruments.

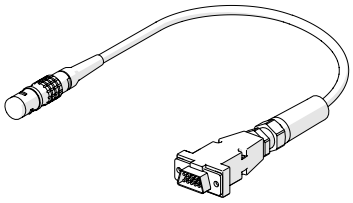


Fig. 68 - Encoder cable

> ***NOTE:*** *Inspect the cable and connectors for damage before use. When damage is evident, the cable must* ***NOT*** *be used.*

4.3.7. Installation/Removal Mat

WARNING! MAGNETIC MATERIAL. The installation/removal mat contains magnetic material. Those with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

The installation/removal mat is used for installation and removal of motorized magnetic-wheeled scanners from the inspection surface. A motorized scanner can drive on/off the mat, while the integrated magnets in the mat hold it firmly in place on the inspection surface. The scanner installation mat can be used on both round and flat surfaces.

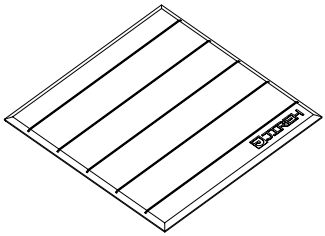


Fig. 69 - Installation/removal mat

4.3.8. Lifting Sling

The lifting sling attaches to the crawler to provide an attachment point for tethers. When operating a **NAVIC** at a height greater than 2 m *(6 ft)*, the crawler **MUST** be tethered with a proper tether system to prevent the crawler from falling *(see "No Entry Fall Zone" on page 39)*.

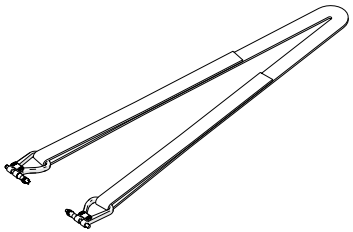


Fig. 70 - Lifting sling

4.3.9. Irrigation Kit

The irrigation kit provides a variety of hoses, fittings, connectors and splitters commonly used during non-destructive inspection.

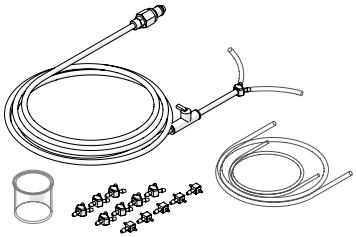


Fig. 71 - Irrigation kit

4.3.10. Cable Management

The cable management provides a means of protecting and organizing cables, tubes and hoses.

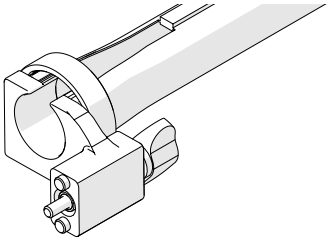


Fig. 72 - Cable management

4.3.11. Cap *(x2)*

Caps prevent contamination and damage to the NAVIC's connection pivots. When the left and right modules are separated, it is imperative the connection pivots remain free of dirt, sand, mud, etc. *(see "Connecting/Disconnecting Left and Right Modules" on page 67 for additional details).*

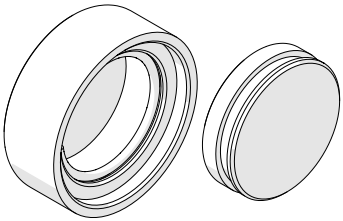


Fig. 73 - Caps

4.3.12. Tools

Several tools are included for various scanner and accessory adjustment. *(see "Included Tools" on page 24 for additional details)*

4.3.13. Cases

Depending on the configuration selected at the time of purchase. This will determine the types and amount of cases included with the system.

4.4. Compatible Components

4.4.1. Low Profile Probe Holder Frame

The low profile probe holder frame carries up to four probes during limited access, circumferential weld inspection. Removal of the **NAVIC** handles and the use of the low profile probe holder frame allows inspection when radial clearance is limited.

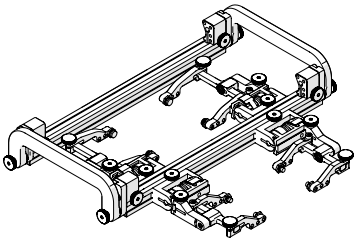


Fig. 74 - Low profile probe holder frame

4.4.2. Vertical Probe Holder Frame

The vertical probe holder frame carries up to six probes during circumferential weld inspection. Available in a myriad of configurations and lengths, the vertical probe holder frame attaches to the front of the **NAVIC** crawler.

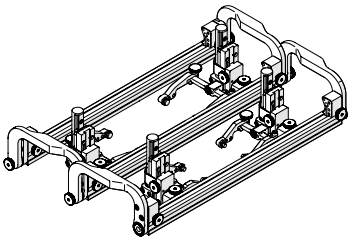


Fig. 75 - Vertical probe holder frame

4.4.3. Pivoting Probe Holder Frame

The pivoting probe holder frame carries up to six probes during longitudinal weld inspection. Available in a myriad of configurations and lengths, the pivoting probe holder frame may also be used for circumferential weld inspection.

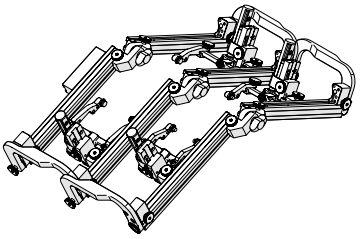


Fig. 76 - Pivoting probe holder frame

4.4.4. Frame Bar

Frame bars use dovetail grooves into which probe holders and accessories may be attached. Available in various lengths.

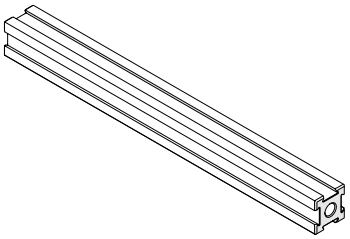


Fig. 77 - Frame bar

4.4.5. Slip Joint Probe Holder

The slip joint probe holder is generally used during limited access inspection. The low profile design requires minimal radial clearance. The slip joint probe holder is designed to carry many different types of probes and wedges, it is available with various types of yokes, arms and pivot buttons.

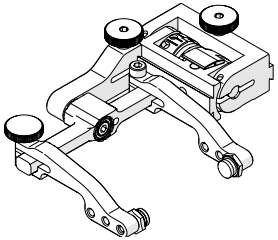


Fig. 78 - Slip joint probe holder

4.4.6. Vertical Probe Holder

The vertical probe holder is designed to carry many different types of probes and wedges. Available with various types of yokes, arms and pivot buttons. The vertical probe holder features several different adjustment options for each unique probe/wedge setup.

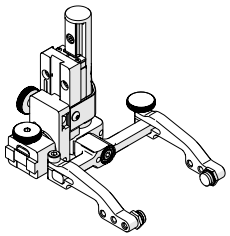


Fig. 79 - Vertical probe holder

4.4.7. Heavy Duty Vertical Probe Holder

The heavy duty vertical probe holder is designed to carry larger probes. Available with various arm, yoke and pivot buttons, the heavy duty vertical probe holder exerts more down force on a large footprint probe/wedge.

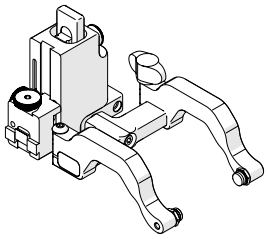


Fig. 80 - Heavy duty vertical probe holder

4.4.8. Corrosion Thickness Probe Holder

The corrosion thickness probe holder carries various probes for the purpose of corrosion inspection and is available with either a flat or curved wear plate.

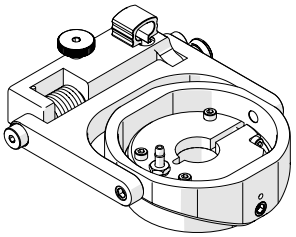


Fig. 81 - Corrosion thickness probe holder

4.4.9. HydroFORM Cart

The HydroFORM Cart carries an Olympus HydroFORM™ probe. The HydroFORM cart is designed to be used in conjunction with the heavy duty vertical probe holder.

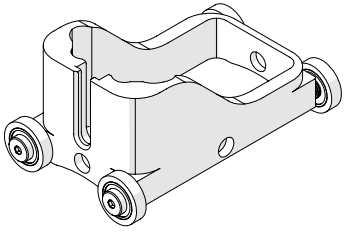


Fig. 82 - HydroFORM cart

4.4.10. Preamp Bracket

The preamp mounts to any dovetail groove. It is compatible with more standard preamps.

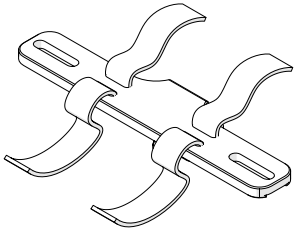


Fig. 83 - Preamp bracket

4.4.11. NAVIC Backpack

The **NAVIC** backpack provides a means of carrying equipment/hardware on a **NAVIC** crawler.

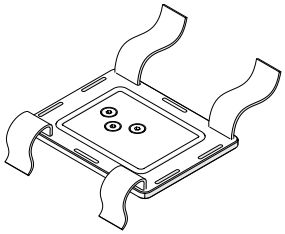


Fig. 84 - NAVIC backpack

4.4.12. NAVIC Camera Mount

The **NAVIC** camera mount provides a mounting point for cameras on a NAVIC crawler.

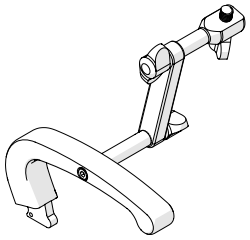


Fig. 85 - NAVIC camera mount

4.4.13. Battery Powered Optical Guide

The battery powered optical guide provides a red colour point of reference useful for guiding scanners along a given path *(i.e. a weld)*.

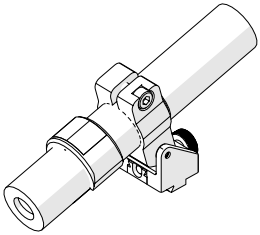


Fig. 86 - Battery powered optical guide

4.4.14. Automated Crawler Medium Temperature Add-On Kit

The automated crawler medium temperature add-on kit enables a **NAVIC** crawler to operate on an inspection surface with a temperature up to 150°C *(302°F)*.

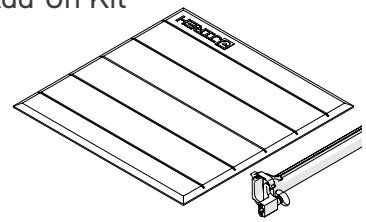


Fig. 87 - Automated crawler medium temperature add-on kit

4.4.15. Encoder Adapter

The encoder adapter changes the scanner's built in encoder connector style.

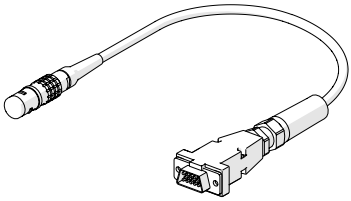


Fig. 88 - Encoder adapter

4.4.16. 3-Axis Nozzle Scanner Add-On Kit

The 3-axis nozzle scanner add-on kit mounts to the right drive module of the **NAVIC** crawler to offer encoded inspection of nozzle and fitting welds.

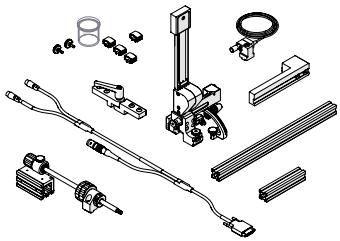


Fig. 89 - 3-axis nozzle scanner add-on kit

4.5. Child Products

4.5.1. Motorized Couplant Pump

The motorized couplant pump is a powered pumping unit used for supplying couplant fluid to the scanning surface.

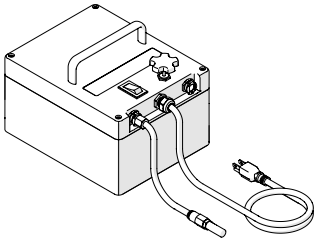


Fig. 90 - Motorized couplant pump

4.5.2. Motorized Raster Arm

The motorized raster arm is available in various lengths and offers programmable speed and travel settings.

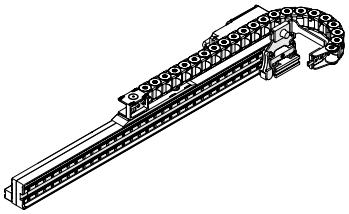


Fig. 91 - Motorized raster arm

4.5.3. Actuated Probe Lift

The actuated probe lift allows the probe to be lifted from the inspection surface, preserving the life or the probe as well as allowing travel over small obstacles and large welds. The actuated probe lift is compatible with various probe styles and is available with either a flat or curved wear plate.

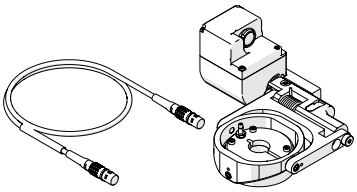


Fig. 92 - Actuated probe lift

4.5.4. Optical Guide

The optical guide mounts to any dovetail and provides a green colour point of reference useful for guiding scanners along a given path *(i.e. a weld)*.

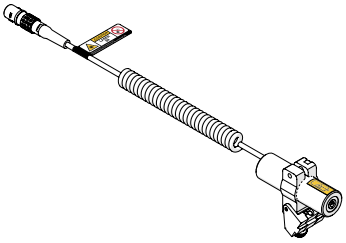


Fig. 93 - Optical guide

4.5.5. Tracker

The tracker is mounted atop any probe holder frame and uses advanced laser guidance to follow elevated profiles *(i.e. welds)*.

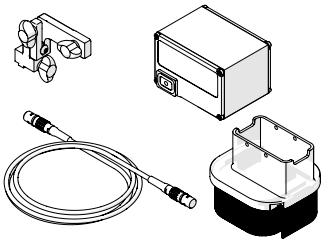


Fig. 94 - Tracker

4.5.6. Preamp

The Preamp is used to amplify the return signal from an ultrasonic transducer and improve the signal-to-noise ratio for transmission over long cables.

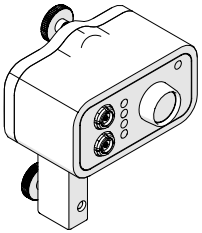


Fig. 95 - Preamp

PREPARATION FOR USE

5.1. Preparation for Transportation

CAUTION! PINCH / CRUSH HAZARD. BE CAREFUL when passing the **NAVIC** 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.

5.2. Preparation for Safe Use

5.2.1. No Entry Fall Zone

WARNING! FALLING OBJECT HAZARD. The area below a 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 a 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 *(Fig. 96)*.

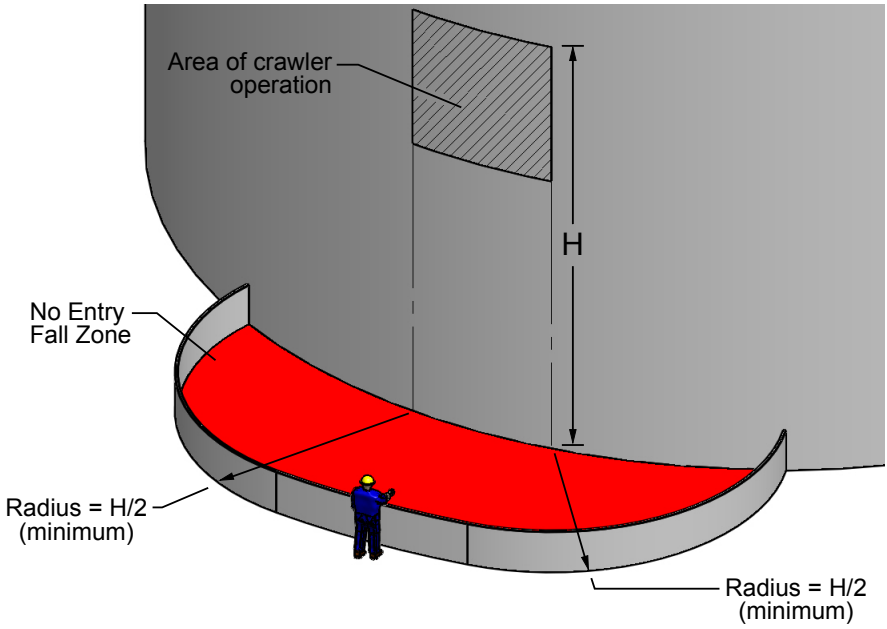


Fig. 96 - No entry fall zone

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

5.2.2. Tether Requirements and Attachment

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

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

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

When used at a height greater than 2 m *(6 ft)*, the **NAVIC** 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;
- have sufficient capacity to catch and hold a 70 kg *(150 lb)* load;
- include a mechanism *(i.e. self retracting inertia reel fall arrester)* 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 *(e.g. tank)*, attach the provided lifting sling to the **NAVIC** and then hook the tether hook to the lifting sling.

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.

5.2.3. Lifting Sling Setup

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.

Secure the lifting sling to the **NAVIC** as indicated here:

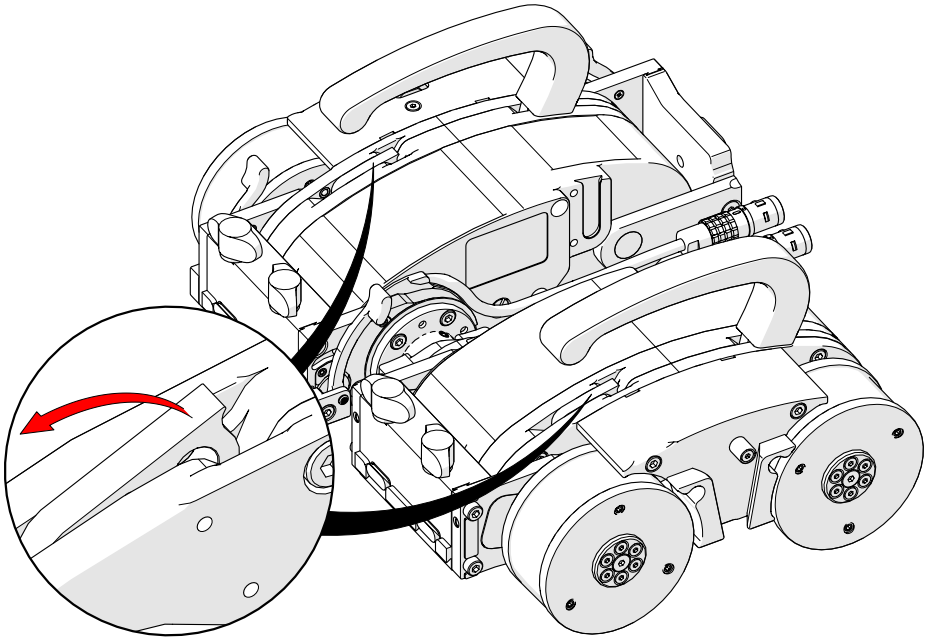


Fig. 97 - Lift tether attachment points

1. Lift the two tether attachment points *(Fig. 97)*.

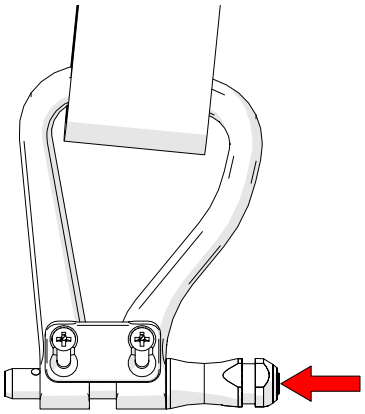


Fig. 98 - Press release button

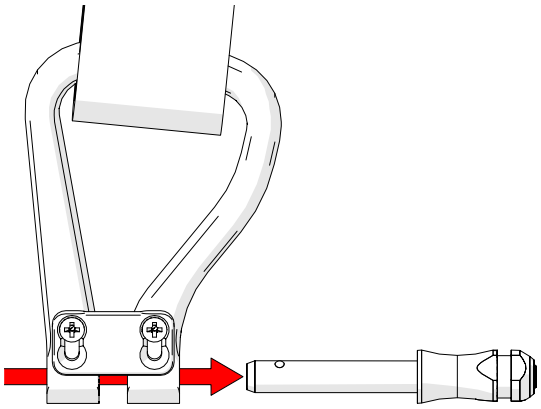


Fig. 99 - Pull pin from

2. Simultaneously press the pin's release button *(Fig. 98)* and pull the pin from the shackle *(Fig. 99)*.

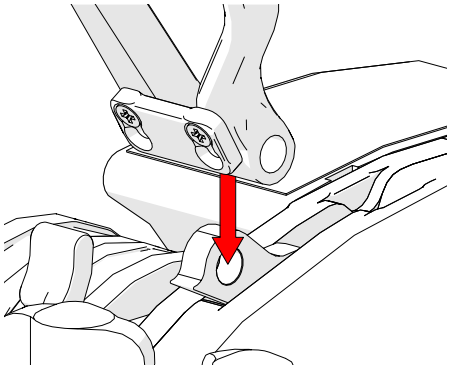


Fig. 100 - Align shackle with tether holes

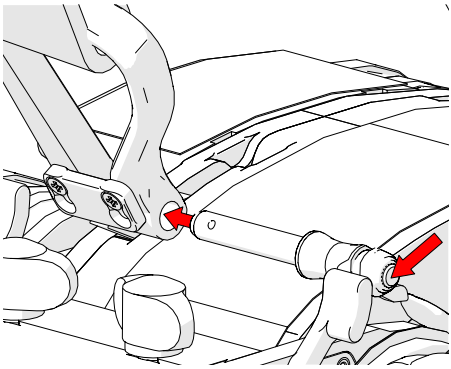


Fig. 101 - Insert pin

3. Slide the shackle around the tether attachment point *(Fig. 100)*.
4. Align the tether attachment point and shackle. Insert the pin while pressing the pin's release button *(Fig. 101)*.

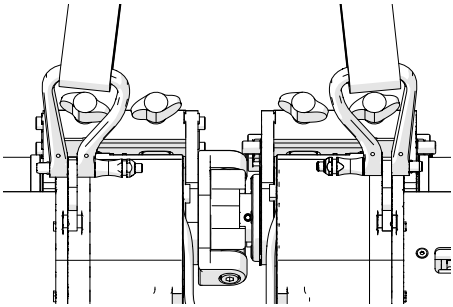


Fig. 102 - Proper shackle setup

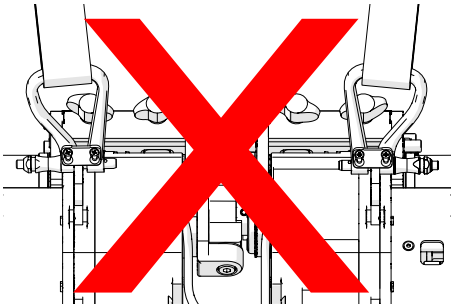


Fig. 103 - Incorrect shackle setup

> ***NOTE:*** *Ensure proper orientation of the shackles (Fig. 103).*

5.2.4. Lifting Sling Low Profile Setup

The following adjustment allows low profile scanning when required.

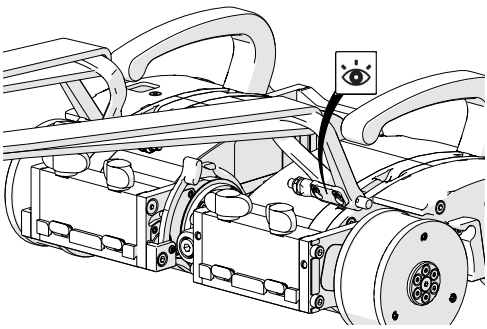


Fig. 104 - Proper shackle setup

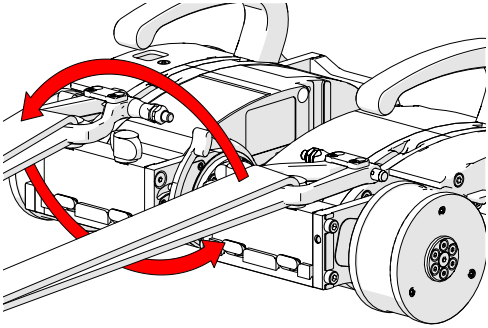


Fig. 105 - Proper shackle setup

1. The shackle plate *(Fig. 104)* in conjunction with the tether attachment point provides the necessary clearance for scanning equipment.
2. Reverse the lifting sling and shackles *(Fig. 105)* so that the shackles are free to lay down flat allowing for low profile sling setup.

5.3. Preparation of Inspection Surface

WARNING! FALLING OBJECT HAZARD.
The inspection surface must adhere to the conditions outlined in sections *"Intended Use" on page 4* and *"Operating Environment" on page 6* of this manual.

- Remove build-up of scale, 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 that no obstructions *(other than standard butt welds)* or voids are in the drive path. Obstructions and voids could cause the crawler to fall if driven into or over.
- Ensure that 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.

5.4. System Connectivity

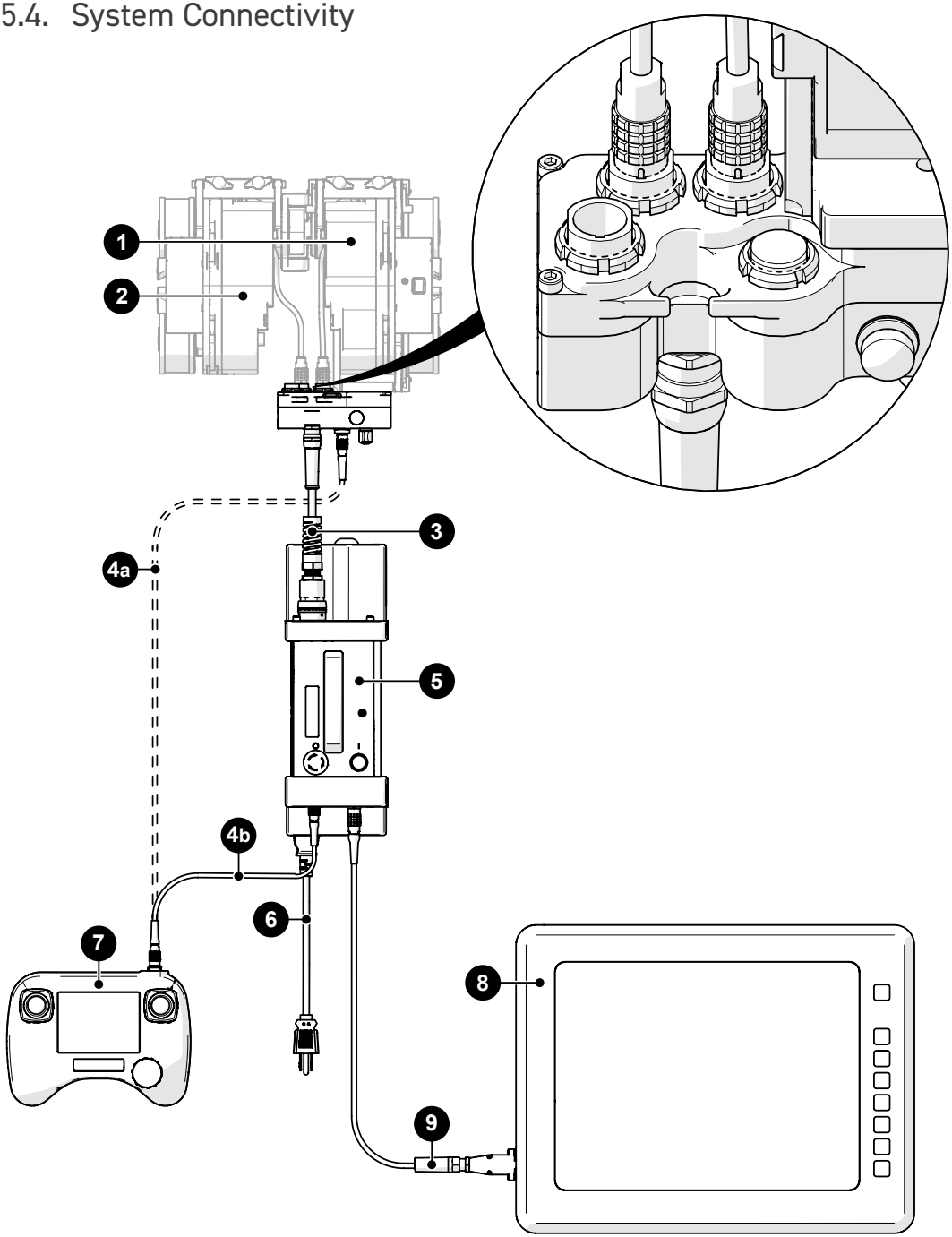


Fig. 106 - Standard crawler configuration

BOM ID	Description
1	Right drive module
2	Left drive module
3	Umbilical
4a	Auxiliary cable *(alternate)*
4b	Auxiliary cable
5	Power controller
6	Power cord
7	Handheld controller
8	User instrument
9	Encoder cable

To configure the **NAVIC** system for scanning, follow these steps:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 3 umbilical to 1 right drive module of the crawler.
2. Connect 3 umbilical to 5 power controller.
3. Connect 7 handheld controller to 5 power controller using the 4b auxiliary cable.

   NOTE: *The 7 handheld controller may also be connected directly to the 3 umbilical using the 4a auxiliary cable.*

4. Connect 9 encoder cable from the 8 user's instrument to the 5 power controller.
5. Plug the 6 power cable into an appropriate power source *(see "Power Requirements" on page 8).*
6. *(see "Configurations" on page 46)* to setup a particular accessory.

5.5. Configurations

5.5.1. Single Drive Module with Frame Bar

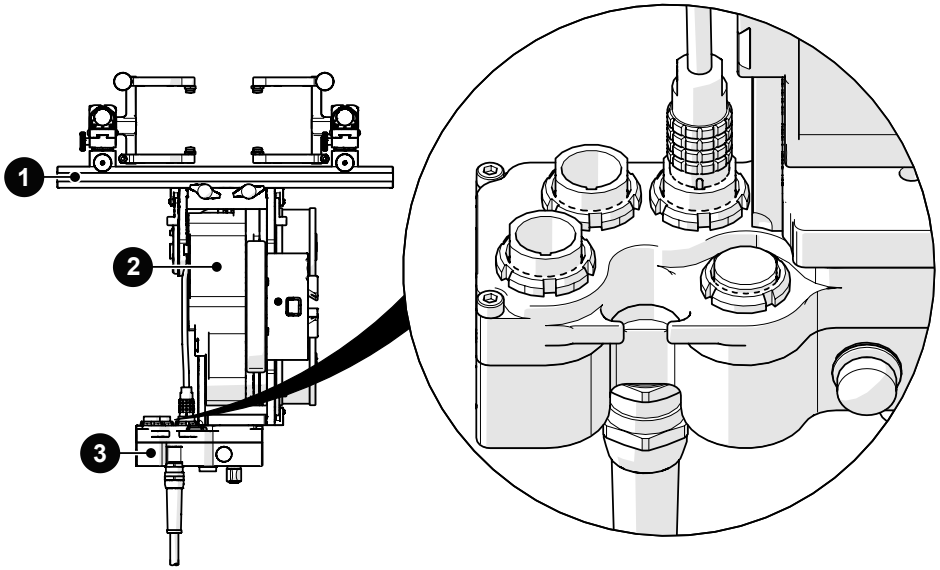


Fig. 107 - Single drive module configuration

BOM ID	Description
1	Frame bar
2	Right drive module
3	Umbilical

To configure the **NAVIC** system for scanning using a single drive module with a frame bar, follow these steps:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Separate the left and right drive modules *(see "Connecting/Disconnecting Left and Right Modules" on page 67).*
2. Mount and connect the 3 umbilical to 2 right drive module.
3. Attach a configured 1 frame bar to the 2 right drive module *(see "Swivel Mount" on page 65).*

5.5.2. Crawler with Actuated Probe Lift

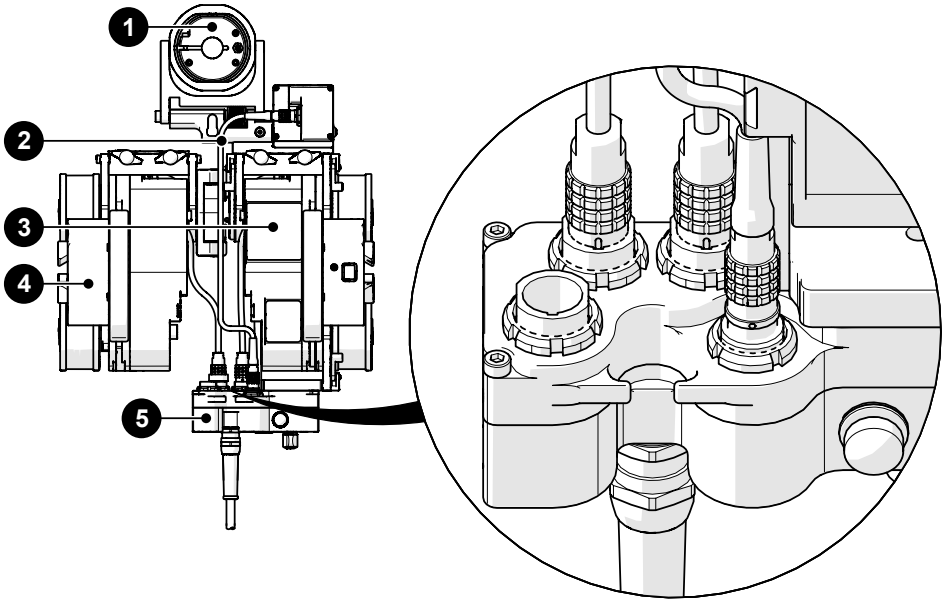


Fig. 108 - Standard NAVIC configuration with actuated probe lift

BOM ID	Description
1	Actuated probe lift
2	Auxiliary cable
3	Right drive module
4	Left drive module
5	Umbilical

To configure the **NAVIC** system for single line corrosion scanning using dual drive modules with a actuated probe lift, follow these steps *(see "Actuated Probe Lift" user manual)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 5 umbilical to 3 right drive module of the crawler.
2. Attach the 1 actuated probe lift *(see "Actuated Probe Lift" user manual)* to the 3 right drive module *(see "Swivel Mount" on page 60)*.
3. Connect the 2 auxiliary cable to the 1 actuated probe lift and to the 6 umbilical.

5.5.3. Crawler with Multiple Probe Holders

5.5.3.1 Probe Holder Frame

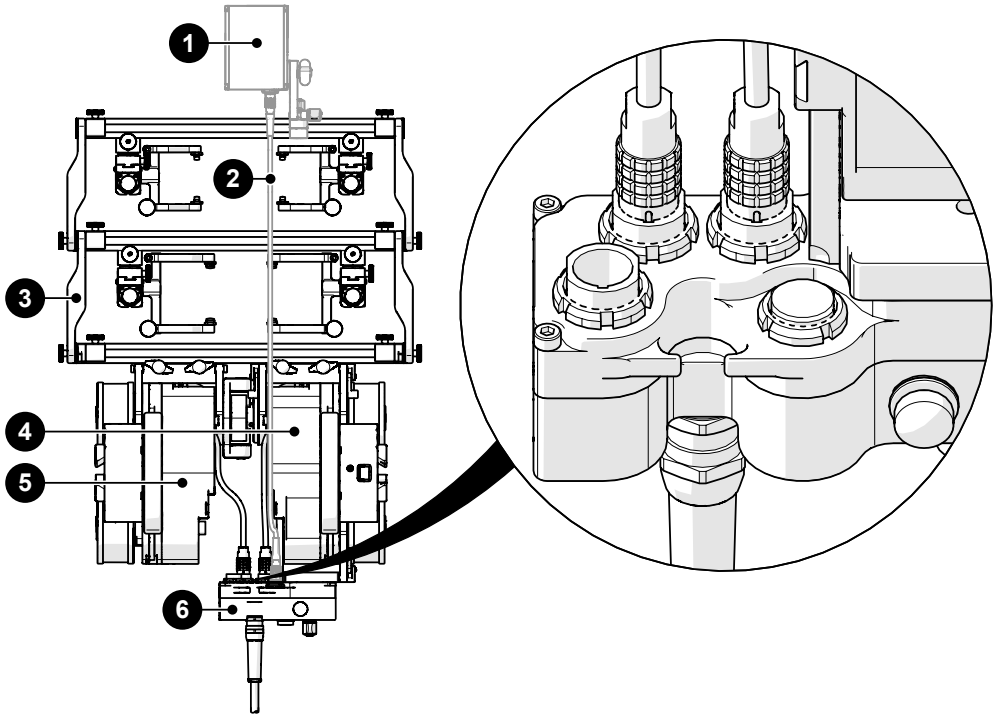


Fig. 109 - Standard crawler configuration with probe holder frame

BOM ID	Description
1	Tracker
2	Tracker cable
3	Vertical probe holder frame
4	Right drive module
5	Left drive module
6	Umbilical

To configure the **NAVIC** system for scanning using dual drive modules with a probe holder frame, follow these steps *(see "Vertical Probe Holder Frame - Flat or Circumferential Only" on page 106)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 6 umbilical to 4 right drive module of the crawler.
2. Attach a configured 3 probe holder frame *(see "Vertical Probe Holder Frame - Flat or Circumferential Only" on page 106)* to the crawler *(see "Swivel Mount" on page 60)*.
3. Optional:
   - Attach the 1 tracker *(see "Tracker" user manual)* to the front of the 3 probe holder frame.
   - Connect the 2 auxiliary cable to the 6 umbilical's 4-pin expansion connector.

5.5.3.2 Low Profile Probe Holder Frame

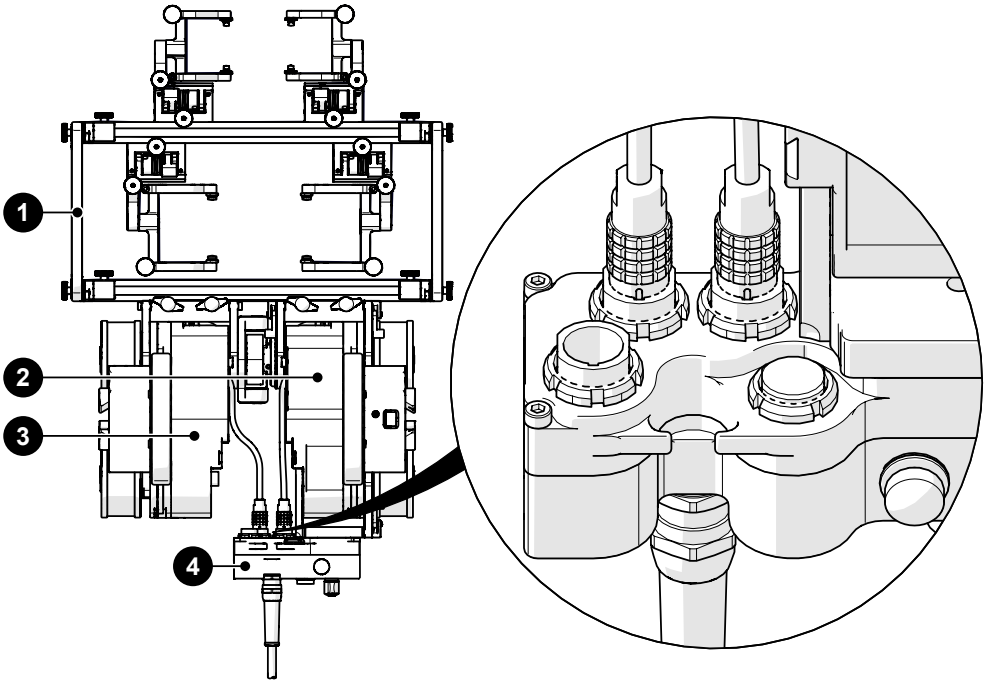


Fig. 110 - Standard crawler configuration with low profile probe holder frame

BOM ID	Description
1	Low profile probe holder frame
2	Right drive module
3	Left drive module
4	Umbilical

To configure the **NAVIC** system for scanning using dual drive modules with a low profile probe holder frame, follow these steps *(see "Low Profile Probe Holder Frame - Flat or Circumferential Only" on page 110)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 4 umbilical to 2 right drive module of the crawler.
2. Attach a configured 1 low profile probe holder frame *(see "Low Profile Probe Holder Frame - Flat or Circumferential Only" on page 110)* to the crawler *(see "Umbilical" on page 61)*.

5.5.3.3 Pivoting Probe Holder Frame

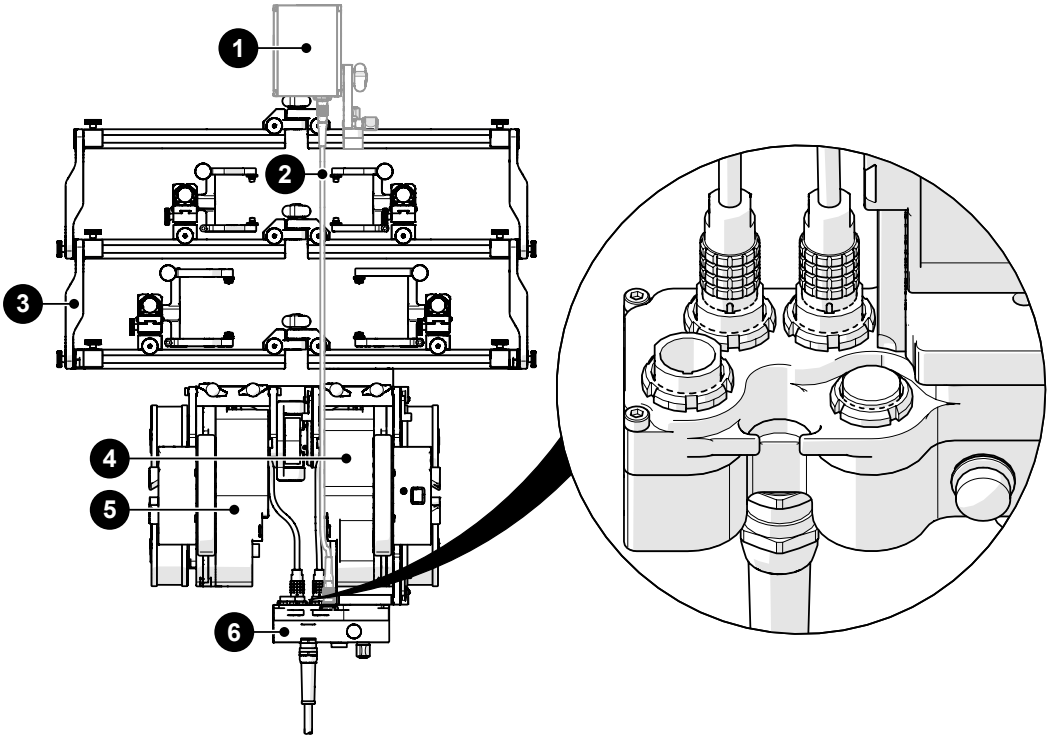


Fig. 111 - Standard crawler configuration with pivoting probe holder frame

BOM ID	Description
1	Tracker
2	Auxiliary cable
3	Pivoting probe holder frame
4	Right drive module
5	Left drive module
6	Umbilical

To configure the **NAVIC** system for scanning using dual drive modules with a pivoting probe holder frame, follow these steps *(see "Pivoting Probe Holder Frame" on page 114)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 6 umbilical to 4 right drive module of the crawler.
2. Attach a configured 3 pivoting probe holder frame *(see "Pivoting Probe Holder Frame" on page 114)* to the crawler *(see "Swivel Mount" on page 60)*.
3. Optional:
   - Attach the 1 tracker *(see "Tracker" user manual)* to the front of the 3 pivoting probe holder frame.
   - Connect the 2 auxiliary cable to the 6 umbilical's 4-pin expansion connector.

5.5.3.4 Flange

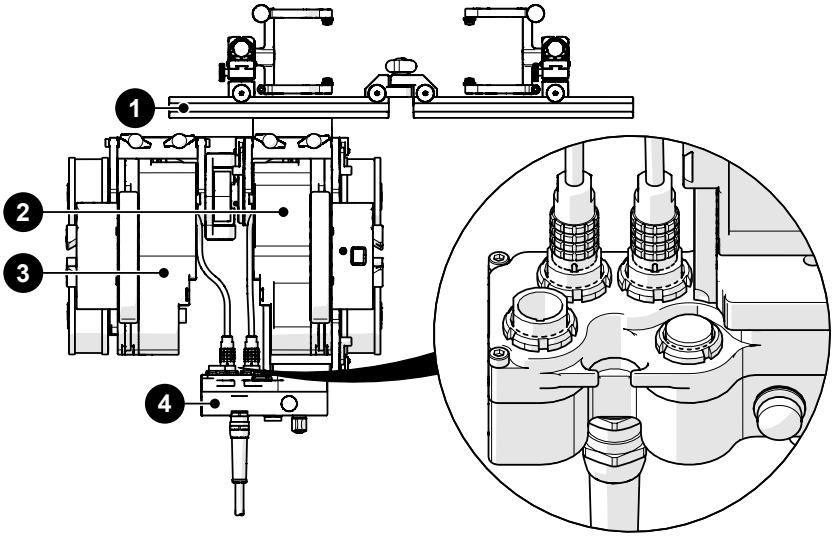


Fig. 112 - Standard crawler configuration with pivoting probe holder frame configured for flange scanning

BOM ID	Description
1	Flange probe holder frame
2	Right drive module
3	Left drive module
4	Umbilical

To configure the **NAVIC** system for scanning using dual drive modules with a pivoting probe holder frame configured for flange scanning, follow these steps *(see "Pivoting Probe Holder Frame - Flange Scanning" on page 118)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Mount and connect the 4 umbilical to 2 right drive module of the crawler.
2. Attach a configured 1 flange probe holder frame *(see "Pivoting Probe Holder Frame - Flange Scanning" on page 118)* to the crawler *(see "Swivel Mount" on page 60)*.

5.5.4. 3-Axis Nozzle Scanning

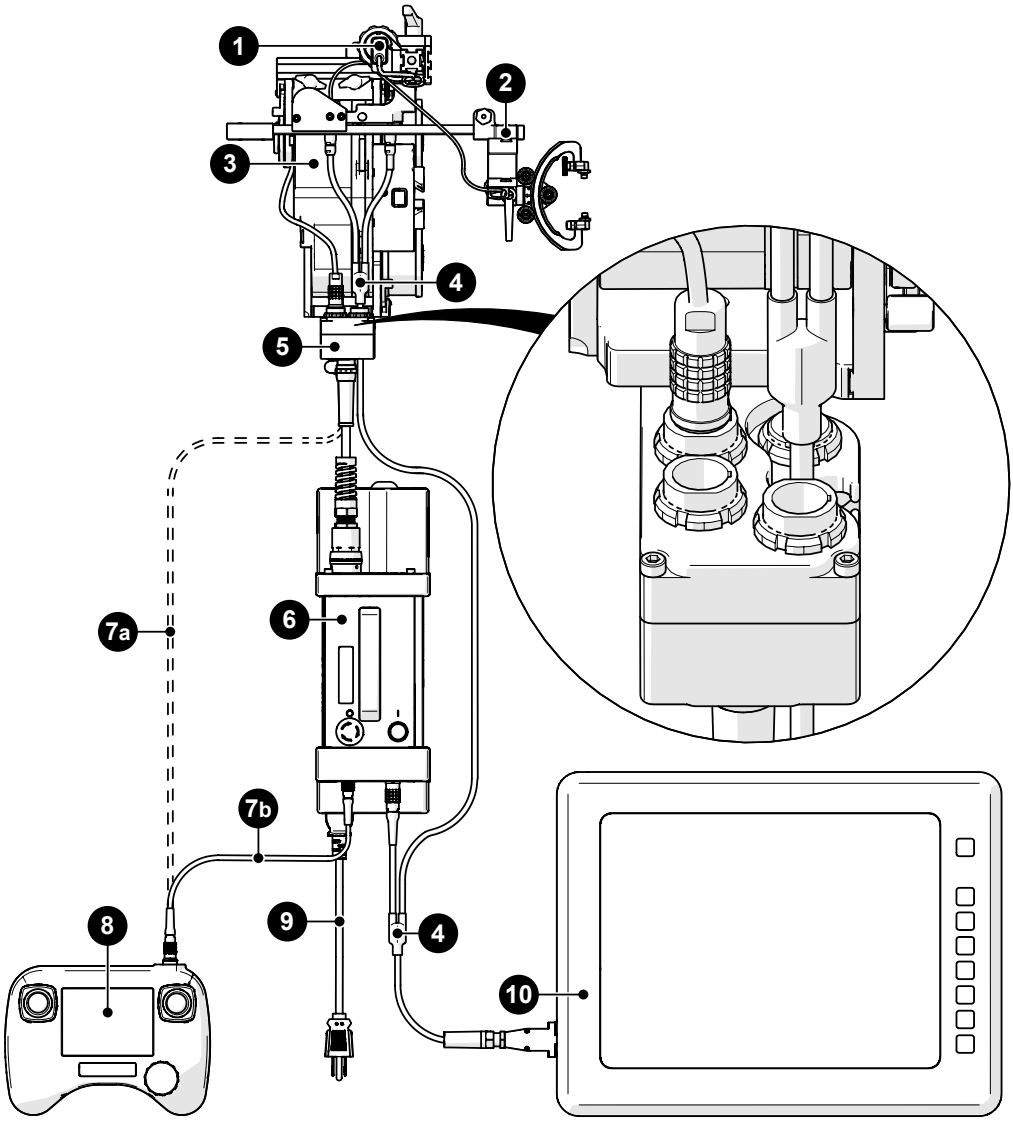


Fig. 113 - Single module with nozzle scanner configuration

BOM ID	Description	BOM ID	
1	Slider PPS encoder	6	Power controller
2	Encoded skew vertical P.H.	7a	Auxiliary cable
3	Right drive module	7b	Auxiliary cable (alternate)
4	3-axis encoder cable	8	Handheld controller
5	Umbilical	9	Power cord
		10	User instrument

To configure the **NAVIC** system for scanning using a single module and a 3-axis nozzle scanning system, follow these steps *(see "3-Axis Nozzle Scanning" on page 87)*:

CAUTION! DO NOT DISCONNECT UNDER LOAD. Shut off power before connection or disconnecting. Permanent damage to electronics could occur.

1. Separate the crawler's drive modules *(see "Connecting/Disconnecting Left and Right Modules" on page 67)*.
2. Mount and connect the 5 umbilical at a 90° angle to 3 right drive module.
3. Connect the 5 umbilical to the 6 power controller.
4. Connect the 8 handheld controller to the 6 power controller using the 7b auxiliary cable.

   NOTE: *The 8 handheld controller may also be connected directly to the 5 umbilical using the 7a auxiliary cable.*

5. Mount the appropriate 3-axis nozzle configuration to the swivel mount of the crawler.
6. Connect the 4 3-axis encoder cable to the encoder cables of the 2 encoded skew vertical probe holder and the 1 slider pps encoder.
7. Connect the opposite end of the 4 3-axis encoder cable to the 10 user's instrument and to the 6 power controller.

5.6. Right Drive Module

5.6.1. Swivel Mount

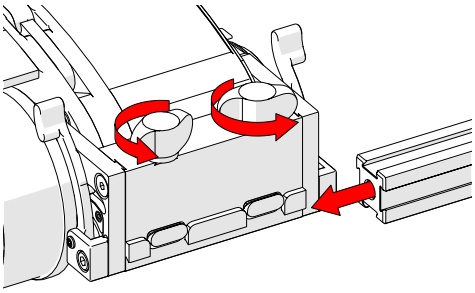


Fig. 114 - Frame bar installation

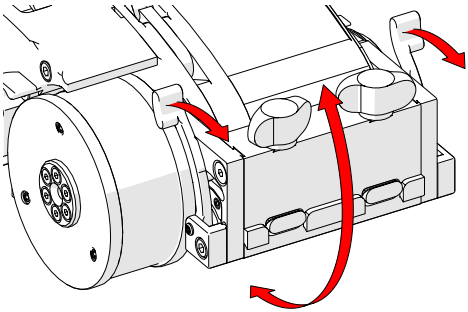


Fig. 115 - Swivel mount angle

Located at the front of the right drive module, the swivel mount is used to connect scanning accessories such as a raster arm module or probe frame system.

Rotate the two black wing knobs *(Fig. 114)* to loosen the dovetail jaws. Slide the accessory's frame bar along the dovetail jaws. Rotate the two black wing knobs to clamp the frame system/raster arm in place.

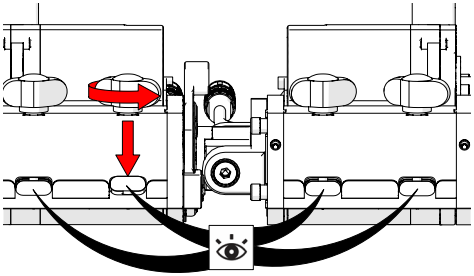


Fig. 116 - Align dovetail jaws

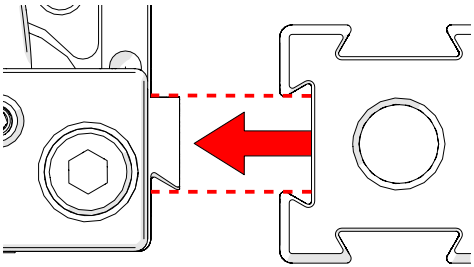


Fig. 117 - Mount frame bar

Alternatively, accessories can also be mounted straight to the swivel mount. Rotate the black wing knobs aligning the dovetail jaws with the mount's grooves *(Fig. 116)*. Press the frame bar or accessory to the swivel mount *(Fig. 117)* and tighten the black wing knobs.

The front mount utilizes two levers *(Fig. 115)* to lock the front mount at the desired angle.

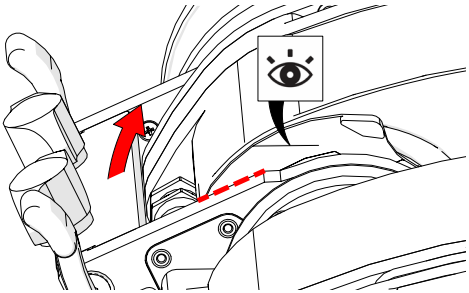


Fig. 118 - Pivot swivel mount

The etched line *(Fig. 118)* is to be used to align the front swivel mount to a horizontal position *(Fig. 119)*.

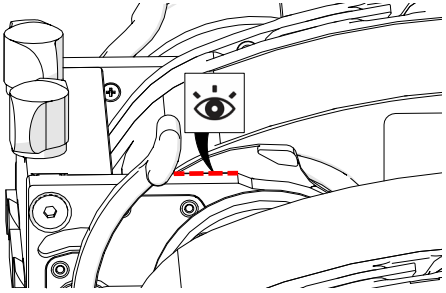


Fig. 119 - Align swivel mount with etched line

5.6.2. Umbilical

WARNING! FALLING OBJECT HAZARD.
For operating at heights greater than 2 m *(6 ft)*, ensure the umbilical strain relief is aligned according to the below instructions and never points upwards as shown in *(Fig. 120)*. The crawler could fall.
SEVERE INJURY or **DEATH** could result.

To mount the umbilical to the crawler's umbilical mount, follow these steps:

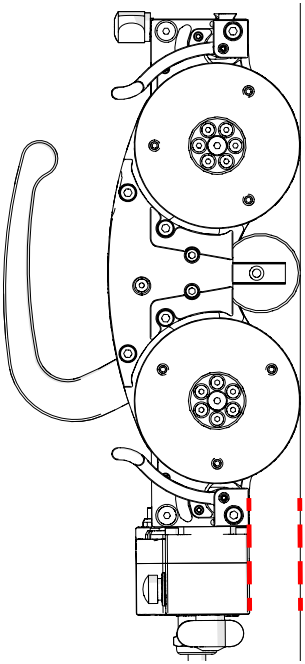


Fig. 120 - Align umbilical mount

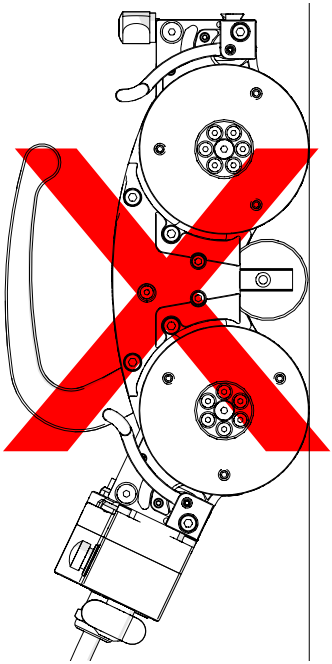


Fig. 121 - Incorrect use

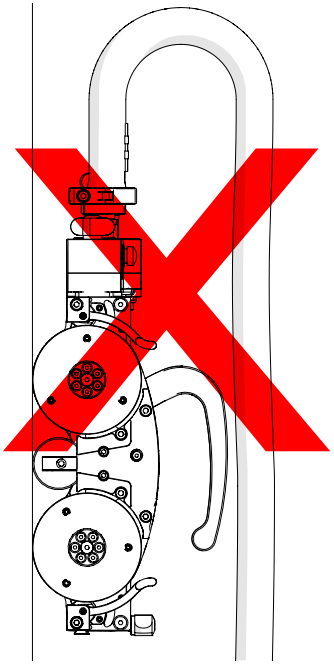


Fig. 122 - Incorrect use

1. For scanning at heights greater than 2 m *(6 ft)* the umbilical must be set

parallel to the scanning surface *(Fig. 120)*.

2. Do not have umbilical pivoted away from the inspection surface *(Fig. 121)*.
3. Ensure the umbilical strain relief never points downwards during operation *(Fig. 122)*.

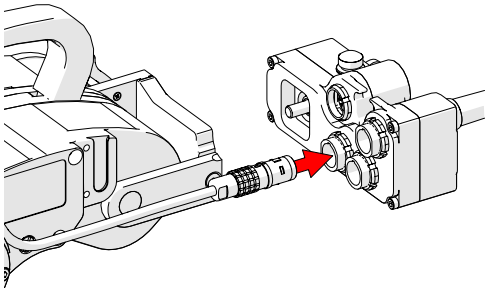


Fig. 123 - Connect to umbilical

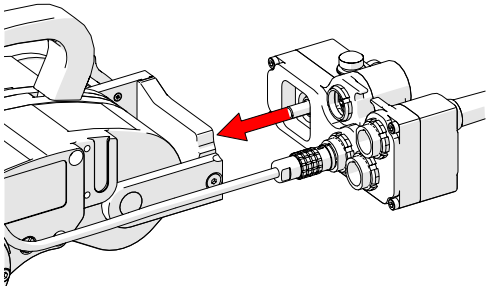


Fig. 124 - Align with drive module mount

4. Connect the right drive module's connector to the umbilical *(Fig. 123)*.
5. Align the umbilical to the umbilical mount of the drive module *(Fig. 124)*.

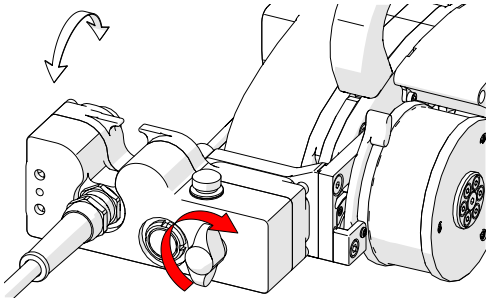


Fig. 125 - Tighten knob

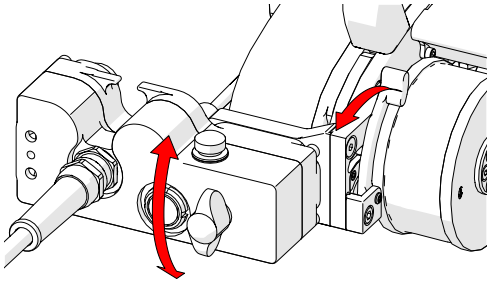


Fig. 126 - Adjust umbilical mount angle

6. Fasten the umbilical to the crawler's umbilical mount by tightening the black wing knob *(Fig. 125)*.
7. Unlock the umbilical mount lock lever, align the umbilical parallel to the scan surface *(Fig. 127)*, and lock *(Fig. 126)*.

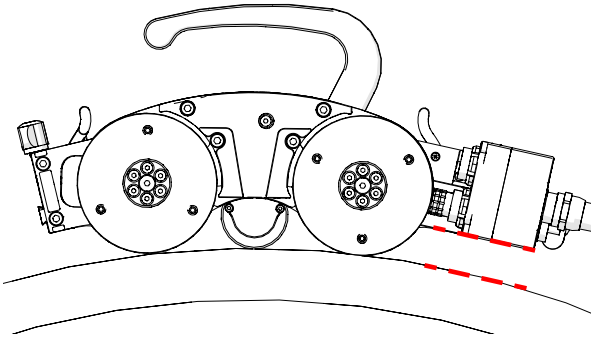


Fig. 127 - Align umbilical parallel to scan surface

5.6.3. Handle

The handle is removable to achieve low profile scanning.

To remove the handle:

Lift the handle lock latch *(Fig. 128)*. Pivot the handle down *(Fig. 129)* and then pull the handle up to remove from the drive module *(Fig. 130)*.

To reinstall the handle, reverse the preceding steps.

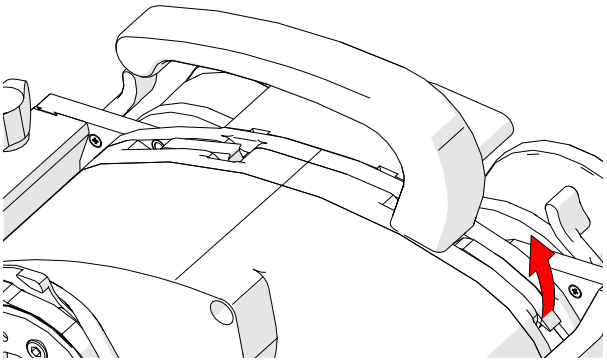


Fig. 128 - Lift handle lock latch

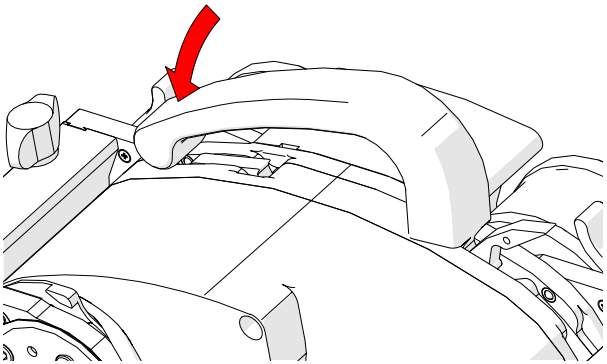


Fig. 129 - Pivot handle nose down

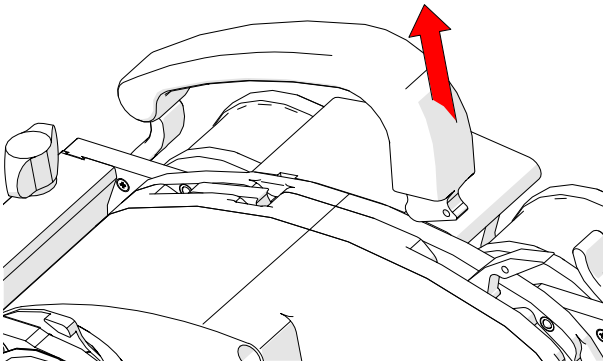


Fig. 130 - Lift handle from module

5.6.4. Dovetail Accessory Mount

Affix optional accessories to the crawler, such as a **NAVIC** backpack, using the dovetail accessory mount.

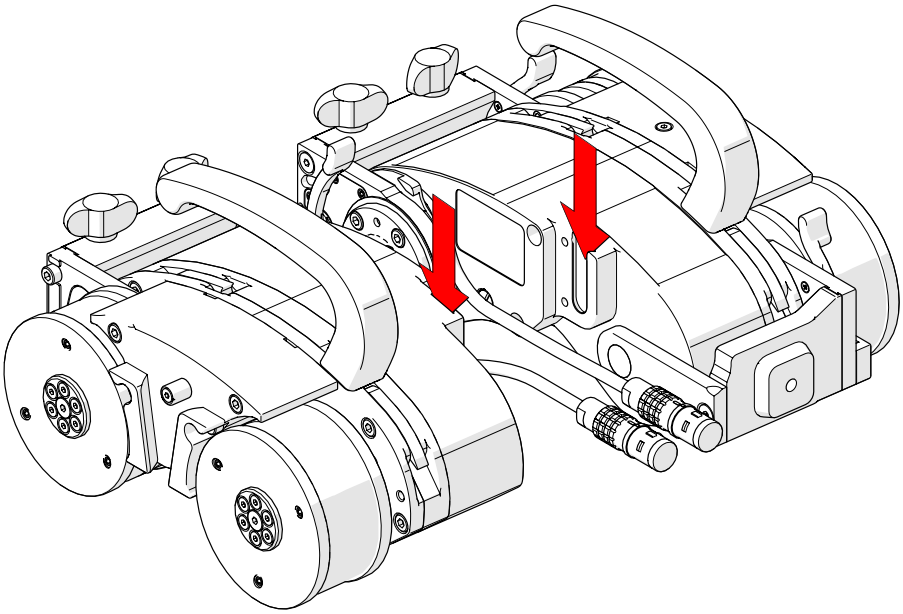


Fig. 131 - Dovetail accessory mounts

5.7. Left Drive Module

5.7.1. Swivel Mount

Located at the front of the left drive module, the swivel mount is used to connect scanning accessories such as a raster arm module or probe frame system.

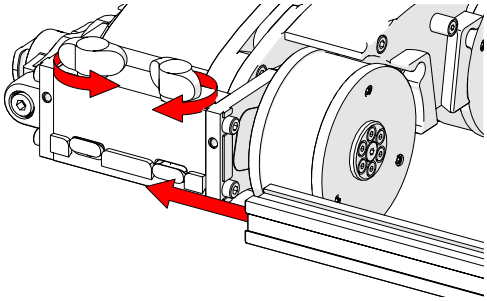


Fig. 132 - Frame bar installation

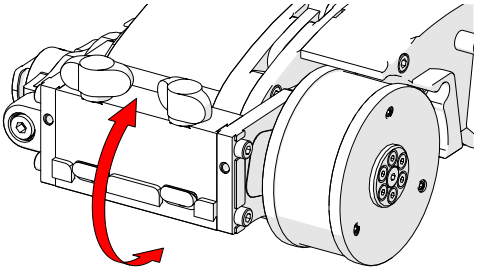


Fig. 133 - Swivel mount angle

Rotate the two black wing knobs *(Fig. 132)* to loosen the dovetail jaws. Slide the accessory's frame bar along the dovetail jaws. Rotate the two black wing knobs to clamp the frame system/raster arm in place.

The front mount pivots freely *(Fig. 133)* and cannot be locked in a fixed position. When a frame bar is connected to both dovetail mounts on the two modules, this free movement allows the scanner to flex while steering.

> ***TIP:*** *Alternate mounting procedure is possible (see "Swivel Mount" on page 60 for additional details).*

5.7.2. Umbilical Connection

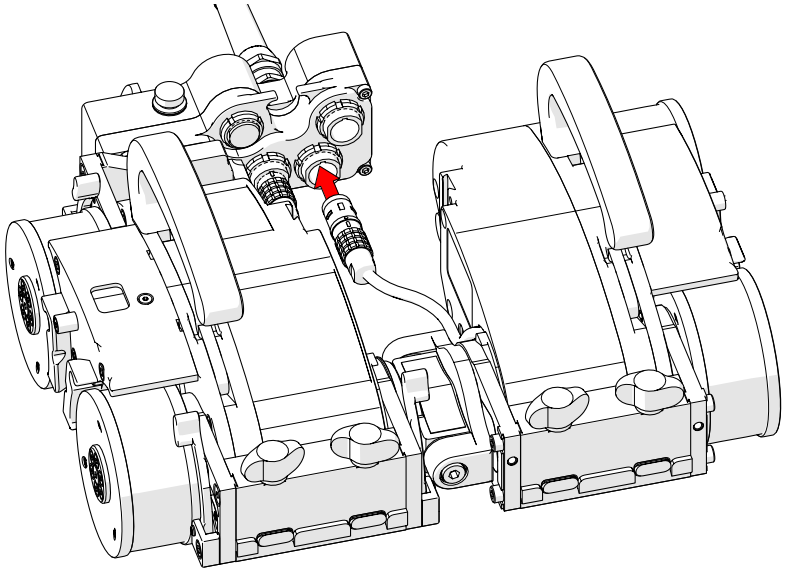


Fig. 134 - Connect to umbilical

1. Connect the left drive module's connector to umbilical *(see "Umbilical" on page 29 for additional details)*.

5.7.3. Handle

(see "Handle" on page 63)

5.7.4. Dove-tail Accessory Mount

(see "Dovetail Accessory Mount" on page 64)

5.7.5. Connecting/Disconnecting Left and Right Modules

CAUTION! PINCH POINT HAZARD. Keep fingers clear of pinch points when connecting/ disconnecting left and right modules.

TIP: *This operation is best performed with two people.*

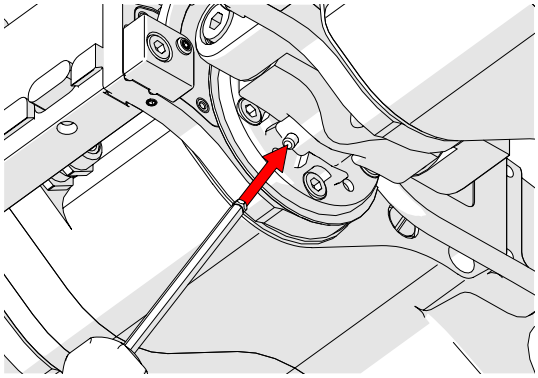


Fig. 135 - Press release pin

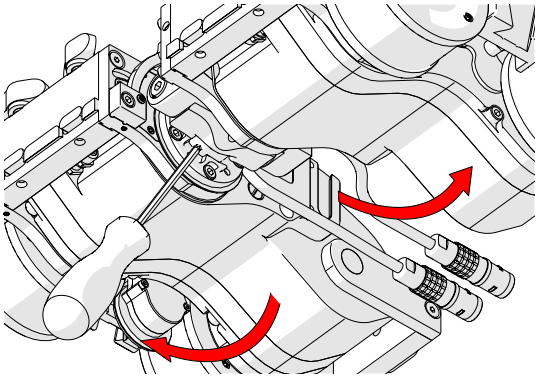


Fig. 136 - Press pin and rotate modules

1. Locate the release pin at the bottom of the **NAVIC** *(Fig. 135)*. Using the supplied 3 mm hex driver, press the pin while rotating the two modules *(Fig. 136)*.

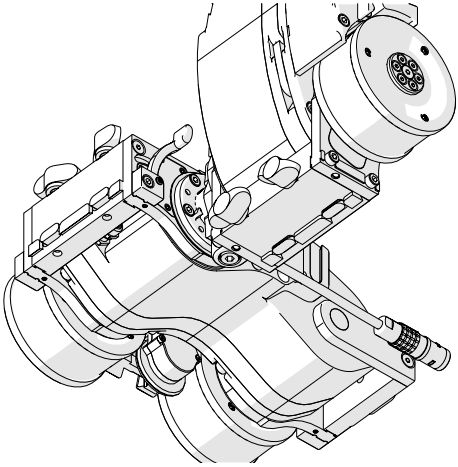


Fig. 137 - Rotate modules to 90°

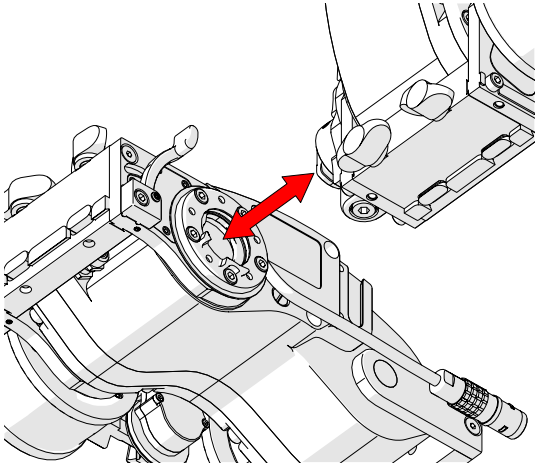


Fig. 138 - Pull modules apart

2. Once the two modules are 90° perpendicular *(Fig. 137)*, gently pull the two modules apart *(Fig. 138)*.

3. Label the left drive module with a magnetic warning that is clearly visible.

WARNING! MAGNETIC MATERIAL. The wheels of 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. People with pacemakers or ICD's must stay at least 75 cm *(30 in)* away.

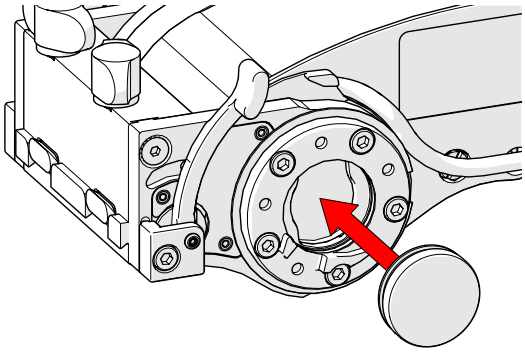


Fig. 139 - Use cap on connection pivot

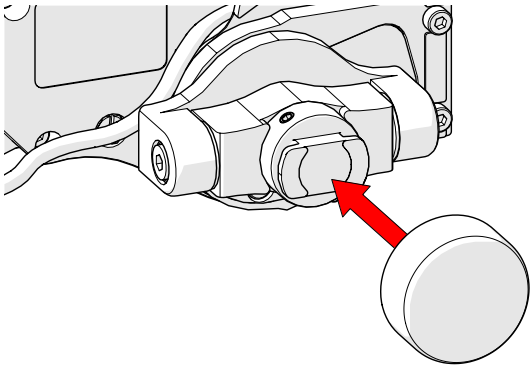


Fig. 140 - Use cap on connection pivot

4. Always use the provided caps to protect the connection pivots from dirt, dust, mud, etc.

> ***NOTE:*** *When modules are separated. It is imperative the connection pivots remain free of dirt, sand, mud, etc. If contamination of the pivots occurs, clean the pivots thoroughly. Once the pivot connections are completely free of debris, apply a liberal amount of anti-seize compound (e.g. Kopr Kote®) to the connection pivots of both modules.*

5.7.6. Probe Holders

5.7.7. Vertical Probe Holder

A	Latch
B	Probe Holder Adjustment Knob
C	Vertical Adjustment Knob
D	Pivot Buttons
E	Probe Holder Arms
F	Yoke
G	Probe Holder Arm Adjustment Knob
H	Transverse Adjustment Screw
I	Frame Bar

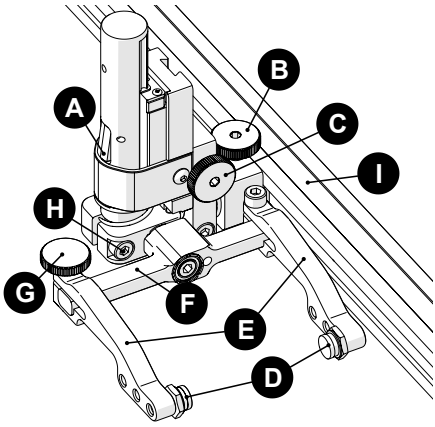


Fig. 141 - Vertical probe holder

5.7.7.1 Probe Holder Setup

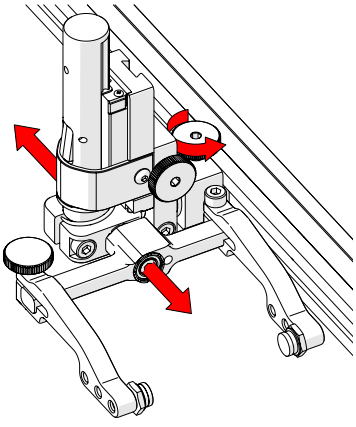


Fig. 142 - Adjust on frame bar

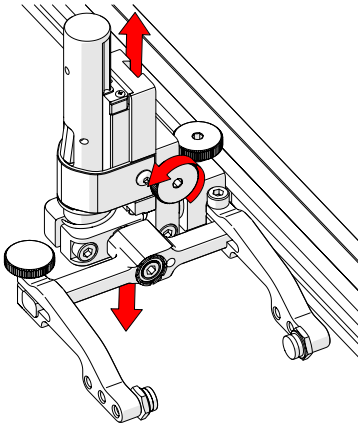


Fig. 143 - Vertical adjustment

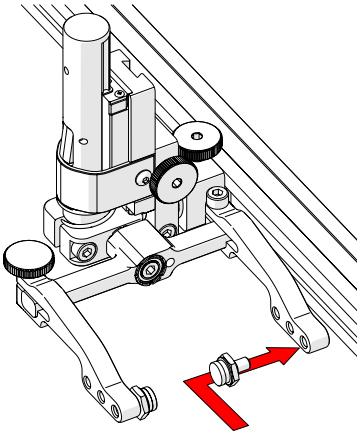


Fig. 144 - Place buttons

1. The probe holder adjustment knob allows the probe holder to be attached to a frame bar, as well as horizontal positioning on a frame bar *(Fig. 142)*.
2. Vertical adjustment knob allows the vertical probe holder height adjustment *(Fig. 143)*.
3. Position the pivot buttons where necessary. When a narrow scanning footprint is required, use the pivot button holes closet to the yoke *(Fig. 144)*.

> ***TIP:*** *Probe pivoting may be impeded when closer to the yoke.*

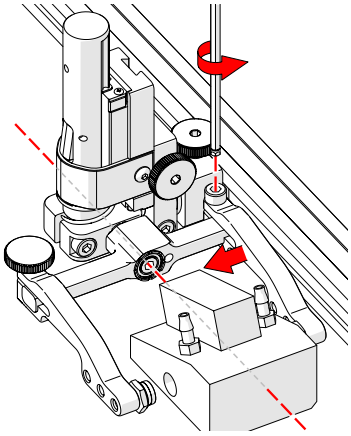


Fig. 145 - Adjust inner arm

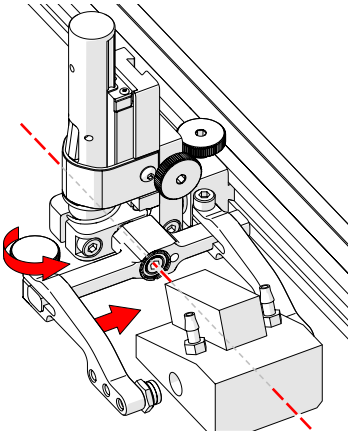


Fig. 146 - Adjust outer arm

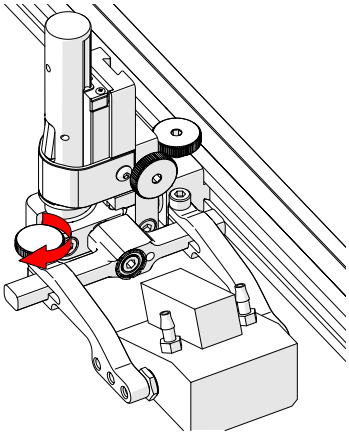


Fig. 147 - Tighten arm knob

4. Position the wedge on the inner probe holder arm *(Fig. 145)*.

> ***TIP:*** *The probe holder yoke can accommodate many different probe and wedge sizes of varying widths. It is best to centre the wedge with the yoke's pivot axis. This can reduce wedge 'rocking' when scanning. Position the inner probe holder arm accordingly (Fig. 145) using the supplied 3 mm hex driver (Fig. 50).*

5. Loosen the probe holder arm adjustment knob *(Fig. 146)* and slide the probe holder arm along the yoke pinching the wedge in place.
6. Tighten the probe holder arm adjustment knob *(Fig. 147)*.

5.7.7.2 Probe Holder Vertical Adjustment

To adjust the probe holder vertically, follow these steps:

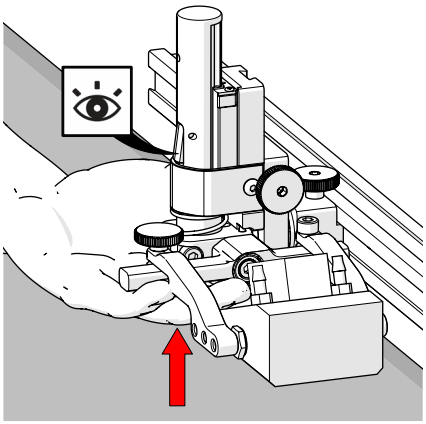


Fig. 148 - Latch probe holder

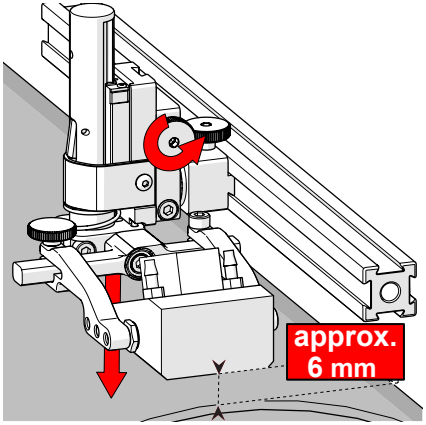


Fig. 149 - Lower toward scan surface

1. Ensure the probe holder is in the latched, upper position. Lift the probe

holder until the latch is fully exposed and snaps out to lock *(Fig. 148)*.

2. Loosen the vertical adjustment knob and slide the probe holder down until the wedge is approximately 6 mm ***(¼ in)*** above inspection surface.
3. Tighten the vertical adjustment knob *(Fig. 149)*.

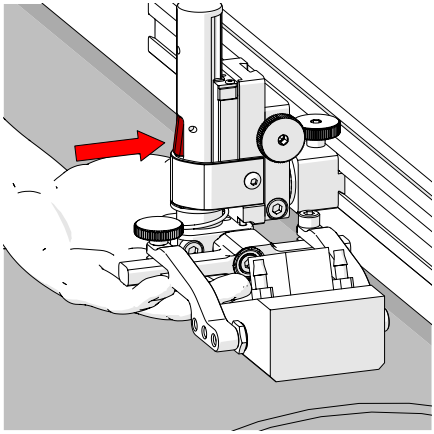


Fig. 150 - Press latch button

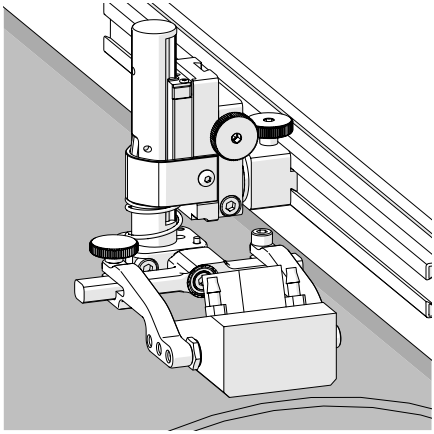


Fig. 151 - Lower toward scan surface

4. Lift the yoke slightly and press the latch button *(Fig. 150)*, then slowly lower towards scanning surface to apply spring pressure to the wedge *(Fig. 151)*.

> ***TIP:*** *If less spring force is desired, refer to step 2 and place the wedge approximately 20 mm (¾ in) above inspection surface.*

5.7.7.3 Probe Holder Transverse Adjustment

To adjust the probe holder's transverse angle, follow these steps:

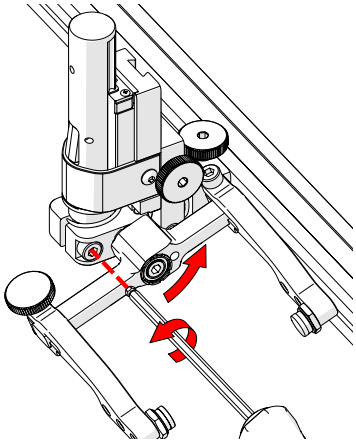


Fig. 152 - Loosen 3 mm screw

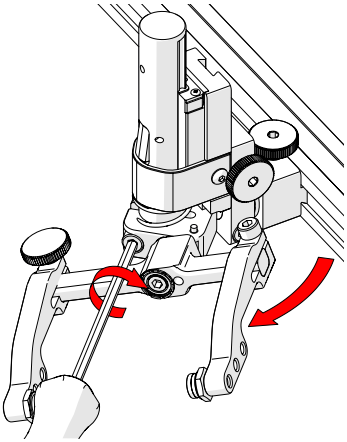


Fig. 153 - Rotate and tighten

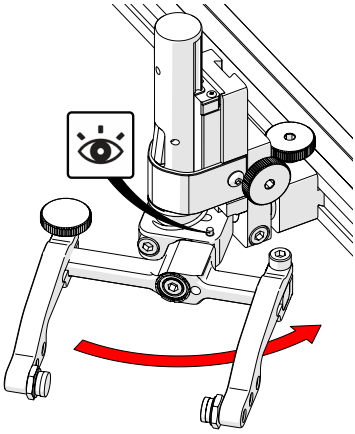


Fig. 154 - Stop post locates 90°

1. Ensure the probe holder is in latched, upper position *(Fig. 148)*.

2. Using the supplied 3 mm hex driver loosen the transverse adjustment screw *(Fig. 152)* and rotate the yoke about the vertical shaft achieving the desired angle.
3. Tighten the transverse adjustment screw *(Fig. 153)*.

To return the transverse adjustment to neutral *(90°)*. The probe holder must be in the latched, upper position *(Fig. 148)*. Rotate the yoke until the stop post contacts the base of the probe holder *(Fig. 154)*. Then tighten the transverse adjustment screw.

5.7.7.4 Probe Holder Longitudinal Adjustment

To adjust the probe holder's vertical angle for longitudinal scanning, follow these steps:

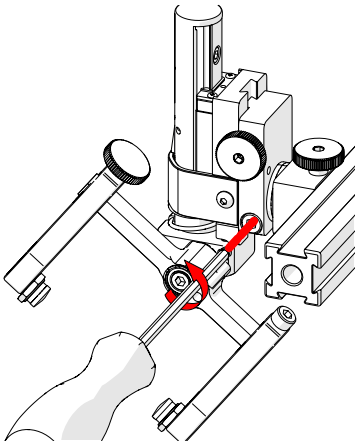


Fig. 155 - Loosen 3 mm screw

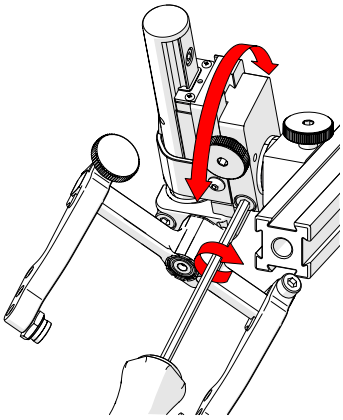


Fig. 156 - Rotate to position

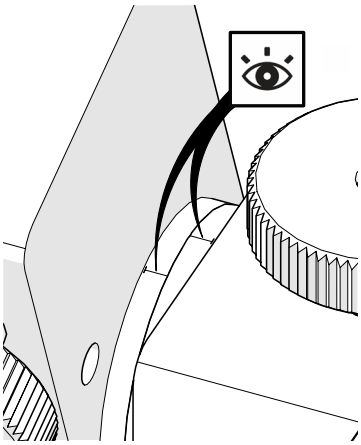


Fig. 157 - Line up markers

1. Ensure the probe holder is in latched, upper position *(Fig. 148)*.
2. Using the supplied 3 mm hex driver *(Fig. 50)*, loosen the longitudinal adjustment screw *(Fig. 155)*.
3. Rotate the main body of the probe holder until it is at the desired angle *(Fig. 156)*.
4. Tighten the longitudinal adjustment screw *(Fig. 156)*.

To return the longitudinal adjustment to neutral *(90°)*. Line up the longitudinal adjustment indicator markers *(Fig. 157)*.

5.7.7.5 Probe Holder Left/Right Conversion

To reverse the probe holder, follow these steps:

> ***NOTE:*** *To perform this operation the 1.5 mm hex wrench (Fig. 53) is required.*

1. Ensure the probe holder is in latched, upper position *(Fig. 148)*.

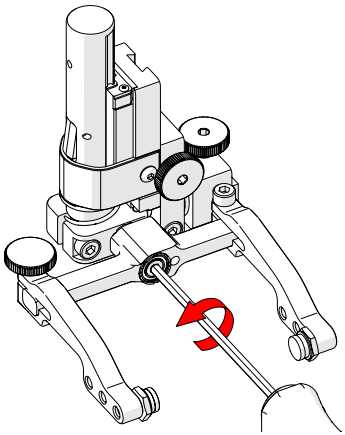


Fig. 158 - Unscrew yoke pivot screw

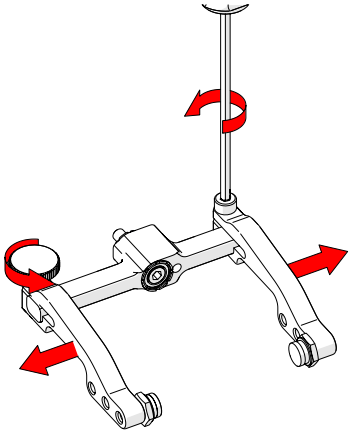


Fig. 159 - Remove probe holder arms

2. Using the supplied 3 mm hex driver *(Fig. 50)*, unscrew the yoke pivot screw and remove yoke *(Fig. 158)*.
3. Loosen the probe holder arm adjustment knob and the arm clamp screw. Slide the probe holder arms off the yoke *(Fig. 159)*.

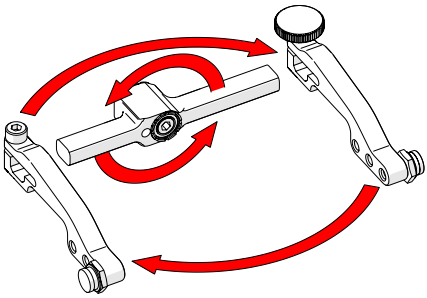


Fig. 160 - Flip yoke and reverse arms

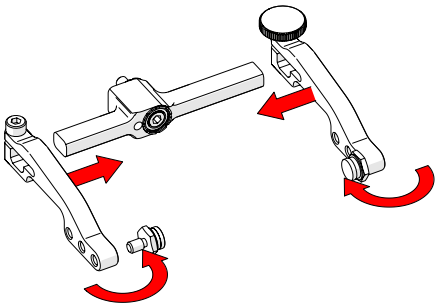


Fig. 161 - Attach arms & move buttons

4. Flip the yoke 180° and reverse the probe holder arms *(Fig. 160)*.
5. Place the pivot buttons on the inside of the probe holder arms *(Fig. 161)* using a 3/8 in wrench *(Fig. 51)*.

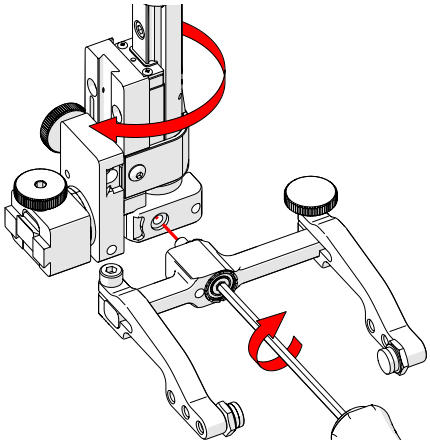


Fig. 162 - Screw yoke to opposite side

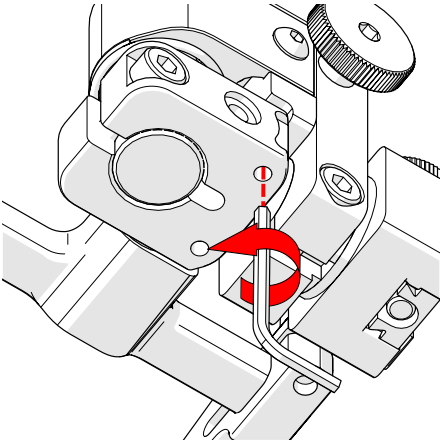


Fig. 163 - Lower 90° stop post

6. Mount the yoke to the opposite side of the base using the supplied 3 mm hex driver *(Fig. 162)*.

> ***TIP:*** *Keep the yoke level with the base as to ensure no conflicts with the plunger/set screw attached to the yoke.*

7. Locate the recessed M3 screw *(stop post)* on the bottom of the probe holder. Unscrew the stop post using a 1.5 mm hex wrench until it has cleared all obstructions. Do not remove stop post *(Fig. 163)*.

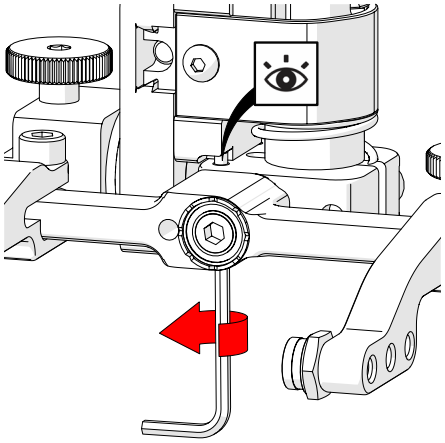


Fig. 164 - Raise opposite 90° stop post

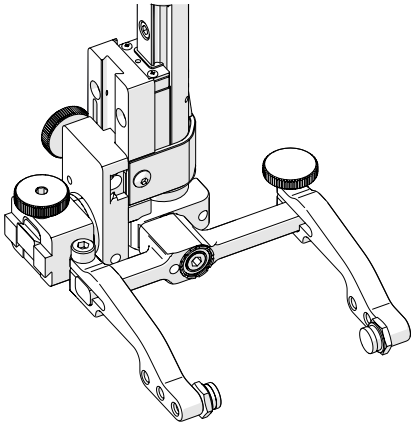
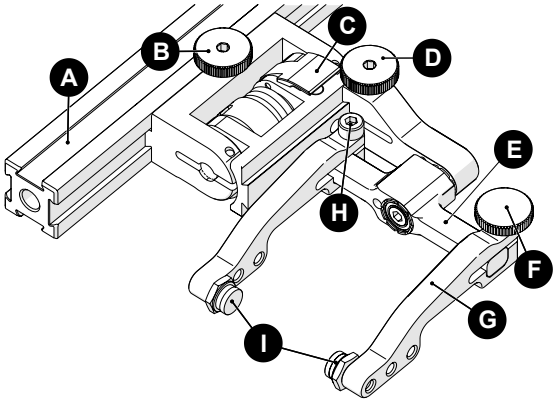


Fig. 165 - Reversed probe holder

8. Raise the stop post on the opposite side until the side of the post clearly contacts the 90° stop point on the probe holder's base *(Fig. 164)*.

5.7.8. Slip Joint Probe Holder



A	Frame Bar
B	Probe Holder Adjustment Knob
C	Latch
D	Swing Arm Knob
E	Yoke
F	Probe Holder Arm Adjustment Knob
G	Probe Holder Arm
H	Arm Clamp Screw
I	Pivot Buttons

Fig. 166 - Slip Joint Probe Holder

5.7.8.1 Probe Holder Setup

To mount a UT wedge in the probe holder, follow these steps:

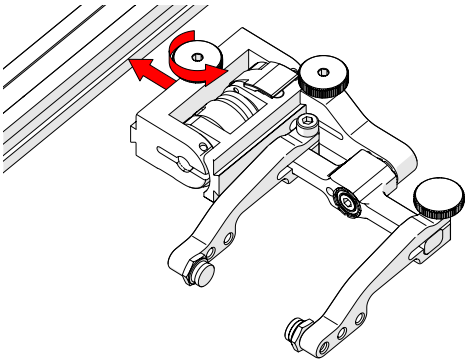


Fig. 167 - Attach to frame bar

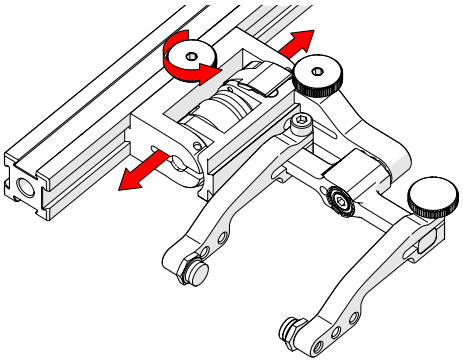


Fig. 168 - Adjust on frame bar

1. Rotate the probe holder adjustment knob and attach probe holder to a frame bar *(Fig. 167)*.
2. Use the probe holder adjustment knob to position the probe holder along the frame bar *(Fig. 168)*.

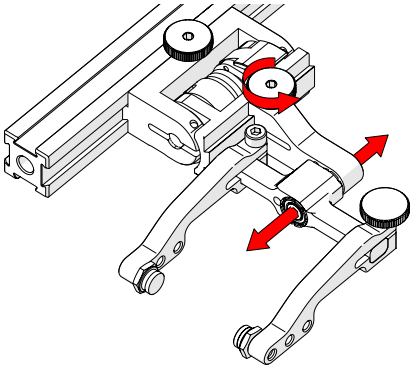


Fig. 169 - Adjust swing arm

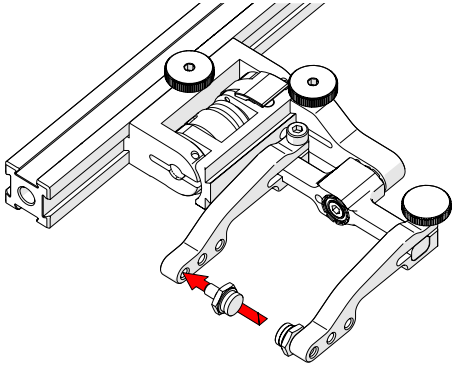


Fig. 170 - Place pivot buttons

3. Use swing arm knob to position the swing arm *(Fig. 169)*.

> ***TIP:*** *The swing arm is typically used to adjust TOFD center to center distance relative to the phased array probes on a four probe configuration.*

4. Using the supplied 3/8 in wrench *(Fig. 51)*, place the pivot buttons *(Fig. 170)* farthest from the yoke for maximum wedge clearance.

> ***TIP:*** *If narrow scanning footprint is required, use pivot button holes closest to the yoke. Wedge pivoting may be impeded when closer to the yoke.*

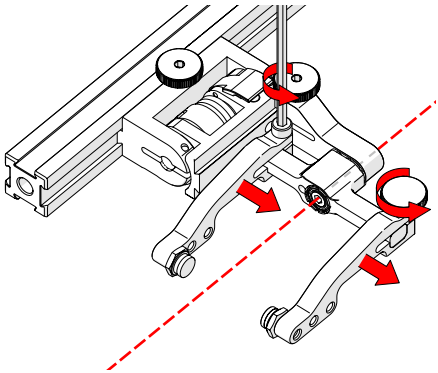


Fig. 171 - Adjust probe holder arms

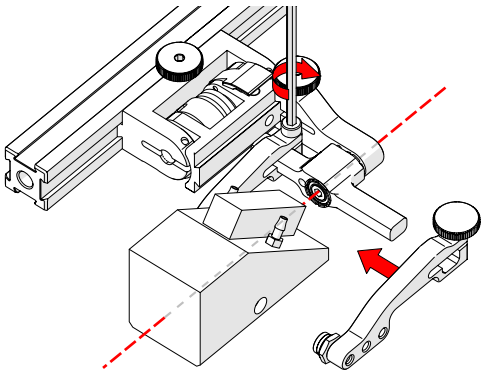


Fig. 172 - Place wedge

5. Loosen the probe holder arm adjustment knob *(Fig. 171)* and remove outer probe holder arm from yoke.
6. Adjust inner probe holder arm as required to best centre the probe on the yoke's pivot axis *(Fig. 171)*.

> ***TIP:*** *The probe holder yoke can accommodate many different probe and wedge sizes of varying widths. It is best to centre the wedge with the yoke's pivot axis to reduce wedge tipping when scanning. Position the inner probe holder arm accordingly with the centre of the yoke (Fig. 171).*

7. Position the wedge on the inner probe holder arm *(Fig. 172)*.
8. Slide outer probe holder arm along the yoke pinching the wedge in place.
9. Tighten probe holder arm adjustment knob *(Fig. 173)*.

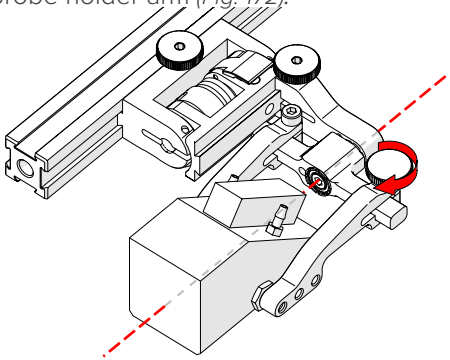


Fig. 173 - Pinch wedge with arm

5.7.8.2 Probe Holder Adjustment

To adjust the probe holder, follow these steps:

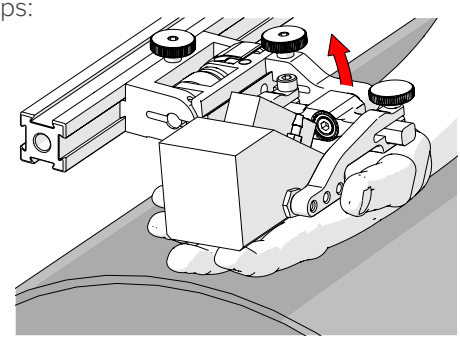


Fig. 174 - Lift to latched position

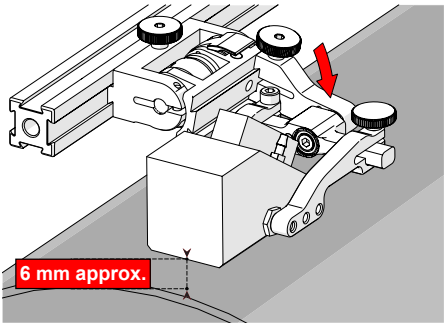


Fig. 175 - Lower to scanning surface

1. Ensure probe holder is in latched, upper position *(Fig. 174)*. If the probe holder is already latched, it will only move within the slip joint adjustment range and have no spring tension.
2. Push the probe holder yoke down toward the inspection surface until the wedge is approximately 6 mm ***(¼ in)*** from the inspection surface *(Fig. 175)*.

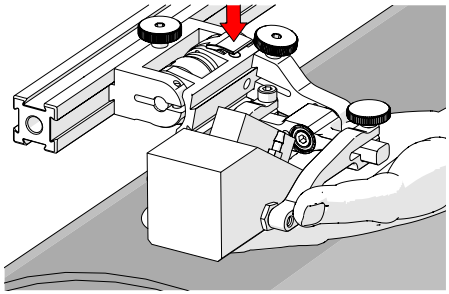


Fig. 176 - Lift and press latch button

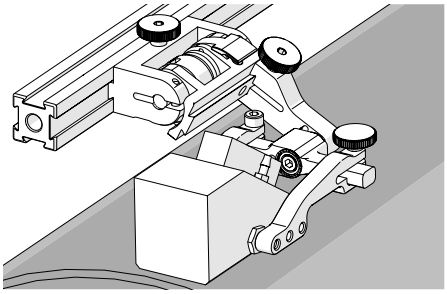


Fig. 177 - Spring loaded scan position

3. Lift probe slightly and press latch button *(Fig. 176)* to apply spring pressure to the wedge.
4. Gently lower probe holder and wedge to the scanning surface *(Fig. 177)*.

5.7.8.3 Probe Holder Force Adjustment

It is possible to adjust the tension of the probe holder spring.

> ***NOTE:*** *To perform this operation the 2 mm hex wrench (Fig. 54) and 3 mm hex wrench (Fig. 56) is required.*

Light	1 kg	2 lb
Medium	2 kg	4 lb
Heavy	3 kg	6 lb

When configured correctly, these settings exert the indicated spring force on the Probe.

To adjust the probe holder's force, follow these steps:

> ***NOTE:*** *Do not perform this operation on scanning surface.*

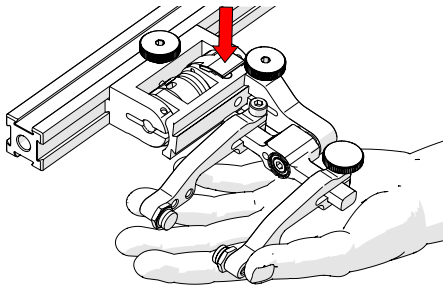


Fig. 178 - Lift slightly and press latch

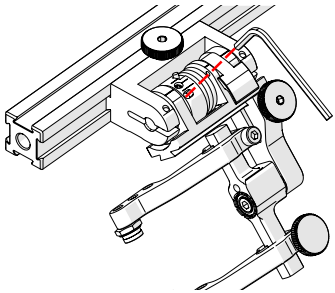


Fig. 179 - Unlatched position

1. Ensure the probe holder is in the upright latched position *(Fig. 174)*.
2. Lift probe holder slightly and press the latch button *(Fig. 178)* to release the probe holder the full 45° degrees.
3. Insert the short arm of a 3 mm hex wrench into the 3 mm slot *(Fig. 179)*.

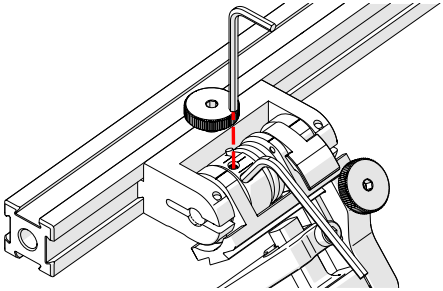


Fig. 180 - Insert hex tools

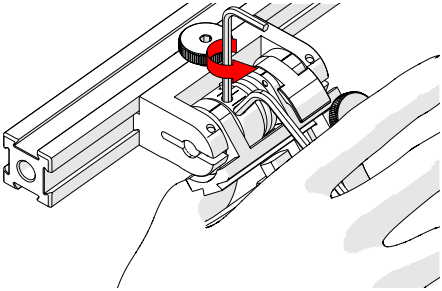


Fig. 181 - Press 3 mm hex wrench down

4. Place the 2 mm hex wrench into the force adjustment screw *(Fig. 180)*.
5. Lightly press the long arm of the 3 mm hex wrench down. Using the 2 mm hex wrench, loosen the force adjustment screw but do not remove it *(Fig. 181)*.
6. Gently apply pressure on the long leg of the 3 mm hex wrench until the force adjustment marker lines up with the desired spring tension. While keeping the markers in line, tighten the force adjustment screw *(Fig. 182)*.

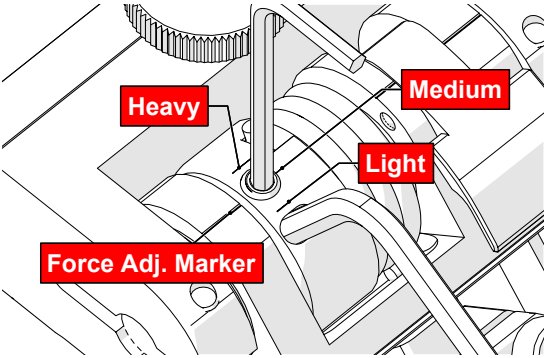


Fig. 182 - Choose desired tension

5.7.8.4 Slip Joint Probe Holder Left/Right Conversion

To reverse the probe holder, follow these steps:

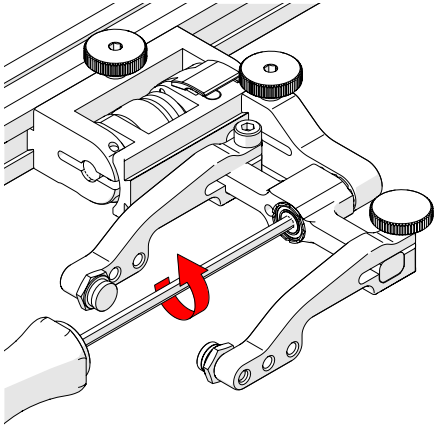


Fig. 183 - Unscrew yoke pivot screw

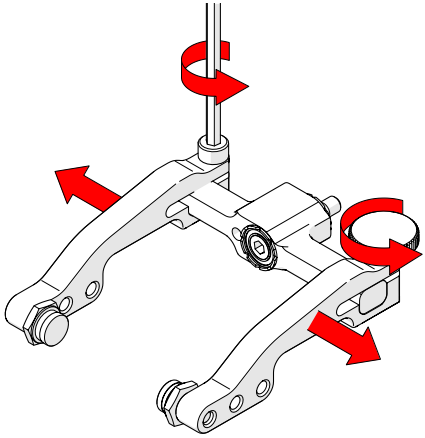


Fig. 184 - Remove arms

1. Unscrew the yoke from the swing arm *(Fig. 183)*.
2. Loosen the probe holder arm adjustment knob and arm clamp screw. Slide the arms from the yoke *(Fig. 184)*.

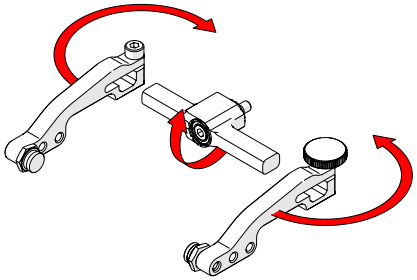


Fig. 185 - Flip yoke and reverse arms

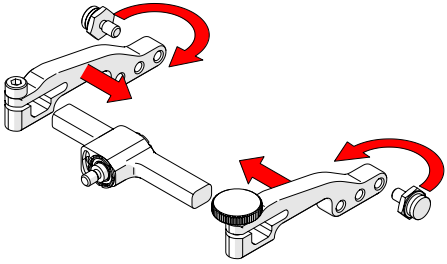


Fig. 186 - Attach arms and move buttons

3. Flip the yoke 180° and reverse the probe holder arms *(Fig. 185)*.
4. Place the pivot buttons on the inside of the probe holder arms *(Fig. 186)* using a 3/8 in wrench *(Fig. 2)*. Slide the arms onto the yoke and tighten the probe holder arm adjustment knob and the arm clamp screw.

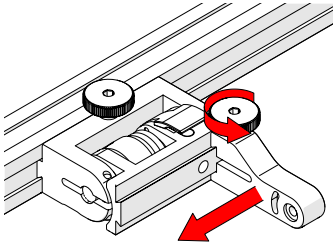


Fig. 187 - Position swing arm

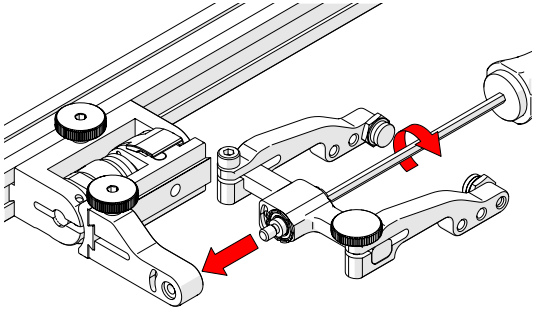


Fig. 188 - Install yoke to swing arm

5. Loosen the swing arm knob and slide the swing arm to the opposite end of the probe holder bracket *(Fig. 187)* or preferred position. Tighten swing arm knob.
6. Using the 3 mm hex driver, screw the yoke pivot screw into the opposite side of the probe holder swing arm *(Fig. 188)*. Ensure the yoke is level to avoid issues with the plunger/set screw.

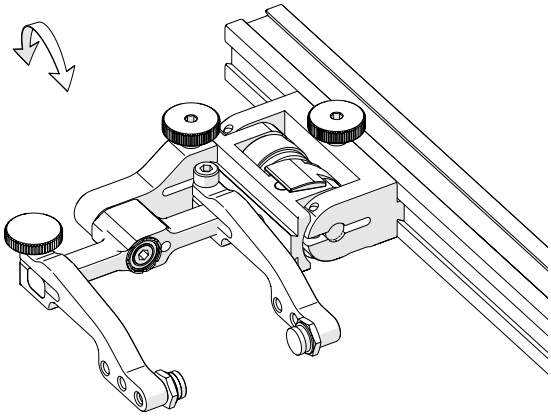


Fig. 189 - Reversed probe holder

5.7.9. Heavy Duty Vertical Probe Holder

A	Latch
B	Probe Holder Arm Adjustment Knob
C	Yoke
D	Probe Holder Arms
E	Pivot Buttons
F	Arm Clamp Screw
G	Probe Holder Adjustment Knob
H	Vertical Adjustment Knob

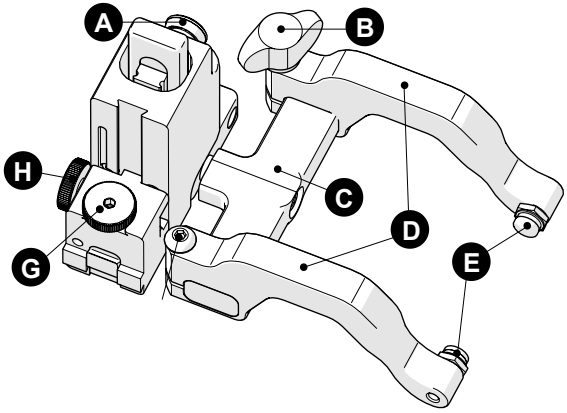


Fig. 190 - Heavy duty vertical probe holder

5.7.9.1 Probe Holder Setup

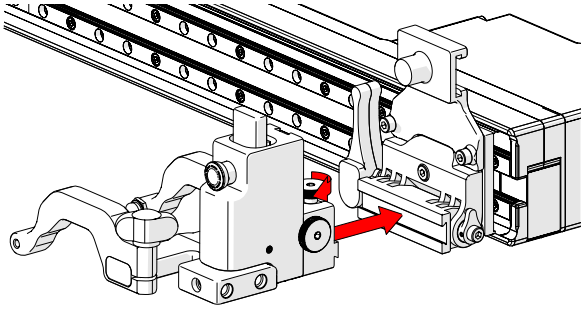


Fig. 191 - Mount probe holder to carrier

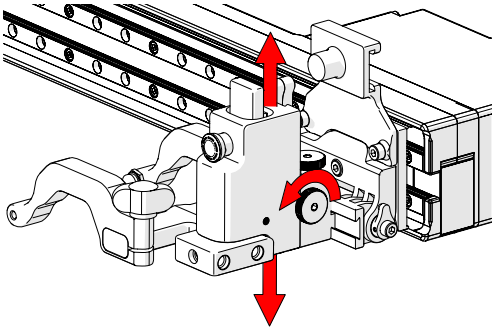


Fig. 192 - Vertical adjustment

1. Loosen the probe holder adjustment knob *(Fig. 191)* and mount the heavy duty vertical probe holder's dovetail jaw to the carrier.
2. The vertical adjustment knob *(Fig. 192)* allows the heavy duty vertical probe holder's height adjustment. This adjustment also controls the probe holders spring tension.

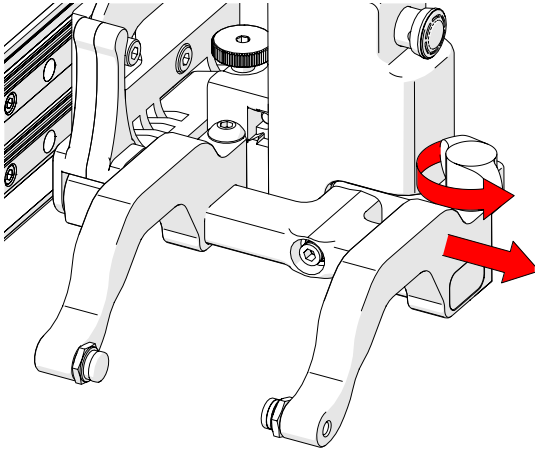


Fig. 193 - Remove outer arm

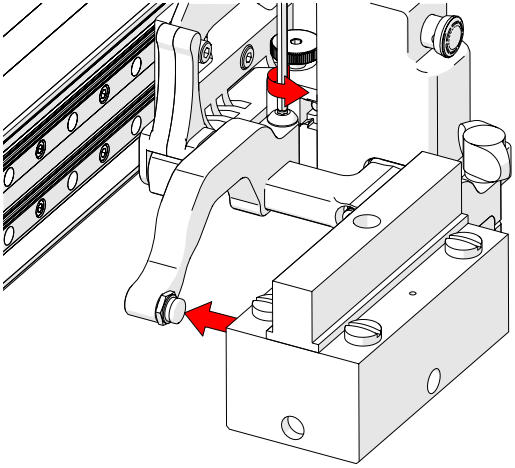


Fig. 194 - Adjust inner arm

3. Loosen the probe holder adjustment knob and remove the outer probe holder arm *(Fig. 193)*.
4. Loosen the arm clamp screw *(Fig. 194)*.
5. Place the wedge on the pivot button of the inner probe holder arm *(Fig. 194)*.

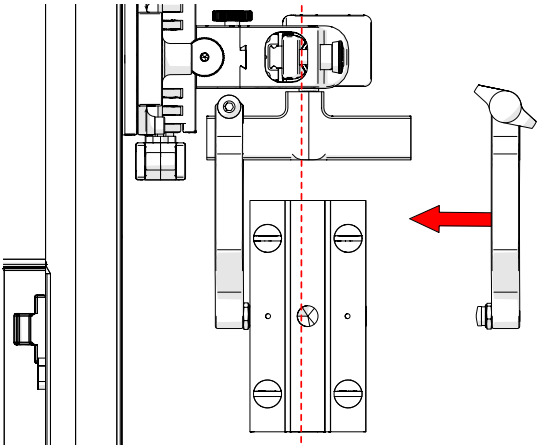


Fig. 195 - Align probe with yoke

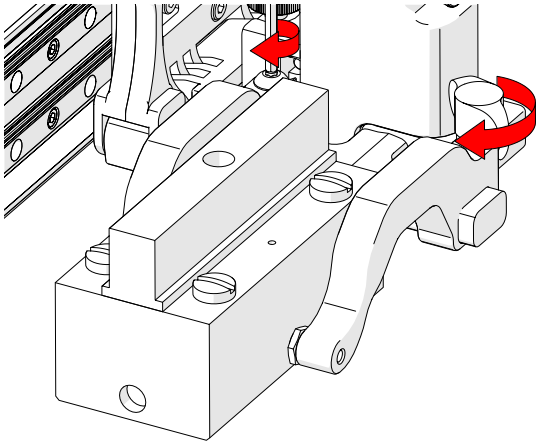


Fig. 196 - Tighten knob and screw

6. Align the middle of the wedge with the centre of the yoke *(Fig. 195)*.
7. Tighten both the probe holder adjustment knob and the arm clamp screw *(Fig. 195)* while ensuring the wedge remains centred with the yoke.

5.7.9.2 Probe Holder Vertical Adjustment

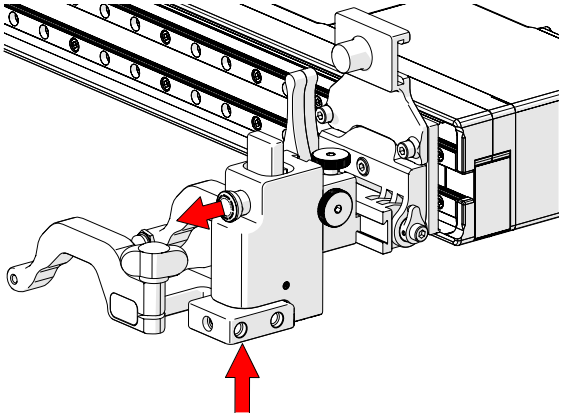


Fig. 197 - Press up and pull latch

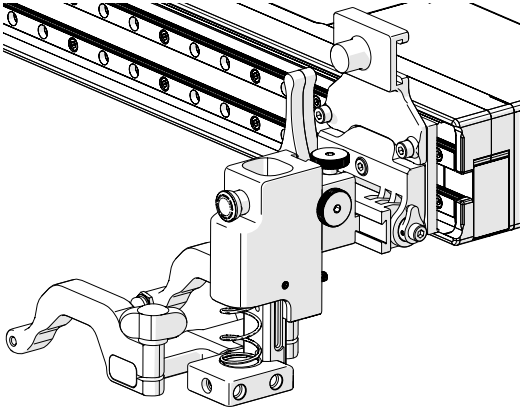


Fig. 198 - Lowered toward scan surface

1. Gently lift the heavy duty vertical probe holder and simultaneously pull the latch *(Fig. 197)*. This action will unlock the probe holder. Slowly lower the probe holder towards the scan surface *(Fig. 198)*.

5.7.9.3 Probe Holder Left/Right Conversion

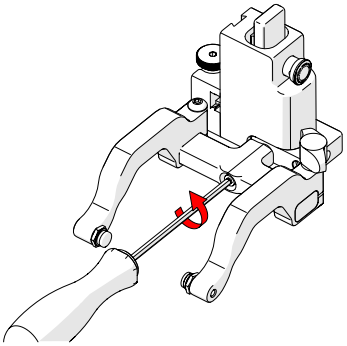


Fig. 199 - Remove yoke

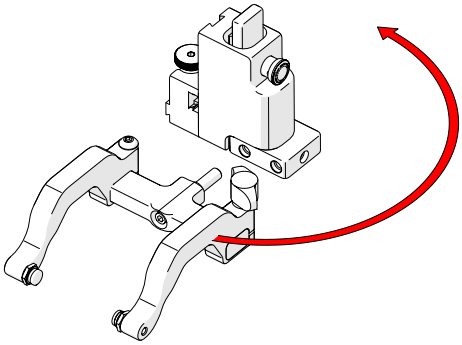


Fig. 200 - Orient to opposite side

1. Using the supplied 3 mm driver, unscrew the yoke *(Fig. 199)*.
2. Position the yoke and arms to the opposite side of the probe holder *(Fig. 200)*.

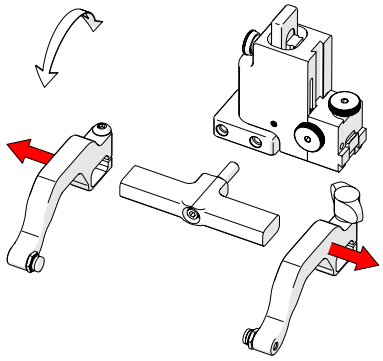


Fig. 201 - Remove probe holder arms

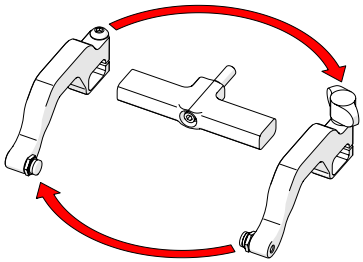


Fig. 202 - Reverse position around yoke

3. Loosen the arm clamp screw and probe holder arm adjustment knob allowing removal of the probe holder arms *(Fig. 201)*.
4. Position removed arms to opposite sides of the yoke *(Fig. 202)*.

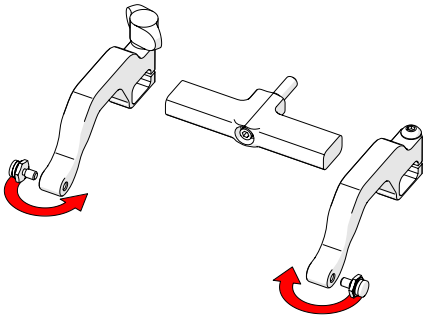


Fig. 203 - Position pivot buttons

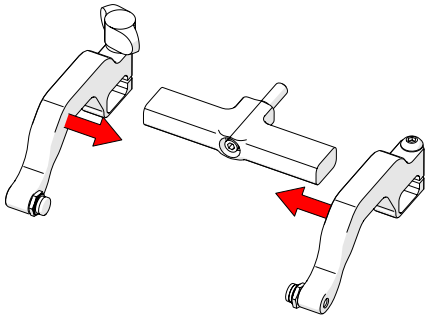


Fig. 204 - Place arms back onto yoke

5. Position the pivot buttons to the inside of the probe holder arms *(Fig. 203)*.
6. Place the probe holder arms on the yoke and tighten the arm clamp screw and probe holder adjustment knob *(Fig. 204)*.
7. Screw the yoke to the probe holder *(Fig. 205)*.

> ***TIP:*** *When using a standard yoke length, position the yoke in the threaded hole closest to the frame bar. When using a long yoke length, position the yoke in the threaded hole furthest from the frame bar.*

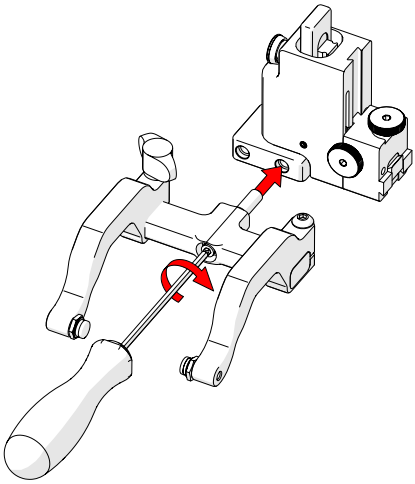


Fig. 205 - Screw into threaded hole

5.7.9.4 Probe Holder 90° Adjustment

1. Remove the yoke using the supplied 3 mm hex driver *(Fig. 50)*.
2. Orient the yoke to the front of the probe holder and screw the yoke into the threaded hole provided *(Fig. 206)*.

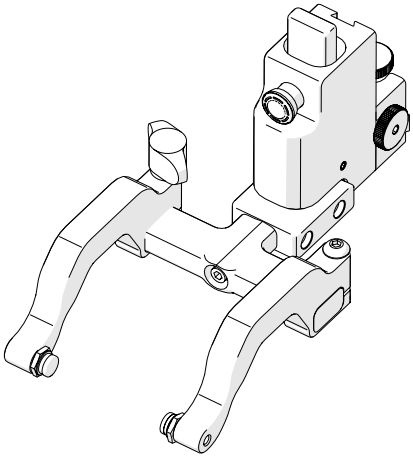


Fig. 206 - 90° probe holder positioning

5.8. 3-Axis Nozzle Scanning

Using only the right drive module, the **NAVIC** may be configured to perform nozzle scan operations. To setup the scanner, follow these steps:

WARNING! MAGNETIC MATERIAL. The wheels of 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. People with pacemakers or ICD's must stay at least 75 cm *(30 in)* away.

CAUTION! PINCH POINT HAZARD. Keep fingers clear of pinch points when connecting/ disconnecting left and right modules.

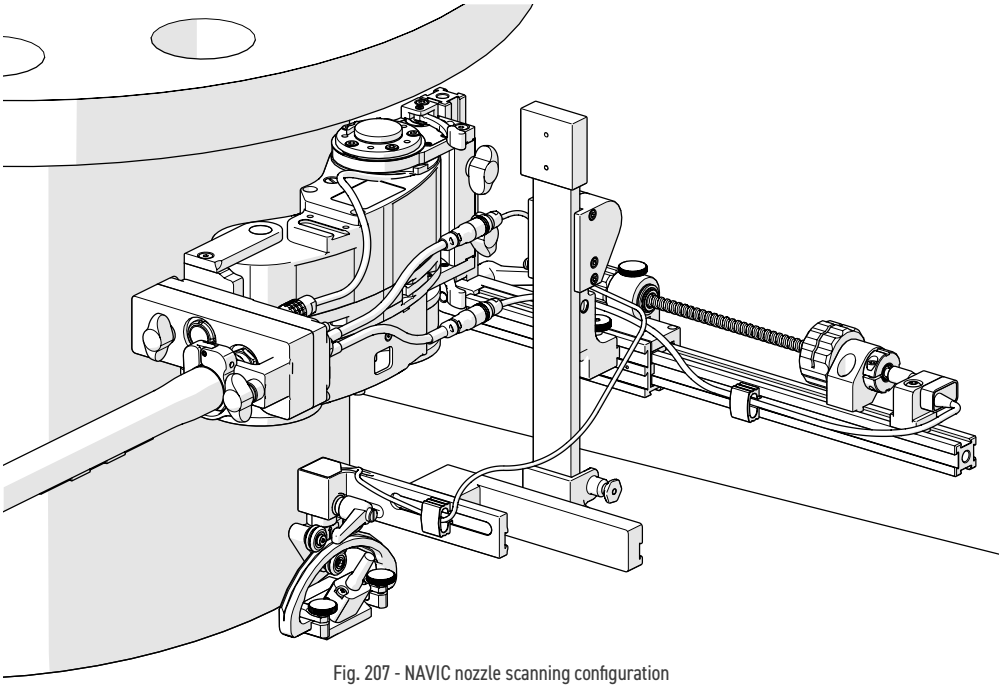


Fig. 207 - NAVIC nozzle scanning configuration

5.8.1. Scanner Preparation

1. Remove the left drive module from the crawler *(see "Connecting/Disconnecting Left and Right Modules" on page 67)*.

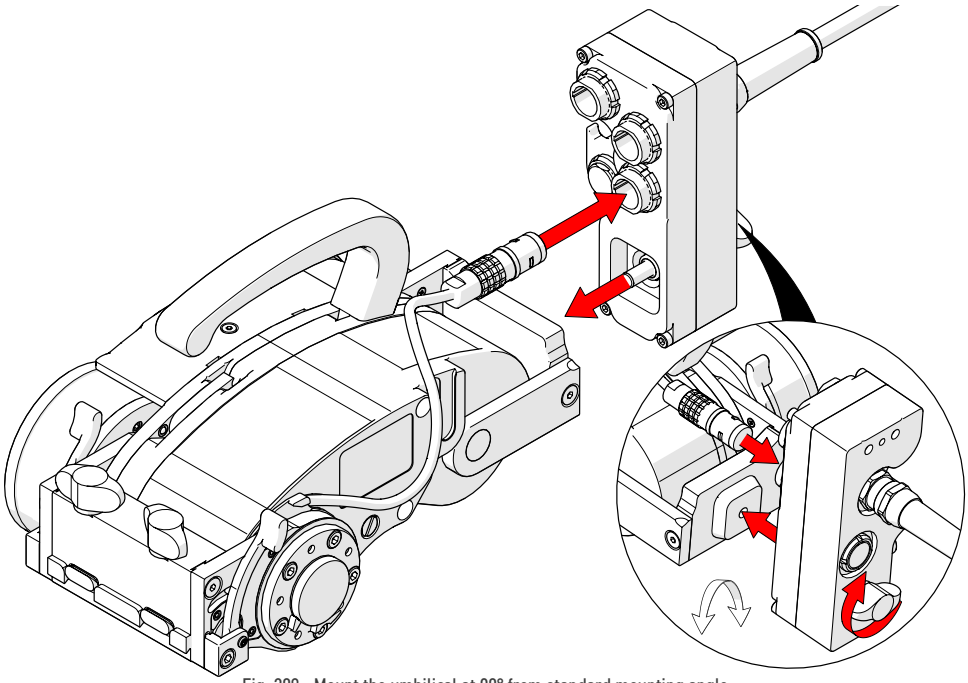


Fig. 208 - Mount the umbilical at 90° from standard mounting angle

2. Mount the umbilical at a 90° angle to the right drive module *(see "Umbilical" on page 61)*, tighten the black wing knob *(Fig. 208)*.
3. Plug in the right drive module's connector to the umbilical *(Fig. 208)*.
4. Mount cable management to the umbilical *(see "Mounting Cable Management" on page 122)*.
5. Mount the probe/wedge *(Fig. 210)* to the long stroke vertical probe holder *(see "Probe Holder Setup" on page 96)*.

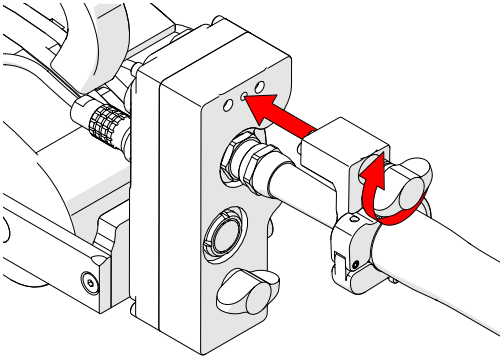


Fig. 209 - Mount cable management to the umbilical

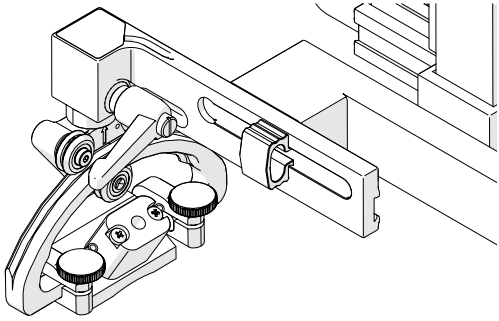


Fig. 210 - Probe/wedge affixed to probe holder

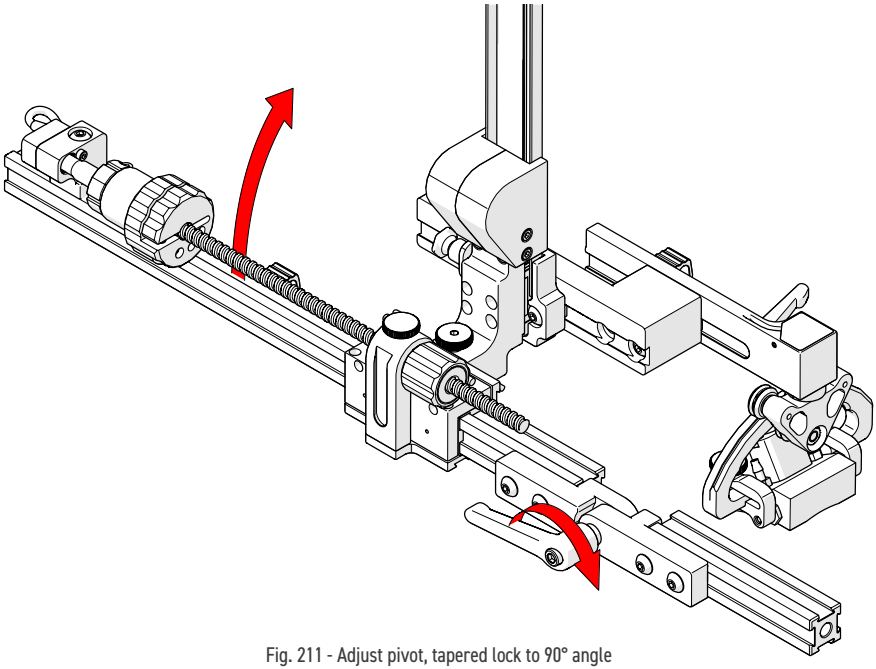


Fig. 211 - Adjust pivot, tapered lock to 90° angle

6. Release the pivot, tapered lock and position the 3-axis nozzle frame 90° *(Fig. 211)*. Tighten the pivot tapered lock.
7. Ensure the swivel mount of the **NAVIC** is horizontally aligned *(Fig. 212)* with the etched line on the crawler *(see "Swivel Mount" on page 60 for additional details)*.

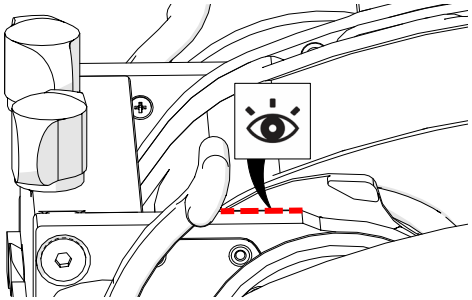


Fig. 212 - Align swivel mount with etched line

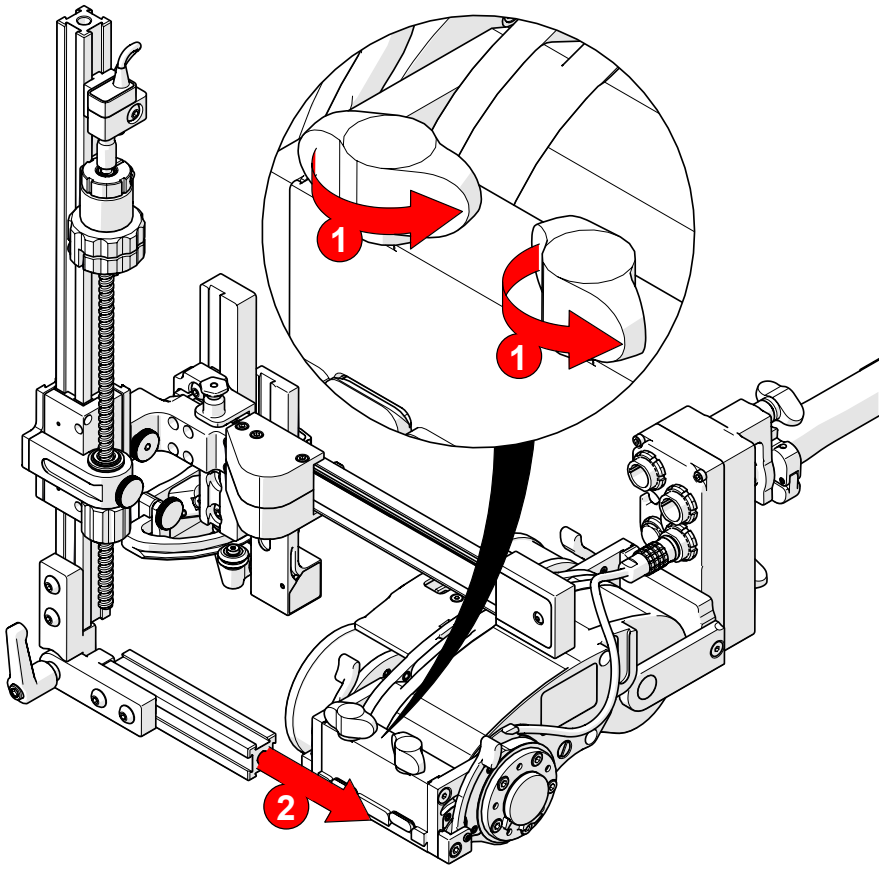


Fig. 213 - Mount the umbilical at 90° from standard mounting angle

8. Loosen the black wing knobs of the **NAVIC** swivel mount *(Fig. 213-1)*.
9. Mount the frame bar of the 3-axis nozzle frame to the right drive module's swivel mount *(see "Swivel Mount" on page 60)*.
10. Tighten the swivel mount's black wing knobs.

> ***NOTE:*** *Reposition the slider pps if the probe holder contacts right drive module.*

11. Route the 3-axis encoder cable *(Fig. 214)* through the cable management *(see "Cable Management" on page 122)*.

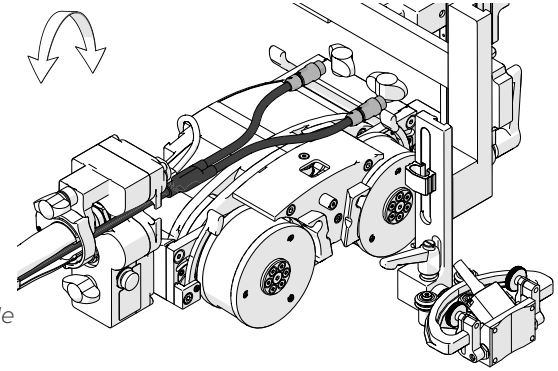


Fig. 214 - Route the 3-axis encoder cable through the cable management

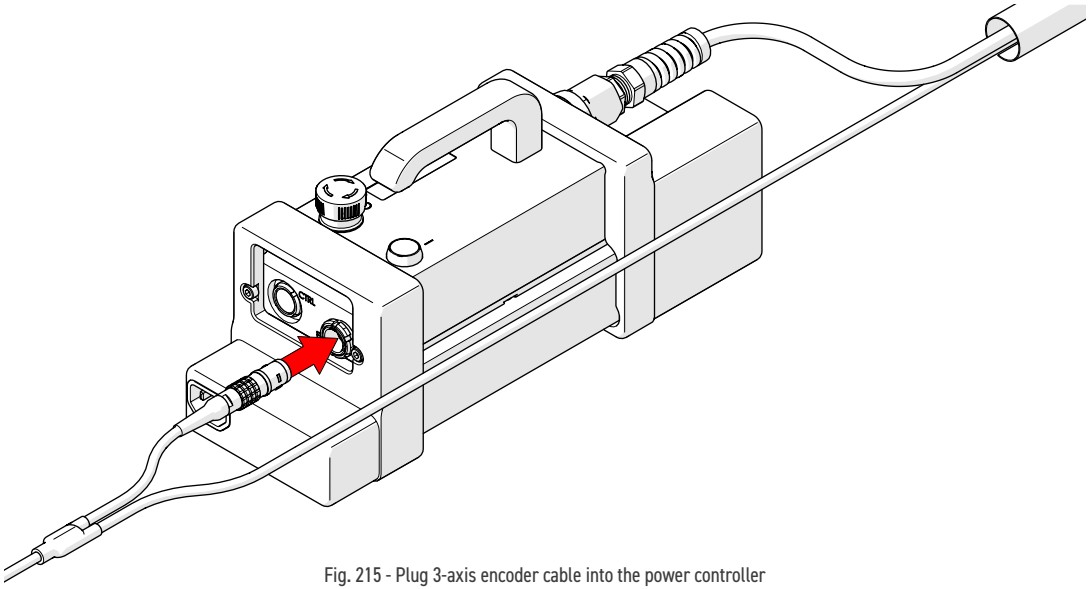


Fig. 215 - Plug 3-axis encoder cable into the power controller

12. Plug the opposite end of the 3-axis encoder cable into the power controller's encoder receptacle *(Fig. 215)*.
13. Connect the 3-axis encoder cable into the user's instrument *(see "3-Axis Nozzle Scanning" on page 58)*
14. Using the cable clips, route the encoder cable from the slider pps to the 3-axis encoder cable *(Fig. 216)*.
15. Using the cable clips, route the encoder cable from the probe holder to the 3-axis encoder cable *(Fig. 216)*.
16. Plug the encoder

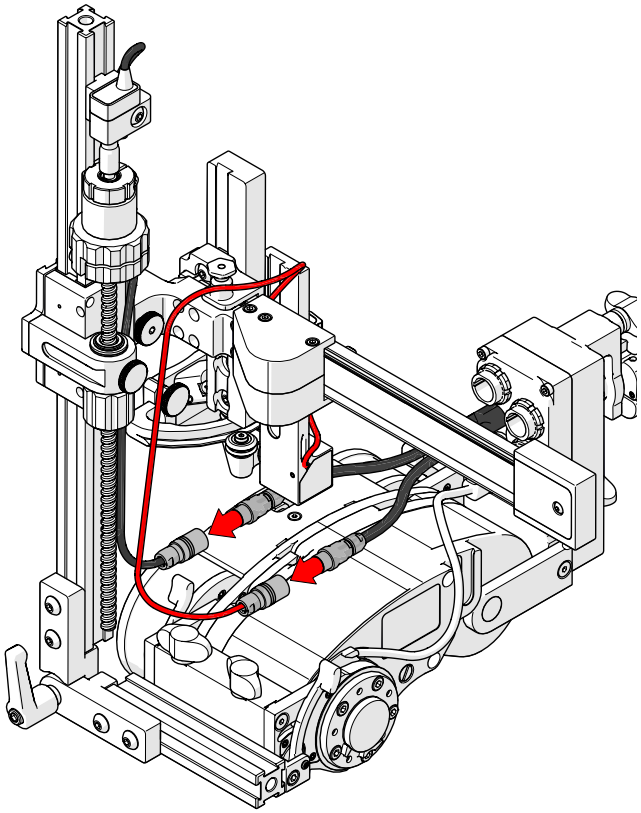


Fig. 216 - Connect encoder cables to 3-axis encoder cable

cables into the 3-axis encoder cable connectors *(Fig. 216)*.

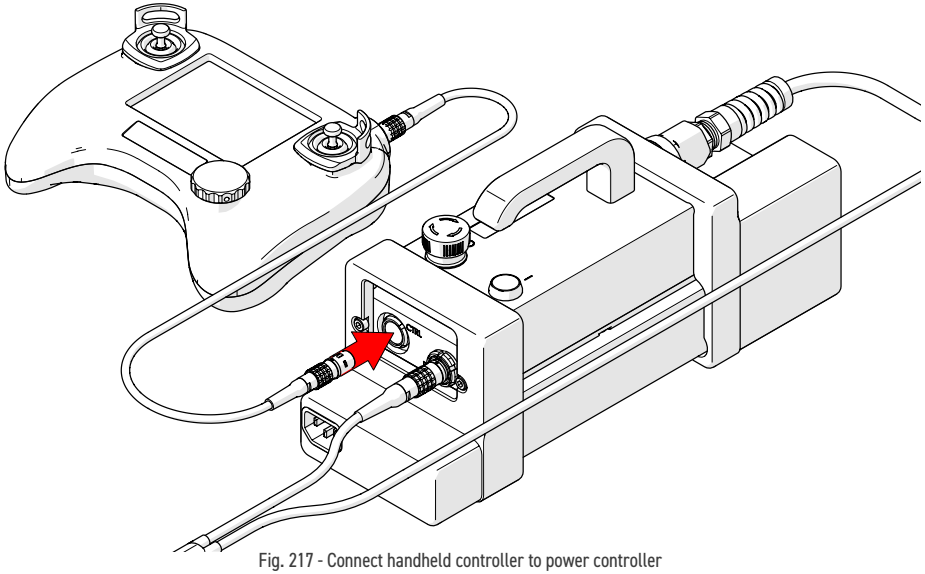


Fig. 217 - Connect handheld controller to power controller

17. Connect the handheld controller to the power controller using the auxiliary cable *(Fig. 217)*.

5.8.2. 3-Axis Nozzle Operation

NOTE: *The encoder cabling removed for illustration purposes.*

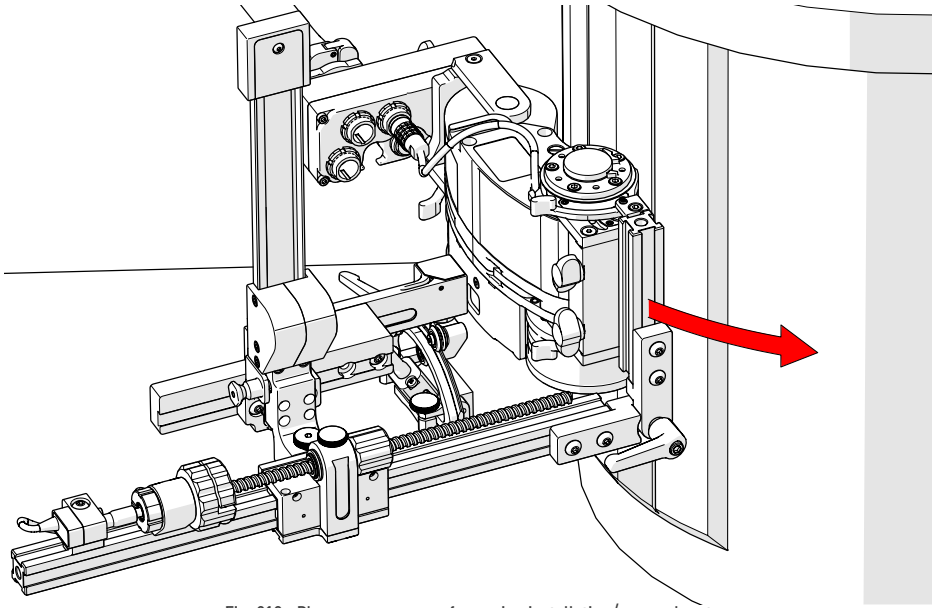


Fig. 218 - Place scanner on surface using installation/removal mat

1. Place the configured scanner on the inspection surface *(see "Scanner Installation/Removal Mat Use" on page 130)*.

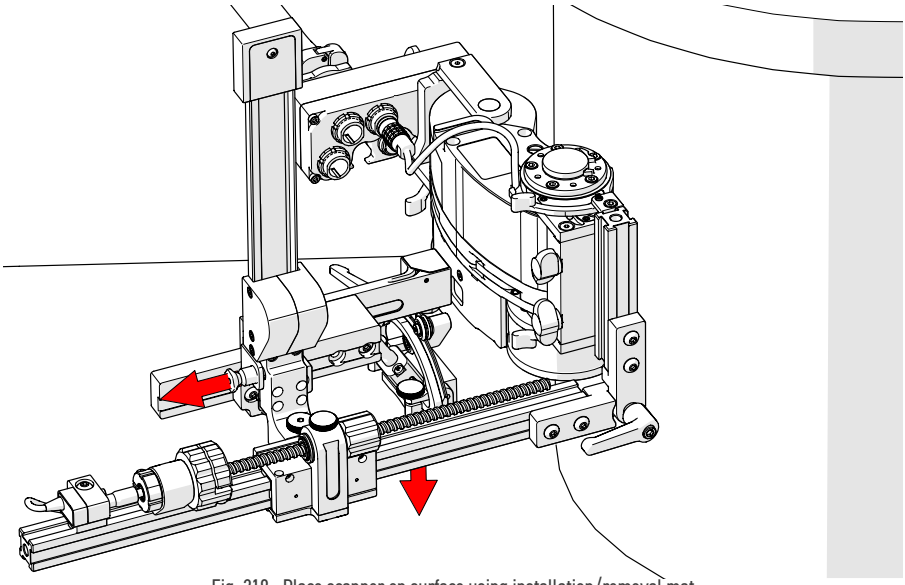


Fig. 219 - Place scanner on surface using installation/removal mat

2. Unlatch the encoded skew vertical probe holder *(see "Encoded Skew Vertical Probe Holder Adjustment" on page 98)*.

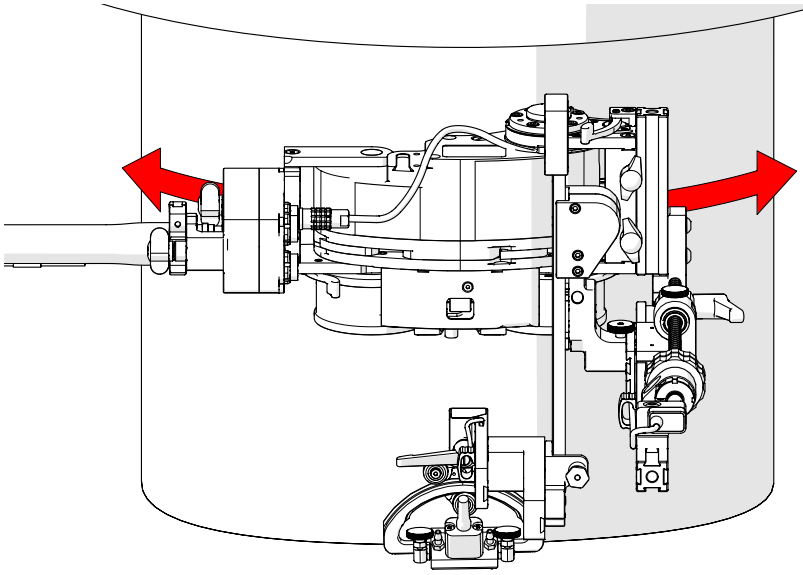


Fig. 220 - Place scanner on surface using installation/removal mat

3. Using the handheld controller, drive the crawler around the nozzle as required *(see "Jog Mode" on page 134)*.

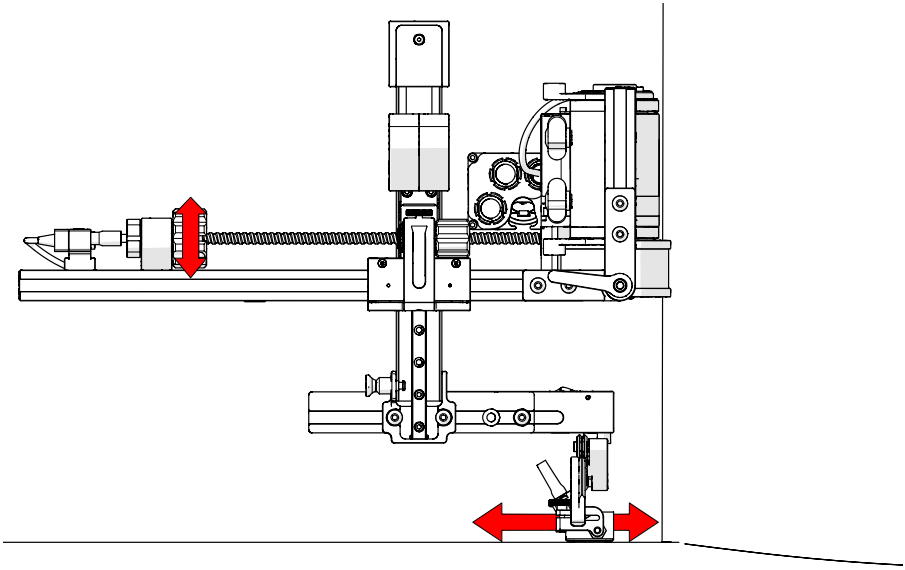


Fig. 221 - Place scanner on surface using installation/removal mat

4. Adjust the Slider PPS as required *(Fig. 221)* to position the probes distance from the weld.
5. Ensure the slider lock knob *(Fig. 223-A)* is tight and rotate the main knob to position the slider.

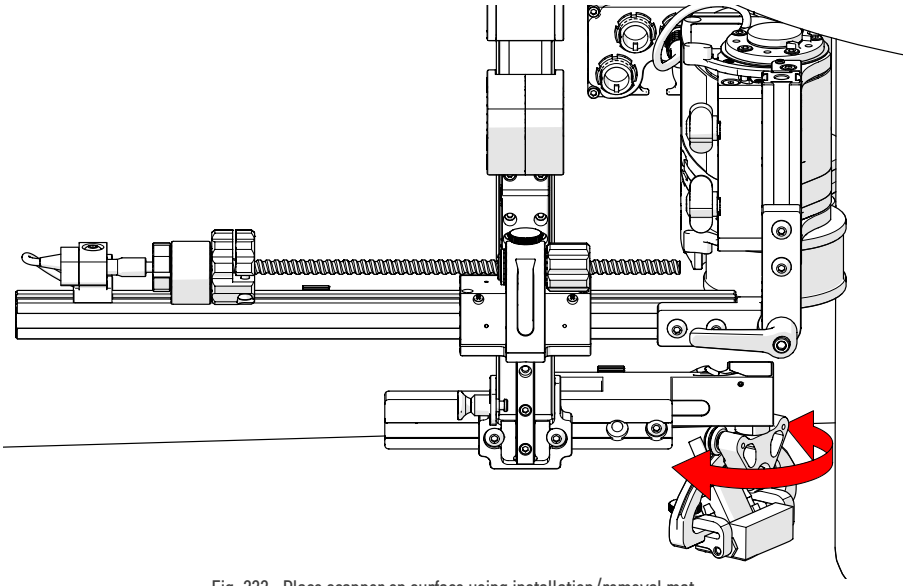


Fig. 222 - Place scanner on surface using installation/removal mat

6. Adjust the skew angle of the probe as required *(see "Skew Angle Adjustment" on page 100)*.

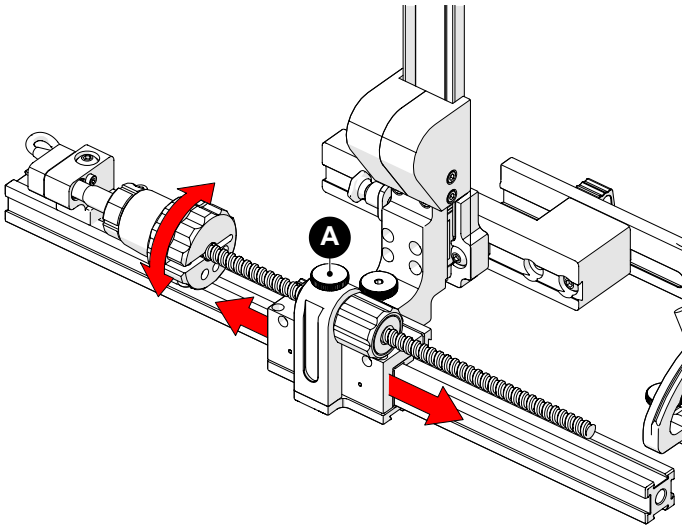


Fig. 223 - Slider positioning

5.8.3. Encoded Skew Vertical Probe Holder

A	Probe Holder Adjustment Knob
B	Extension Bracket
C	Encoder Cable
D	Pivot Buttons
E	Probe Holder Arm Adjustment Knob
F	Skew Adjustment Indicator
G	Ratchet Lever
H	Probe Holder Arms
I	Cable Clip
J	Latch Pin

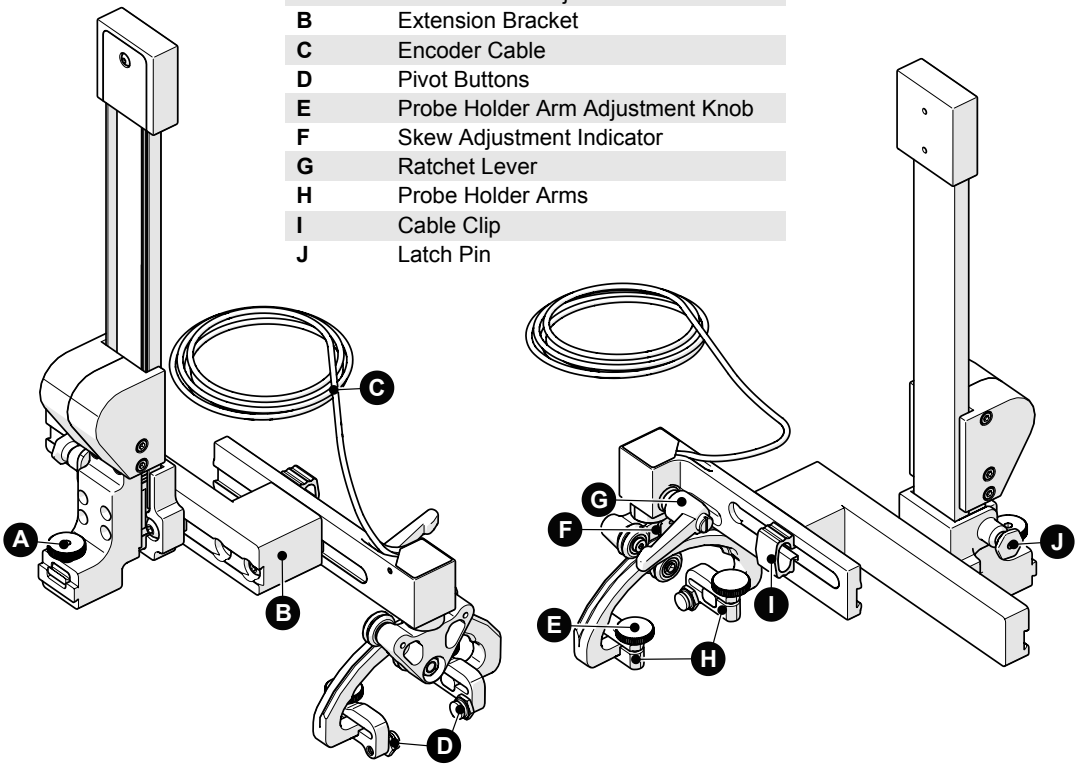


Fig. 224 - Encoded skew vertical probe holder identification

5.8.4. Probe Holder Setup

1. Using the supplied 3/8 in wrench *(Fig. 51),* install the appropriate pivot buttons to the probe holder arms *(Fig. 225).*

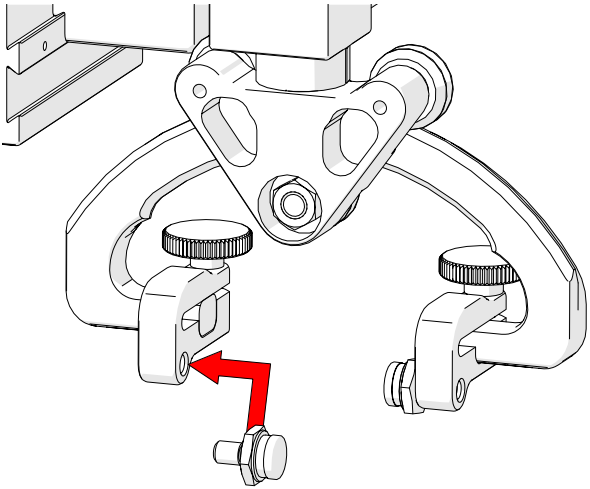


Fig. 225 - Attach pivot buttons

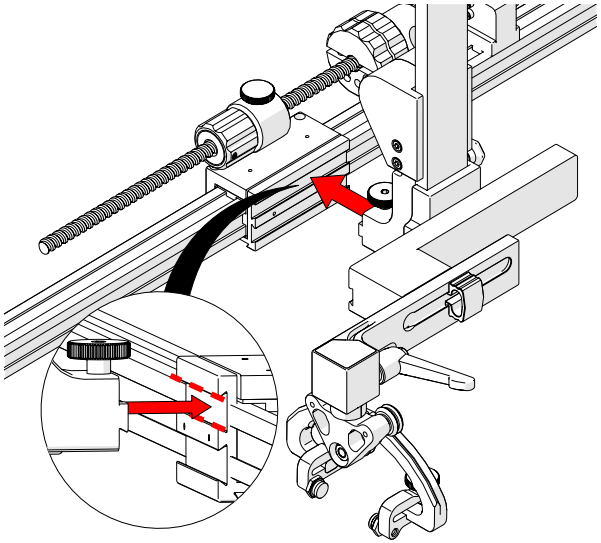


Fig. 226 - Mount to slider pps

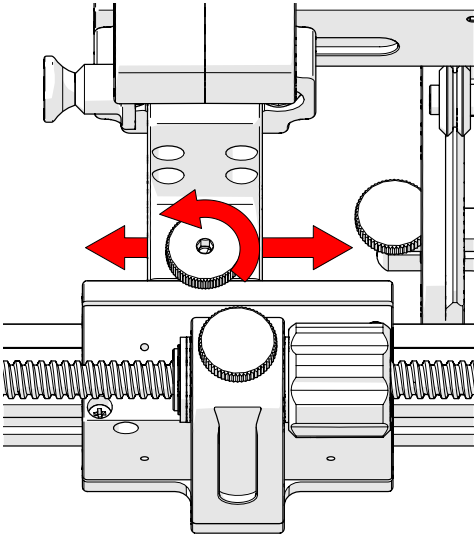


Fig. 227 - Mount to slider pps

2. Loosen the probe holder adjustment knob to attach the encoded skew vertical probe holder to the slider pps slider *(Fig. 226)*.
3. Loosen the knob to position the probe holder horizontally along the slider pps slider *(Fig. 227)*. Tighten the probe holder adjustment knob when positioning is complete.

To mount a UT wedge in the probe holder, follow these steps:

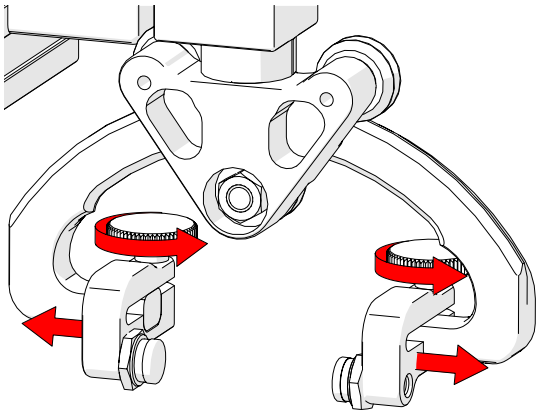


Fig. 228 - Loosen knobs and move arms

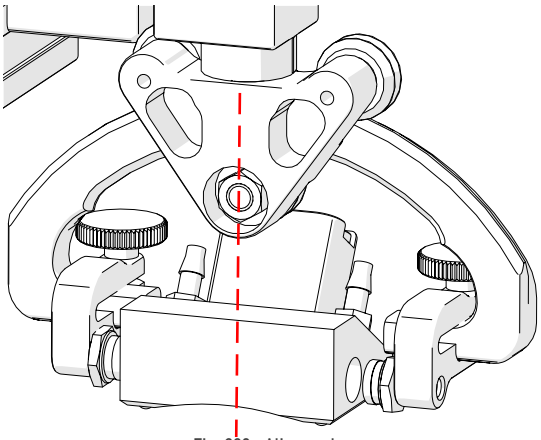


Fig. 229 - Align probe

4. Loosen the two probe holder arm adjustment knobs and move the arms apart to create space for the probe *(Fig. 228)*.
5. Align the probe to be used with the centre of yoke pivot *(Fig. 229)*.

6. Move the probe holder arms and insert the pivot buttons into the probes pivot button holes while maintaining the probes alignment relative to the yoke's pivot *(Fig. 230)*.
7. Tighten the two probe holder arm adjustment knobs *(Fig. 230)*.

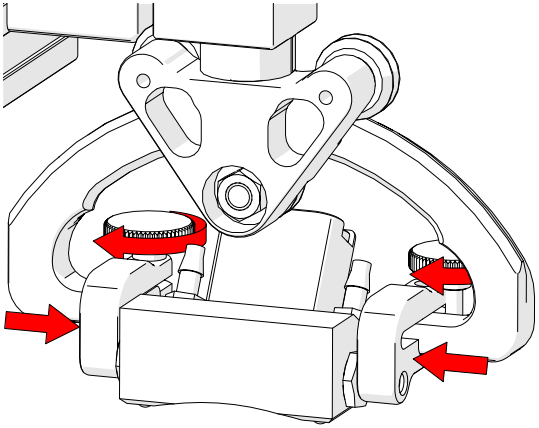


Fig. 230 - Clamp probe with arms and tighten knobs

5.8.5. Skew Encoder Cable

The encoder cable of the encoded skew vertical probe holder provides encoded feedback of the probe holder's skew angle. Cable routing is at the discretion of the user. Cable clips have been provided to assist with cable management.

1. Route the skew encoder cable through any required cable clips.
2. Plug the skew encoder cable into **ENC 2** at the rear of the low profile link.

5.8.6. Encoded Skew Vertical Probe Holder Adjustment

To lower the probe *(and probe holder)* to the scan surface, follow these steps:

> ***TIP:*** *The skew encoder cable removed for illustration purposes.*

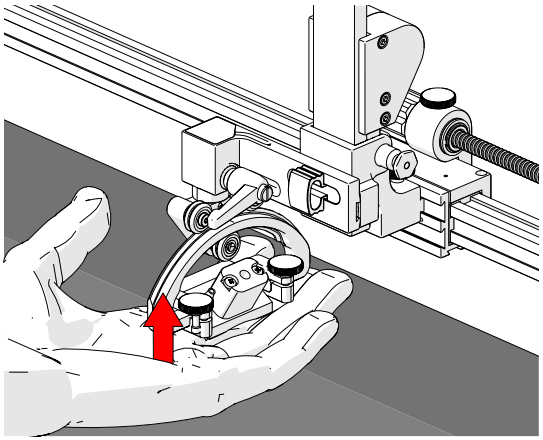


Fig. 231 - Lift probe holder

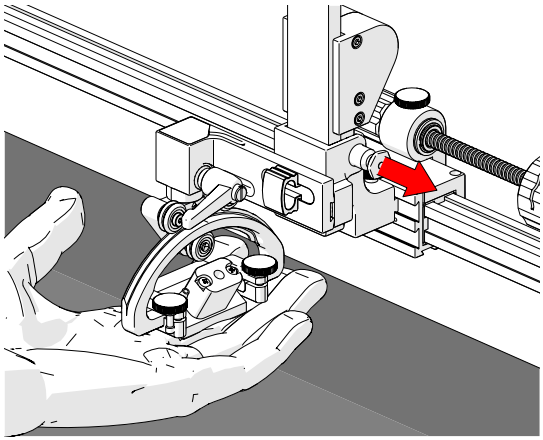


Fig. 232 - Pull latch pin

1. Lift the probe holder slightly to allow the release of the latch pin *(Fig. 246)*.

2. Pull the latch pin *(Fig. 232)* and slowly lower the probe holder to the scan surface *(Fig. 233)*.

> ***NOTE:*** *The probe holder must be lifted slightly to pull and release the latch pin.*

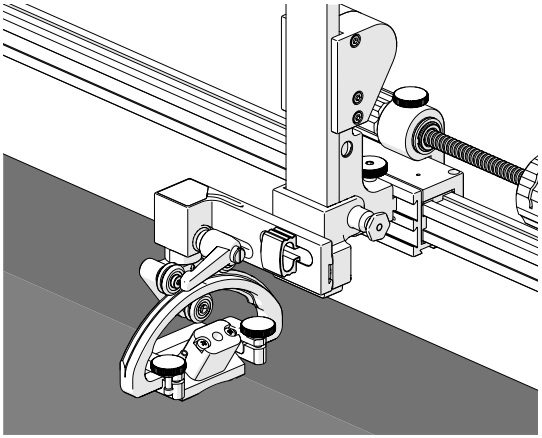


Fig. 233 - Lower probe to inspection surface

5.8.6.1 Latch Pin

The latch pin may be used in one of two methods:

1. Slightly lift the probe holder *(Fig. 231)*.
2. Pull the latch pin to allow movement of the probe holder *(Fig. 234)*.
3. Release latch pin and probe holder will lock when lifted to the upper most position.

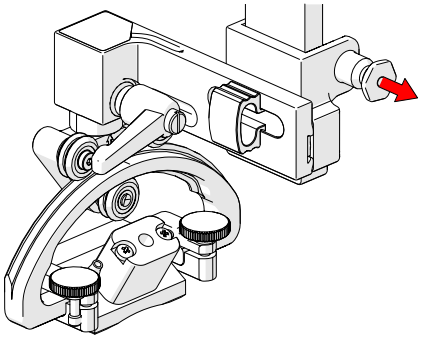


Fig. 234 - Pull latch pin

Method two allows free movement of the probe holder along the entire length of the stroke without locking in place at the upper most position:

4. Slightly lift the probe holder *(Fig. 231)*.
5. Pull the latch pin and slightly rotate the latch pin left or right *(Fig. 235)*.
6. Release the latch pin and probe holder movement is now available through the entire

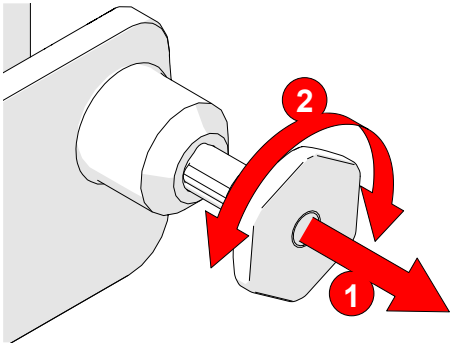


Fig. 235 - Pull latch pin and rotate

length of the stroke without latching.

7. Rotate the latch pin to return to the probe holder to the locking capable position.

5.8.7. Skew Angle Adjustment

Rotation of the probe holder is possible through adjustment of the skew angle.

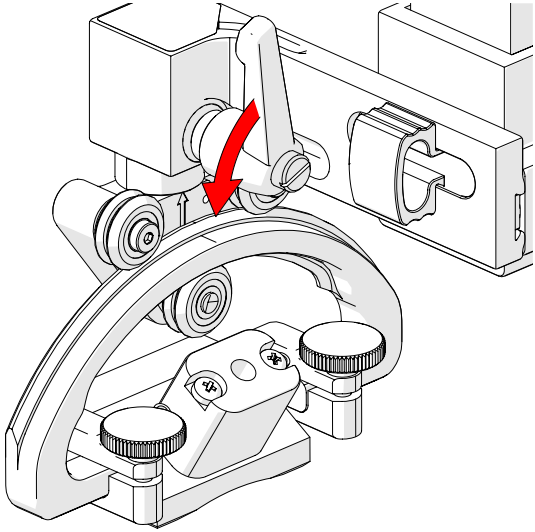


Fig. 236 - Loosen ratchet lever

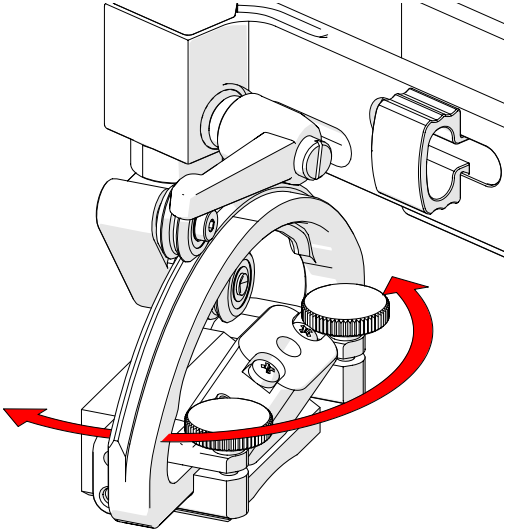


Fig. 237 - Adjust skew angle

1. Loosen the ratchet lever above the yoke *(Fig. 236)*.
2. Rotate the yoke *(Up to 90° in either direction)* to the angle required *(Fig. 237)*.
3. Tighten the ratchet lever to lock the yoke in place. Should the ratchet lever be unable to fully tighten or release the yoke *(see Ratchet Lever on page 101 for more information)*.
4. The engraved arrow above the yoke may be used to align the yoke to the required degree.

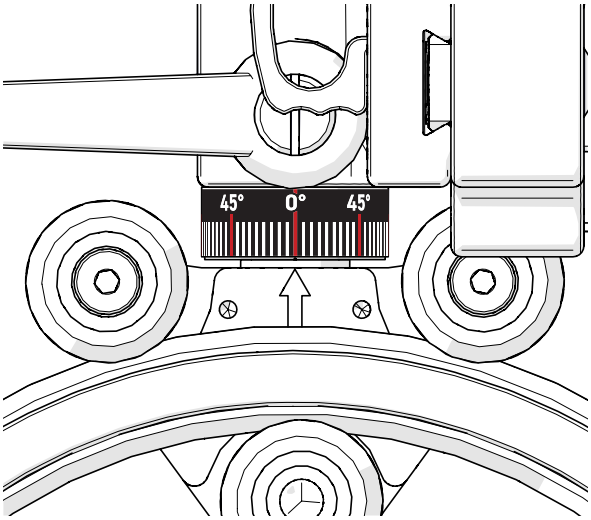


Fig. 238 - Engraved arrow aligns with various degree measurements

5.8.7.1 Ratchet Lever

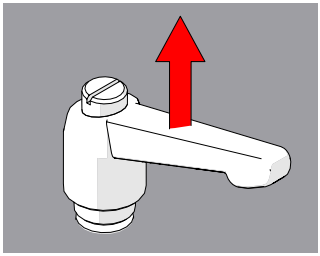


Fig. 239 - Pull ratchet handle

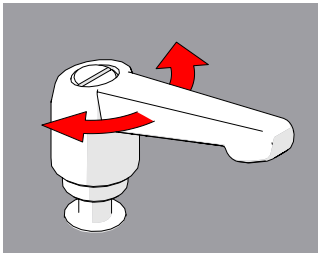


Fig. 240 - Rotate handle

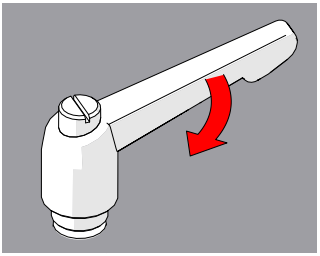


Fig. 241 - Tighten handle

The rachet levers are used for various locking functions on the **NAVIC** system. Occasionally, movement of the lever locking position is required. The lever placement can be adjusted by following these steps:

1. Pull the ratchet lever away from the base of which it is connected *(Fig. 239)*.
2. Continue to pull while rotating the lever in the appropriate direction *(Fig. 240)*.
3. Release the lever and utilize the new tightening position *(Fig. 241)*.

5.8.8. Pivot Buttons

Available in a variety of shapes and sizes fitting various wedge dimensions.

Use the supplied 3/8 in wrench *(Fig. 51)* to remove and install pivot buttons *(Fig. 242)*.

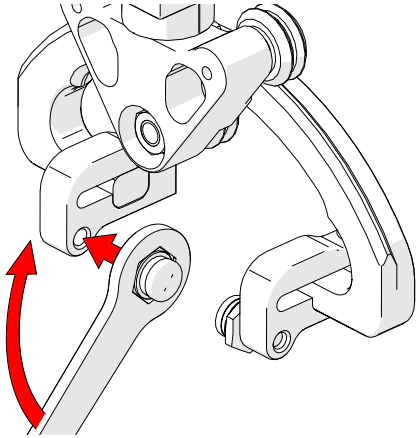


Fig. 242 - Tighten pivot buttons to probe holder arms

5.8.9. Cable Clips

Cable clips have been provided to assist with cable management. Simply pinch the clip and press it into the dovetail groove of the frame bar or the probe holder.

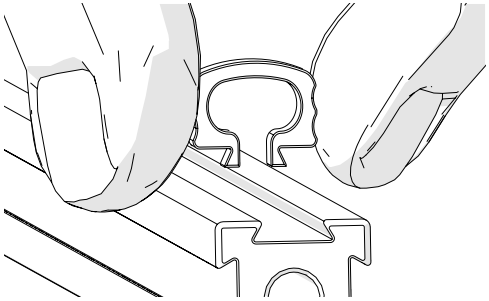


Fig. 243 - Pinch clip

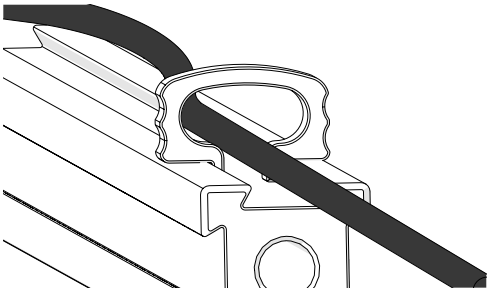


Fig. 244 - Cable clip

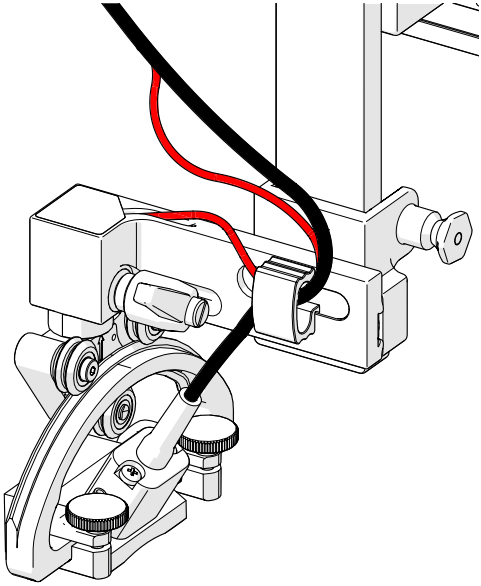


Fig. 245 - Route cables

5.9. Slider PPS *(Slider Probe Positioning System)*

The slider PPS uses a slide and leadscrew system to manipulate a probes position along a frame bar. To setup and install a slider PPS follow these steps:

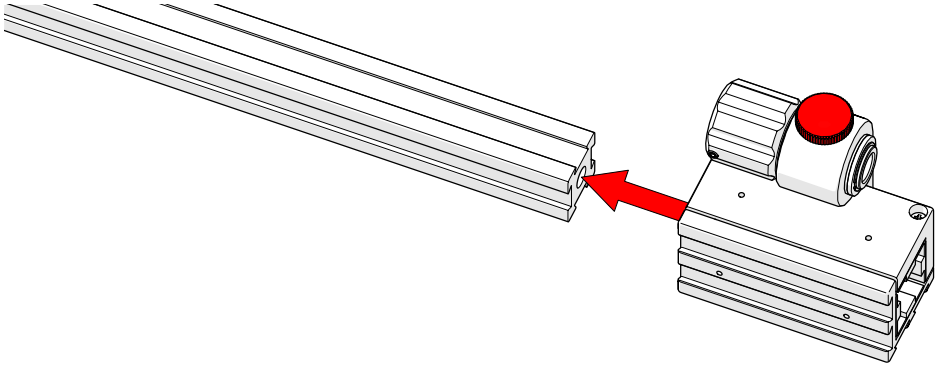


Fig. 246 - Place slider on frame bar and loosen slider lock knob

1. Ease the slider onto the frame bar and push to into position *(Fig. 246)*. The slider's friction fit requires an appropriate amount of force to position the slider.
2. Loosen the slider's lock knob *(Fig. 246 - note red highlight)*.

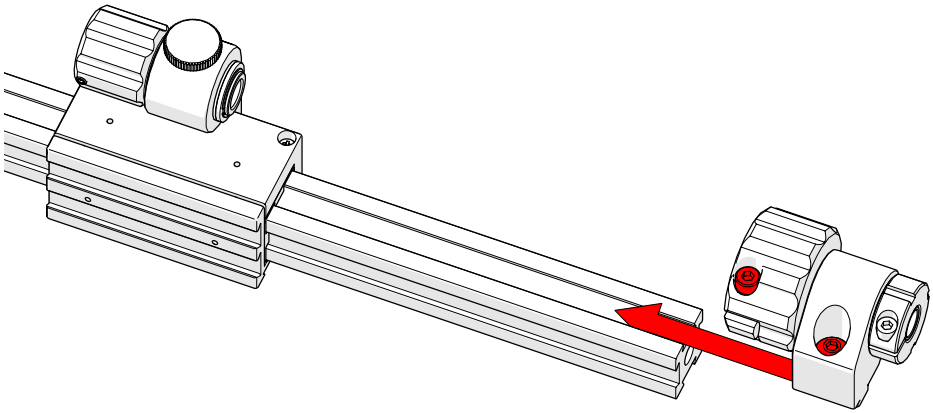


Fig. 247 - Place main knob on frame bar

3. Loosen the main knob's hexagonal screw and lock screw *(Fig. 247 - note red highlight)*.
4. Align dovetail nut of the main knob with the frame bar and slide into position *(Fig. 247)*.

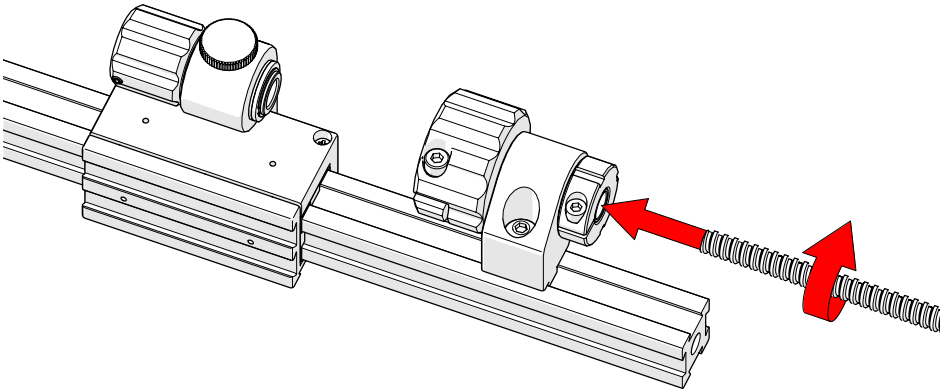


Fig. 248 - Insert leadscrew into main knob and slider

5. Rotate the leadscrew to insert into the main knob and slider *(Fig. 248)*.

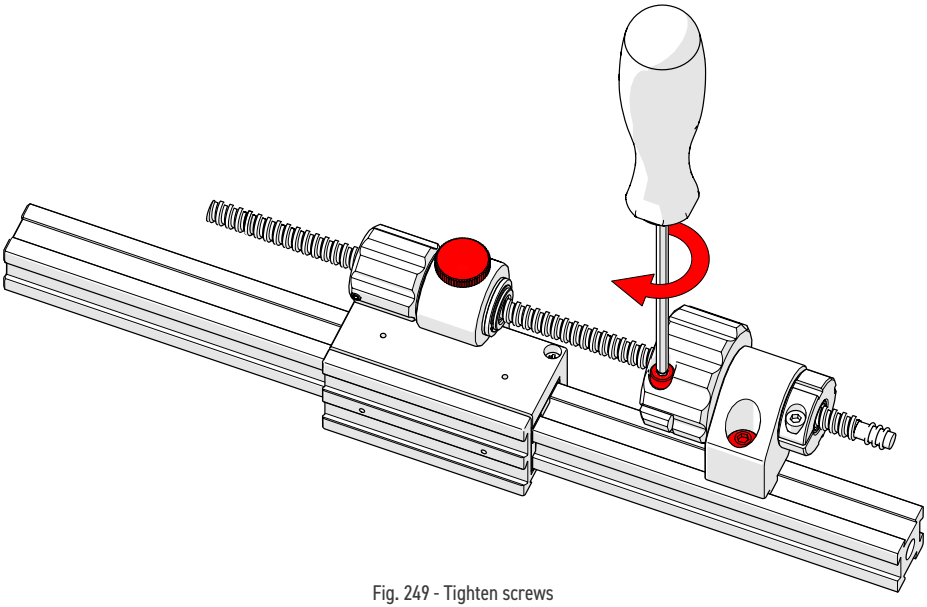


Fig. 249 - Tighten screws

6. Position the slider and main knob where required along the frame bar.
7. Tighten the the main knob's hexagonal screw and lock screw as well as tighten the slider lock knob *(Fig. 249 - note red highlight)*.

5.9.1. Slider PPS Encoder

The slider PPS *(probe positioning system)* encoder is used to provide positional feedback perpendicular to the scan direction of travel. Follow these steps for installation:

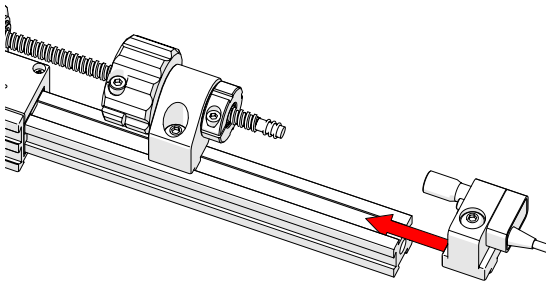


Fig. 250 - Loosen and slide post in place

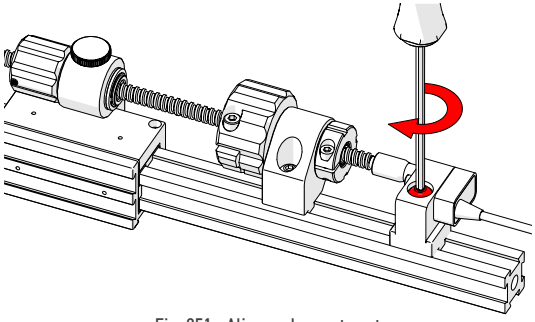


Fig. 251 - Align and mount post

1. Ensure the encoder's lock screw is loose.
2. Slide the encoder's dovetail nut onto the frame bar *(Fig. 250)*, continue sliding the encoder towards the leadscrew until the leadscrew is pressed snuggly into the encoder's coupling *(Fig. 251)*.
3. Tighten the encoder's lock screw *(Fig. 251 - note red highlight)*.

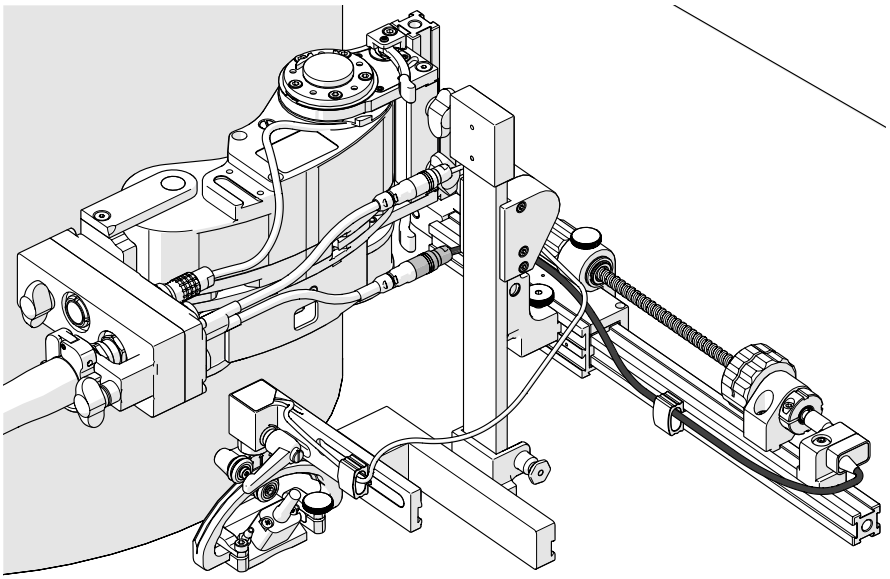


Fig. 252 - Route encoder cable to the 3-axis encoder cable

4. Route the encoder cable as required to plug into the 3-axis encoder cable *(Fig. 252)*.

5.10. Probe Holder Frames

5.10.1. Vertical Probe Holder Frame - Flat or Circumferential Only

WARNING! FALLING OBJECT HAZARD.
When the Probe Holder Frame is mounted in both the left hand and right hand swivel mounts, operation must be limited to driving in the circumferential direction. Only very slight corrective steering is permitted. Excessive steering may cause the crawler to fall and **SEVERE INJURY** or **DEATH** could result.

WARNING! FALLING OBJECT HAZARD.
It is imperative that the steps below be followed to properly set the height of the probe holder frame. If the height of the probe holder frame is set too low, the crawler may fall and **SEVERE INJURY** or **DEATH** could result.

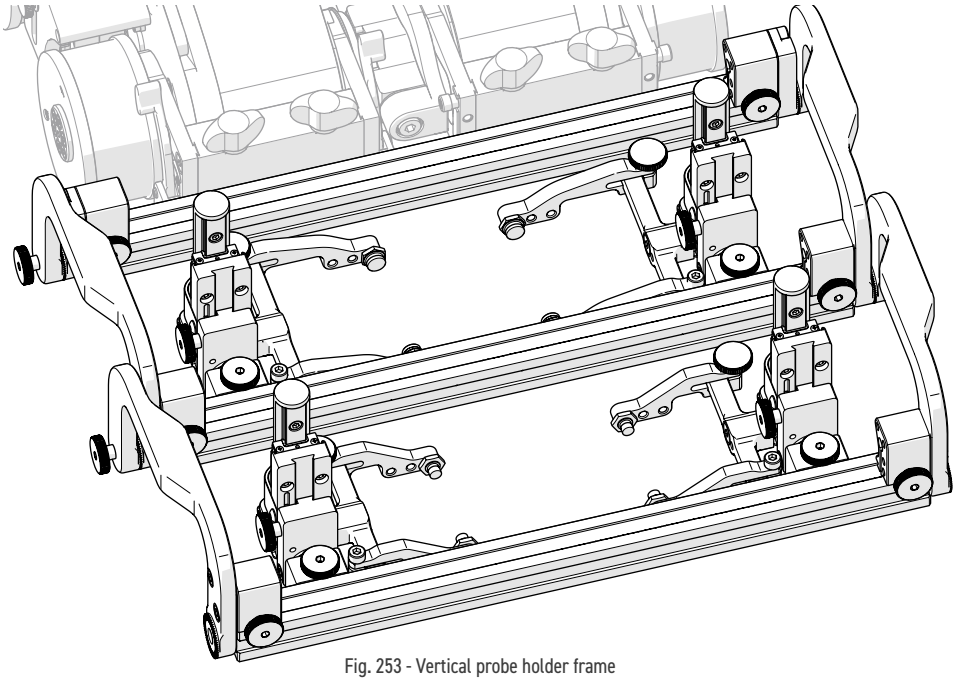


Fig. 253 - Vertical probe holder frame

The vertical probe holder frame adds weld scanning capability to the **NAVIC** motorized scanner. This frame uses (4) vertical probe holders. Additional frame components allow up to six probes to be used *(contact Jireh Industries Ltd. on page 2)*.

1. Attach the wedges to the probe holders that will be used *(see "Probe Holder Setup" on page 69 for additional details)*.

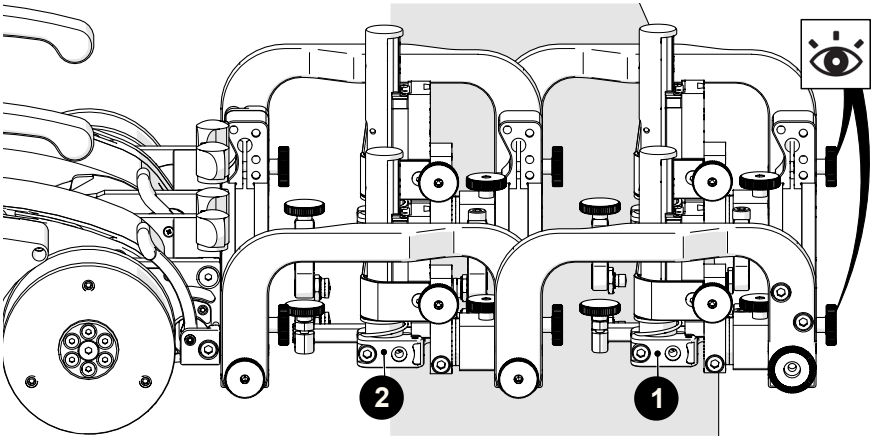


Fig. 254 - Position primary and secondary probe holders

2. Affix the probe holders *(with attached wedges)* to the probe holder frame. Place the secondary probe holder at the front of the 1 frame and place the primary probe holders at the rear of the 2 frame bar *(Fig. 254)*.

> ***TIP:*** *Due to their larger size, scan results are generally improved when pulling or dragging phased array wedges.*

3. Mount the probe holder frame to the crawler *(see "Swivel Mount" on page 65 for additional details)*. When mounting the probe holder frame, ensure the attachment knobs *(Fig. 254)* are at the front (non crawler side).

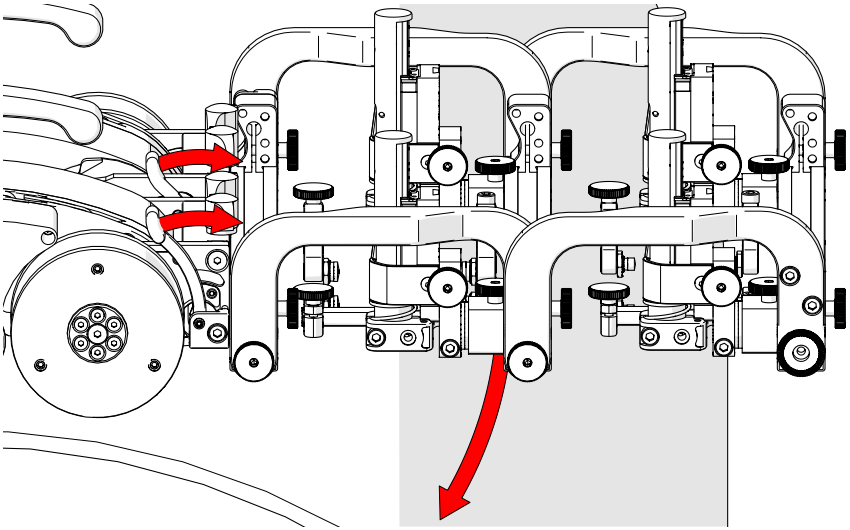


Fig. 255 - Align swivel mount with scan surface

4. Release the two swivel mount levers *(Fig. 255)* to position the swivel mount parallel to the scan surface *(Fig. 256)*. When alignment with scan surface is achieved, lock the crawler swivel mount levers.

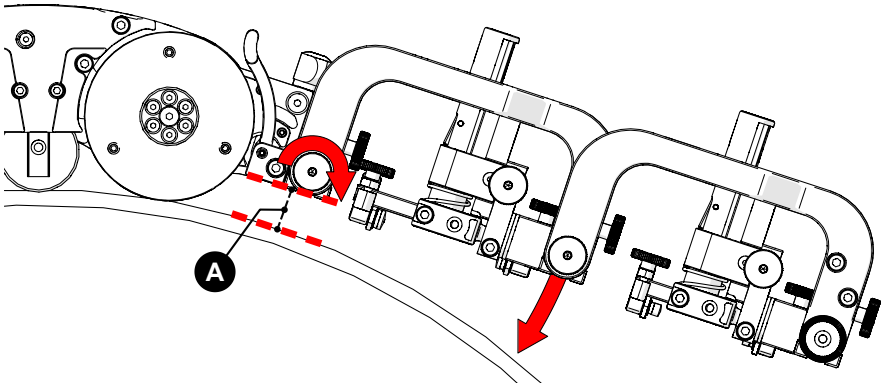


Fig. 256 - Set rear rotational adjustment knob

5. Loosen the rear rotational adjustment knob to lower the weld scan frame towards the inspection surface *(Fig. 256)*. Ensure gap **B** *(Fig. 257)*is no smaller than gap **A** *(Fig. 256).*

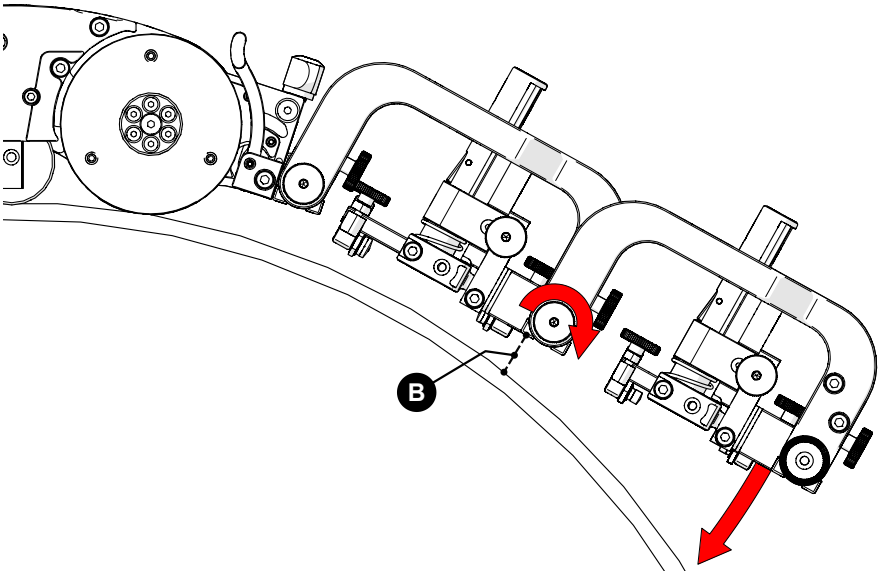


Fig. 257 - Set front rotational adjustment knob

6. Loosen the front rotational adjustment knob *(Fig. 257)* to lower the weld frame towards the inspection surface while ensuring gap **C** *(Fig. 258)* is no smaller than gap **A** *(Fig. 256).*

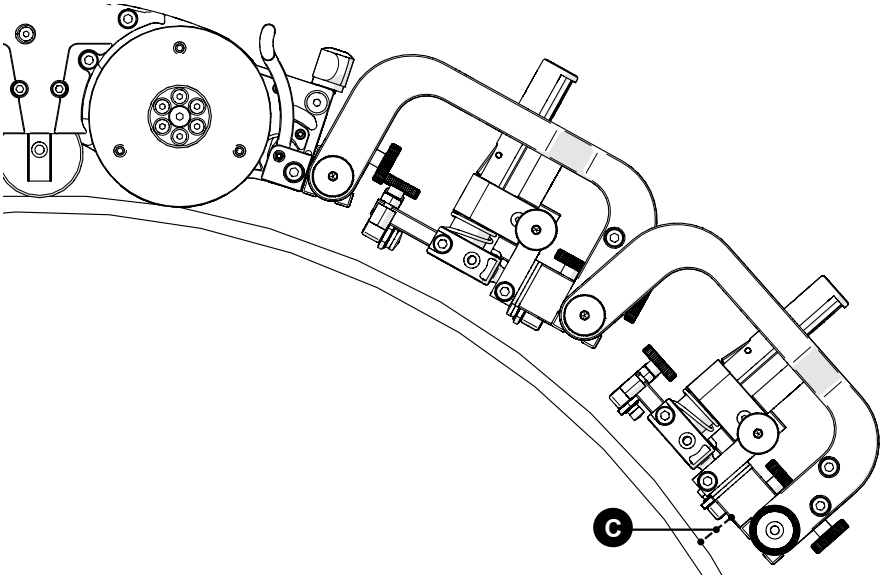


Fig. 258 - Align probes with the scan surface tangent

7. Lower the probe holders to the inspection surface.
(see "Probe Holder Vertical Adjustment" on page 70).

5.10.2. Low Profile Probe Holder Frame - Flat or Circumferential Only

WARNING! FALLING OBJECT HAZARD.
When the Probe Holder Frame is mounted in both the left hand and right hand swivel mounts, operation must be limited to driving in the circumferential direction. Only very slight corrective steering is permitted. Excessive steering may cause the crawler to fall and **SEVERE INJURY** or **DEATH** could result.

WARNING! FALLING OBJECT HAZARD.
It is imperative that the steps below be followed to properly set the height of the probe holder frame. If the height of the probe holder frame is set too low, the crawler may fall and **SEVERE INJURY** or **DEATH** could result.

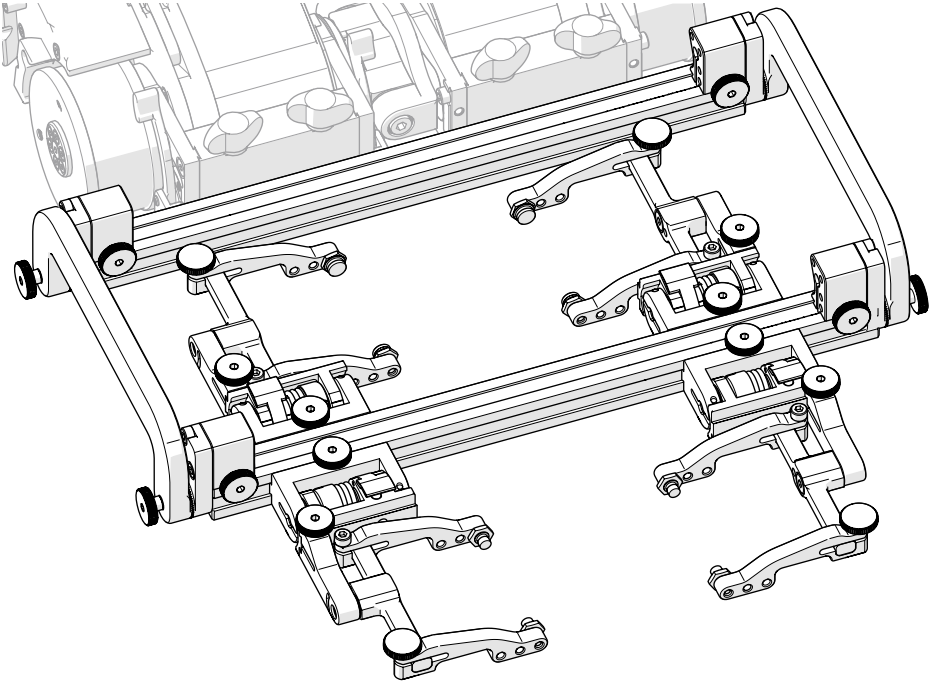


Fig. 259 - Low profile probe holder frame

The low profile frame adds weld scanning capability to the **NAVIC** motorized scanner. This frame can utilize ***(4)*** slip joint probe holders *(2 Phased Array and 2 TOFD, typically)*. The low profile design of this frame allows for scanning on diameters where radial clearance is limited.

1. Attach the wedges to the probe holders that are to be used *(see "Probe Holder Setup" on page 69 for additional details)*.

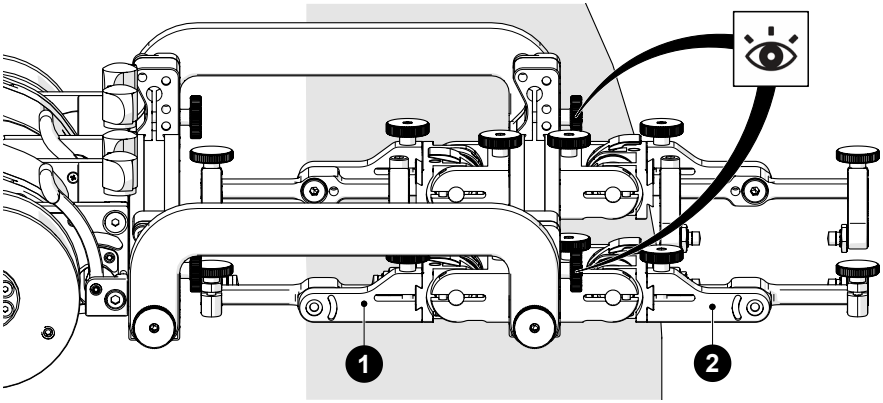


Fig. 260 - Position primary and secondary probe holders

2. Affix the probe holders (with attached wedges) to the low profile probe holder frame. On the frame bar, place the 2 secondary probe holders at the front and the 1 primary probe holders at the rear *(Fig. 260)*.

> ***TIP:*** *Due to their larger size, scan results are generally improved when pulling or dragging phased array wedges.*

3. Mount the low profile probe holder frame to the crawler *(see "Swivel Mount" on page 65 for additional details)*. When mounting the low profile frame, ensure the attachment knobs *(Fig. 260)* are at the front (non crawler side).

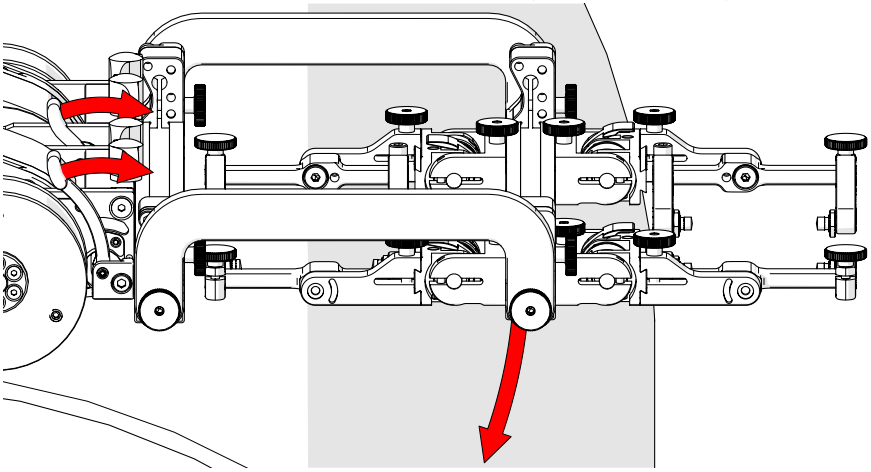


Fig. 261 - Align swivel mount with scan surface

4. Release the two swivel mount levers *(Fig. 261)* to position the swivel mount parallel to the scan surface *(Fig. 262)*. When alignment with scan surface is achieved, lock the crawler swivel mount levers.

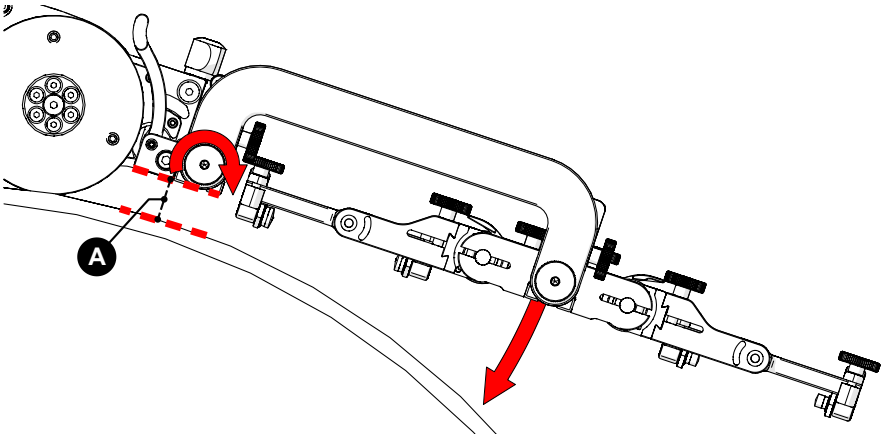


Fig. 262 - Set rear rotational adjustment knob

5. Loosen the rear rotational adjustment knob to lower the front frame bar of the low profile frame towards the inspection surface *(Fig. 262)*. Ensure gap **B** *(Fig. 263)* is no smaller than gap **A** *(Fig. 262)*.

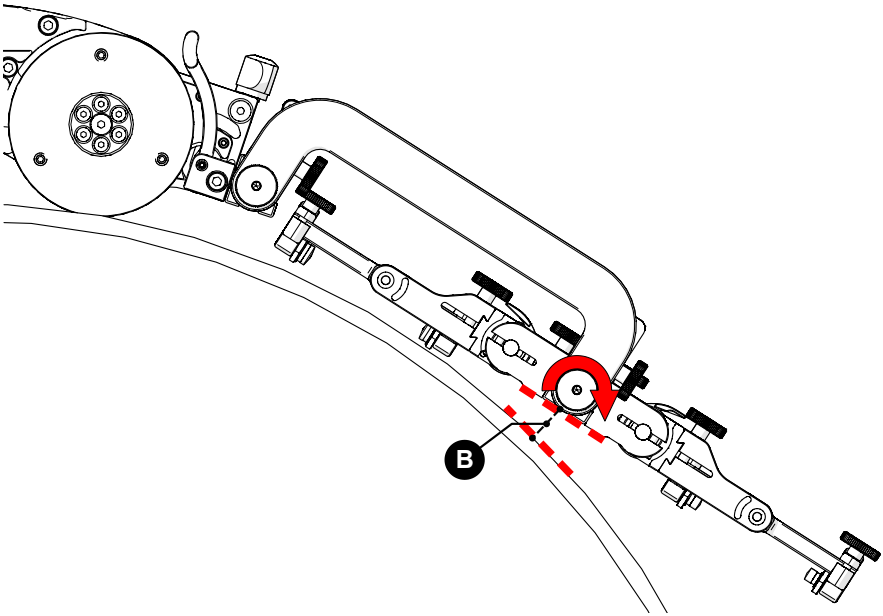


Fig. 263 - Align probe holder tangent with scan surface

6. Loosen the front rotational adjustment knob *(Fig. 263)* to align the frame bar parallel with the scan surface *(Fig. 264)*.

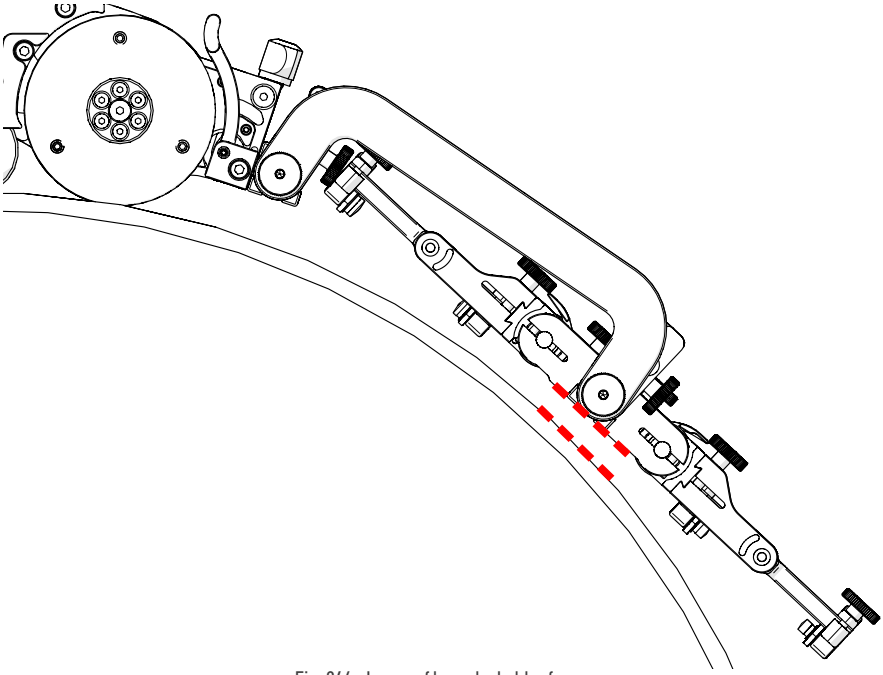


Fig. 264 - Low profile probe holder frame

7. Lower the probe holders to the inspection surface.
(see "Probe Holder Adjustment" on page 77).

5.10.3. Pivoting Probe Holder Frame

WARNING! FALLING OBJECT HAZARD.
It is imperative that the steps below be followed to properly set the height of the probe holder frame. If the height of the probe holder frame is set too low, the crawler may fall and **SEVERE INJURY** or **DEATH** could result.

The pivoting probe holder frame utilizes vertical probe holders. The **NAVIC** can guide as many as 6 probes in the longitudinal direction.

NOTE: *A minimum OD of 305 mm (12 in) is required for longitudinal scanning.*

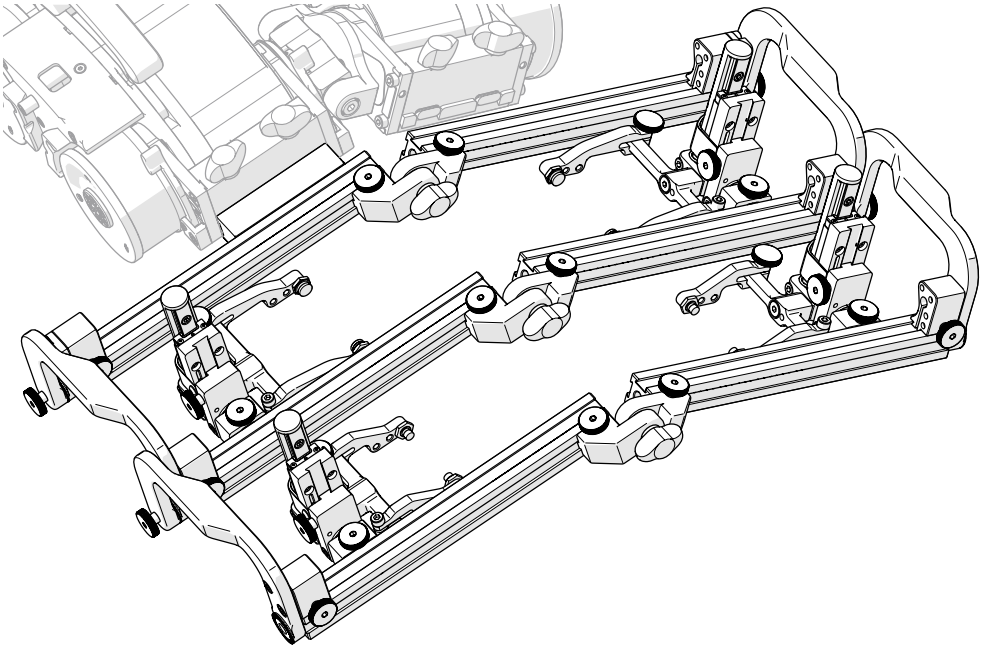


Fig. 265 - Pivoting Probe Holder Frame

5.10.3.1 Mounting a Pivoting Probe Holder Frame

WARNING! FALLING OBJECT HAZARD.
The Pivoting Probe Holder Frame is to be mounted only in the right hand swivel mount. Mounting it in both the left hand and right hand swivel mounts may cause the crawler to fall and **SEVERE INJURY** or **DEATH** could result.

1. Attach the wedges that are to be used with the probe holders *(see "Probe Holder Setup" on page 69 for additional details).*

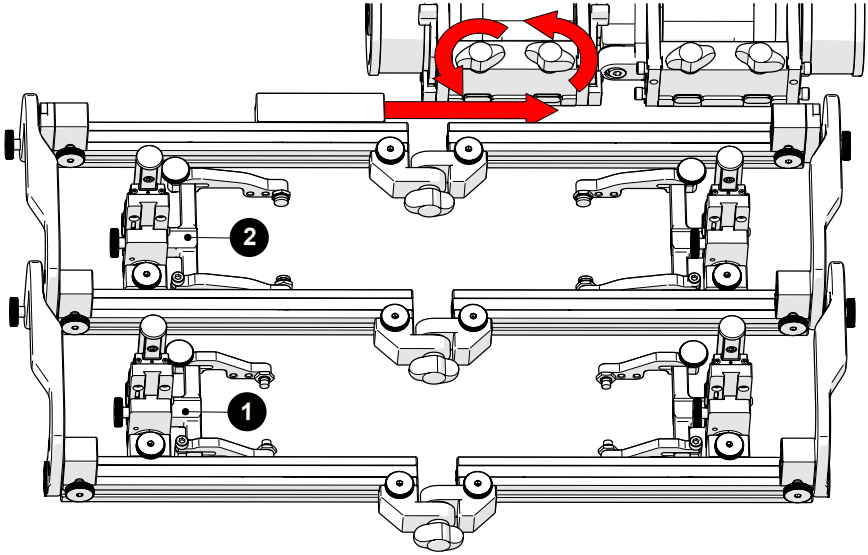


Fig. 266 - Connect frame to right drive module

2. Affix the probe holders *(with attached wedges)* to the probe holder frame. Place the secondary probe holders at the front of the 1 frame while placing the primary probe holders at the rear of the 2 frame system *(Fig. 266).*

> ***TIP:*** *Phased array wedges are designed to be pulled along a scan surface.*

3. Mount the pivoting probe holder frame to the crawler *(see "Swivel Mount" on page 65 for additional details).*

5.10.3.2 Pivoting Probe Holder Frame Setup - Longitudinal Scanning

WARNING! FALLING OBJECT HAZARD.
When scanning in the longitudinal direction with the Pivoting Probe Holder Frame, operation must be limited to driving in the longitudinal direction only. Only very slight corrective steering is permitted. Excessive steering may cause the crawler to fall and **SEVERE INJURY** or **DEATH** could result.

To prepare the pivoting probe holder frame for longitudinal scanning, follow these steps:

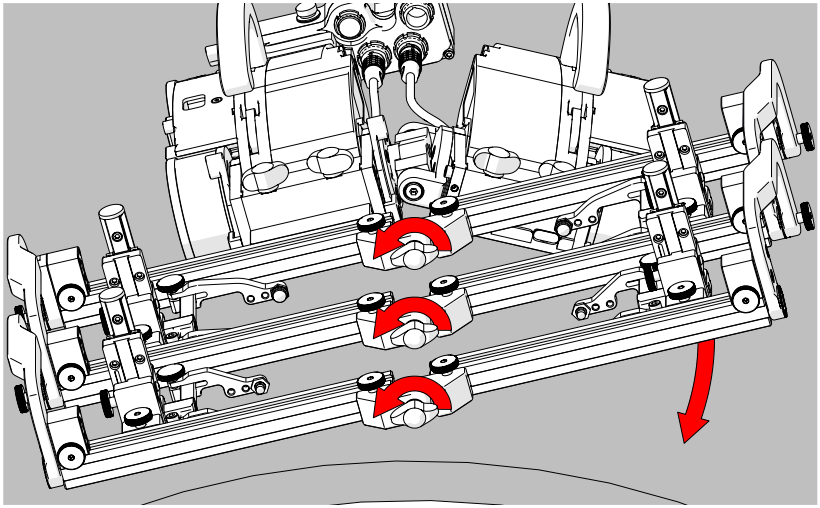


Fig. 267 - Loosen pivot wing knobs

NOTE: *The swivel mount must be in a horizontal position during longitudinal scanning (see "Swivel Mount" on page 60).*

1. Loosen the pivot wing knobs at the centre of the frame system *(Fig. 267)*. Lower the left side of the frame system to align with the tangent of the scan surface. Tighten the pivot wing knobs.

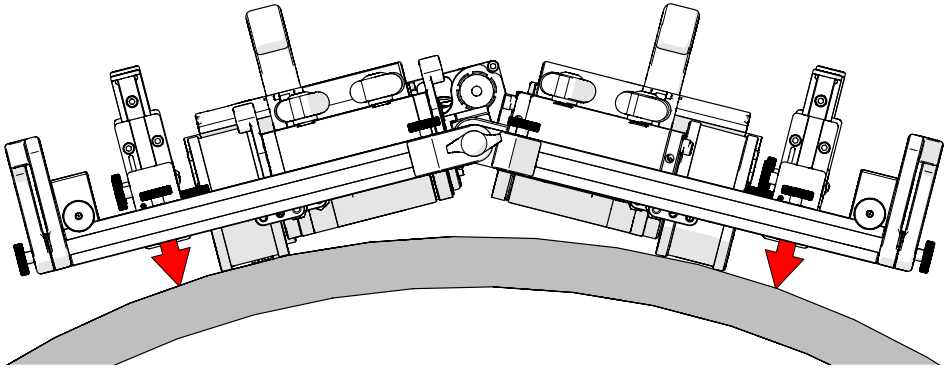


Fig. 268 - Tighten pivot wing knobs

2. Lower the vertical probe holders *(see "Probe Holder Vertical Adjustment" on page 70).*

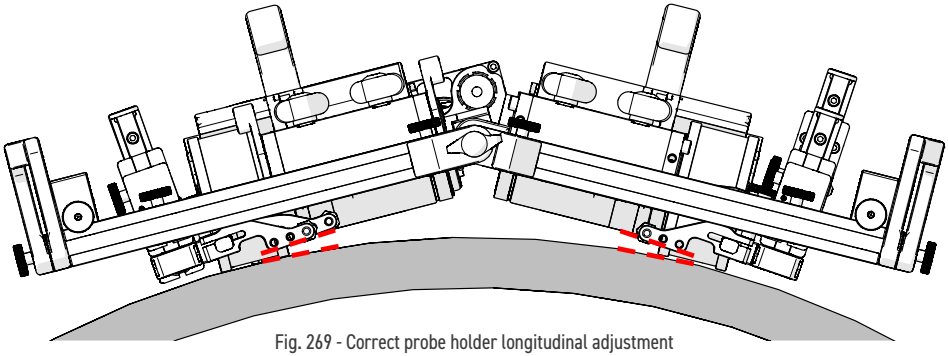


Fig. 269 - Correct probe holder longitudinal adjustment

3. Ensure probe holder arms are parallel to the scan surface *(see "Probe Holder Longitudinal Adjustment" on page 72).*

5.10.3.3 Pivoting Probe Holder Frame - Circumferential Scanning

(see "Vertical Probe Holder Frame - Flat or Circumferential Only" on page 106 for additional details)

5.10.3.4 Pivoting Probe Holder Frame - Flange Scanning

> ***NOTE:*** *The optical guide pivot mount is not compatible with the following configuration.*

The pivoting probe holder frame may be configured to allow scanning of flanges and the like. The following steps explain setup of this configuration:

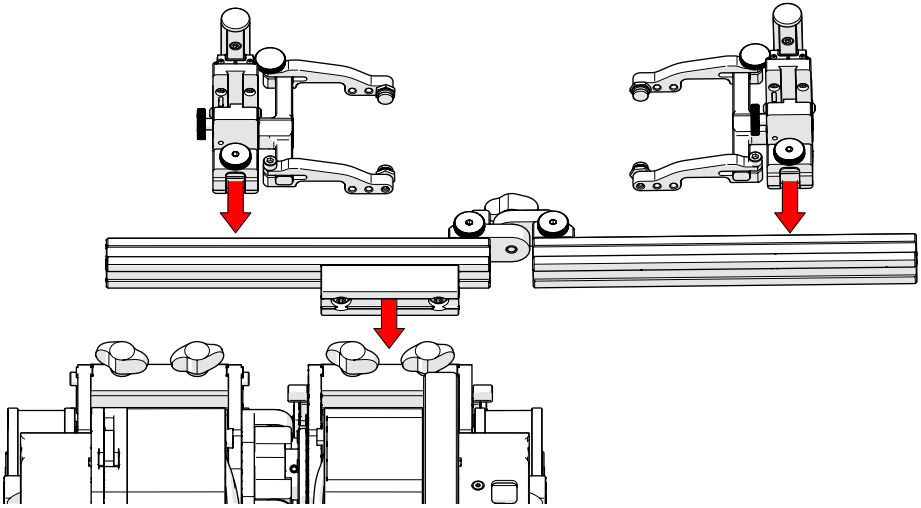


Fig. 270 - Configure assembly and mount to NAVIC

1. Disassemble the pivoting probe holder frame to achieve the setup shown *(Fig. 270)*. Ensure proper placement of the frame bar with attached mounting point in relation to the **NAVIC**.

> ***TIP:*** *When the scanning surface is circumferential, only one frame bar with two probes can be used.*

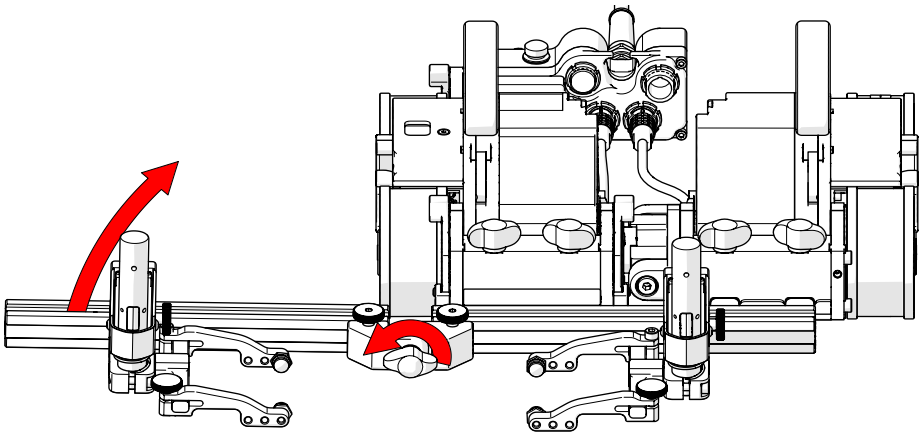


Fig. 271 - Lift frame bar to avoid interference

2. Loosen the pivot wing knob and raise the frame bar to an angle greater than the surface to be scanned *(Fig. 271)*. Tighten the pivot wing knob and place crawler on scan surface *(see "Placement of Crawler on Inspection Surface" on page 129)*.

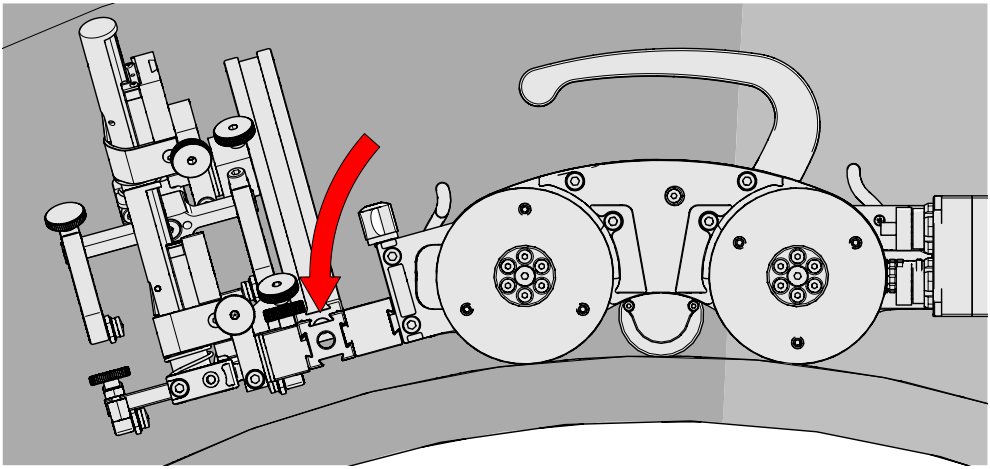


Fig. 272 - Align swivel mount with scan surface

3. Release the front swivel mount adjustment levers to align the swivel mount parallel to the scan surface *(Fig. 272)*.

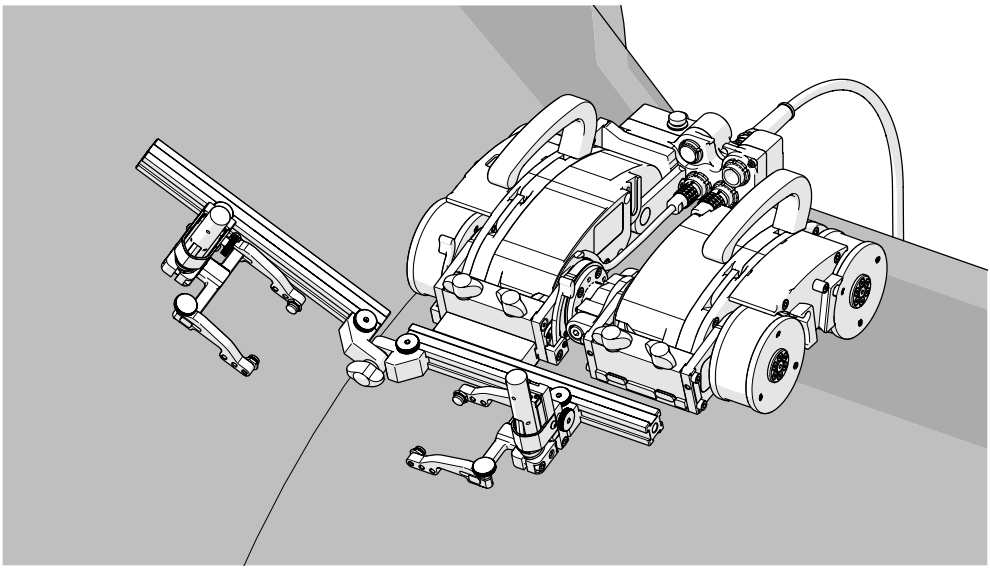


Fig. 273 - Align frame bar with flange scan surface

4. Loosen the pivot wing knob and align the frame bar parallel with the scan surface *(Fig. 273)*.

5.10.3.5 Optical Guide Pivot Mount

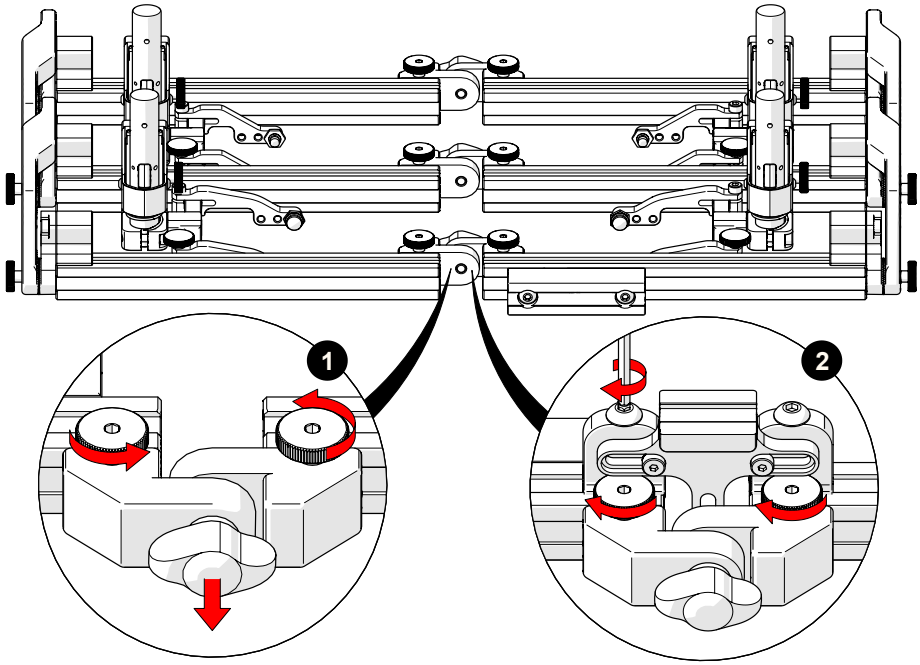


Fig. 274 - Optical guide pivot mount installation

An optional mounting point for any optical guide is available.

- *(see “Battery Powered Optical Guide” on page 121)*
- *(see “Optical Guide” user manual)*

To install the pivot mount, see these following instructions:

1. Remove the dovetail bar pivot from one of the sets of **1** frame bars *(Fig. 274)*. The choice of which dovetail bar pivot to remove is at the user’s discretion.
2. Attach the optical guide pivot mount to the **2** frame bars *(Fig. 274)*, tighten the dovetail knobs and the dovetail screws. Ensure a flush alignment of the pivot mount and the frame bars to achieve proper centering of the optical guide pivot mount.
3. To mount an optical guide see the appropriate instructions listed above.

5.11. Accessories

5.11.1. Battery Powered Optical Guide

WARNING! LASER RADIATION. The battery powered optical guide contains a Class 1M laser. Do not view directly with optical instruments.

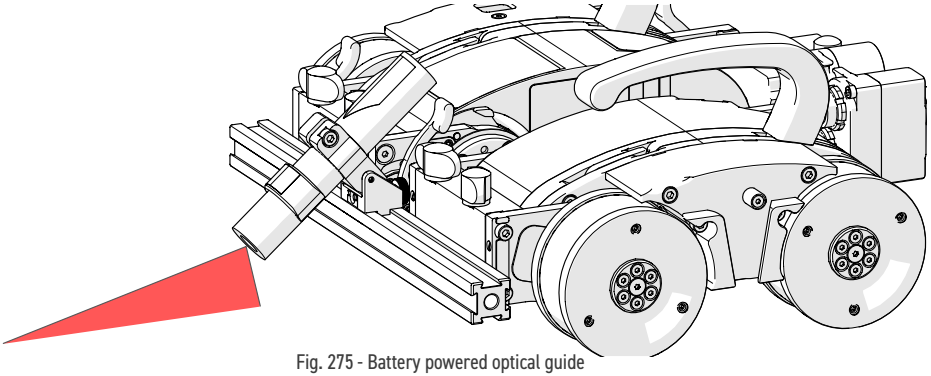


Fig. 275 - Battery powered optical guide

The battery powered optical guide provides a reference point to align the **NAVIC** to a given path *(i.e. a weld)*.

1. Loosen the battery powered optical guide knob *(Fig. 276)* and mount the optical guide to the frame bar.
2. Tighten the optical guide knob.

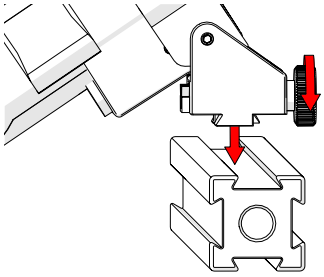


Fig. 276 - Mount on frame bar

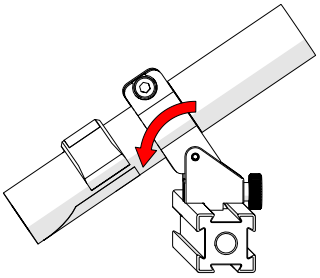


Fig. 277 - Aim guide

3. Adjust the optical guide's friction pivot to direct the laser beam as required *(Fig. 277)*.
4. Loosen the optical guide knob to adjust the side-to-side position as required. Retighten the optical guide knob.
5. The included perpendicular mount allows for alternate mounting positions when required.

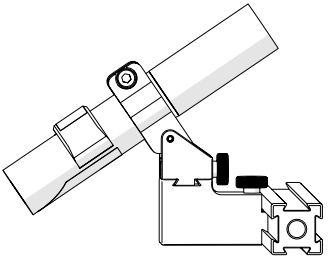


Fig. 278 - Perpendicular mount

NOTE: *The battery powered optical guide requires 1 AA battery for operation.*

5.11.2. Cable Management

The cable management is offered in a variety of lengths and provides a means of bundling and protecting cables and hoses that connect to the scanner.

5.11.2.1 Mounting Cable Management

To attach the cable management with threaded mount, follow these steps:

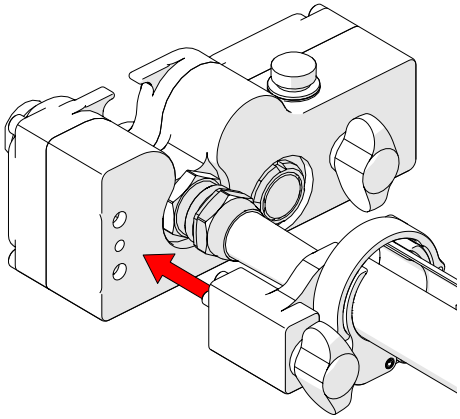


Fig. 279 - Align with umbilical

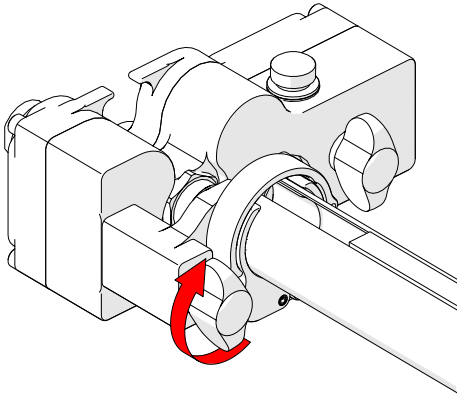


Fig. 280 - Tighten wing knob

1. Align the cable management clamp with the appropriate mounting position on the umbilical *(Fig. 279)*.
2. Tighten the cable management clamp wing knob *(Fig. 280)*.

5.11.2.2 Cable Management Setup

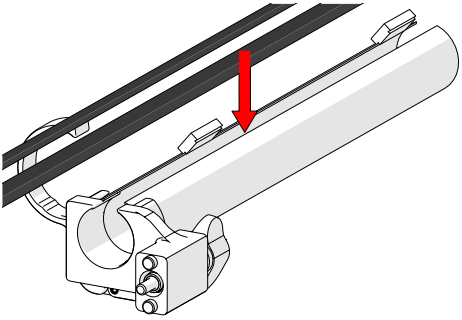


Fig. 281 - Insert cables and hoses

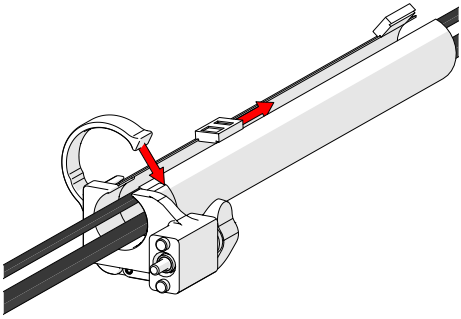


Fig. 282 - Zip to close

1. Open the cable management tube. Begin at the clamp end and start placing the cabling in the tube *(Fig. 281)*.
2. Follow the cable placement zipping the tube closed *(Fig. 282)*.

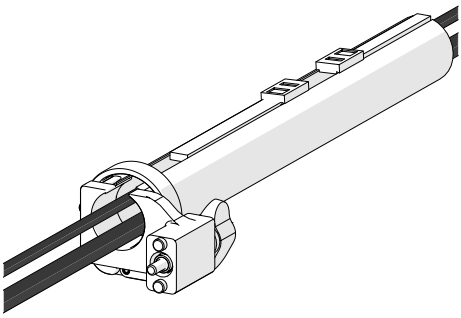


Fig. 283 - Zip opposite end

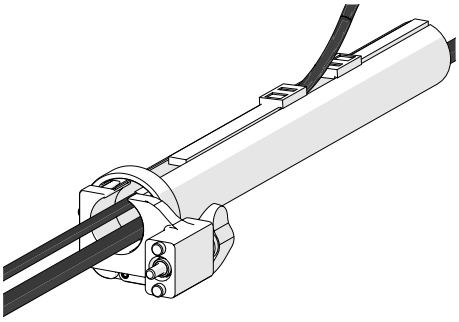


Fig. 284 - Flexible routing

3. Once the cable is placed the entire length of tube, bring the zipper from the opposite end to meet at any point in the middle.

When necessary, the two zippers may be opened to allow any cables to be routed out of the tube.

5.11.2.3 Clamp Setup

In the event the tube becomes disconnected from the cable management clamp, follow these instructions to reattach the tube and clamp.

Loosen the clamp screw using the supplied 3 mm hex driver. Slide the clamp around the tube first and then slide the tube around the outside of the cable management mount *(Fig. 285)*. Align the tube opening and the cable management clamp opening.

Slide the clamp over the tube and cable management mount pinching the tube in between *(Fig. 286)*.

Tighten the clamp screw *(Fig. 287)*.

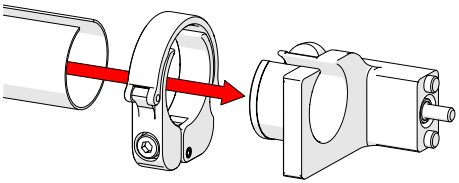


Fig. 285 - Slide tube around mount

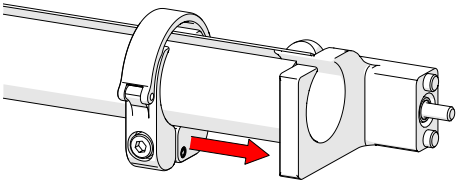


Fig. 286 - Slide clamp onto mount

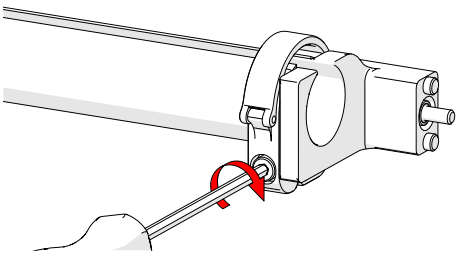


Fig. 287 - Tighten clamp screw

5.11.3. NAVIC Backpack

Intended Use

- The **NAVIC** backpack is intended to mount objects *(eg. preamps, splitters, etc)* that:
- have a maximum weight of 1.36 kg *(3 lb)*
- are attached to the **NAVIC** with a lanyard or probe cables strong enough to prevent the object from falling
- have smooth edges so as not to cut backpack velcro strap

To install and use the backpack, follow these steps:

> ***NOTE:*** *The backpack is only compatible with* ***NAVIC*** *crawlers manufactured after the spring of 2015.*

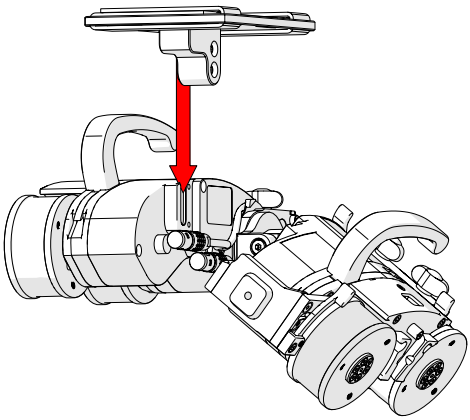


Fig. 288 - Pivot and insert dovetail nut

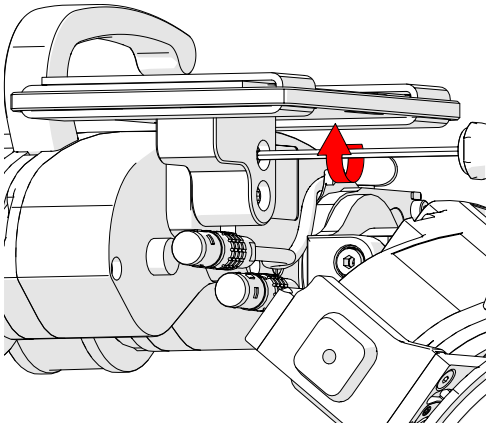


Fig. 289 - Tighten screws

1. Allow the **NAVIC** crawler to pivot exposing the inside of the left drive module *(Fig. 288)*.
2. Slide the dovetail nuts of the backpack into the accessory dovetail groove *(Fig. 288)*.
3. Tighten the two backpack screws using the supplied 3 mm hex driver *(Fig. 289)*.
4. Pull the Velcro straps tight around the item on the backpack *(Fig. 290)*.

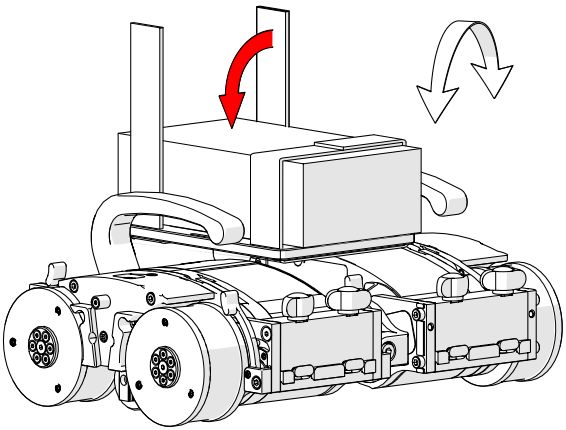


Fig. 290 - Use velcro straps

5.11.4. Preamp Bracket

Compatible with most standard preamps, use screws or the optional velcro straps to attach a preamp to the preamp bracket.

Intended Use

- The **NAVIC** preamp bracket is intended to mount objects *(eg. preamps, splitters, etc)* that:
- have a maximum weight of 1.36 kg *(3 lb)*
- are attached to the **NAVIC** with a lanyard or probe cables strong enough to prevent the object from falling
- have smooth edges so as not to cut bracket's velcro strap

5.11.4.1 Mounting Preamp Bracket

The preamp bracket mounts to any dovetail groove.

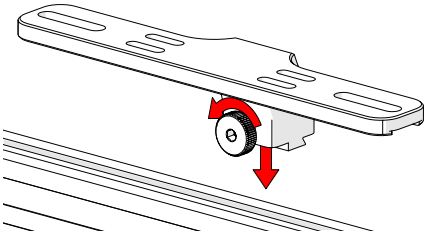


Fig. 291 - Loosen knob and mount to dovetail groove

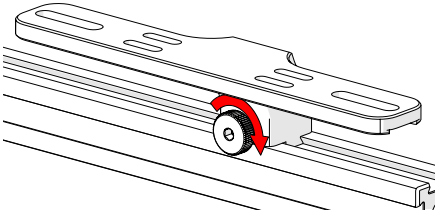


Fig. 292 - Tighten knob

1. Loosen the knob and align with dovetail groove *(Fig. 291)*.
2. Tighten the knob to lock preamp bracket in place *(Fig. 292)*.

5.11.4.2 Attaching Preamp with Screws

Use the adjustable screw mounting channel on the bottom of the bracket to attach a preamp *(screws not included)*.

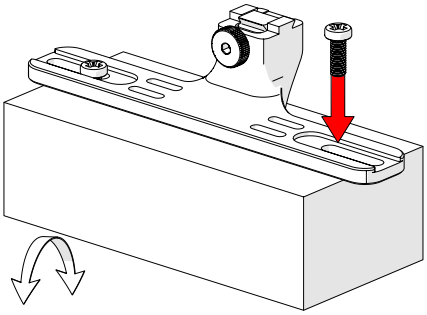


Fig. 293 - Attach preamp with screws

5.11.4.3 Attaching Preamp with Velcro Straps

To attach the preamp to the bracket using velcro straps *(sold separately*, follow these steps:

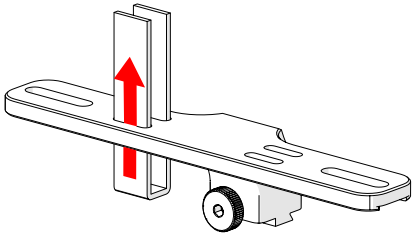


Fig. 294 - Insert velcro straps

1. Slide the velcro strap through the bracket's holes *(Fig. 294)*.
2. Centre and place the preamp on the bracket wrapping the velcro around the preamp *(Fig. 295)*.

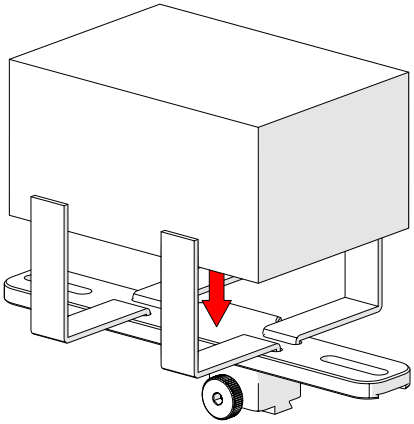


Fig. 295 - Place preamp and wrap velcro

Secure the preamp to the bracket attaching each side of the velcro *(Fig. 296)*.

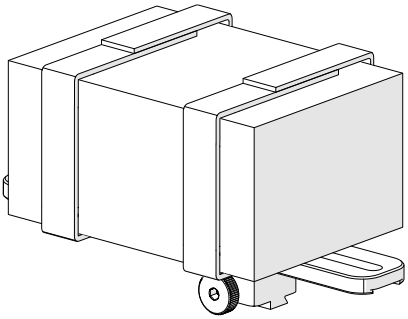


Fig. 296 - Velcro wrapped around preamp

6.1. System Startup

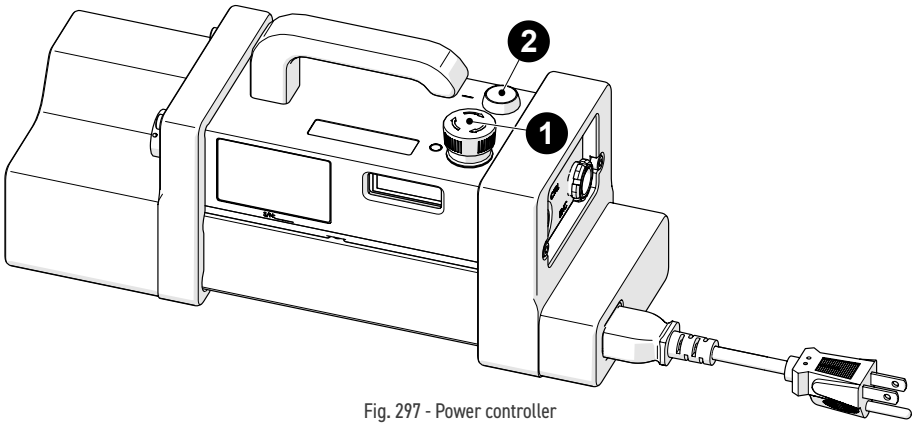


Fig. 297 - Power controller

To activate the system, follow these steps:

1. Plug-in the power controller to the appropriate power source *(see "Power Requirements" on page 8)*.
2. Connect the components *(see "Configurations" on page 46)*
3. Locate the 1 red emergency stop push-button on the power controller. Rotate this button clockwise to unlatch *(Fig. 297)*.
4. The 2 green push-button on the power controller activates the system *(Fig. 297)*.

Fig. 298 - Handheld controller

5. A warning message will display on the handheld controller when power has been activated. Once the dangers of using the **NAVIC** are recognized and understood by reading this user manual, touch **Ok** to acknowledge the warning.

Fig. 299 - Falling object warning

6. A second warning message *(Fig. 299)* will display requesting assurance that a no entry fall zone has been established *(see "Preparation for Safe Use" on page 39)* and tether requirements are met *(see "Tether Requirements and Attachment" on page 40)*. Acknowledge this warning by touching **Yes**.

Once the system is initialized, the **Mode Select** screen will appear *(see "Mode Select Screen" on page 133)*. The system is now ready for operation.

6.2. Placement of Crawler on Inspection Surface

WARNING! FALLING OBJECT HAZARD. Read and understand the proper procedure for using the Installation/Removal Mat. If crawler installation is done at elevated heights, improper use may cause the crawler to fall and **SEVERE INJURY** or **DEATH** could result.

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

IMPORTANT! Do not place the crawler directly on the inspection surface. Use of the scanner installation/removal mat as a spacer between the wheels and the inspection surface is required during scanner placement. This is necessary to protect the electronic components within the crawler from damaging shock, should the crawler be slammed directly onto the inspection surface.

WARNING! MAGNETIC MATERIAL. The wheels of 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 75 cm *(30 in)* away.

WARNING! MAGNETIC MATERIAL. The installation/removal mat contains magnetic material. Those with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

6.2.1. Scanner Installation/Removal Mat Use

To place the crawler on the inspection surface using a scanner installation mat, follow these steps:

> ***NOTE:*** *For scanner installation/removal on inspection surfaces with a temperature between 50°C and 150°C (122°C and 302°C), use the medium temperature installation/removal mat found in the automated crawler medium temperature add-on kit. Also, ensure the medium temperature cable management is used in place of cable management (see "Cable Management" on page 122)*

> ***NOTE:*** *The manufacturer recommends two persons install the crawler on an inspection surface when using the scanner installation/removal mat.*

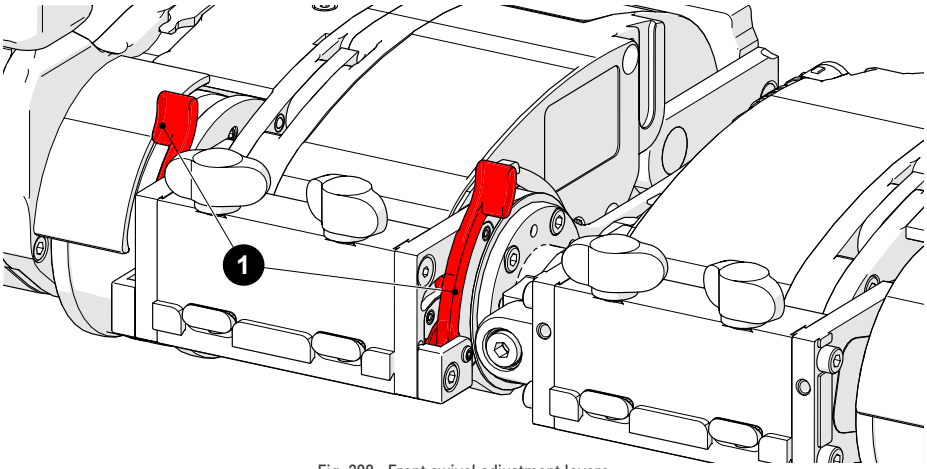


Fig. 300 - Front swivel adjustment levers

Once crawler preparation is complete *(see "Preparation for Use" on page 39)*.

Raise the front swivel mounts *(see "Swivel Mount" on page 60)* and umbilical mount *(see "Umbilical" on page 61)* to ensure they will not hinder the wheels from contacting the inspection surface *(Fig. 302)*.

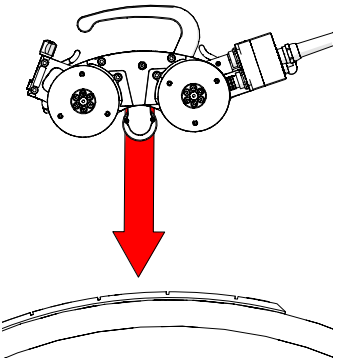


Fig. 301 - Proper swivel mount position

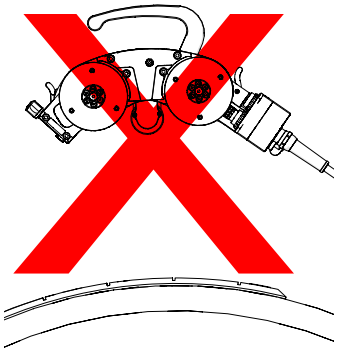


Fig. 302 - Incorrect swivel mount position

1. Set the crawler to Jog Mode *(see "Jog Mode" on page 134)*.

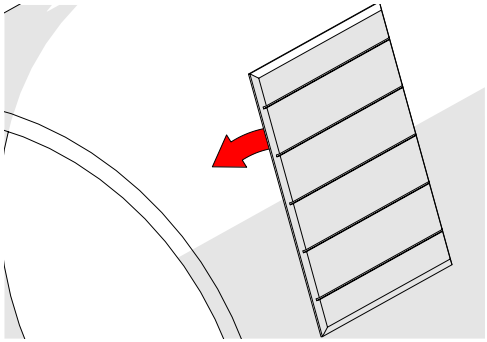


Fig. 303 - Place installation/removal mat

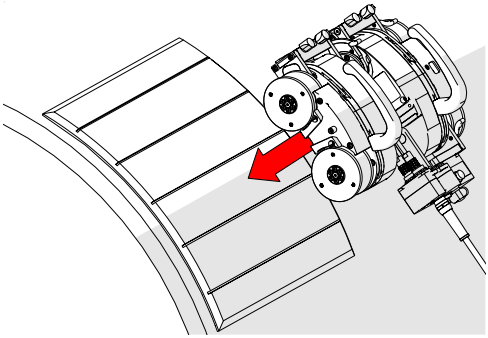


Fig. 304 - Lower crawler to mat

2. Place the installation/removal mat *(Fig. 303)* on the inspection surface *(Fig. 303)*.
3. Place and hold the crawler on the installation/removal mat *(Fig. 304)*.

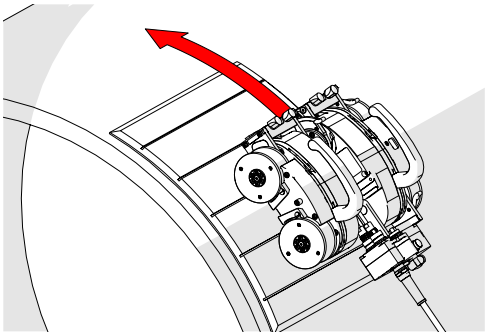


Fig. 305 - Drive crawler off the mat

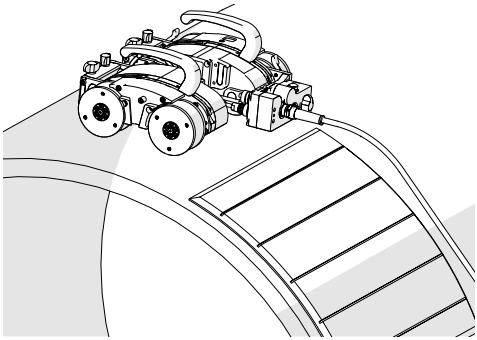


Fig. 306 - Magnetized to surface

> ***NOTE:*** *Do* ***NOT*** *let go of the crawler until instructed to do so below.*

4. Ensure all four wheels of the crawler are held firmly against the installation/removal mat. While holding the crawler, use **Jog Mode** *(see "Jog Mode" on page 134)* to carefully drive *(Fig. 305)* the crawler off the installation/removal mat and onto the inspection surface *(Fig. 306)*.
5. Once the crawler is securely on the inspection surface the user may let go of the crawler *(Fig. 306)*.

> ***TIP:*** *Avoid the drive modules slamming to the inspection surface. This can occur when all four wheels are not in contact with the installation/removal mat while the crawler is driven onto the inspection surface.*

6. Remove the installation/removal mat from the inspection surface.

TIP: *Circumstance may arise when only one person is available for placement of the crawler on a inspection surface. With the system power off, it is possible to place the crawler on the inspection/removal mat and manually push the crawler off the mat and onto the inspection surface.*

7. Align front swivel mounts and umbilical mount to appropriate relationship to the scan surface *(Fig. 307).*

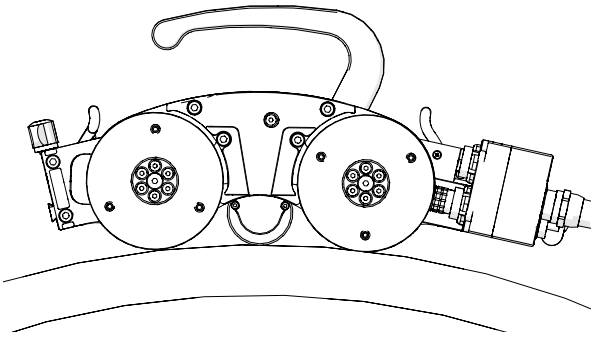
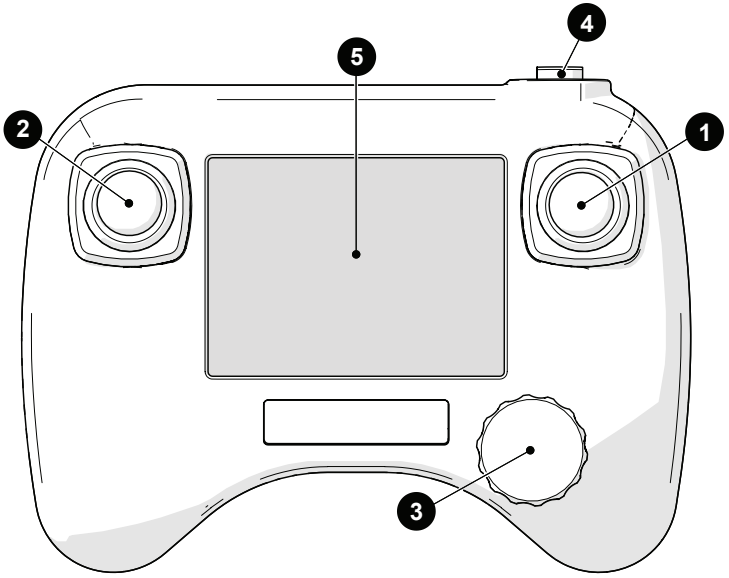


Fig. 307 - Align swivel mounts parallel to scan surface

6.2.2. Handheld Controller Layout



BOM ID	Description
1	Steering/Raster Joystick
2	Fwd/Rev Joystick
3	Click Wheel
4	Controller Cable Connector
5	Touchscreen

Fig. 308 - Handheld Controller

6.2.2.1 Touchscreen

The handheld controller's touchscreen *(Fig. 308-5)* is the primary operator interface for the system. Buttons are indicated on-screen with a 3D border *(Fig. 309)*.

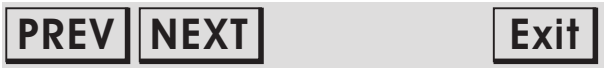


Fig. 309 - Sample touchscreen buttons

6.2.2.2 Click Wheel

The click wheel *(Fig. 308-3)* provides a redundant system control that may be utilized in lieu of the touchscreen. A blinking box around a button indicates the click wheel selection. Rotating the click wheel selects different buttons on-screen. Press the click wheel to choose the button currently selected.

6.2.3. Mode Select Screen

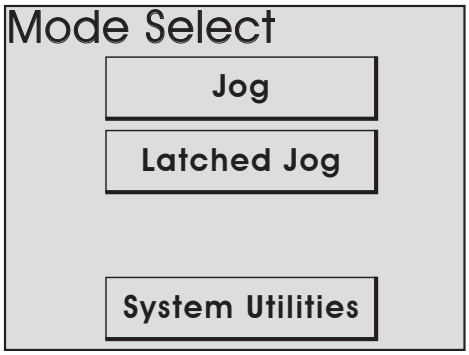


Fig. 310 - Mode select

The **Mode Select** screen offers four modes of operation for the system:

Jog Mode	*(see "Jog Mode" on page 134)*
Latched Jog Mode	*(see "Latched Jog Mode" on page 136)*
System Utilities	*(see "System Utilities Screen" on page 137)*

6.2.4. Jog Mode

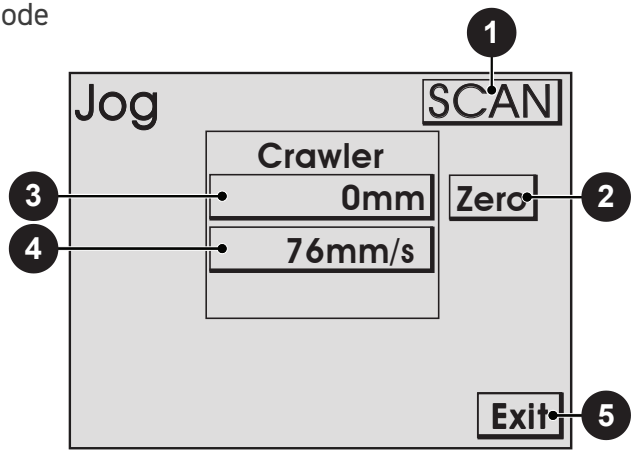


Fig. 311 - Button identification

Jog mode manually controls the system movement using the joysticks.

6.2.4.1 Joysticks

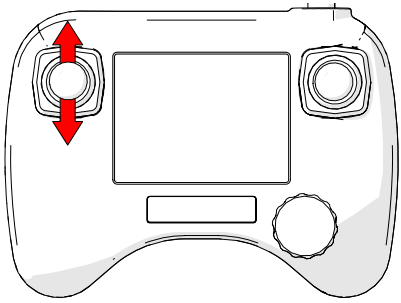


Fig. 312 - Drive the crawler

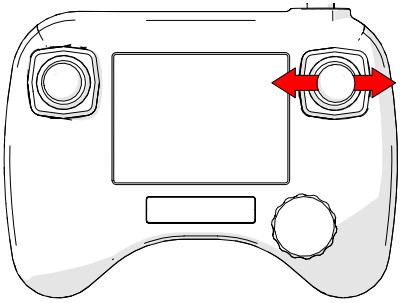


Fig. 313 - Crawler steering or raster arm movement

The joysticks control the system's motion. The left joystick *(Fig. 312)* controls the forward/reverse movement of the crawler. The right joystick *(Fig. 313)* function is selected on screen. Functions include crawler steering or raster arm movement.

1	Scan/Rapid Button *(Fig. 311)*	Used to quickly switch between crawler speeds. The speed in either mode can be manually set to the users preference. Rapid mode also changes the steering sensitivity according to the user settings. ***TIP:*** *Fine adjustments of speed and steering can be made in the User Settings (see "User Settings Screen" on page 137).*
2	Zero Button *(Fig. 311)*	Sets the current position to zero for all modules.

3	Module Position Button(s) *(Fig. 311)*	Displays the current position of the crawler. Press to set the position to any value using the **Edit** screen. When a module position is modified, the position will be modified for all other system modes. When the right crawler module is connected, the crawler position displayed refers to the position of the auxiliary idler encoder which is located between the module's wheels. ***NOTE:*** *This function only zeroes the number displayed on the **NAVIC** handheld controller. It does not zero the position used in the data acquisition instrument.*
4	Module Rate Button(s) *(Fig. 311)*	Displays the current maximum rate for the selected speed mode. Press to set the maximum rate using the **Edit** screen. The movement commanded by the joysticks will be limited to the indicated rate. When a rate is modified, the rate will be modified for all other system modes.
5	Exit Button: *(Fig. 311)*	Exits the jog mode and returns to the **Mode Select** screen.
6	BiasOn/BiasOff button *(Fig. 314)*	When the Steering Bias setting is non-zero, this button will be displayed to allow the set steering bias for the right steering joystick to be turned on and off.

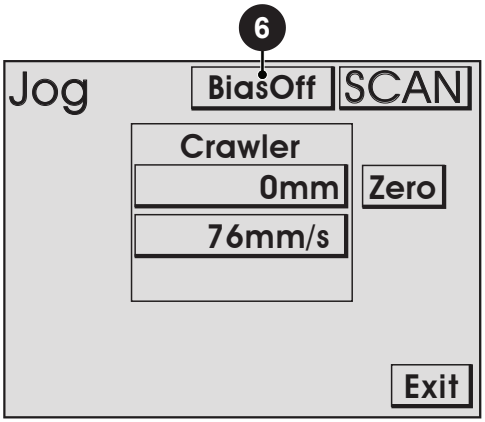


Fig. 314 - BiasOn/BiasOff button identification

6.2.5. Latched Jog Mode

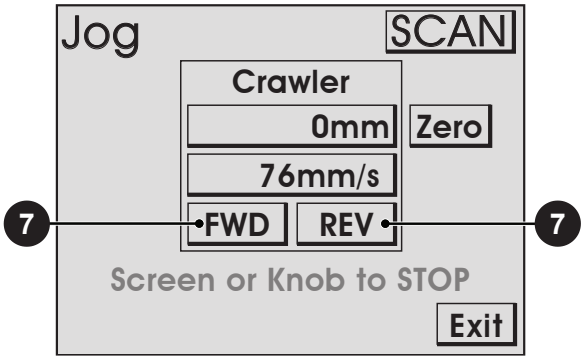


Fig. 315 - Latched jog mode

Identical to standard jog mode, latched jog mode adds forward or reverse crawler movement at the selected scan rate. This eliminates the need to manually hold the left joystick *(see "Jog Mode" on page 134)*.

7	FWD & REV Buttons:	The **FWD** and **REV** buttons are located in the crawler tab. Press the **FWD** or **REV** button to drive the crawler at the current maximum scan rate. When the crawler is in motion, the steering joystick is still enabled. Touching the handheld controller screen or pressing the click wheel stops crawler movement. ***NOTE:*** *The FWD & REV Buttons will not be present in rapid mode.*

6.2.6. System Utilities Screen

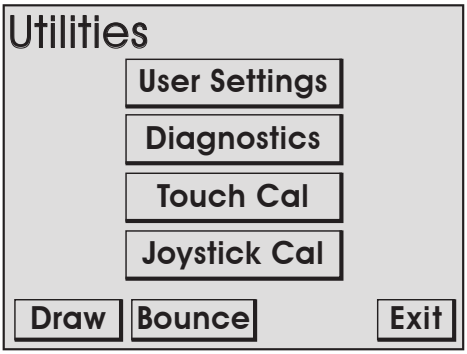


Fig. 316 - Utilities screen

The **Utilities** screen provides access to the setup, diagnostics and user preference settings.

1	User Settings Button *(Fig. 316)*	Access the **User Settings** screen allowing for various user preferences to be adjusted.
2	Diagnostics Button *(Fig. 316)*	Enters the Diagnostic screens which may be used to monitor system components and function.
3	Touch Cal Button *(Fig. 316)*	Used to initiate the Touch Calibration screen.
4	Joystick Cal Button *(Fig. 316)*	Used to enter the Joystick Calibration screen.
5	Draw Button *(Fig. 316)*	Enters mode used to test the touch screen accuracy and response

6.2.6.1 User Settings Screen

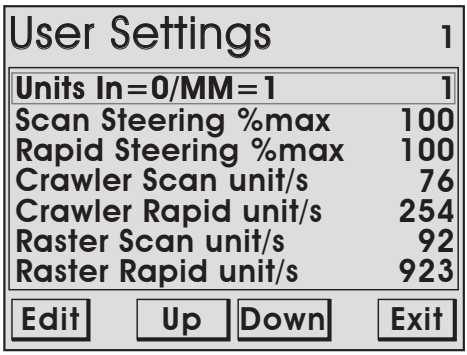


Fig. 317 - User settings screen

Allows user to customize the system to their preferences.

The blinking highlighted box indicates the current selection. Use the click knob or **Up** and **Down** buttons to select different settings.

Press **Edit** to enter the **Edit** screen to apply changes to the selected setting.

The **Exit** button directs to the **System Utilities** screen.

TITLE	DESCRIPTION	VALID RANGE	DEFAULT
Units In=0/MM=1	Changes the measurement units for display and user entry. When set to 0, units measure in inches. When set to 1, units measure in millimeters.	0-1	1
Scan Steering %max	Sets the steering limit maximum when using the jog mode scan setting. Lower values make the steering joystick less sensitive and more accurate enabling better control following a guide or feature. Units are a percentage of the maximum system allowed.	0-100	100
Rapid Steering %max	Sets the steering limit maximum when using the Rapid setting within Jog mode. Recommended to be left at 100 to allow maximum crawler maneuverability.	0-100	100
Crawler Scan unit/s	Sets the crawler scan rate in the current units/second. This setting can also be changed through the Jog or Two Axis Scan Speed screens	0-254 mm/s *(0-10 in/s)*	76 mm/s *(3.0 in/s)*
Crawler Rapid unit/s	Sets the crawler rapid rate in the current units/second. This setting can also be changed through the Jog screen.	0-254 mm/s *(0-10 in/s)*	254 mm/s *(10 in/s)*
Steering Bias +/-%	Sets a steering bias for the steering joystick which may be turned on and off in jog mode. Setting this setting to anything other than 0 will show the bias button on the Jog screen. Steering bias allow the operator to set a fixed steering value when the steering joystick is in its neutral position.	0	-30 to +30

6.2.6.2 Diagnostics Screens

Several diagnostic screens allow various system functions to be monitored. Navigate to different diagnostic screens using the **PREV** and **NEXT** buttons. The **Exit** button returns to the **System Utilities** screen.

NOTE: *The diagnostic information requires an in depth understanding of the underlying technologies and programming in the system. Not all functions and information is explained in this manual.*

6.2.6.2.1 Detected Modules

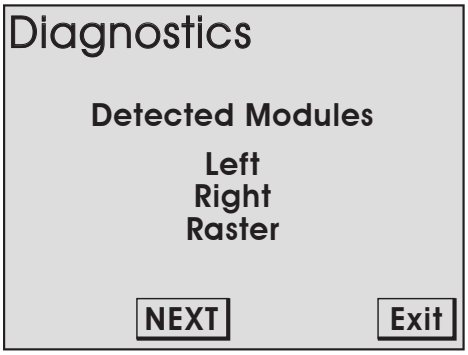


Fig. 318 - Detected modules screen

Screen indicates the system software version and displays which modules were detected when the system was activated.

6.2.6.2.2 System 1

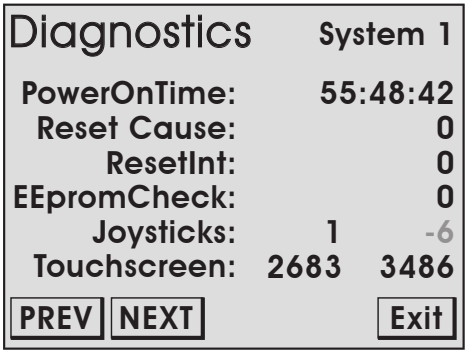


Fig. 319 - Diagnostic screen

System 1 diagnostic screen displays general system function information.

PowerOnTime	The total accumulative time the handheld controller has been powered
Joysticks	Indicates the raw position reading from the joysticks
TouchScreen	Indicates the raw position reading from the last touchscreen contact

6.2.6.2.3 System 2

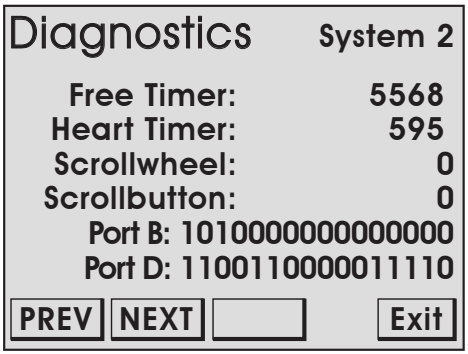


Fig. 320 - Diagnostic screen

Additional general system function information is displayed within the **System 2** screen. An empty button is provided to allow testing of the click wheel.

Free Timer	Value from a free running system timer. If this timer is static, an internal controller issue is present
Scrollwheel	Counter indicating the rotary position of the click wheel
Scrollbutton	Indicates the status of pressing the click wheel

6.2.6.2.4 System 3

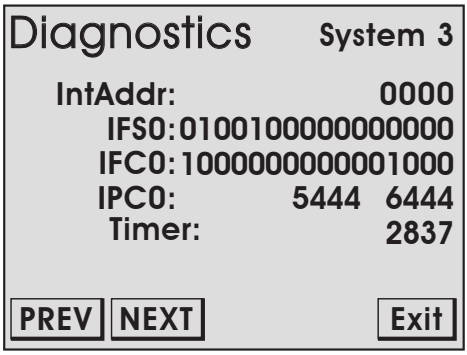


Fig. 321 - Diagnostic screen

The **System 3 Diagnostic** screen displays additional system information. The information provided does not typically assist the user.

6.2.6.2.5 LeftDrv, Right Drv,

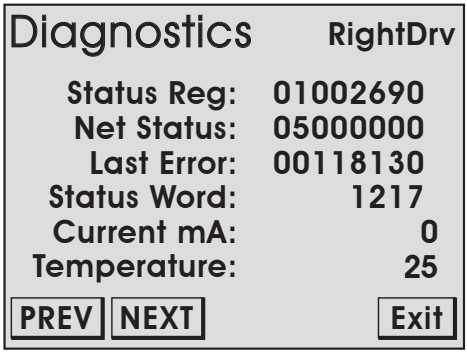


Fig. 322 - Diagnostic screen

The **LeftDrv**, **Right Drv** screens provide information regarding the status of each motorized module. A screen is available for these components if they are detected upon startup.

Current mA	Displays the output of the module to the motor. The current *(mA)* displayed is directly proportional to the motor's output torque. This reading can be used to check if the control system is responding to forces on the modules motor
Temperature	Internal temperature reading of the module in degrees Celsius

Fig. 323 - Diagnostic screen

AuxEncPos	Displays the position of the auxiliary encoder in counts when connected to the module. When the auxiliary encoder is moved, this number will change. When the encoder is moved from its current position and then back to that exact same position, this number will also return to its original position
EncPos	The position of the module's motor encoder in counts

6.2.6.3 Touch Calibration Screen

Fig. 324 - Touch calibration screen

This option allows calibration of the touch screen. Typically, this should not be necessary.

Touch the screen as the markers appear in the four corners of the screen.

> ***TIP:*** *It is recommended that the markers be touched with a small object to enhance the touch position accuracy during calibration.*

The new calibration is stored immediately when the fourth marker is pressed. The calibration utility exits and return to the **System Utilities** screen. To abort the calibration, the system power may be turned off before the last marker is pressed.

6.2.6.4 Joystick Calibration Screen

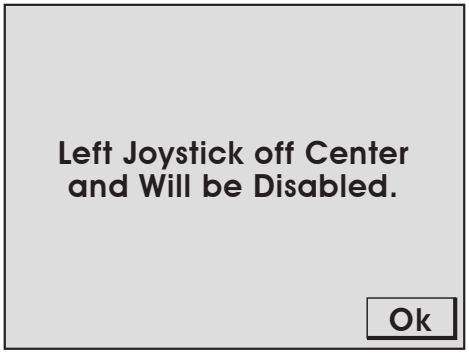


Fig. 325 - Joystick error

Typically joystick calibration is only necessary when a joystick off center error is detected upon startup *(Fig. 325)*. Calibration may also be used when a joystick function does not appear to be properly centred.

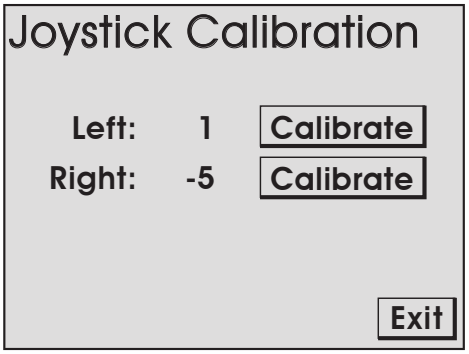


Fig. 326 - Joystick calibration screen

Current readings of the joysticks are displayed in the **Joystick Calibration** screen *(Fig. 326)*. When the numbers are not near zero, press the **Calibrate** button to recalibrate to 0. The new calibration is stored when the **Exit** button is pressed.

6.2.6.5 Draw

Fig. 327 - Draw utility

The draw utility may be used to test the function of the touchscreen. Exit the utility by pressing the click wheel.

6.2.7. High Internal Temperature Screen

CAUTION! HOT SURFACE. The handles of the crawler and crawler body may be hot to the touch. Use appropriate protective equipment when removing a crawler from a high temperature surface.

Fig. 328 - High internal temperature screen

When the system approaches its maximum operating temperature, the high internal temperature screen will display. When this alert screen is displayed, all motor and system function will cease.

Press **OK** to reactivate the system to remove **NAVIC** from the scan surface.

7.1. Safety Precautions Before Maintenance

WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the power controller when servicing the equipment. The power controller is powered even when the E-Stop push-button is latched in the off position.

WARNING! MAGNETIC MATERIAL. The wheels of 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**.

Those with pacemakers or ICD's must stay at least 75 cm *(30 in)* away at all times.

7.2. Cleaning

General cleaning of components is important to keep your system working well. All components that have no wiring or cables are completely waterproof. Components can be washed with warm water, dish soap and a medium bristle brush.

Before using the scanner, ensure all connectors are free of water and moisture.

NOTE: *All components with wiring, cables or electrical connections are splash proof. However, these components are* ***NOT*** *submersible.*

NOTE: *Never use strong solvents or abrasive materials to clean your scanner components.*

7.3. Maintenance Schedule

The **NAVIC** system must be maintained according to the following schedule:

Task	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 *(e.g. cuts, abrasion, etc)* do **NOT** use.	Every Use
Clean the drive wheels Debris will collect on the magnetic wheels. Remove this debris before every use. An effective cleaning method uses adhesive backed tape *(e.g. duct tape)* to 'pull' the debris off the wheels.	Every Use
Inspect cables and connectors Inspect the umbilical cable, the power controller cable and the power cable for damage. Have any damaged cable repaired 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. *(see "Cleaning" on page 146).*	Every Use

8.1. Startup Issues

Two messages are possible in the event of a startup issue: **Joystick Off Center** or **Checking Network**.

8.1.1. Joystick Off Center

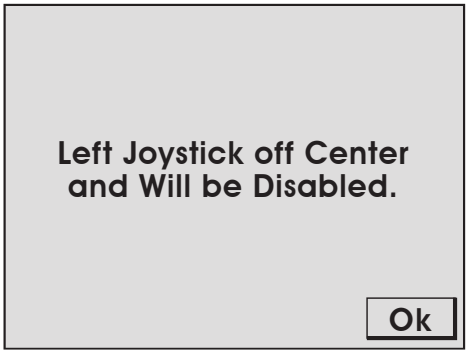


Fig. 329 - Joystick off centre screen

Upon system startup, the joystick positions are detected. When a joystick is detected outside the centre position, the **Joystick Off Center** screen displays indicating the joystick will be disabled. Press **Ok** to continue system startup. All system functions will work normally with the exception of movements that require joystick operation.

Ensure the handheld controller's joysticks are free of interference and reset the system power to enable joystick control.

If no interference of the joystick is present, the joystick calibration may need to be performed *(see "Joystick Calibration Screen" on page 144)*

8.1.2. Checking Network

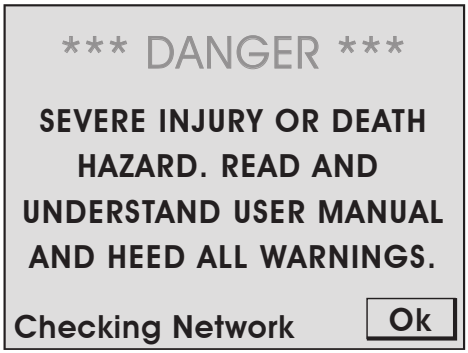


Fig. 330 - Checking network screen

During startup, the system initializes the communications to all the devices on the network. If the network communication fails for any reason, the **Checking Network** message will appear and remain on screen.

Likely causes of this failure:

1. No devices connected to the network.
2. A problem with one of the devices.
3. Cable issue causing the entire network to fail.

Check the connections of the devices or try removing one device at a time from the system to isolate the problem device.

NOTE: *Always turn off the system power before connecting or disconnecting any devices.*

8.2. Startup Override

A system maintenance mode may be accessed to correct system issues. Enter the maintenance mode by pressing the handheld controller click wheel while system power is activated. Continue pressing the handheld controller click wheel until the **Startup Override** screen appears.

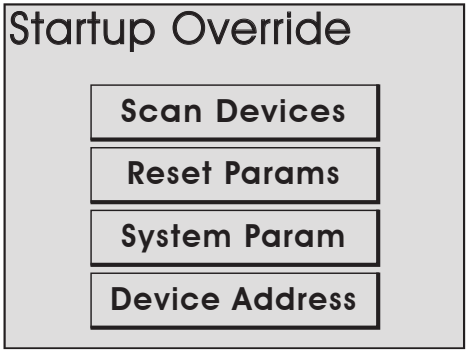


Fig. 331 - Startup override screen

8.2.1. Scan Devices

This utility scans the system network for devices. All possible device addresses and speeds are scanned. As devices are found, the address of the device and speed are displayed. When the scanning is complete, power to the system must be cycled.

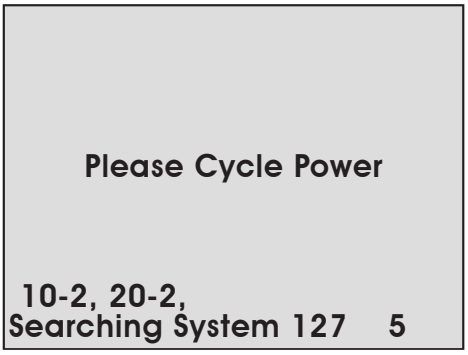


Fig. 332 - Cycle power screen

When a device is connected to the system but is not detected, this most likely indicates an internal device problem. Plug the suspect device into a different umbilical port and perform the scan again to confirm the device is faulty.

Normal network speeds will be **2** for all devices. When a device is not operating at the correct speed the internal software attempts to correct the device speed.

When a device is not operating at the correct speed, it may disrupt communications of the system network. Power should be cycled and the scan restarted.

> ***TIP:*** *Within normal operation, issues with device speed will be very rare. Device network speeds are set by the manufacturer and should not deviate.*

8.2.2. Reset Parameters

If the system parameters become corrupt or a change is made that prevents the system from functioning properly. All system parameters may be restored to their factory settings by selecting this option. When pressing the **Reset Params** button, the changes occur immediately. Power will need to be cycled for the reset to be complete.

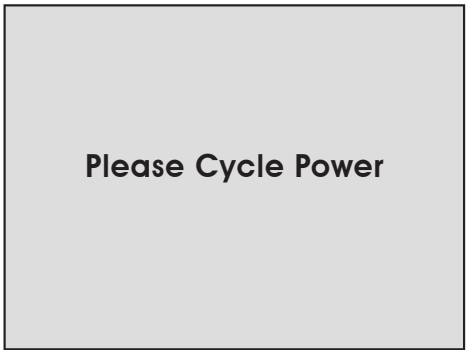


Fig. 333 - Cycle power screen

8.2.3. System Parameters

System parameters are factory set to control a variety of functions. These parameters can not be modified. However, special circumstances may occur when modification of these parameters could be recommended by the manufacturer.

Instructions for making changes to the system parameters will only be provided when deemed necessary by the manufacturer.

8.2.4. Device Address

Each device type in the system is factory assigned a unique identifier. This option allows for these identifiers to be changed in the field. Instructions for making changes to the identifiers will only be provided when deemed necessary by the manufacturer.

8.3. Encoder Failure

In the event of an encoder failure, the left drive module's motor encoder may be used to output encoder signals to an instrument.

> ***NOTE:*** *When using the motor encoder to track position, steering may cause wheel slippage which will affect encoder accuracy.*

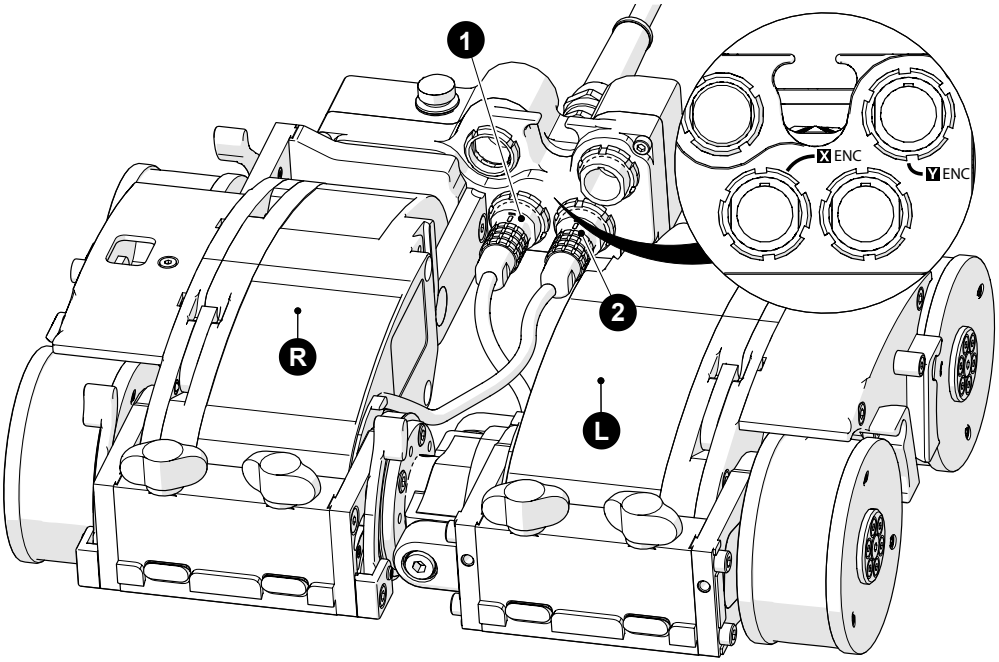


Fig. 334 - Left drive module encoder connection

To output the motor encoder's signal:

1. Ensure power to the system has been turned off.
2. Plug the left drive *(Fig. 334-L)* module's connector into the umbilical's **X-ENC** socket *(Fig. 334-1)*.
3. Plug the right drive *(Fig. 334-R)* module's connector into the remaining socket *(Fig. 334-2)*.
4. Ensure instrument receiving encoder signals is programed with motor encoder's resolution *(see "Performance Specifications" on page 9 for additional details)*.

8.4. Umbilical Troubleshooting

Troubleshooting by way of simple continuity checks through the umbilical are not effective due to the isolation circuit.

Static, spike and signal conditioning are built into the umbilical for the network signals. Power fuses are provided within the umbilical for the power distribution to the various receptacles. When troubleshooting, if a module is not functioning properly when plugged into a receptacle, it may be plugged into any other matching receptacle.

8.5. Additional Issues

PROBLEM	POSSIBLE CAUSE	SOLUTION
Handheld controller display does not activate	Input power requirements not met.	Ensure input power meets requirements. *(see "Power Requirements" on page 8)*
	Handheld controller not plugged into umbilical	Plug handheld controller into umbilical. Ensure connectors are dry, clean and connector pins are not bent.
	Umbilical cable not properly connected.	Check umbilical cable connections at both ends. Ensure connectors are dry, clean and connector pins are not bent.
	NAVIC system not started.	Start the **NAVIC** system. *(see "System Startup" on page 127)*
	Damaged components in handheld controller, crawler, power controller or cabling.	Contact manufacturer. *(see "Jireh Industries Ltd." on page 2)*
Handheld controller display is activated, yet crawler does not drive	Handheld controller is not in correct mode for driving.	*(see "Mode Select Screen" on page 133 for additional details)*.
	Damaged components in handheld controller, crawler, power controller or cabling.	Contact manufacturer. *(see "Jireh Industries Ltd." on page 2)*
Crawler does not drive and is unreachable	See possible causes for problem one.	See solutions for problem one. If the crawler is still unresponsive *(see "Retrieval of a Stranded Crawler" on page 154)*
Crawler does not steer properly	A drive module is dead	Contact manufacturer. *(see "Jireh Industries Ltd." on page 2)*

All four wheels do not remain on the inspection surface.	Inspection surface is interfering with underside of the drive module housing(s) due to excessive steering on curved inspection surfaces with OD less than 2.1 m (84 in).	Do not steer crawler so severely. Do not use the crawler outside of its intended use *(see "Intended Use" on page 4)*.

8.6. Retrieval of a Stranded Crawler

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

Should the **NAVIC** crawler become inoperative while out of reach, first attempt, the solutions offered in this manual *(see "Troubleshooting" on page 148)*

If troubleshooting does not rectify the issue, it may be necessary to retrieve the crawler manually. To do so:

1. Press the E-Stop push-button. This will turn the crawler power off.

   NOTE: *Under normal conditions, the crawler should begin descending slowly.*

2. If the crawler stops descending due to some kind of impediment, use a ladder, man lift or scaffolding to retrieve the crawler.

   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).*

WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the power controller when servicing the equipment. The power controller is powered even when the E-Stop push-button is latched in the off position.

WARNING! MAGNETIC MATERIAL. The wheels of 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**.

Those with pacemakers or ICD's must stay at least 75 cm *(30 in)* away at all times.

9.1. Technical Support

For technical support contact Jireh Industries *(see "Jireh Industries Ltd." on page 2)*

SPARE PARTS

To order accessories or replacement parts for your **NAVIC** system.
(contact Jireh Industries Ltd. on page 2)

> ***NOTE:*** *These drawings are for parts order. This is not a list of kit contents.*

10.1. Crawler

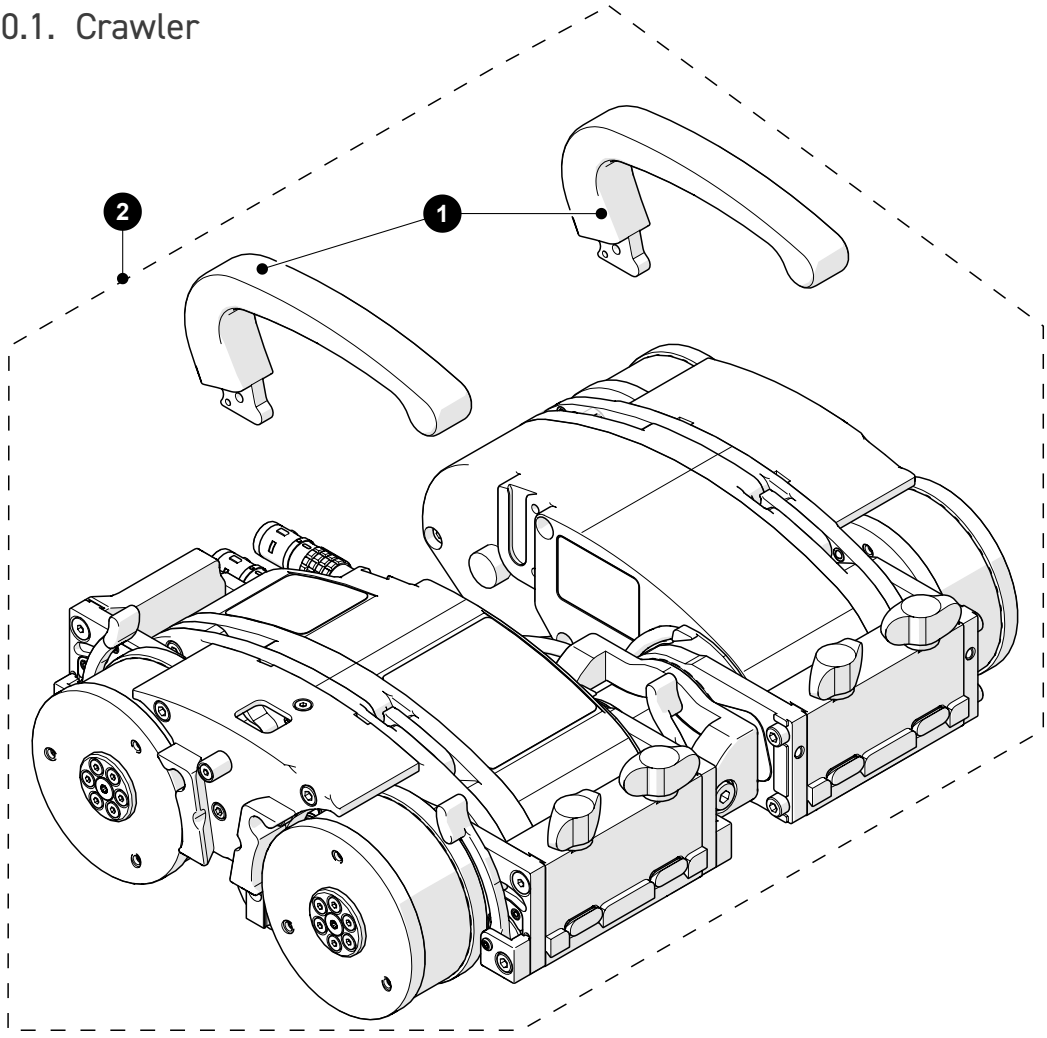


Fig. 335 - Crawler parts

BOM ID	Part #	Description
1	CX0061	Handle
2	CXA016	**NAVIC** Crawler

10.2. Kit Components

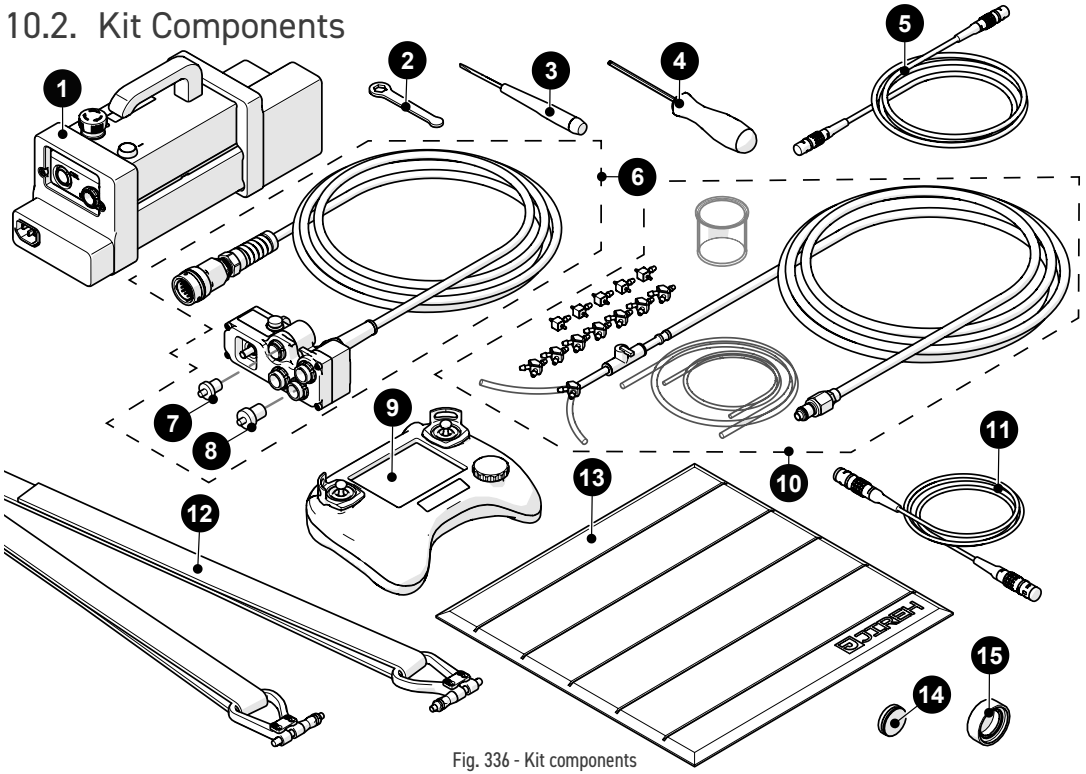


Fig. 336 - Kit components

BOM ID	Part #	Description
1	CXA019-X	**NAVIC** power controller *(see Power Cord Type)*
2	EA470	10 mm *(3/8 in)* wrench
3	EA480	3 mm *(0.118 in)* flat driver
4	EA414	3 mm *(0.118 in)* hex driver
5	UMA017-06	Auxiliary cable
6	UMA030-	Umbilical *(various lengths available)*
7	JP069	Plug: Lemo Receptacle, 10 mm
8	JP070	Plug: Lemo Receptacle, 12 mm
9	CXA008	Handheld controller
10	CMG009-	Irrigation kit, 2-4 probe, large tube *(various lengths available)*
11	UMA025-	J300 Encoder cable *(see Encoder Connector Type)*
12	CXA009	Lifting sling
13	AAS061	Installation/removal mat
14	CX0174	Cap
15	CXS066	Cap: NAVIC hinge cover

10.2.1. Encoder Connector Type

Connector Type	Company/Instrument	Connector Type	Company/Instrument
B	Olympus OmniScan MX Zetec Topaz	G	Sonotron Isonic 25xx
C	Olympus Focus LT Zetec Z-Scan Eddyfi Ectane 2	U	Sonatest Veo / Prisma
E	Olympus OmniScan SX/MX2/X3 M2M MANTIS/GEKKO LEMO	V	Pragma PAUT
F	TD *(Technology Design)*	AD	Sonatest Veo / Prisma - Single Axis

NOTE: *Additional encoder connector types available.*
(contact Jireh Industries Ltd. on page 2)

10.2.2. Power Cord Type

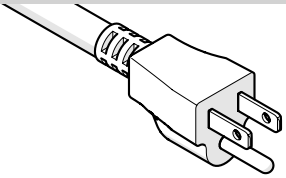
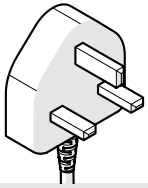
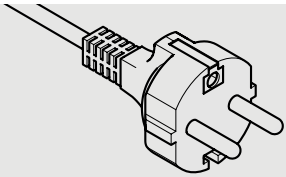
Connector Type	Power Cord	Connector Type/ Part #	Power Cord
N **SL032**	North American 	**U** **SL059**	United Kingdom 
E **SL039**	European 	**Z**	No Cord

Fig. 337 - Encoder connector type

10.3. Probe Holder Frame

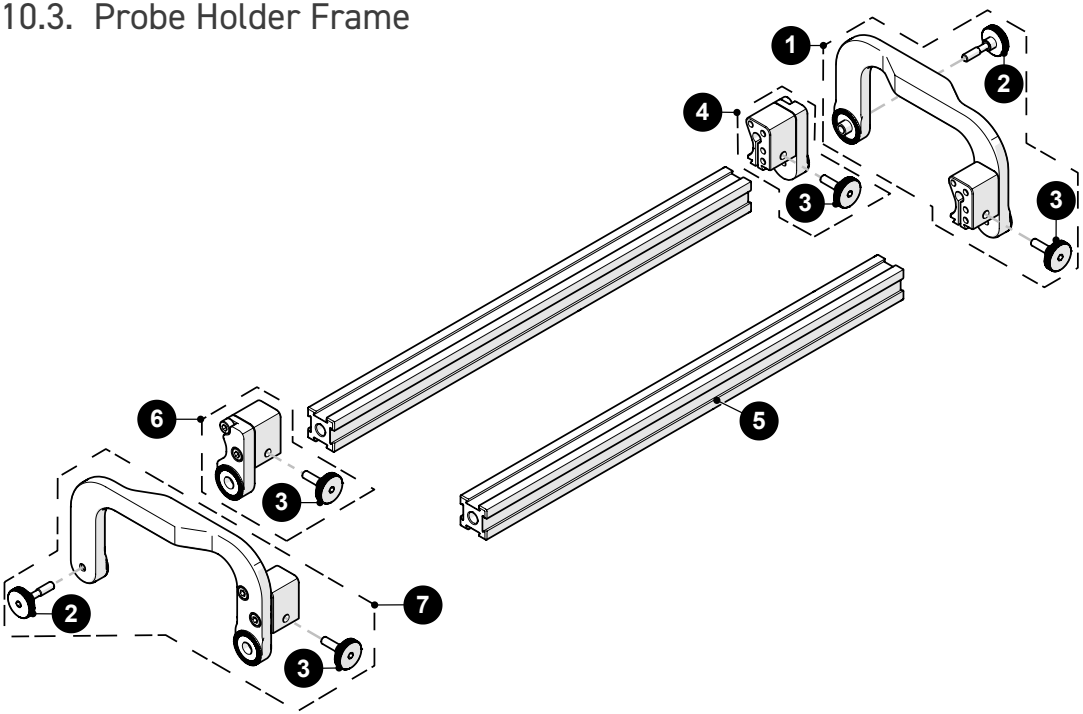


Fig. 338 - Probe holder frame parts

BOM ID	Part #	Description
1	CXS043	Vertical probe holder side arm, left
2	CX0125	Knob, M4 x 16 mm
3	CX0126	Knurled Knob, M4 x 0.7 x 11.5 mm, 3 mm hex, 4 mm stand off, SST
4	CXS072-L	Arm mount block, left
5	BG0038-	Frame bar *(see Frame Bar)*
6	CXS072-R	Arm mount block, right
7	CXS042	Vertical probe holder side arm, right

10.4. Low Profile Probe Holder Frame

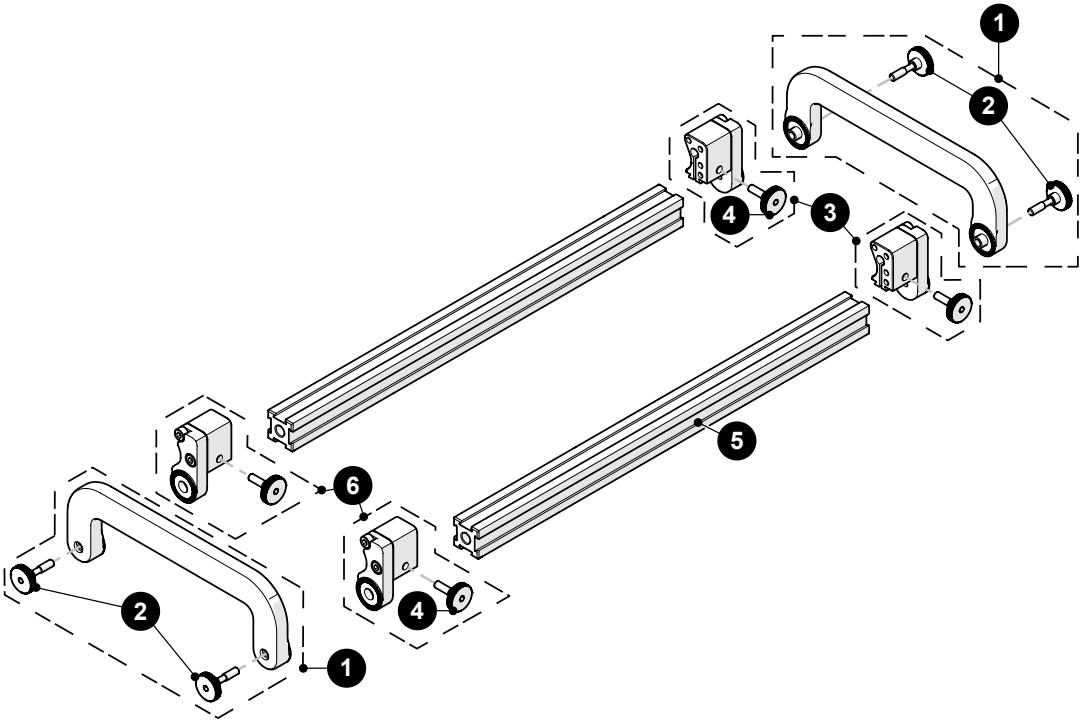
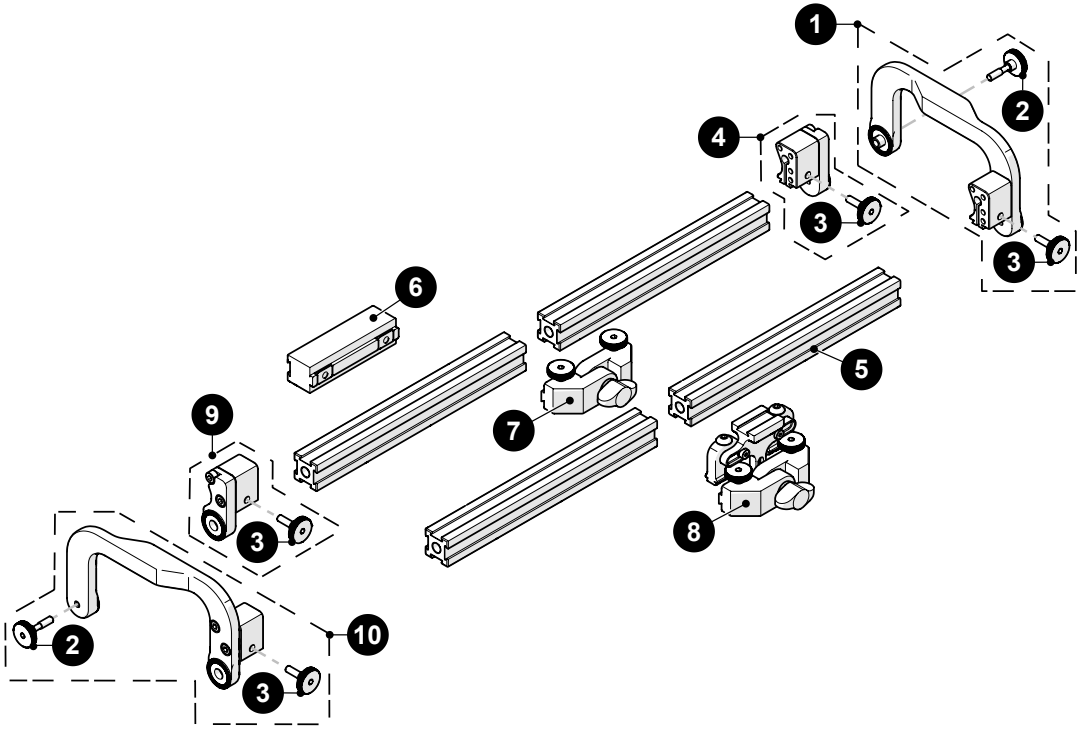


Fig. 339 - Low profile probe holder frame parts

BOM ID	Part #	Description
1	CXS023	Low profile side arm
2	CX0125	Knob, M4 x 16 mm
3	CXS072-L	Arm mount block, left
4	CX0126	Knurled knob, M4 x 0.7 x 11.5 mm, 3 mm hex, 4 mm stand off, SST
5	BG0038-	Frame bar *(see Frame Bar)*
6	CXS072-R	Arm mount block, right

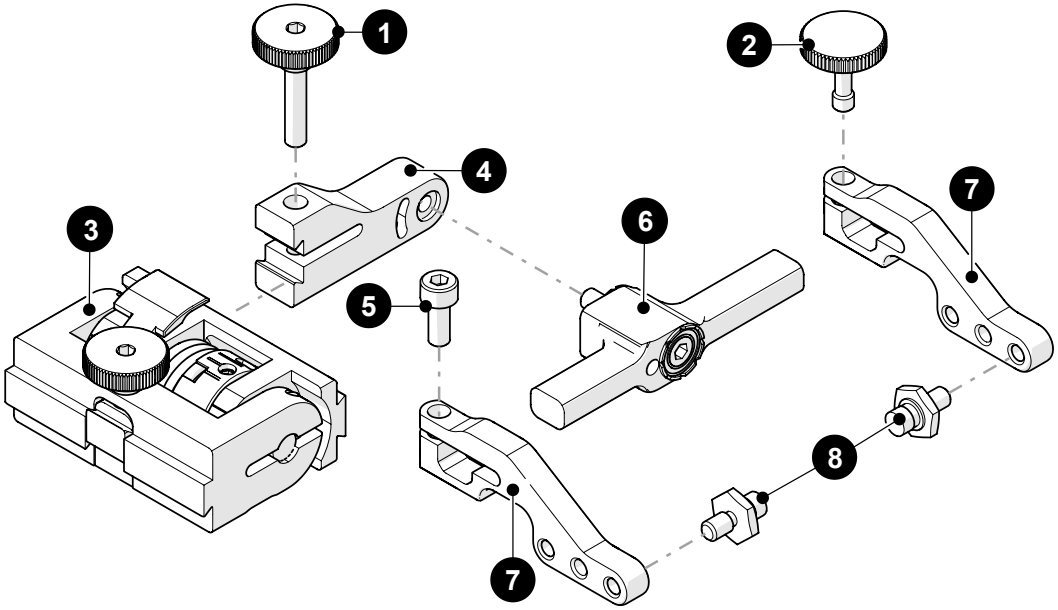
10.5. Pivoting Probe Holder Frame



BOM ID	Part #	Description
1	CXS043	Vertical Probe Holder Side Arm, Left
2	CX0125	Knob, M4 x 16 mm
3	CX0126	Knurled Knob, M4 x 0.7 x 11.5 mm, 3 mm hex, 4 mm stand off, SST
4	CXS072-L	Arm Mount Block, Left
5	BG0038-X	Frame Bar *(see Frame Bar)*
6	CXS064	NAVIC Front Spacer Mount
7	CXS055	Frame Bar Pivot
8	CXS059	Optical Guide Pivot Mount
9	CXS072-R	Arm Mount Block, Right
10	CXS042	Vertical Probe Holder Side Arm, Right

Fig. 340 - Pivoting probe holder parts

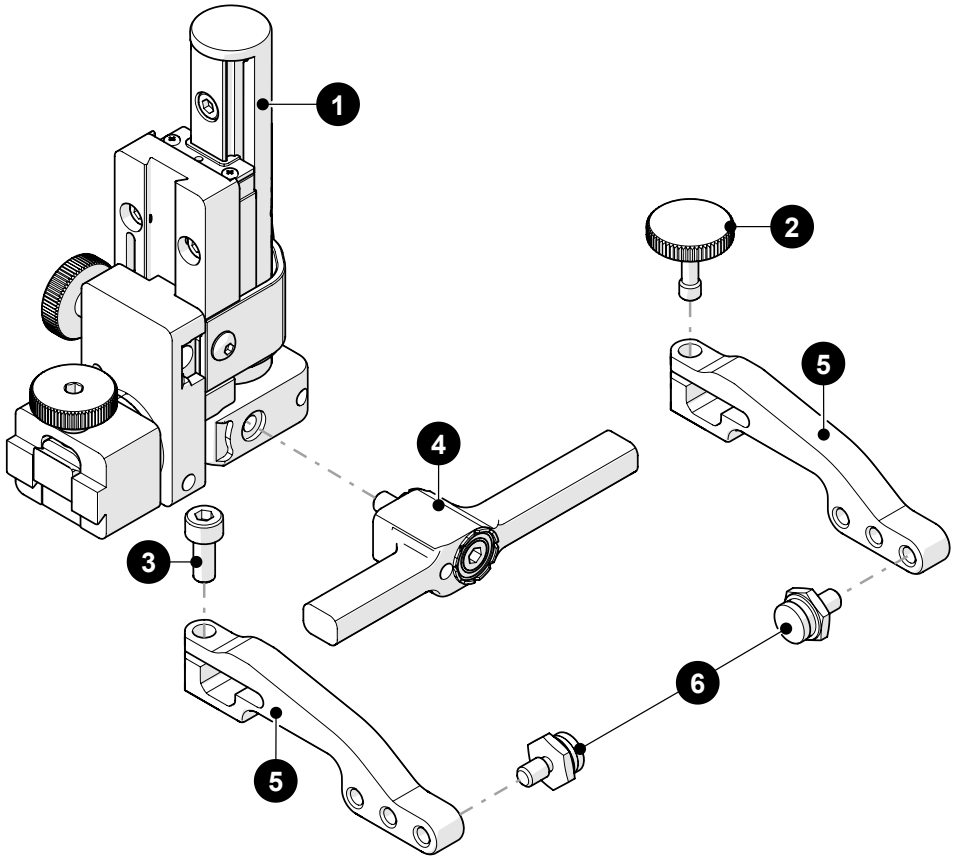
10.6. Slip Joint Probe Holder Parts



BOM ID	Part #	Description
1	PH0104	Knurled Knob, M4 x 0.7 x 18 mm, 4 mm stand off, SST
2	PH0082	Knurled Knob, M4 x 0.7 x 10 mm, 3 mm stand off, SST
3	PHS022	Slip Joint Probe Holder Subassembly
4	*see Swing Arm Style*	
5	MD050-010	SHCS, M4 x 0.7 x 10 mm, SST
6	*see Yoke Style*	
7	*see Arm Style*	
8	PH0011-X	Pivot Button Style *(see Pivot Button Style)*

Fig. 341 - Slip joint probe holder parts

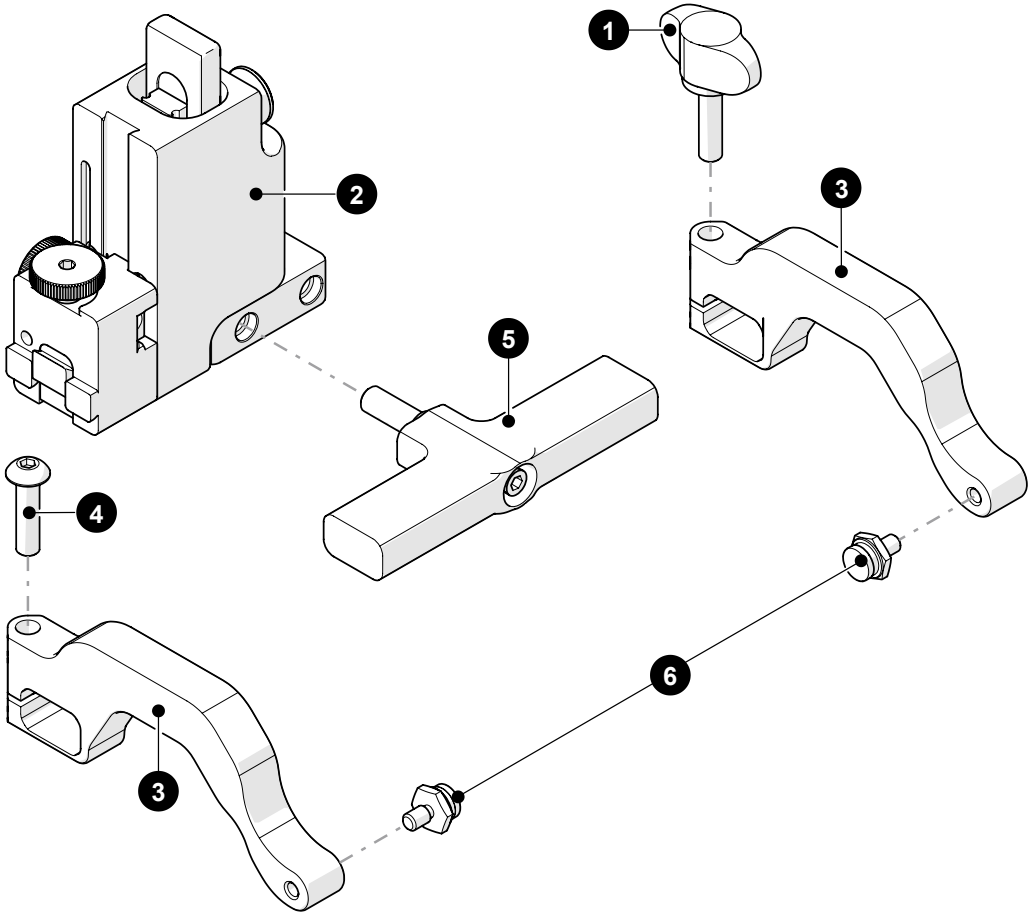
10.7. Vertical Probe Holder Parts



BOM ID	Part #	Description
1	PHS028	Vertical Probe Holder Subassembly
2	PH0082	Knurled Knob, M4 x 0.7 x 10 mm, 3 mm stand off, SST
3	MD050-010	SHCS, M4 x 0.7 x 10 mm, SST
4	*see Yoke Style*	
5	*see Arm Style*	
6	PH0011-X	Pivot Button Style *(see Pivot Button Style)*

Fig. 342 - Vertical probe holder parts

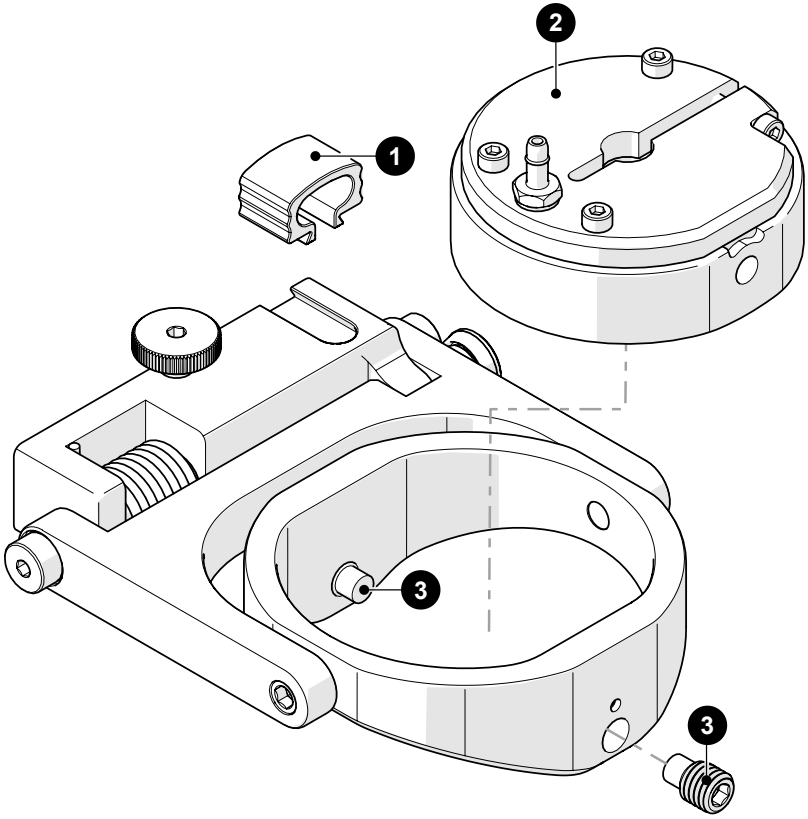
10.8. Heavy Duty Vertical Probe Holder



BOM ID	Part #	Description
1	EA154	Probe Holder Arm Adjustment Knob
2	PHS049	Heavy Duty Probe Holder Subassembly
3	PH0165	Heavy Duty Probe Holder Arm, Standard, Drop
4	MD074-020	BHCS, M5 x 0.8 x 20 mm, SST
5	*See Heavy Duty Yoke Style*	
6	PH0011-X	Pivot Button Style *(See Pivot Button Style)*

Fig. 343 - Heavy duty vertical probe holder parts

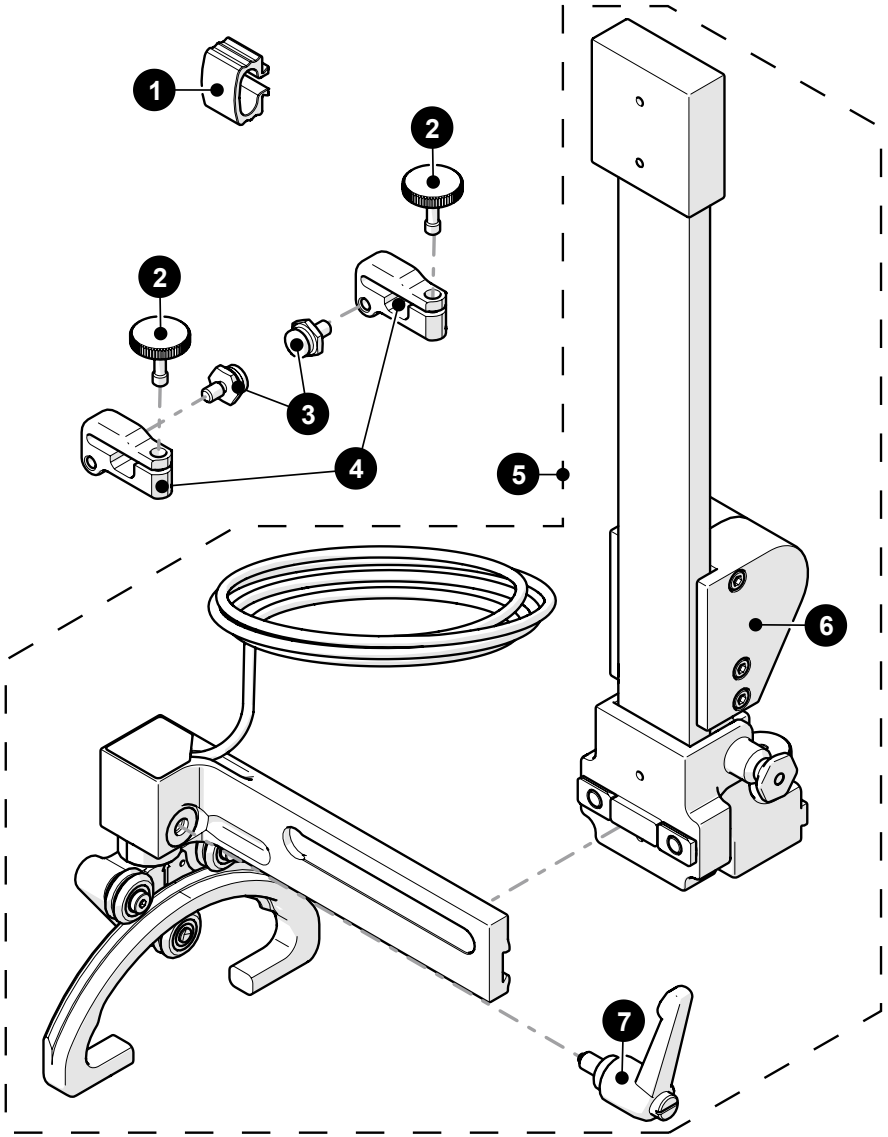
10.9. Corrosion Thickness Probe Holder



BOM ID	Part #	Description
1	BG0091	Cable Clip
2	*See Probe Holder Receptacle and Wear Plate*	
3	MA264	SHSS, M8 x 1.25 x 12 mm, dog point, SST

Fig. 344 - Corrosion thickness probe holder parts

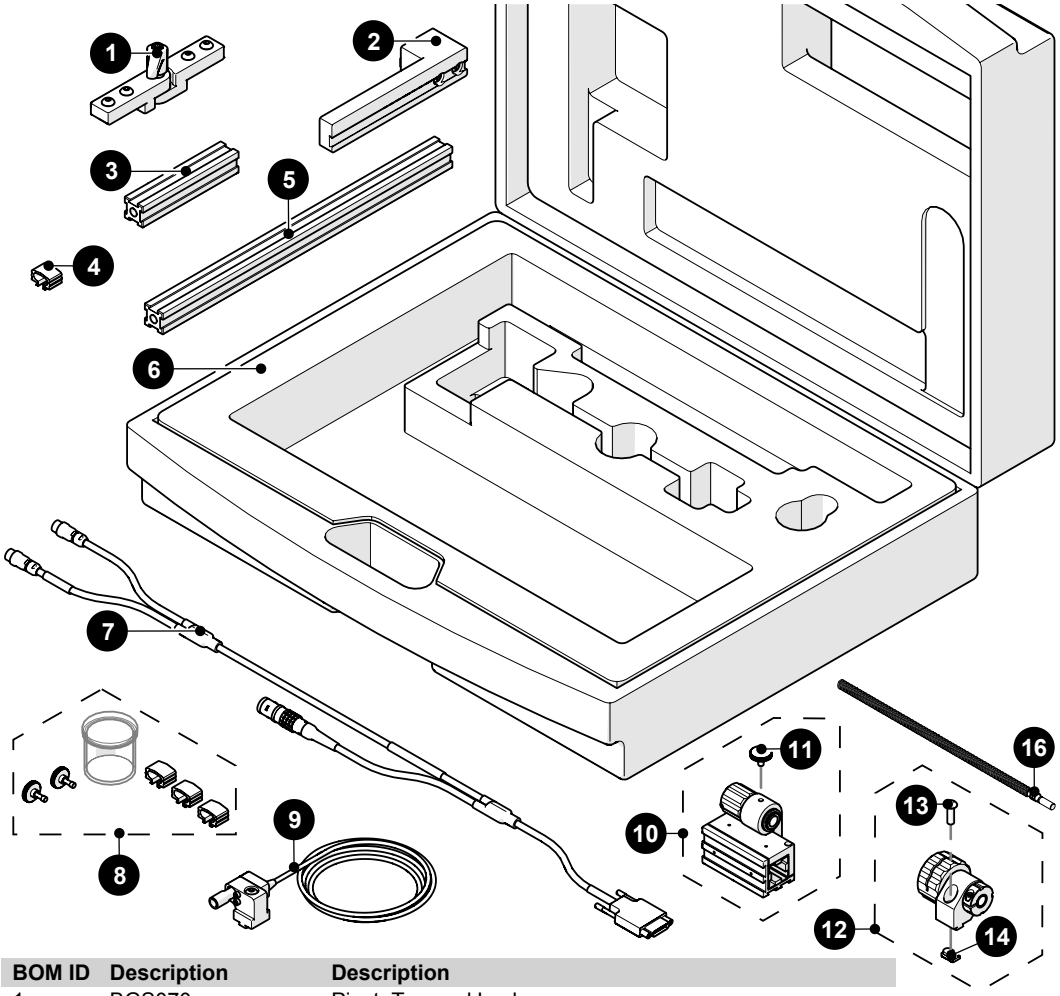
10.10.Encoded Skew Vertical Probe Holder



BOM ID	Part #	Description
1	BG0091	Cable Clip
2	PH0082	Knurled Knob, M4 x 0.7 x 10 mm, SST, 3 mm stand off, SST
3	PH0011-X	*see Pivot Button Style*
4	PH0237	*Arm Style:* Nozzle, Extra Short
5	PHS069	Encoded Skew Vertical Probe Holder Subassembly
6	PHS068	Encoded Skew Vertical Probe Holder Slide
7	BTS018	Brake Handle

Fig. 345 - Encoded skew vertical probe holder parts

10.11.3-Axis Nozzle Scanner Add-On Kit



BOM ID	Description	Description
1	BGS070	Pivot, Tapered Lock
2	CXS111	Extension Bracket
3	BG0038-20	Frame Bar, 20 cm
4	BG0091	Cable Clip
5	BG0090-35	Frame Bar with Ruler, 35 cm
6	CEA029	3-Axis Nozzle Case
7	UMA038-X-07.5	3-Axis Encoder Cable, 7.5 m *(see Encoder Connector Type)*
8	CEG039	Nozzle Spare Parts Kit
9	CJS017-S-0.6	Slider PPS Encoder
10	CJS008	Slider PPS Slider
11	EA212	Knurled Knob, M4 x 0.7 x 8 mm, SST
12	CJS001	Slider PPS Main Knob
13	MD074-016	BHCS: M5 x 0.8 x 16 mm, SST
14	BT0014	Dovetail Nut
16	*see Slider PPS Encoded Leadscrew*	

Fig. 346 - 3-axis nozzle scanner add-on kit parts

10.11.1. Slider PPS Encoded Leadscrew

Part #	Length	Part #	Length
CJS009-16	16 cm *(6.3 in)*	CJS009-21	21 cm *(8.3 in)*
CJS009-23	23 cm *(9.1 in)*	CJS009-28	28 cm *(11 in)*
CJS009-33	33 cm *(13 in)*	CJS009-38	38 cm *(15 in)*
CJS009-43	43 cm *(16.9 in)*	CJS009-48	48 cm *(18.9 in)*

Fig. 347 - Slider PPS encoded leadscrew selection

10.12. Probe Holder Components

10.12.1. Arm Style

	Arm Style	Part #		Arm Style	Part #
A	Standard, Flat	PH0090	**B**	Short, Flat	PH0089
C	Long, Flat	PH0099	**D**	Standard, Drop	PH0093
E	Short, Drop	PH0092	**F**	Long, Drop	PH0094
G	Standard, Extra-Drop	PH0096	**H**	Short, Extra-Drop	PH0095
I	Extra-Short, Flat	PH0159	**J**	Extra-Short, Drop	PH0161

Fig. 348 - Probe holder arm selection

10.12.2. Yoke Style

	Yoke Style	Part #	Length		Yoke Style	Part #	Length
S	Standard	PHS052	6.3 cm *(2.47 in)*	**W**	Wide	PHS063	7.9 cm *(3.06 in)*

Fig. 349 - Probe holder yoke selection

10.12.3. Swing Arm Style

Swing Arm Style	Part #	Length	Swing Arm Style	Part #	Length
Short	PH0069	4.1 cm *(1.61 in)*	Long	PH0100	4.6 cm *(1.81 in)*

Fig. 350 - Swing arm selection

> ***NOTE:*** *Short swing arm only compatible with standard yoke style.*

10.12.4. Heavy Duty Yoke Style

	Yoke Style	Part #	Length		Yoke Style	Part #	Length
S	Standard	PHS048	8.3 cm *(3.26 in)*	**W**	Wide	PHS047	12.2 cm *(4.79 in)*

Fig. 351 - Heavy duty yoke selection

10.12.5. Pivot Button Style

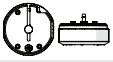
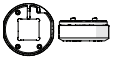
	Pivot Hole Size	Wedge Type	
01	8.0 mm *(0.32 in)*	Olympus PA	
03	2.7 mm *(0.11 in)*	Sonatest DAAH PA	
06	3.0 mm *(0.12 in)*	-	
08	Conical Head	-	

	Pivot Hole Size	Wedge Type	
02	5.0 mm *(0.20 in)*	Olympus TOFD	
04	9.5 mm *(0.38 in)*	-	
07	2.3 mm *(0.09 in)*	-	
09	5 mm *(0.20 in)* Internal	Zetec PA/TOFD	

Fig. 352 - Pivot button selection

> ***NOTE:*** *Additional probe holder pivot button types available. (contact Jireh Industries Ltd. on page 2)*

10.13. Probe Holder Receptacle and Wear Plate

Part #	Wear Plate	Receptacle	
PHS066-A	Curved	9.53 mm (0.375 in) dia.	
PHS066-C	Curved	19 mm (0.75 in) dia.	
PHS067-A	Flat	9.53 mm (0.375 in) dia.	
PHS067-C	Flat	19 mm (0.75 in) dia.	
PHS067-E	Flat	25.4 mm (1 in)	

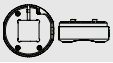
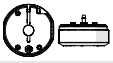
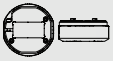
Part #	Wear Plate	Receptacle	
PHS066-B	Curved	12.7 mm (0.5 in) dia.	
PHS066-E	Curved	25.4 mm (1 in)	
PHS067-B	Flat	12.7 mm (0.5 in) dia.	
PHS067-D	Flat	Technisonic	

Fig. 353 - Probe holder receptacle and wear plate selection

10.14. Variable Components

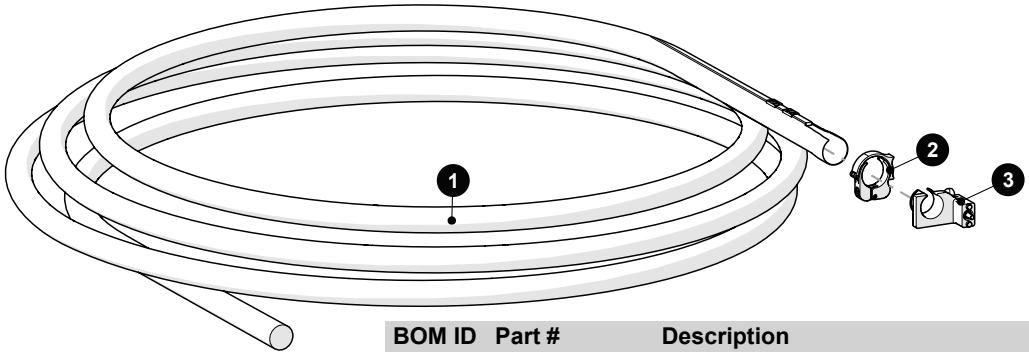
10.14.1. Frame Bar

Part #	Length
BG0038-05	5 cm *(1.97 in)*
BG0038-15	15 cm *(5.91 in)*
BG0038-25	25 cm *(9.84 in)*
BG0038-35	35 cm *(13.78 in)*
BG0038-45	45 cm *(17.72 in)*
BG0038-55	55 cm *(21.65 in)*

Part #	Length
BG0038-10	10 cm *(3.94 in)*
BG0038-20	20 cm *(7.87 in)*
BG0038-30	30 cm *(11.81 in)*
BG0038-40	40 cm *(15.75 in)*
BG0038-50	50 cm *(19.69 in)*

Fig. 354 - Frame bar selection

10.14.2. Cable Management



BOM ID	Part #	Description
1	*See Cable Management Sleeving*	
2	CES066	Cable Management Clamp
3	CXS073	Cable Management Mount

Fig. 355 - Cable management parts

10.14.2.1 Cable Management Sleeving

Part #	Length
CX0141	4.5 m *(14.8 ft)*
CX0145	9.5 m *(31.2 ft)*
CX0146	14.5 m *(47.6 ft)*
CX0147	29.5 m *(96.8 ft)*

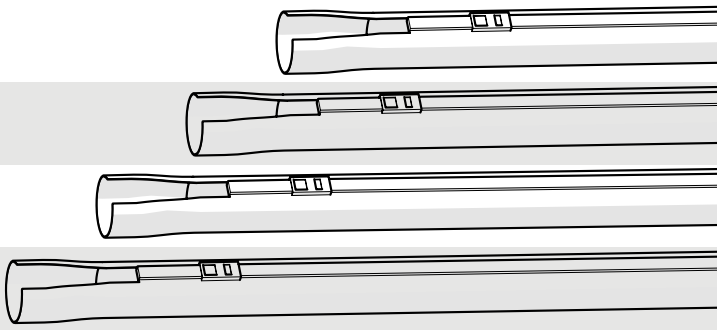
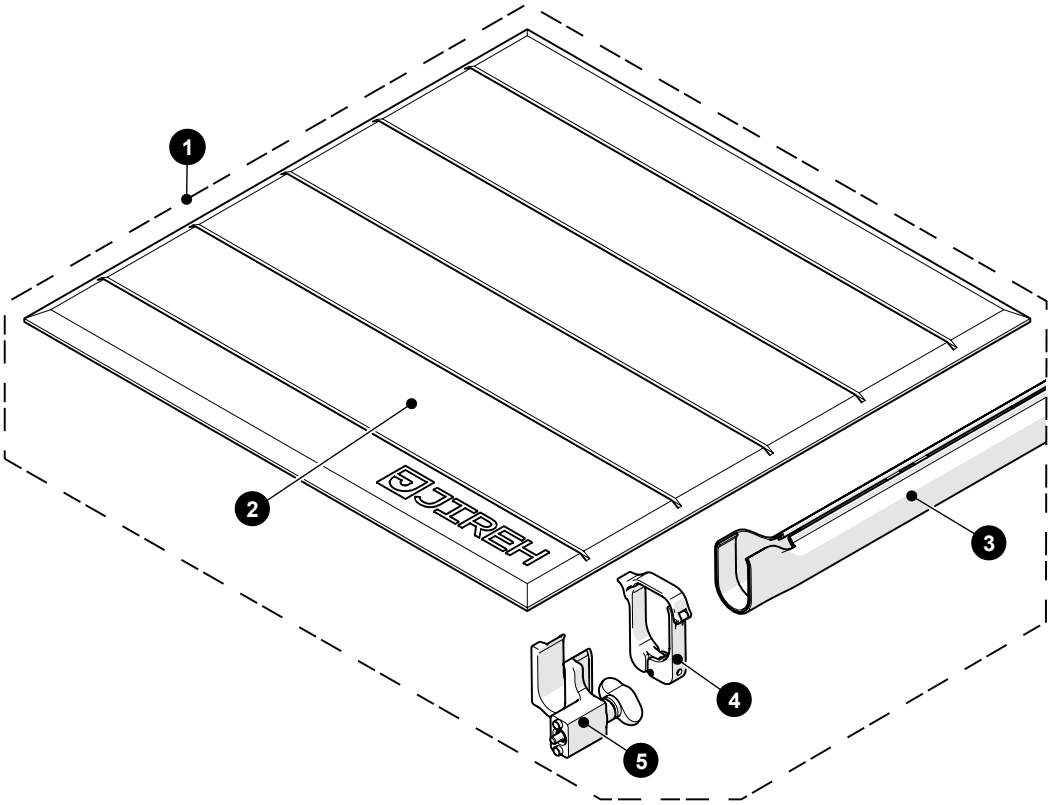


Fig. 356 - Cable management sleeving

10.14.3. Automated Crawler Medium Temperature Add-On Kit



BOM ID	Part #	Description
1	CXG031-04.5	Automated Crawler Medium Temperature Add-On Kit
2	CXS102	Medium Temperature Installation/Removal Mat
3	CX0371-04.5	Medium Temperature Sleeving
4	CXS114	Medium Temperature Clamp
5	CXS112	Medium Temperature Mount

Fig. 357 - Automated Crawler Medium Temperature Add-On Kit

10.15.Accessories

10.15.1. Preamp Bracket

Part #	Description
CES029	Preamp Bracket
CES029-V	Preamp Bracket with Velcro

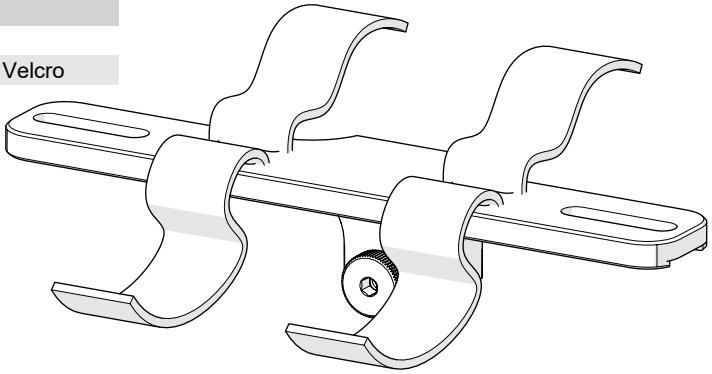


Fig. 358 - Preamp bracket

10.15.2. NAVIC Backpack

Part #	Description
CXS077	Backpack with Velcro
CXS063	Velcro Strap

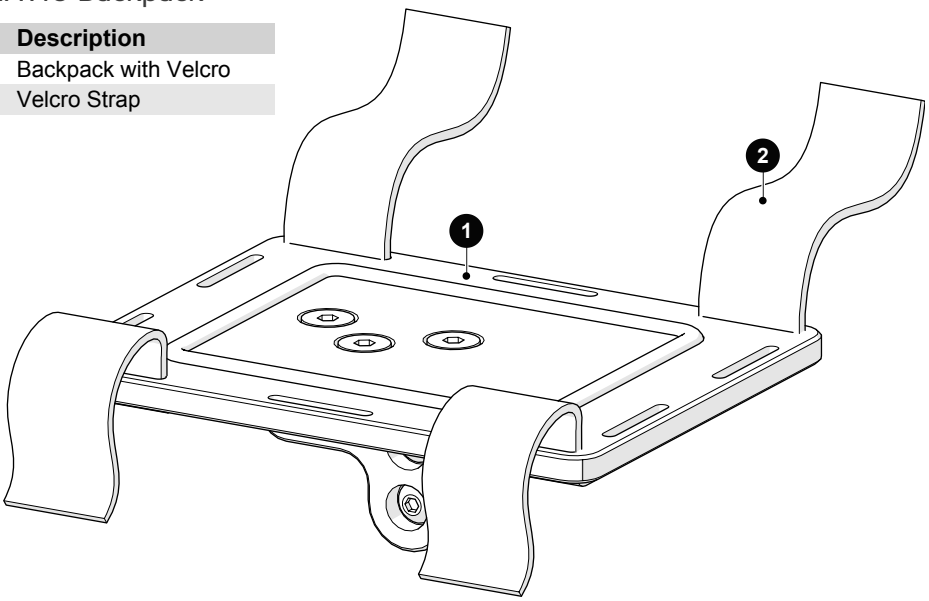
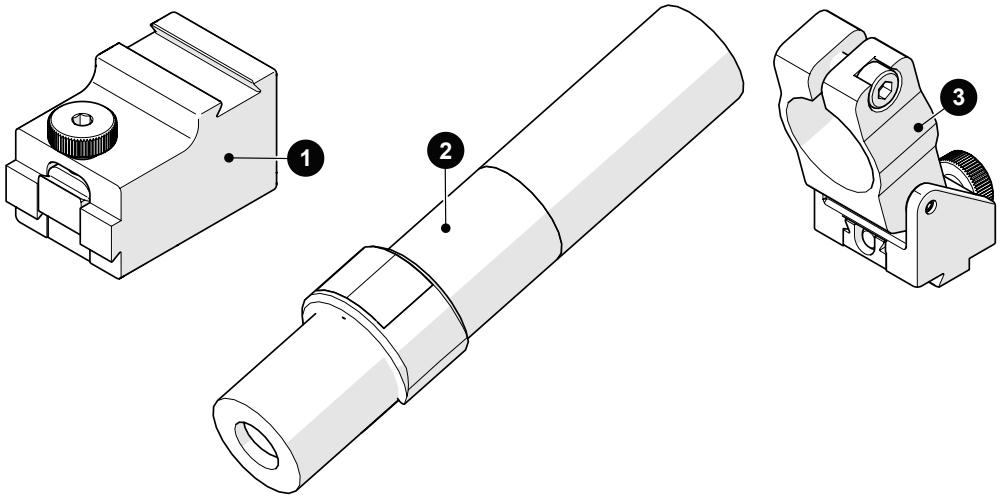


Fig. 359 - NAVIC backpack

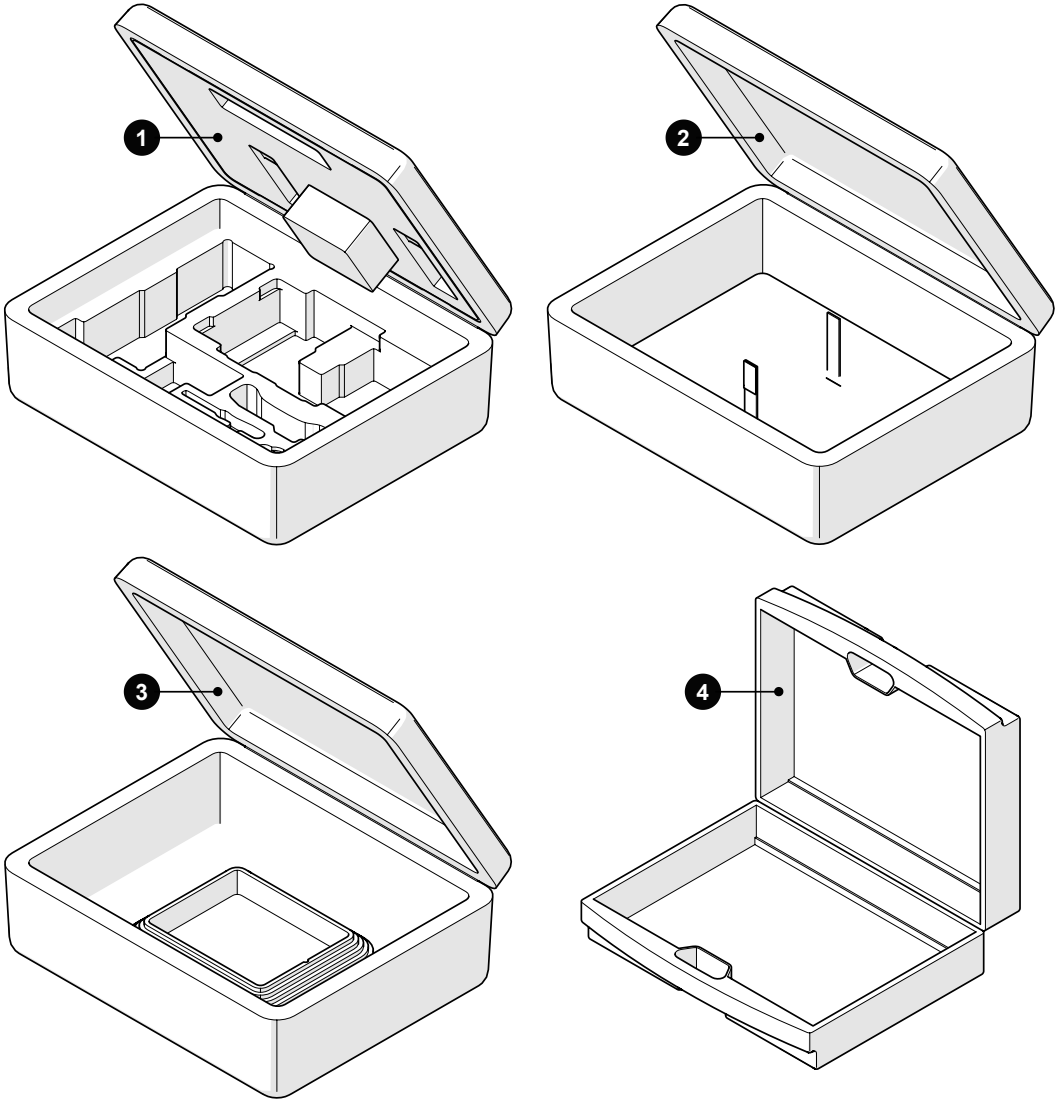
10.15.3. Battery Powered Optical Guide



BOM ID	Part #	Description
1	BGS068	Perpendicular Dovetail Mount
2	JV024	Line Laser, Battery Powered, Class 1
3	CXS082	Optical Guide Clamp

Fig. 360 - Battery powered optical guide

10.16.Cases

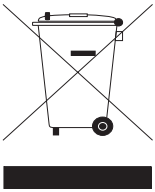


BOM ID	Part #	Description
1	CXA037	Case, NAVIC Crawler
2	CXA023	Case, NAVIC Accessories
3	CMA016	Motorized Pump / Umbilical Case
4	EA421	Case

Fig. 361 - Carrying cases

DISPOSAL

WEEE Directive



In accordance with European Directive on Waste Electrical and Electronic Equipment (WEEE), this symbol indicated that the product must not be disposed of as unsorted municipal waste, but should be collected separately. Refer to Jireh Industries for return and/or collection systems available in your country.

LIMITED WARRANTY

WARRANTY COVERAGE

Jireh Industries warranty obligations are limited to the terms set forth below: Jireh Industries Ltd. (“Jireh”) warrants this hardware product against defects in materials and workmanship for a period of THREE (3) YEARS from the original date of purchase. If a defect exists, at its option Jireh will (1) repair the product at no charge, using new or refurbished replacement parts, (2) exchange the product with a product that is new or which has been manufactured from new or serviceable used parts and is at least functionally equivalent to the original product, or (3) refund the purchase price of the product. A replacement product/part assumes the remaining warranty of the original product or ninety (90) days from the date of replacement or repair, whichever provides longer coverage for you. When a product or part is exchanged, any replacement item becomes your property and the replaced item becomes Jireh’s property. When a refund is given, your product becomes Jireh’s property.

OBTAINING WARRANTY SERVICE

To utilize Jireh’s warranty service you must ship the product, at your expense, to and from Jireh Industries. Before you deliver your product for warranty service you must phone Jireh and obtain an RMA number. This number will be used to process and track your product. Jireh is not responsible for any damage incurred during transit.

EXCLUSIONS AND LIMITATIONS

This Limited Warranty applies only to hardware products manufactured by or for Jireh Industries. This warranty does not apply: (a) to damage caused by accident, abuse, misuse, misapplication, or non-Jireh products; (b) to damage caused by service (including upgrades and expansions) performed by anyone who is not a Jireh Authorized Service Provider; (c) to a product or a part that has been modified without the written permission of Jireh.

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