NAVIC

CX0098 Rev 07.5
Automated Steerable Scanner

JIREH
SCANNING TECHNOLOGY FOR NDT

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.

DANGER! 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.

DANGER! 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 No Entry Fall Zone on page 9 for additional details)

DANGER! 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 10 for additional details)

DANGER! 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 25 cm *(10 in)* away.

The magnetic base of the raster arm cable tray contains magnetic material. People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

WARNING! MAGNETIC MATERIAL. The installation/removal mat *(Fig. 28 on page 14)* contains magnetic material. People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

WARNING! LASER RADIATION. Do not view directly with optical instruments. Class 1M laser product.

WARNING! LIFTING HAZARD. The **NAVIC** case can be heavy. Single person lift could cause injury. Two person lift recommended.

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 connection 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 111 for additional details).

TABLE OF CONTENTS

INTRODUCTION

1.1. Product information

1.1.1. Intended use

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

The intended ferrous surface is to:

- be bare metal for up-side-down surfaces, or
- be coated to a thickness no greater than:
  - 0.5 mm *(.02 in)* for vertical surfaces
  - 1 mm *(.04 in)* for horizontal surfaces on which the crawler is right-side-up
- be free of excess rust, scale, ferrous debris, ice, frost
- have a minimum thickness of 3 mm *(0.12 in)*
- have a minimum ID of 610 mm *(24 in)* for internal circumferential driving
- have a minimum OD of 70 mm *(2.75 in)* for external circumferential driving
- have a minimum OD of 305 mm *(12 in)* for longitudinal driving

The **NAVIC** is intended to:

- be used by trained personnel *(see "Intended User" on page 4).*
- operate in an appropriate environment *(see "Operating Environment" on page 7)*
- operate with a proper tether system *(see "Tether Requirements and Attachment" on page 10)*
- The **NAVIC** backpack is intended to mount objects that:
  - have a maximum weight of 1.36 kg *(3 lb)*
  - are attached to the **NAVIC** via a tether or probe cables strong enough to prevent the object from falling
  - have smooth edges so as not to cut backpack strap

1.1.2. Unintended Use

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

The **NAVIC** is **NOT** intended for:

- operation on surfaces that are not clean *(e.g. excess rust, scale, ferrous debris, ice, frost)*
- lifting / lowering objects or people *(i.e. using the crawler as a crane / elevator)*
- driving into obstructions
- operating in ambient temperatures below -20° C *(-4° F)* or above 50° C *(122° F)*
- In addition to the preceding points, operating at a height greater than 2 m *(6 ft)*, the crawler is not intended for:
- operation without a proper tether system
- operating up-side-down
- operating while oriented such that the umbilical strain relief points upwards *(front of the* **NAVIC** *is lower than the umbilical connection)*
- operating with objects mounted in backpack that have a weight greater than 1.36 kg *(3 lb)* or objects that are not attached to the **NAVIC** via a tether or probe cables, or objects with sharp edges

1.2. Regulations

1.2.1. FCC

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.

1.2.2. Industry Canada

CAN ICES-3 (A)/NMB-3(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. Intended User

The **NAVIC** is intended to be used by persons who have read and understood this user manual.

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

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

The **NAVIC** is intended to be used by persons without limitations in the physical abilities of the upper and lower limbs, sight and hearing. The **NAVIC** should not be used by anyone with a pacemaker or ICD.

1.4. Dimensions and Weight

WARNING! LIFTING HAZARD. The **NAVIC** can be heavy. Single person lift could cause injury. Two person lift recommended.

Crawler weight*	7.7 kg	17 lb
Crawler dimensions**	21x25x8 cm	8.3x10x3.2 in
Shipping weight, crawler case	30 kg	100 lb
Shipping dimensions, crawler case	52x32x81 cm	20.5x12.5x32 in
Raster arm 300 mm *(12 in)*	2.45 kg	5.4 lb
Raster arm 600 mm *(24 in)*	3.36 kg	7.4 lb
Raster arm 900 mm *(35 in)*	4.04 kg	8.9 lb
Raster arm 1160 mm *(45 in)*	4.54 kg	10.0 lb

** Dual Module Configuration excluding case, attachments, umbilical, power supply and controller.*

*** Crawler height is 12.45 cm (4.9 in) with handles attached.*

1.5. Scanner Operation Specifications

Scanner diameter range	External, circumferential scans: 70 mm *(2.75 in)* OD to Flat. Internal, circumferential scans: 610 mm *(24 in)* ID to Flat. External, longitudinal scans: 305 mm *(12 in)* OD to Flat.
Right module *(Idler encoder)*	13.78 counts/mm *(349.9 counts/inch)*
Left module *(Motor encoder)*	872.5 counts/mm *(22162.8 counts/inch)*
Raster arm module encoder	240.2 counts/mm *(6100.9 counts/inch)*
Environmental sealing	Dust tight, water tight *(not submersible)*
Required radial clearance*	70 mm *(2.75 in)* on pipes under 200 mm *(8 in)* OD and 81.5 mm *(3.2 in)* on pipes over 200 mm *(8 in)* OD

** With handles removed, using slip joint probe holders only.*

1.6. Performance specifications

Crawler vertical payload:*	10 kg	22 lb
Drive module speed	0 - 25 cm/sec	0 - 10 in/sec
Raster arm module speed	0.5 - 76.2 cm/sec	0.2 - 30 in/sec

** Performance may vary with surface type.*

***Heavy payloads may require reduced speeds.*

1.7. Maintenance

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.*

1.8. 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.

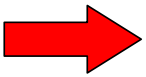
Power Requirements: 90-270VAC, 45-65Hz, 5 Amps

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

1.9. Operating Environment

The **NAVIC** is designed for use in an industrial environment that is between -20° C *(-4° F)* and 50° C *(122° F)*.

1.10. 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

1.11. Included Tools

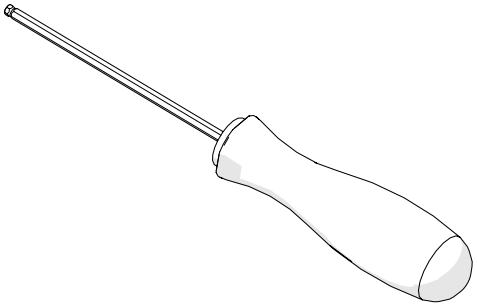


Fig. 1 - 3 mm hex driver

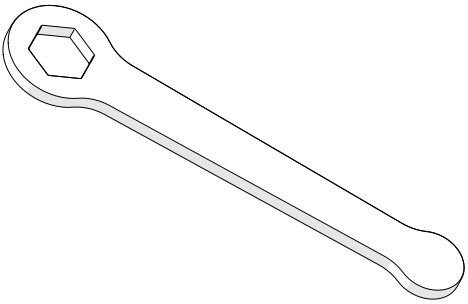


Fig. 2 - 3/8 in wrench

The included 3 mm hex driver *(Fig. 1)* is suitable for most typical adjustments of the **NAVIC** modules.

Also included in this kit is a 3/8 in wrench *(Fig. 2)* which is used to remove and install probe holder buttons.

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

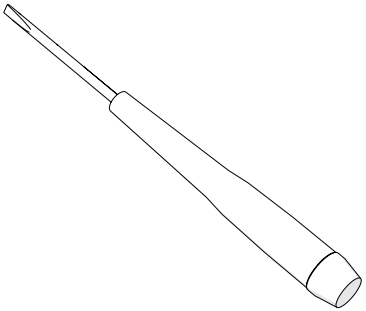


Fig. 3 - 3 mm flat driver

1.11.1. Optional tools

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

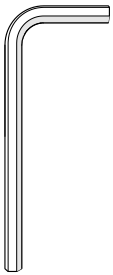


Fig. 4 - 1.5 mm hex wrench

Fig. 5 - 2 mm hex wrench

Fig. 6 - 2.5 mm hex wrench

Fig. 7 - 3 mm hex wrench

PREPARATION FOR USE

2.1. 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.

2.2. No Entry Fall Zone

DANGER! 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. 8)*.

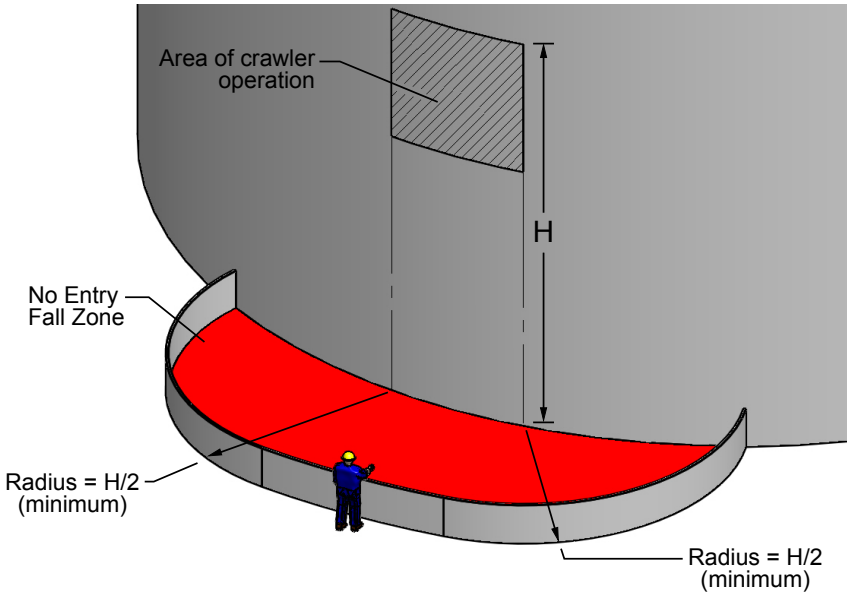


Fig. 8 - No entry fall zone

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.

2.3. Tether Requirements and Attachment

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

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

DANGER! Hook the tether hook to the provided lifting sling **BEFORE** placing the crawler on the surface to be inspected *(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.

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

2.3.1. Lifting Sling Setup

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

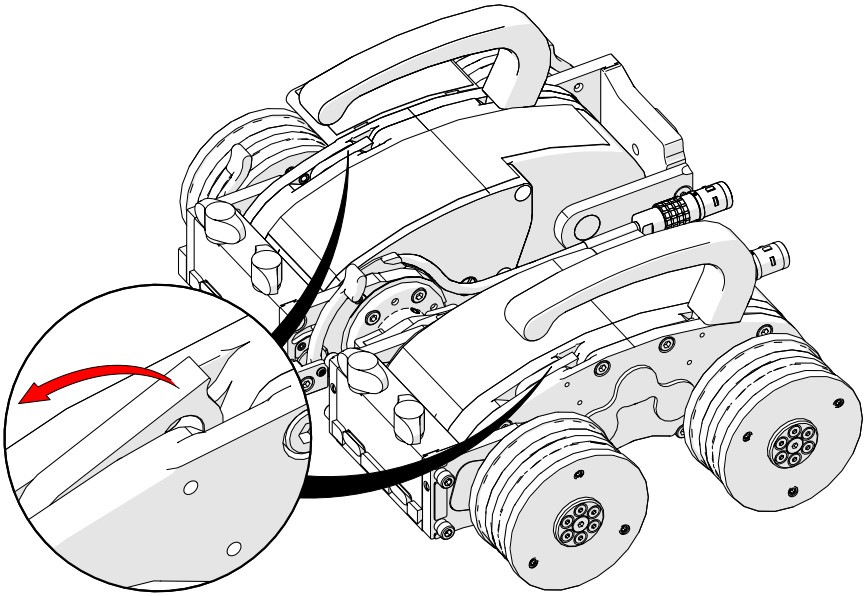


Fig. 9 - Lift tether attachment points

1. Lift the two tether attachment points *(Fig. 9)*.

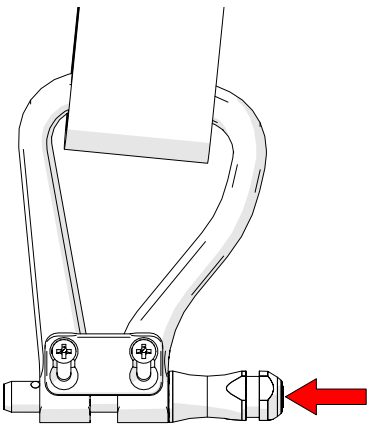


Fig. 10 - Press release button

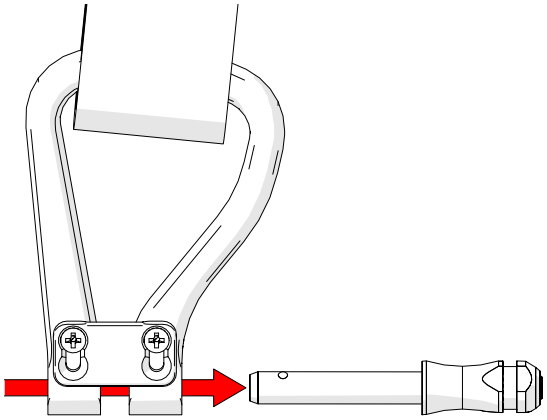


Fig. 11 - Pull pin from

2. Simultaneously press the pin's release button *(Fig. 10)* and pull the pin from the shackle *(Fig. 11)*.

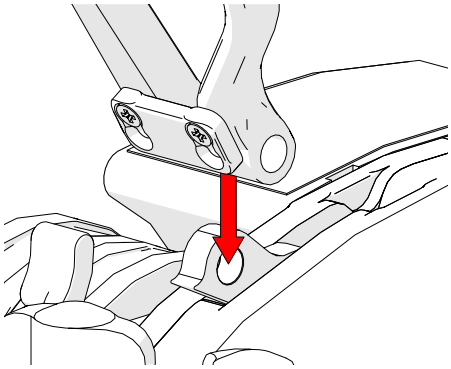


Fig. 12 - Align shackle with tether holes

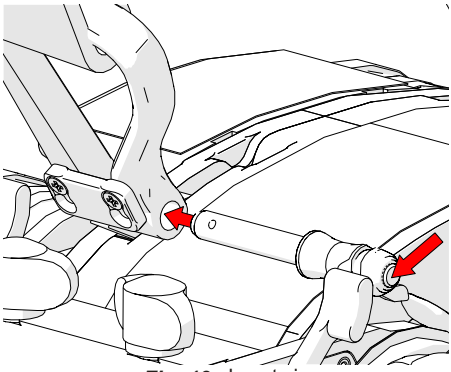


Fig. 13 - Insert pin

3. Slide the shackle around the tether attachment point *(Fig. 12)*.
4. Align the tether attachment point and shackle. Insert the pin while pressing the pin's release button *(Fig. 13)*.

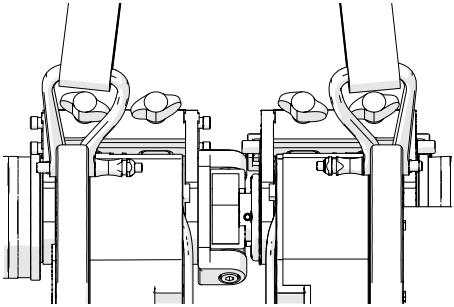


Fig. 14 - Proper shackle setup

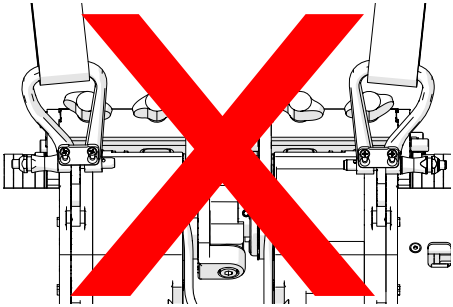


Fig. 15 - Incorrect shackle setup

> ***NOTE:*** *Ensure proper orientation of the shackles (Fig. 14).*

2.3.2. Lifting Sling Low Profile Setup

The following adjustment allows low profile scanning when required.

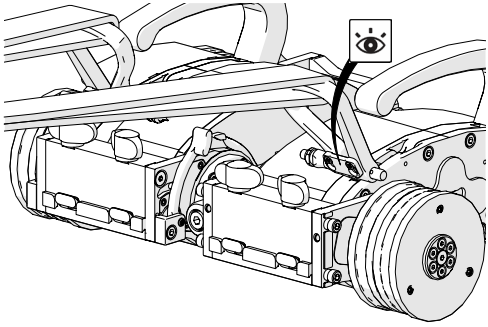


Fig. 16 - Proper shackle setup

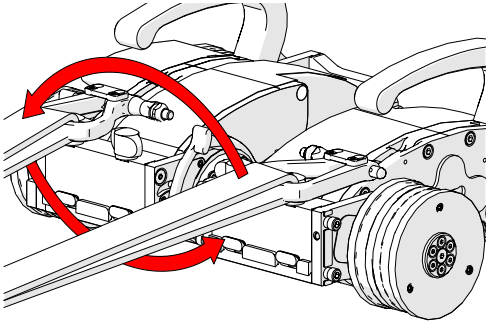


Fig. 17 - Proper shackle setup

1. The shackle plate *(Fig. 16)* in conjunction with the tether attachment point provides the necessary clearance for scanning equipment.
2. Reverse the lifting sling and shackles *(Fig. 17)* so that the shackles are free to lay down flat allowing for low profile sling setup.

2.4. Preparation of Inspection Surface

CAUTION! Do **NOT** operate crawler on surfaces where ice or frost may be present.

- 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.

2.5. Scanner Component Identification

The **NAVIC** system can contain the following components *(see System Components on page 43 for additional details)*.

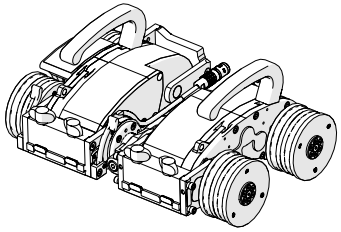


Fig. 18 - Navic *(crawler)*

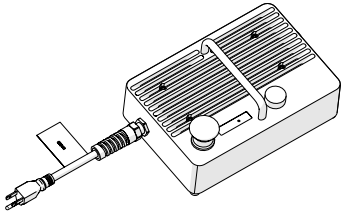


Fig. 19 - Power supply

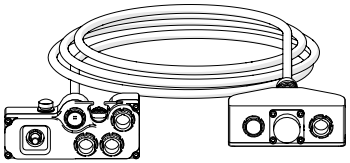


Fig. 20 - Umbilical

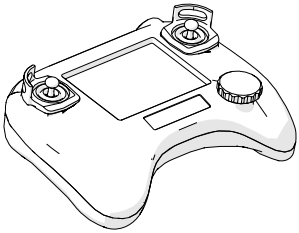


Fig. 21 - Handheld controller

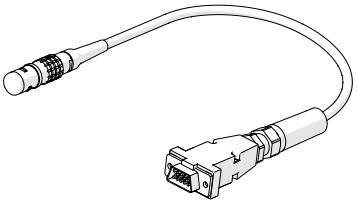


Fig. 22 - Encoder cable

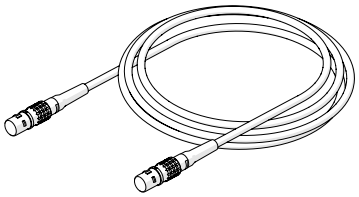


Fig. 23 - Controller cable

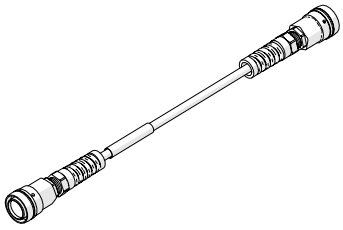


Fig. 24 - Power supply cable

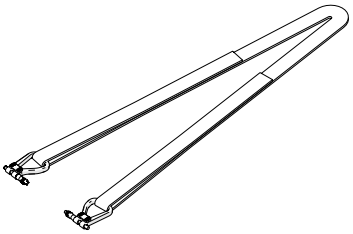


Fig. 25 - Sling

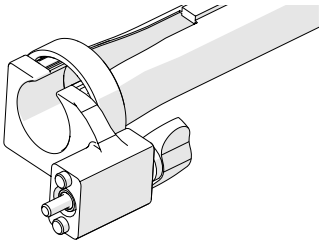


Fig. 26 - Zipper tube

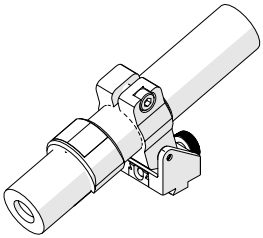


Fig. 27 - Optical guide

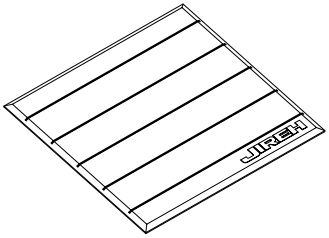


Fig. 28 - Installation/removal mat

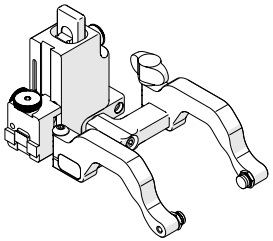


Fig. 29 - Heavy duty vertical probe holder

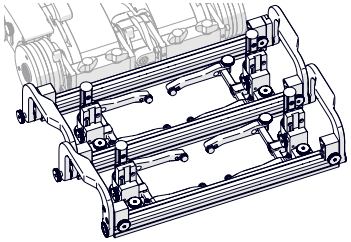


Fig. 30 - Probe holder frame

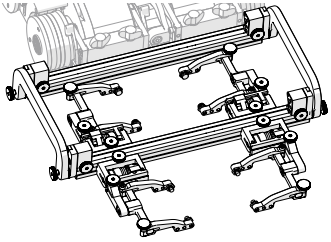


Fig. 31 - Low profile probe holder frame

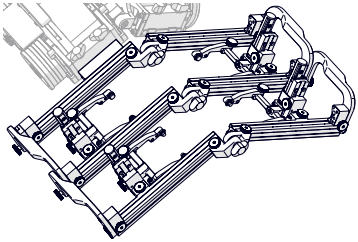


Fig. 32 - Pivoting probe holder frame

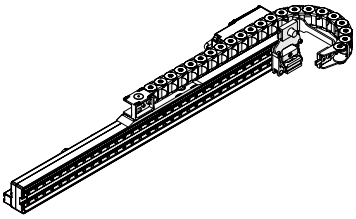


Fig. 33 - Raster arm

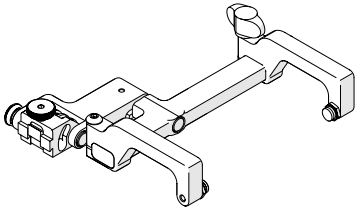


Fig. 34 - HydroFORM™ probe holder

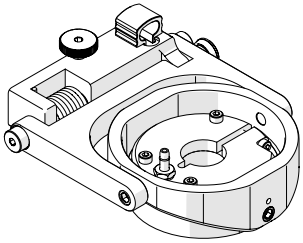
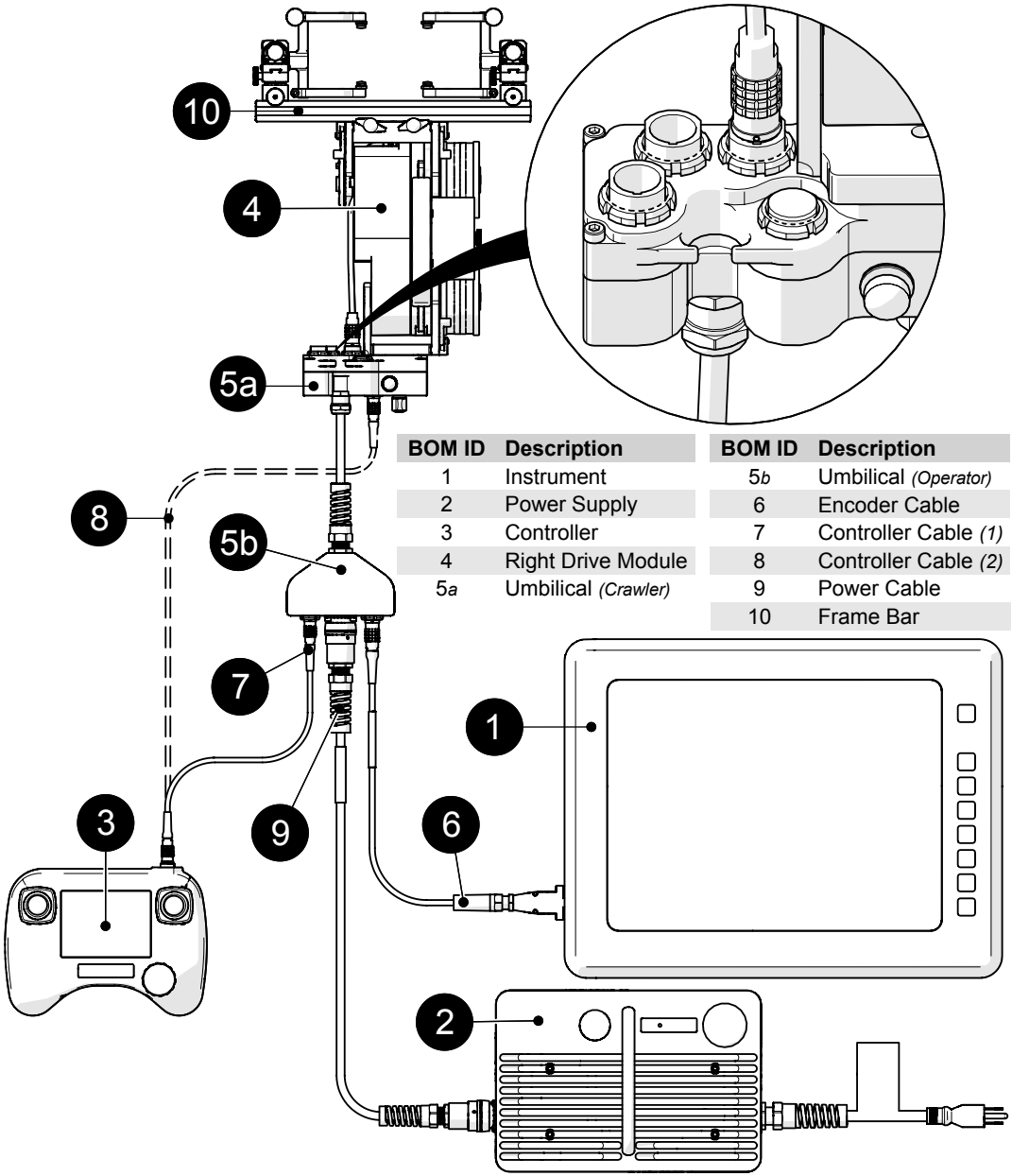


Fig. 35 - Corrosion thickness probe holder

CONFIGURATIONS

3.1. Single Drive Module with Frame Bar



BOM ID	Description
1	Instrument
2	Power Supply
3	Controller
4	Right Drive Module
5*a*	Umbilical *(Crawler)*

BOM ID	Description
5*b*	Umbilical *(Operator)*
6	Encoder Cable
7	Controller Cable *(1)*
8	Controller Cable *(2)*
9	Power Cable
10	Frame Bar

Fig. 36 - Single pod configuration

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

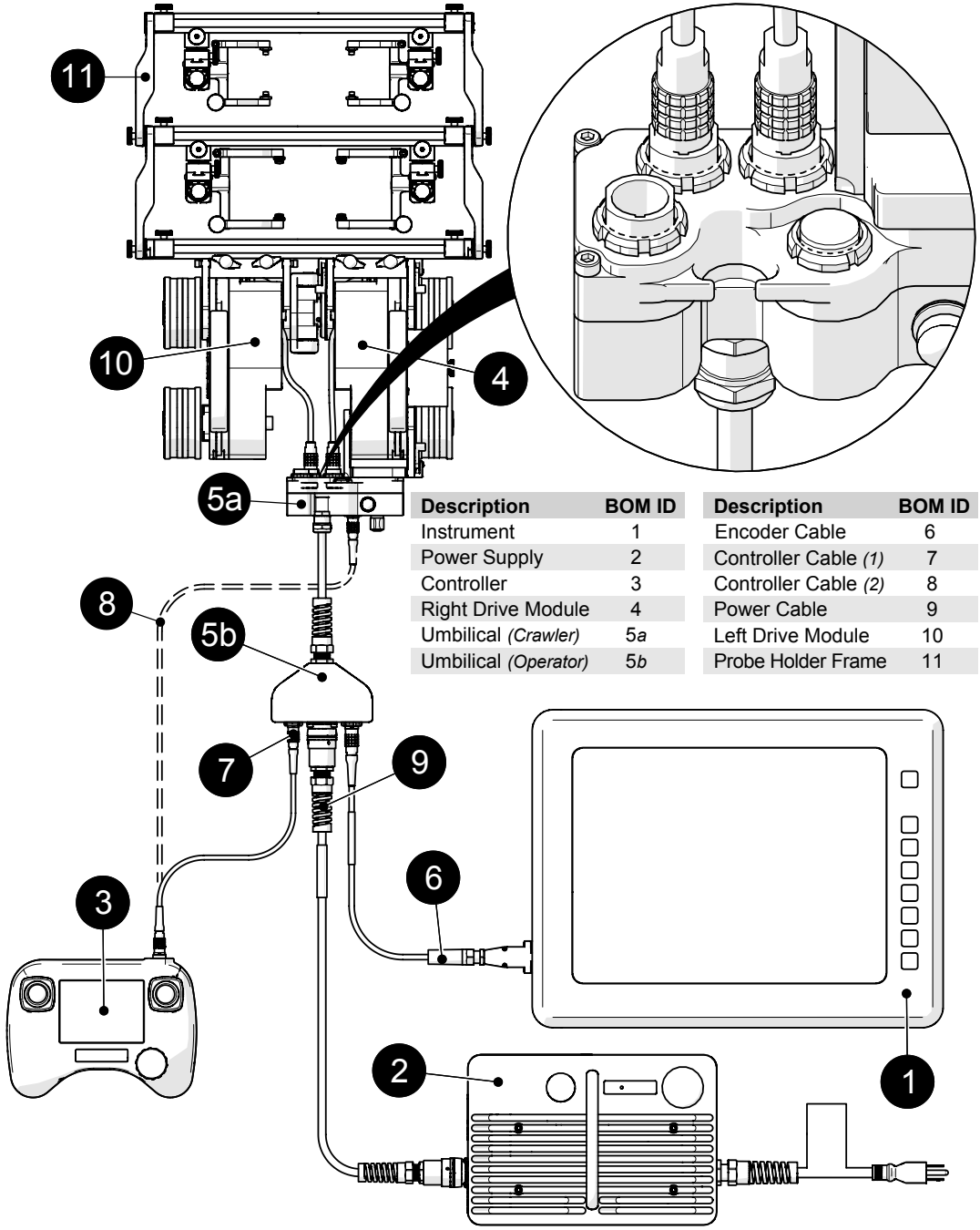
CAUTION! Do not disconnect under load.
Shut off power before connection or disconnecting.
Permanent damage to electronics could occur.

1. Separate the left and right crawler modules *(see "Connecting/Disconnecting Left and Right Modules" on page 50)*.
2. Connect power supply *(Fig. 36-2)* to user umbilical breakout *(Fig. 36-5b)* using the power cable *(Fig. 36-9)*.
3. Plug in right drive module cable *(Fig. 36-4)* to crawler umbilical breakout *(Fig. 36-5a)*.
4. Mount crawler umbilical breakout *(Fig. 36-5a)* to right drive module *(Fig. 36-4)*.
5. Connect controller *(Fig. 36-3)* to user umbilical breakout *(Fig. 36-5b)* using the controller cable *(Fig. 36-7)*.

   NOTE: *The controller may also be connected directly (Fig. 36-8) to the crawler umbilical breakout (Fig. 36-5a).*

6. Connect encoder cable *(Fig. 36-6)* from the instrument *(Fig. 36-1)* to the user umbilical breakout *(Fig. 36-5b)*.
7. Attach a configured frame bar *(Fig. 36-10)* to the crawler *(see "Swivel Mount" on page 48)*.

3.2. Dual Drive Module with Probe Holder Frame



Description	BOM ID
Instrument	1
Power Supply	2
Controller	3
Right Drive Module	4
Umbilical *(Crawler)*	5*a*
Umbilical *(Operator)*	5*b*

Description	BOM ID
Encoder Cable	6
Controller Cable *(1)*	7
Controller Cable *(2)*	8
Power Cable	9
Left Drive Module	10
Probe Holder Frame	11

***Fig. 37* - Dual pod with rack configuration**

To configure the **NAVIC** system for scanning using dual drive modules with a probe holder frame, follow these steps *(see "Probe Holder Frame" on page 89)*:

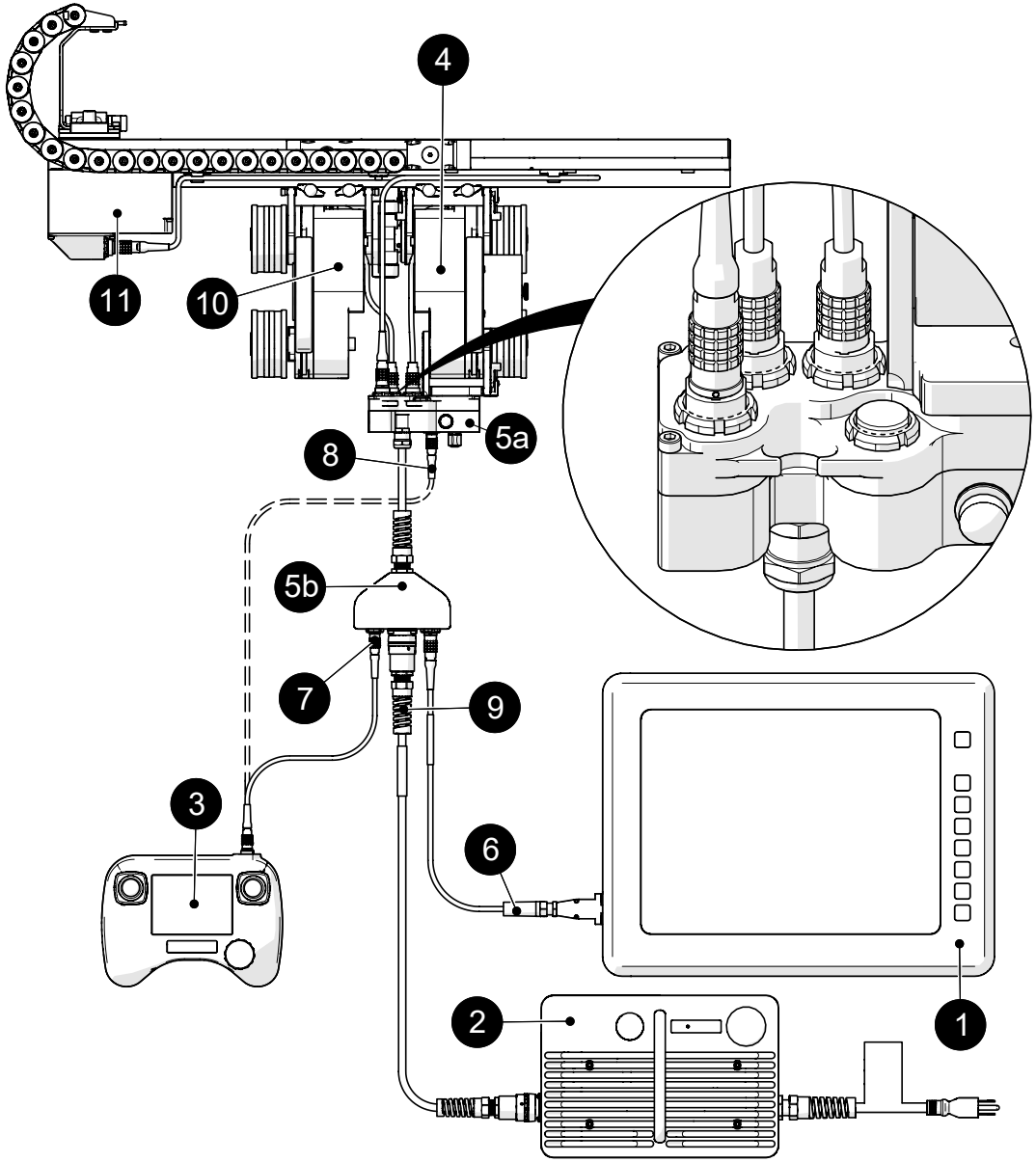
CAUTION! Do not disconnect under load.
Shut off power before connection or disconnecting.
Permanent damage to electronics could occur.

1. Connect power supply *(Fig. 37-2)* to user umbilical breakout *(Fig. 37-5b)* using the power cable *(Fig. 37-9)*.
2. Connect left *(Fig. 37-10)* and right *(Fig. 37-4)* drive modules to crawler umbilical breakout *(Fig. 37-5a)*.
3. Mount crawler umbilical breakout *(Fig. 37-5a)* to right drive module *(Fig. 37-4)*.
4. Connect controller *(Fig. 37-3)* to user umbilical breakout *(Fig. 37-5b)* using the controller cable *(Fig. 37-7)*.

   NOTE: *The controller may also be connected directly (Fig. 37-8) to the crawler umbilical breakout (Fig. 37-5a).*

5. Connect encoder cable *(Fig. 37-6)* from the instrument *(Fig. 37-1)* to the user umbilical breakout *(Fig. 37-5b)*.
6. Attach a configured probe holder frame *(Fig. 37-11) (see "Probe Holder Frame" on page 89)* to the crawler *(see "Swivel Mount" on page 44)*.

3.3. Dual Drive Module with Raster Arm Module



Description	BOM ID
Instrument	1
Power Supply	2
Controller	3
Right Drive Module	4

Description	BOM ID
Umbilical *(Crawler)*	5a
Umbilical *(User)*	5b
Encoder Cable	6
Controller Cable *(1)*	7

Description	BOM ID
Controller Cable *(2)*	8
Power Cable	9
Left Drive Module	10
Raster Arm Module	11

Fig. 38 - Dual drive module with raster arm configuration

To configure the **NAVIC** system for scanning using a dual drive module and a raster arm module, follow these steps *(see Raster Arm Module on page 51 for additional details)*:

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

1. Connect power supply *(Fig. 38-2)* to user umbilical breakout *(Fig. 38-5b)* using the power cable *(Fig. 38-9)*.
2. Connect left *(Fig. 38-10)* and right *(Fig. 38-4)* drive modules to crawler umbilical breakout *(Fig. 38-5a)*.
3. Mount crawler umbilical breakout *(Fig. 38-5a)* to right drive module *(Fig. 38-4)*.
4. Connect controller *(Fig. 38-3)* to user umbilical breakout *(Fig. 38-5b)* using the controller cable *(Fig. 38-7)*.

   NOTE: *The controller may also be connected directly (Fig. 38-8) to the crawler umbilical breakout (Fig. 38-5a).*

5. Connect encoder cable *(Fig. 38-6)* from the instrument *(Fig. 38-1)* to the user umbilical breakout *(Fig. 38-5b)*.
6. Attach raster arm module *(Fig. 38-11)* to the crawler *(see "Raster Arm Module" on page 51)*.
7. Connect raster arm cable *(see "Raster Arm Cable Setup" on page 56)* to crawler umbilical breakout *(Fig. 38-5a)*.

4.1. System Startup

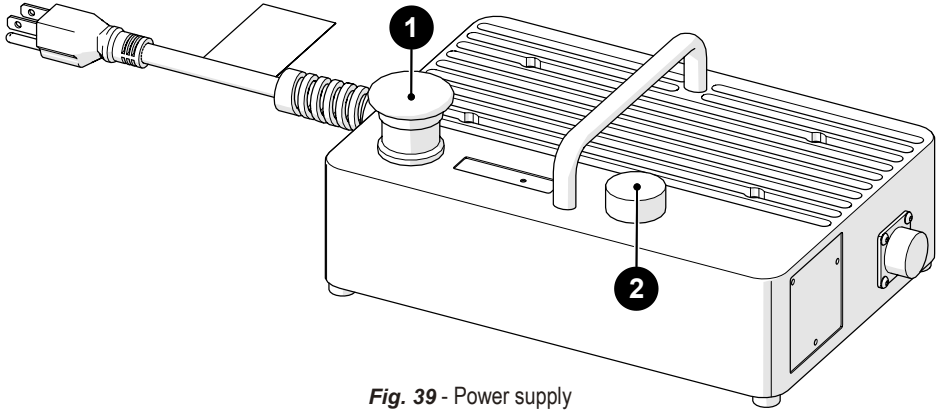


Fig. 39 - Power supply

To activate the system, follow these steps:

1. Plug-in the power supply to the appropriate power source *(see "Power Requirements" on page 6)*.
2. Connect the components *(see "Configurations" on page 16)*
3. Locate the red emergency stop push-button *(Fig. 39-1)* on the power supply. Rotate this button clockwise to unlatch.
4. The green push-button *(Fig. 39-2)* on the power supply activates the system.

Fig. 40 - Controller

5. A warning message will display on the 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.

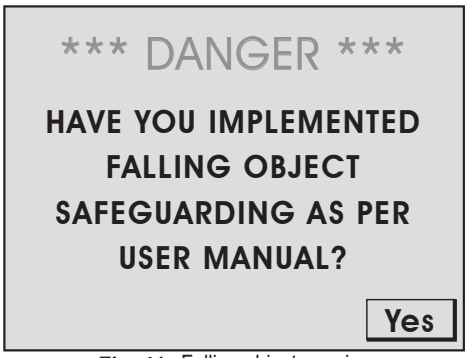


Fig. 41 - Falling object warning

Fig. 42 - Raster homing

6. A second warning message *(Fig. 41)* will display requesting assurance that a no entry fall zone has been established *(see "No Entry Fall Zone" on page 9)* and tether requirements are met *(see "Tether Requirements and Attachment" on page 10)*. Acknowledge this warning by touching **Yes**.
7. The system will now check for attached components and adjust accordingly. When a raster arm is detected, a warning will appear *(Fig. 42)* indicating the carriage must move to the home position. Ensure the raster arm and carriage are free of interference. If an obstruction is present, touch **Disable**. The raster arm will be disabled until the system is restarted.

While the raster arm is performing the homing procedure, the Homing Raster screen will be displayed.

Once the system is initialized, the Jog Mode screen will appear *(see "Jog Mode" on page 28)*. The system is now ready for operation.

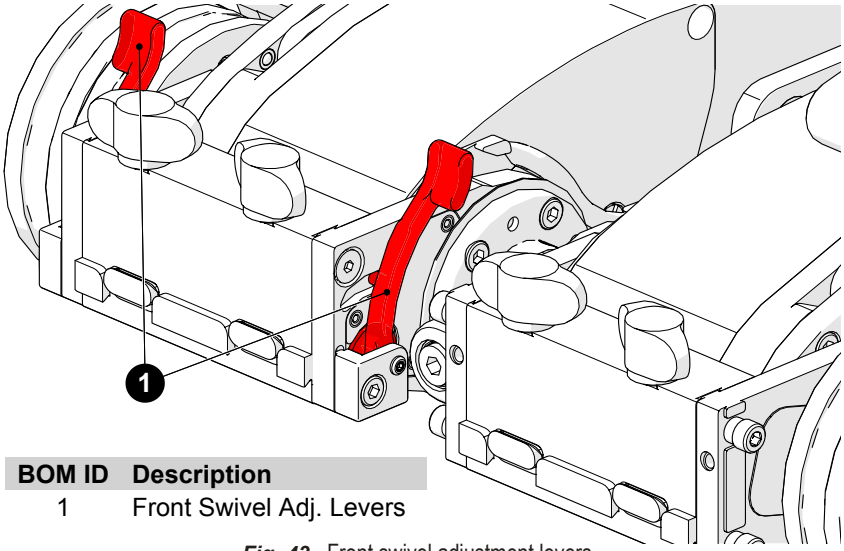
4.2. Placement of Crawler on Inspection Surface

IMPORTANT! To place the crawler on the inspection surface, use the scanner installation/removal mat *(Fig. 28)* as a spacer between the wheels and the surface on which the crawler is to drive. This is necessary to protect the electronic components within the crawler from damaging shock, should the crawler be slammed directly onto the surface.

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

To place the crawler on the inspection surface, follow these steps:

NOTE: *The manufacturer recommends two persons install the crawler on an inspection surface.*



BOM ID	Description
1	Front Swivel Adj. Levers

Fig. 43 - Front swivel adjustment levers

1. Once crawler preparation is complete *(see "Preparation for Use" on page 9)*, raise the front swivel mounts to ensure they will not hinder the wheels from contacting the inspection surface *(see "Swivel Mount" on page 44)*. Release the front swivel adjustment levers *(Fig. 43)* located at the front of the right drive module to position the front swivel mount. The front swivel mount on the left drive module can be positioned by hand.
2. Set the crawler to Jog Mode *(see "Jog Mode" on page 28)*.

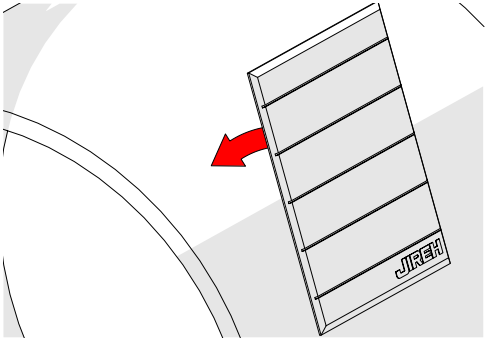


Fig. 44 - Place installation/removal mat

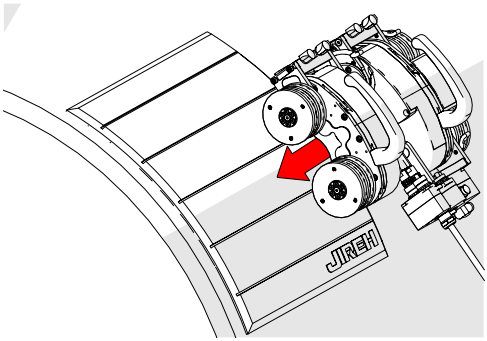


Fig. 45 - Lower crawler to mat

3. Place the installation/removal mat *(Fig. 28)* on the inspection surface *(Fig. 44)*.

> **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.

4. Place and hold the crawler on the installation/removal mat *(Fig. 45)*.

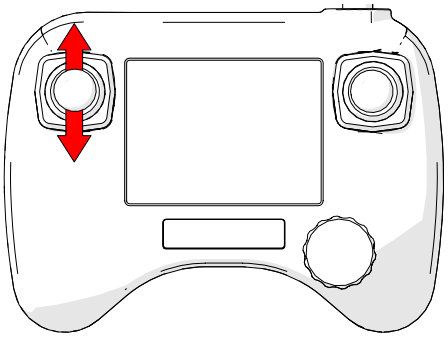


Fig. 46 - Drive the crawler

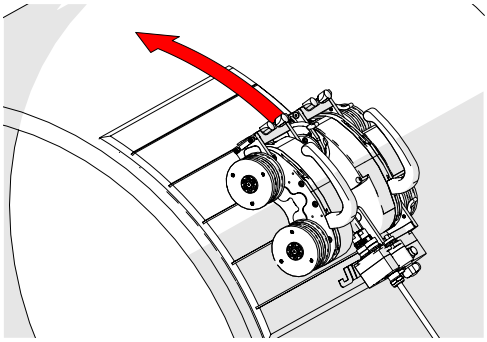


Fig. 47 - Drive crawler off the mat

> ***NOTE:*** *Do **NOT** release crawler when placed on the installation/ removal mat.*

5. Ensure all four wheels of the crawler are held firmly against the installation/ removal mat. While holding the crawler, use the Fwd/Rev joystick *(Fig. 46)* to carefully drive the crawler *(Fig. 47)* off the installation/removal mat and onto the inspection surface *(Fig. 48)*.

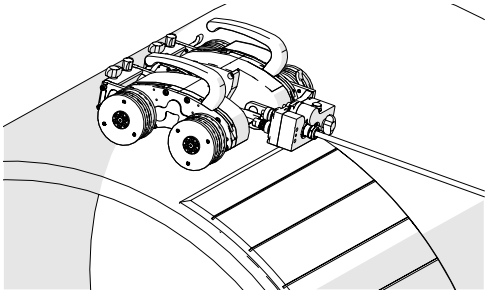


Fig. 48 - Magnetized to surface

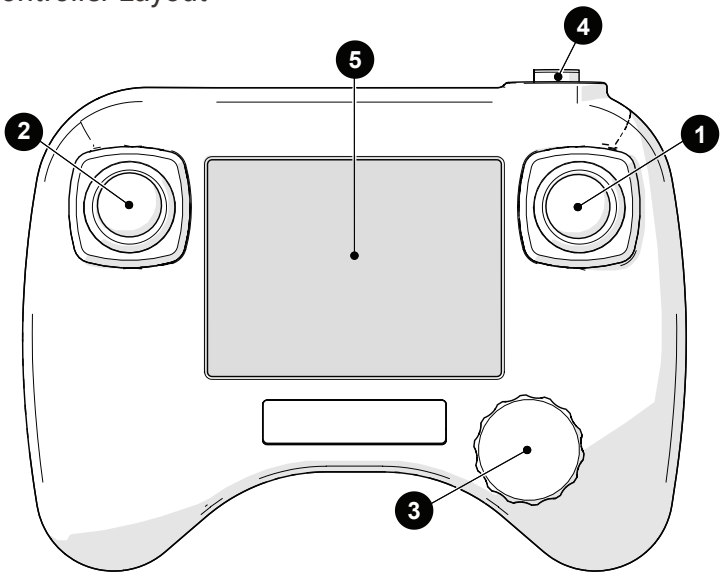
> ***TIP:*** *Avoid the drive modules slamming to the inspection surface. This can occur when all four wheels are not in contact with the installation/removal mat while the crawler is driven onto the inspection surface.*

6. Remove the installation/removal mat from the inspection surface.
7. Check that the trailing wheel encoder is in contact with the inspection surface, adjust if required *(see "Encoder" on page 46)*.

> ***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.*

4.3. Operation

4.3.1. Controller Layout



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

Fig. 49 - Controller

4.3.1.1 Touchscreen

The controllers touchscreen *(Fig. 49-5)* is the primary operator interface for the system. Buttons are indicated on-screen with a 3D border *(Fig. 50)*.

Fig. 50 - Sample touchscreen buttons

4.3.1.2 Click Wheel

The click wheel *(Fig. 49-3)* 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.

4.3.1.3 Joysticks

The joysticks are used to control the system's motion. The left joystick *(Fig. 49-2)* controls the forward/reverse movement of the crawler. The right joystick *(Fig. 49-1)* function is selected on screen. Functions include crawler steering or raster arm movement.

4.3.2. Main Mode Selection Screen

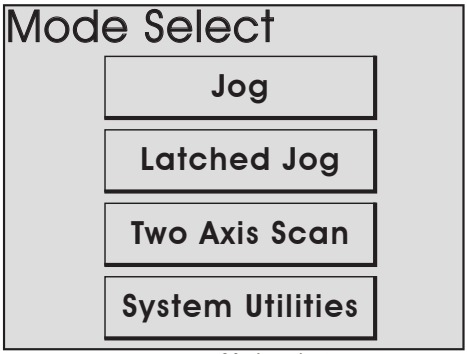


Fig. 51 - Mode select

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

- Jog Mode *(see "Jog Mode" on page 28)*
- Latched Jog Mode *(see "Latched Jog Mode" on page 30)*
- Two Axis Scan* *(see "Two Axis Scan Mode" on page 30)*
- System Utilities *(see "System Utilities Screen" on page 35)*

**Only appears when a raster arm is detected/present.*

4.3.3. Jog Mode

Jog mode manually controls the system movement using the joysticks.

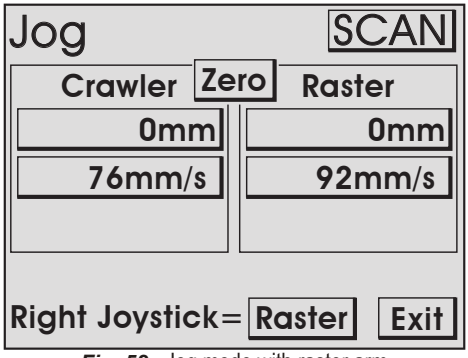


Fig. 52 - Jog mode with raster arm

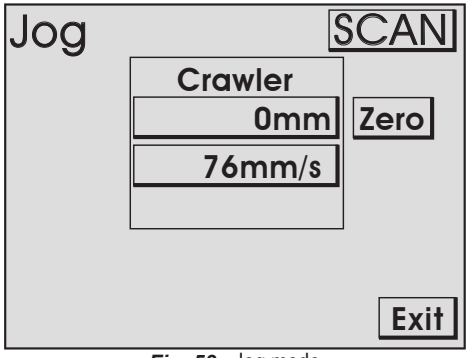


Fig. 53 - Jog mode

> ***NOTE:*** *Jog mode is the default selection when the system is first activated.*

When a raster arm is connected *(see "Raster Arm Module" on page 51)*, both the crawler and raster information is displayed *(Fig. 52)*. When a raster arm is not connected, only the crawler information is displayed *(Fig. 53)*.

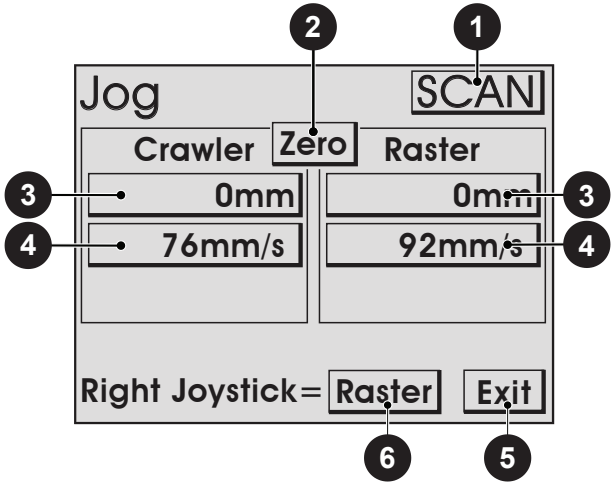


Fig. 54 - Button identification

Scan/Rapid Button: *(Fig. 54-1)* 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 35).*

Zero Button: *(Fig. 54-2)* Sets the current position to zero for all modules.

Module Position Button(s): *(Fig. 54-3)* Displays the current position of the crawler and the raster arm. 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** *controller. It does not zero the position used in the data acquisition instrument.*

Module Rate Button(s): *(Fig. 54-4)* 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.

Raster/Steer Button: *(Fig. 54-6)* Indicates and selects the function of the right joystick when a raster arm is present. The right joystick controls either the raster arm position or crawler steering.

Left Joystick: Moves the crawler forward or reverse at a speed proportional to the joystick displacement.

Right Joystick:

- When steer is selected, the right joystick steers the crawler when moving forward or reverse. The steering sensitivity of the joystick for both scan and rapid speeds may be set in the User Settings screen.
- When raster is selected, the right joystick controls the raster arm movement. The system automatically limits movement to the mechanical end limits of the raster arm.

Exit Button: *(Fig. 54-5)* Exits the jog mode and returns to the Mode Select screen.

4.3.4. Latched Jog Mode

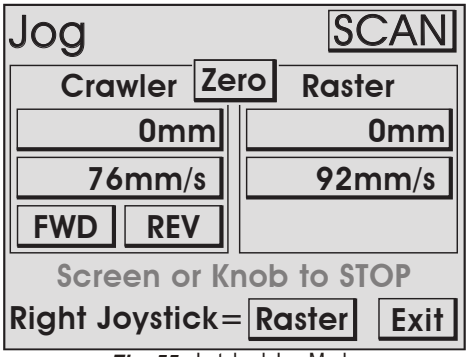


Fig. 55 - Latched Jog Mode

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 28)*.

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/raster joystick is still enabled. Touching the controller screen or pressing the click wheel stops crawler movement.

> ***NOTE:*** *The **FWD & REV Buttons** will not be present in rapid mode.*

4.3.5. Two Axis Scan Mode

The two axis scan mode allows scanning to be performed using the crawler as one axis of movement and a raster arm module as the second axis of movement.

> ***NOTE:*** *Two axis scan mode will not be available unless the raster arm module is connected.*

4.3.5.1 Two Axis Scan Setup Screen

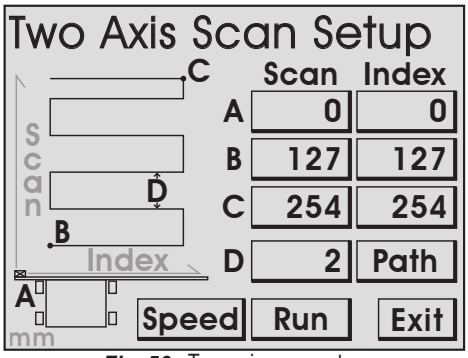


Fig. 56 - Two axis scan setup

The Two Axis Scan Setup screen is used to program the desired scan pattern the system will use.

Point A – The current position of the crawler and index axis. The **A** position may also be set while in the Jog Modes.

Point B – The start point of the scan grid. The system will move the scanner and index axis from the **A** point to this point at the start of a scan.

Point C – The finish point of the scan grid.

Setting D – The distance the system will advance after each sweep.

> ***TIP:*** *Scan determines the crawler movement.*

> ***TIP:*** *Index determines the raster arm movement.*

The diagram *(Fig. 58)* indicates the scan functions that may be entered. Each point and setting, **A**,**B**,**C**,**D**, corresponds to a coordinate entry button on the right side of the screen.

A typical scan begins at the **A** position and moves to the **B** position. Scanning begins at the **B** position and scans using the increment distance **D** until the **C** position is reached.

The units of measurement used is displayed at the bottom left corner of the screen.

Path Button: A toggle between a horizontal *(Fig. 58)* or vertical *(Fig. 58)* scan path.

Speed Button: Access the Scan Speed screen *(see "Scan Speeds Screen" on page 32)*.

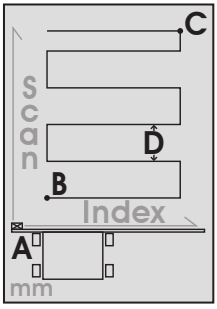


Fig. 57 - Horizontal

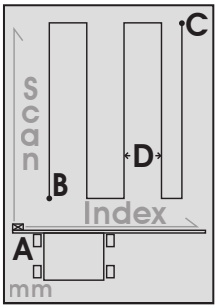


Fig. 58 - Vertical

Fig. 59 - Run button error

Run Button: Initiates a check of the input values to ensure they are within the system capabilities. When a scan pattern is invalid or out of range points entered, a warning will be displayed *(Fig. 60)*. Pressing **OK** returns to the Two Axis Scan Setup screen allowing correction of the error.

When no issues are detected, the Scan screen is enabled *(see "Two Axis Scan Screen" on page 33)*.

4.3.5.2 Scan Speeds Screen

Adjust speed settings for the two axis scan.

> ***TIP:*** *Scan speeds may be adjusted in the Jog Mode or User Settings screens as well.*

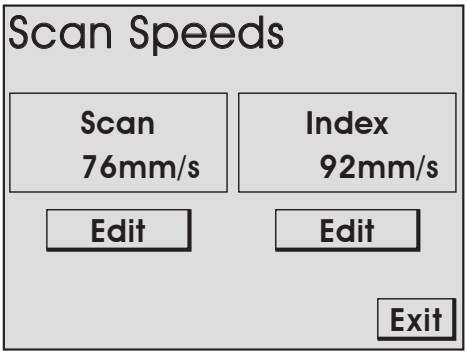


Fig. 60 - Scan speeds

Edit Buttons: Allow adjustment to the corresponding axis speed.

Exit Button: Return to the Two Axis Scan Setup screen.

4.3.5.3 Two Axis Scan Screen

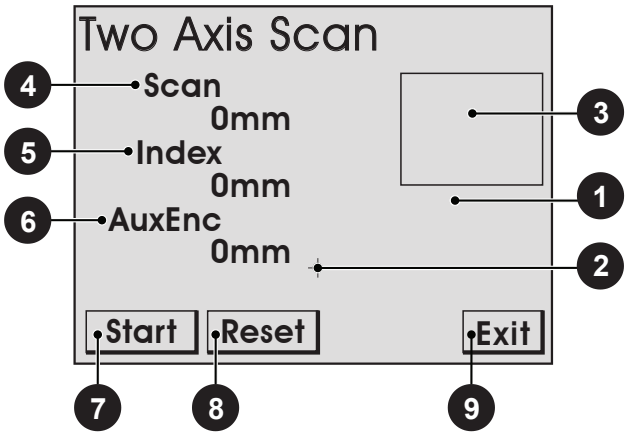


Fig. 61 - Two axis scan screen

The Two Axis Scan screen initiates and monitors the two axis scan. The screen displays a visual representation of the scan area *(Fig. 61-1)*. The small circle *(Fig. 61-2)* indicates the **A** position. The square *(Fig. 61-3)* indicates the scan area described by the **B** and **C** positions. The blinking cross hair indicates the current scanner position *(Fig. 61-2)*.

The current position of the scan *(Fig. 61-4)* and index *(Fig. 61-5)* axis are displayed. When a right drive module is detected with an auxiliary encoder, the auxiliary encoder position *(Fig. 61-6)* is displayed.

Start/Stop Button: *(Fig. 61-7)* Start or stop the scan sequence. When a scan has been stopped while in progress, the start button resumes the scan.

Reset Button: *(Fig. 61-8)* Return the scanner to the **A** position. Press the **Start Button** to begin the scan sequence from the initial setting.

Exit Button: *(Fig. 61-9)* Exit to the Two Axis Scan Setup screen.

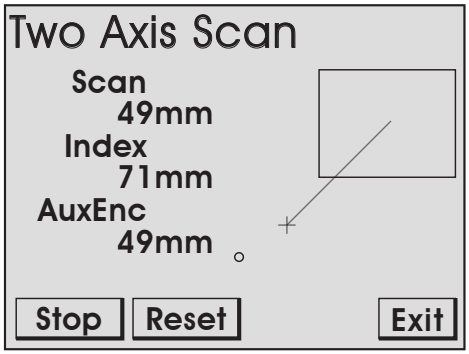


Fig. 62 - Scan path

During a scan, a graphical representation of the scanner path is displayed *(Fig. 62)*.

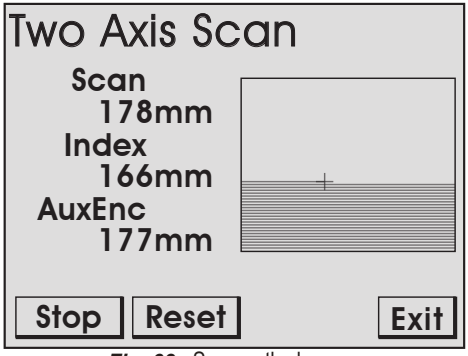


Fig. 63 - Scan path close up

When the scanner reaches the scan area, the graphic zooms to display that scan area. The scan path will be illustrated *(Fig. 63)* as the scan sequence takes place.

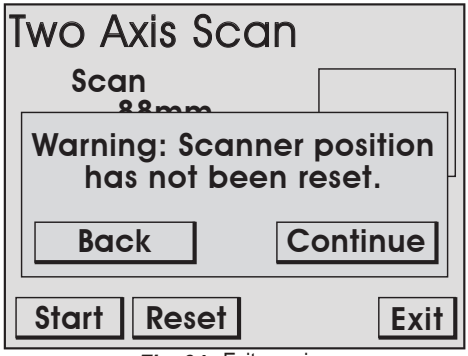


Fig. 64 - Exit warning

Pressing **Exit** stops all scanning and motion. If the scanner is not in the **A** position a warning appears *(Fig. 64)*. The warning alerts that the **A** position of the scanner will be changed to the current position. Press **Back** to return to the Two Axis Scan screen to reset scanner and maintain original **A** position. Press **Continue** to reset the **A** position and exit to the Two Axis Scan Setup screen.

4.3.6. System Utilities Screen

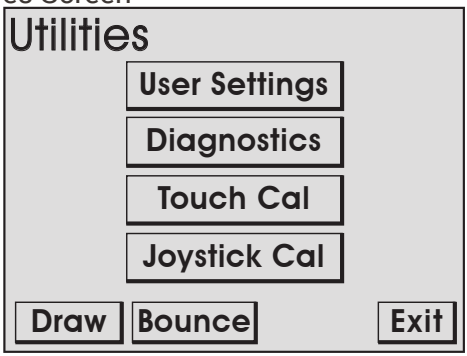


Fig. 65 - Utilities screen

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

User Settings Button: Access the User Settings screen allowing for various user preferences to be adjusted.

Diagnostics Button: Enters the Diagnostic screens which may be used to monitor system components and function.

Touch Cal Button: Used to initiate the Touch Calibration screen.

Joystick Cal Button: Used to enter the Joystick Calibration screen.

Draw Button: Enters mode used to test the touch screen accuracy and response.

4.3.6.1 User Settings Screen

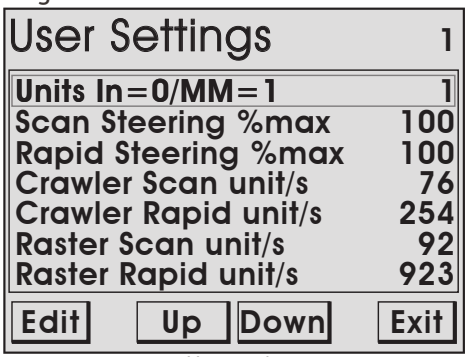


Fig. 66 - User settings screen

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
1	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
2	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
3	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
4	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)*
5	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)*
6	Raster Scan unit/s	Sets the raster arm scan rate in the current units/second. This setting can also be changed through the Jog or Two Axis Scan Speed screens.	0-923 mm/s *(0-36.3 in/s)*	92 mm/s *(3.6 in/s)*
7	Raster Rapid unit/s	Sets the raster arm rapid rate in the current units/second. This setting can also be changed through the Jog screen.	0-923 mm/s *(0-36.3 in/s)*	923 mm/s *(36.3 in/s)*

8	*Raster Flip 0/1	Set raster arm orientation. When the raster arm is mounted with the motor housing to the left of the crawler, the appropriate setting is 1. When the raster arm is mounted with the motor housing to the right of the crawler, the appropriate setting is 0. When this setting is changed, the system must be rebooted.	0-1	1

4.3.6.2 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.*

4.3.6.2.1. Detected Modules

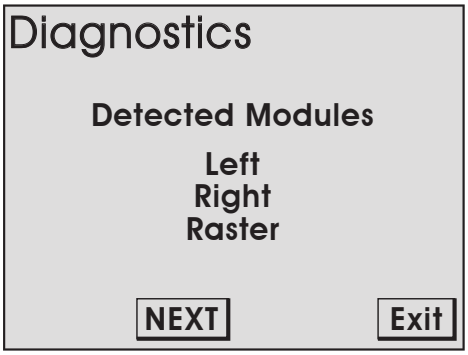


Fig. 67 - Detected modules screen

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

4.3.6.2.2. System 1

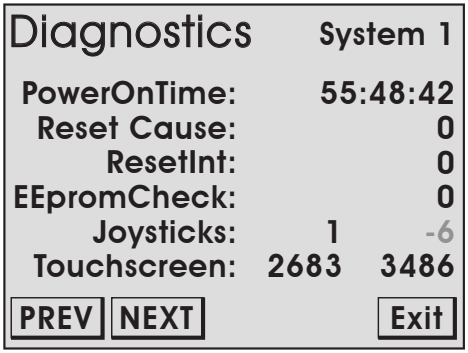


Fig. 68 - Diagnostic screen

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.

4.3.6.2.3. System 2

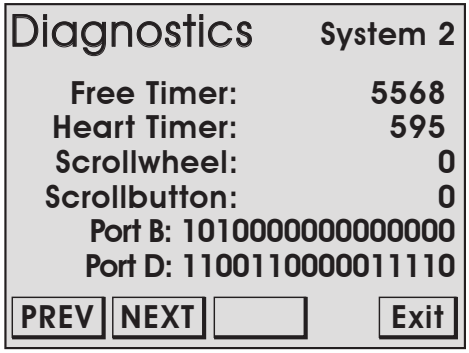


Fig. 69 - Diagnostic screen

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.

4.3.6.2.4. System 3

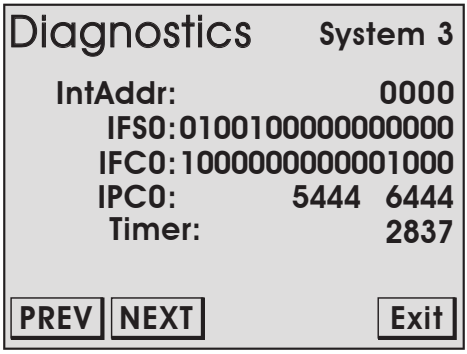


Fig. 70 - Diagnostic screen

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

4.3.6.2.5. LeftDrv, Right Drv, Raster

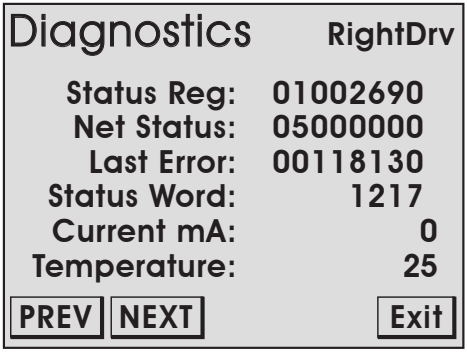


Fig. 71 - Diagnostic screen

LeftDrv and Right Drv diagnostic screens provide information regarding the status of the drive modules. A separate screen is available for each module detected upon system startup.

CURRENT MA Displays the output of the drive 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 drive module in degrees Celsius.

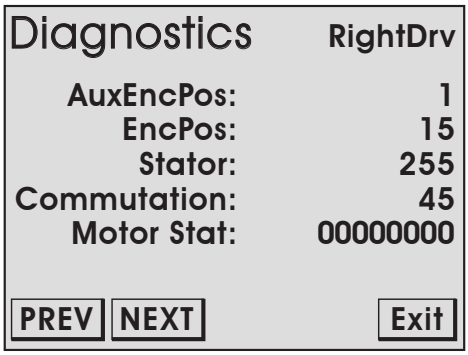


Fig. 72 - Diagnostic screen

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 modules motor encoder in counts.

4.3.6.3 Touch Calibration Screen

Fig. 73 - Touch calibration screen

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

Touch the screen as 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.

4.3.6.4 Joystick Calibration Screen

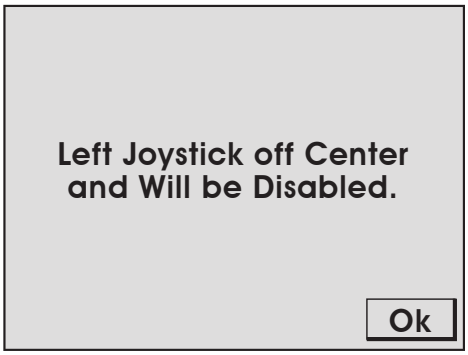


Fig. 74 - Joystick error

Typically joystick calibration is only necessary when a joystick off center error is detected upon startup *(Fig. 74)*. Calibration may also be used when a joystick function does not appear to be properly centred.

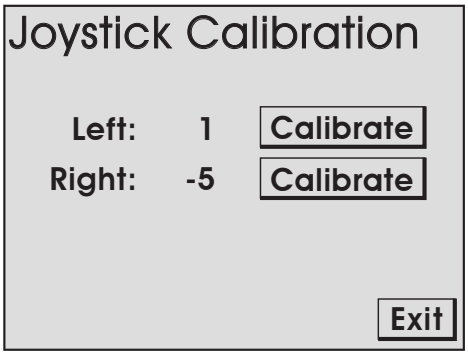


Fig. 75 - Joystick calibration screen

Current readings of the joysticks are displayed in the Joystick Calibration screen *(Fig. 75)*. 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.

4.3.6.5 Draw

Fig. 76 - Draw utility

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

5.1. Controller

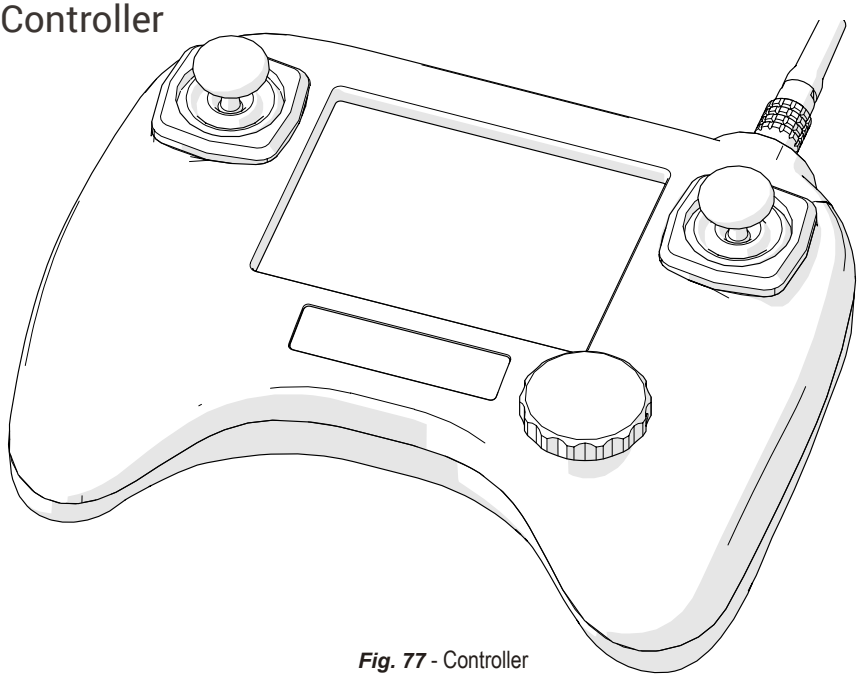


Fig. 77 - Controller

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

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

The controller is not watertight and is not intended to be used in extremely wet environments. The 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 controller while system activated.*

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

5.2. Right Drive Module

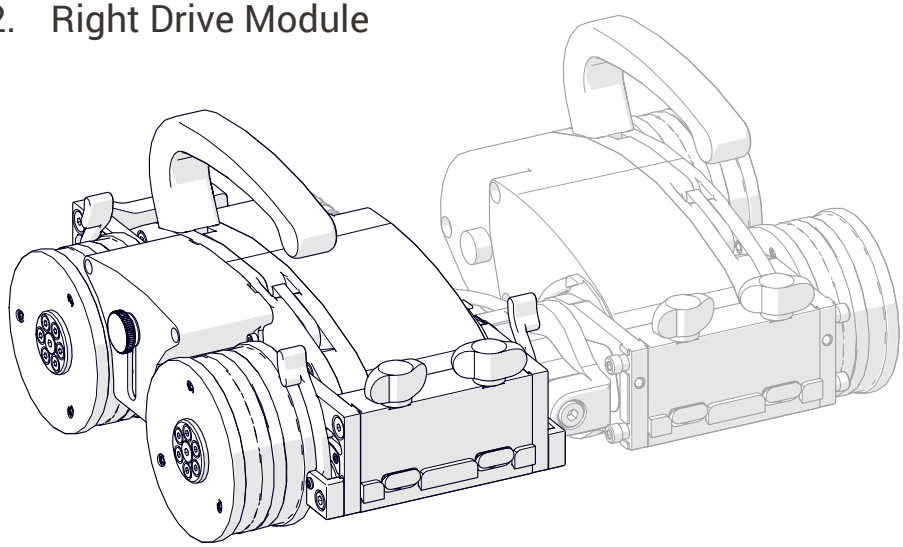


Fig. 78 - Right drive module

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

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.

5.2.1. Swivel Mount

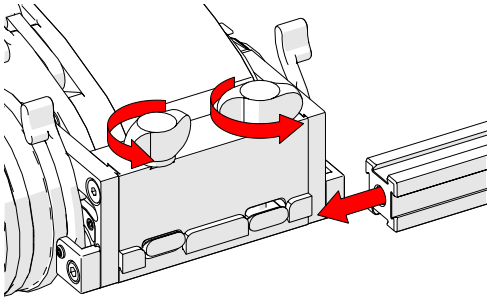


Fig. 79 - Frame bar installation

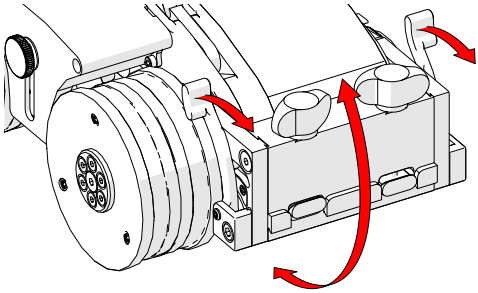


Fig. 80 - Swivel mount angle

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. 79)* 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.

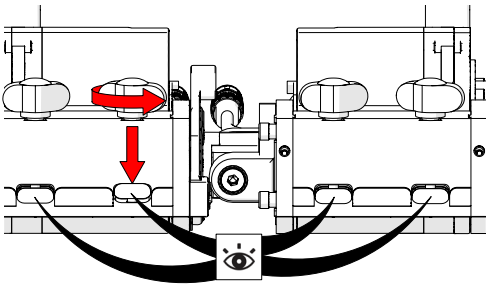


Fig. 81 - Align dovetail jaws

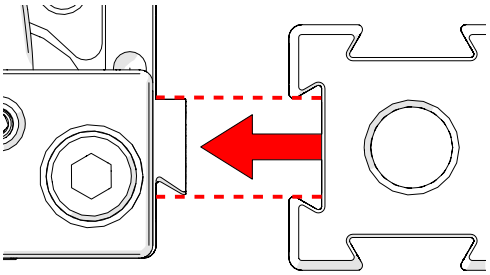


Fig. 82 - Mount frame bar

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. 81)*. Press the frame bar or accessory to the swivel mount *(Fig. 82)* and tighten the black wing knobs.

The front mount utilizes two levers *(Fig. 80)* to lock the front mount at the desired angle.

The etched line *(Fig. 83)* near the base of the swivel mount can be used to align the front swivel mount to a horizontal position.

> ***NOTE:*** *The front mount must be horizontal when using the pivoting probe holder frame to scan longitudinally on piping.*

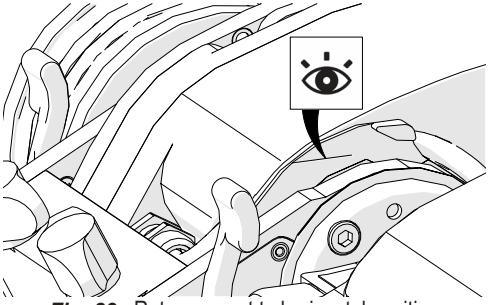


Fig. 83 - Return mount to horizontal position

5.2.2. Umbilical

To mount the umbilical to the right drive module, follow these steps:

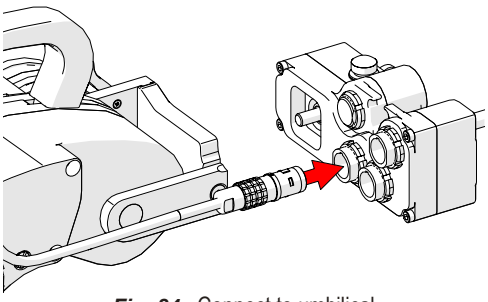


Fig. 84 - Connect to umbilical

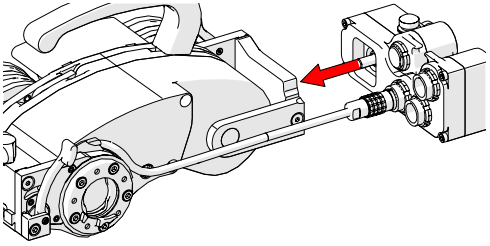


Fig. 85 - Align with drive module mount

1. Connect the umbilical by first plugging in the right drive module's connector *(Fig. 84)*.

2. Align the umbilical to the umbilical mount of the drive module *(Fig. 85)*.

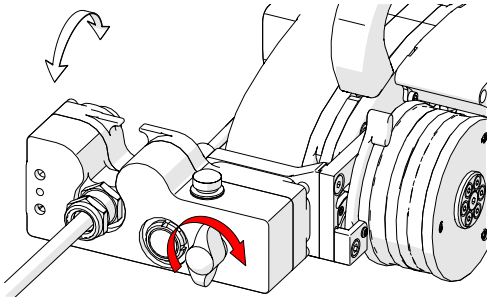


Fig. 86 - Tighten knob

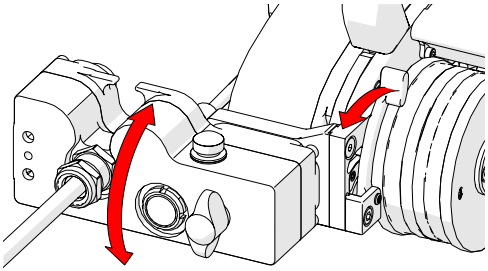


Fig. 87 - Adjust umbilical mount angle

3. Tighten the black wing knob to fasten the umbilical to the crawler *(Fig. 86)*.
4. The right drive module's umbilical mount can pivot to allow low profile scanning. Use the lock lever to position the umbilical mount at the desired angle *(Fig. 87)*.

5.2.3. Encoder

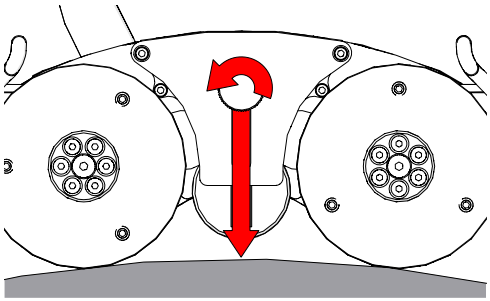


Fig. 88 - Lower encoder

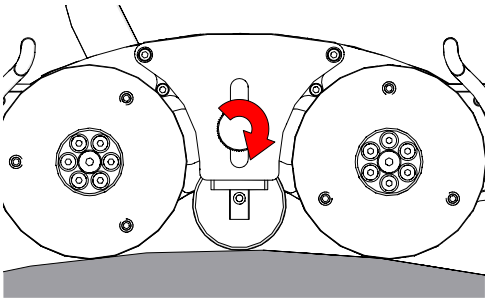


Fig. 89 - Tighten slide lock knob

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

The encoder is fixed to a spring loaded linear slide which allows for some vertical travel while maintaining contact pressure to the scan surface. The linear slide is in turn mounted to a vertical friction slide that allows for operator adjustment to accommodate the full range of pipe diameters and also limits the force on the encoder assembly to prevent damage.

To adjust the vertical the position of the encoder. Loosen the encoder slide lock knob *(Fig. 88)*, adjust the encoder wheel to make contact with the inspection surface, then lower an additional *(approximately)* 8 mm *(0.315 in)*, tighten the encoder slide lock knob *(Fig. 89)*.

> ***NOTE:*** *Do* **NOT** *use tools to tighten encoder slide lock knob, overtightening can damage encoder and/or spring loaded vertical slide system.*

5.2.4. Handle

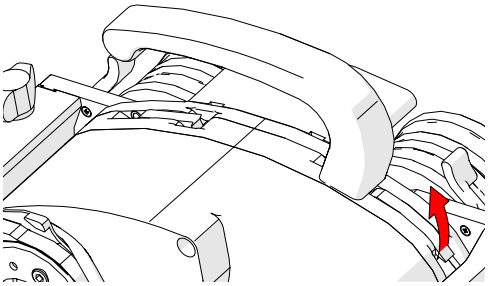


Fig. 90 - Lift handle lock latch

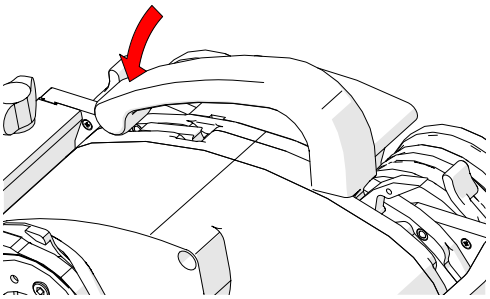


Fig. 91 - Pivot handle nose down

The handle is removable to achieve low profile scanning.

To remove the handle, lift the handle lock latch *(Fig. 90)*. Pivot the handle down *(Fig. 91)* and then pull the handle up to remove from the drive module *(Fig. 92)*.

To reinstall the handle, reverse the preceding steps.

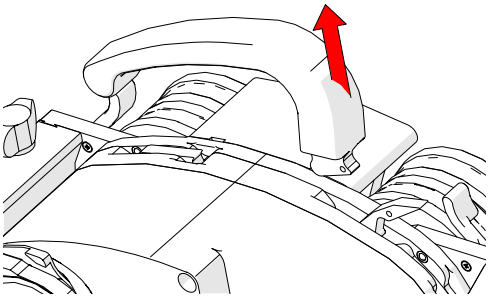


Fig. 92 - Lift handle from module

5.3. Left Drive Module

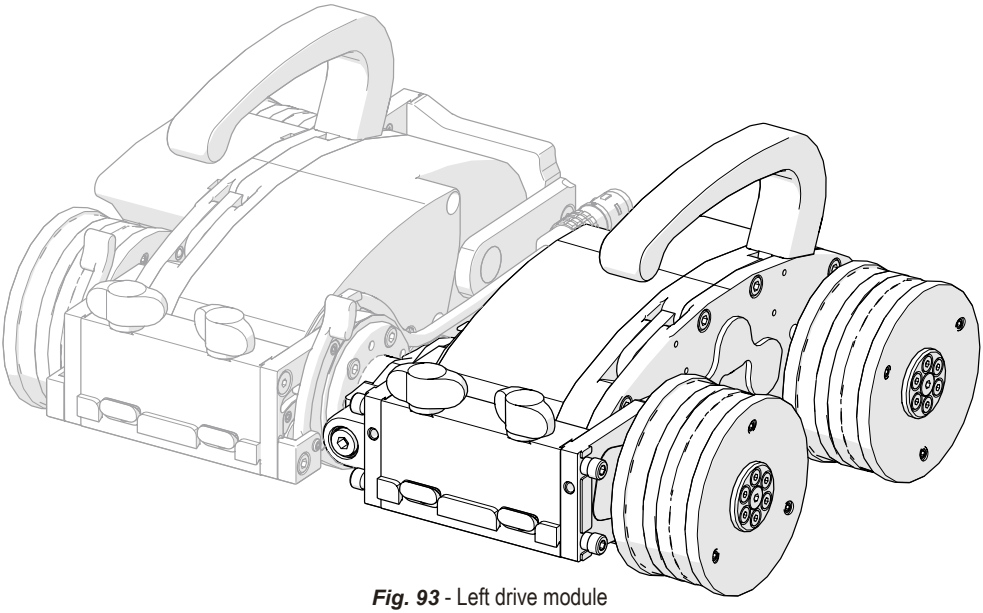


Fig. 93 - Left drive module

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.*

5.3.1. 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.

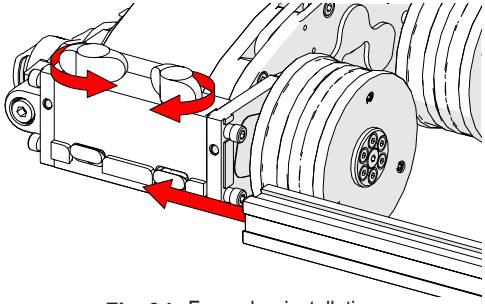


Fig. 94 - Frame bar installation

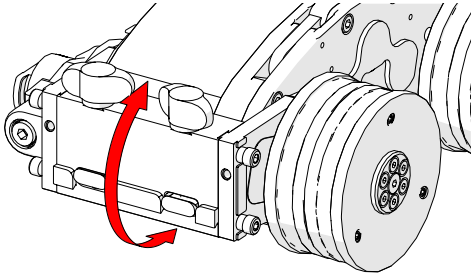


Fig. 95 - Swivel mount angle

Rotate the two black wing knobs *(Fig. 94)* 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. 95)* 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 44 for additional details).*

5.3.2. Encoder

The left drive module's motor encoder, can be used to output encoder signals to an instrument *(see Scanner Operation Specifications on page 5 for additional details)*.

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

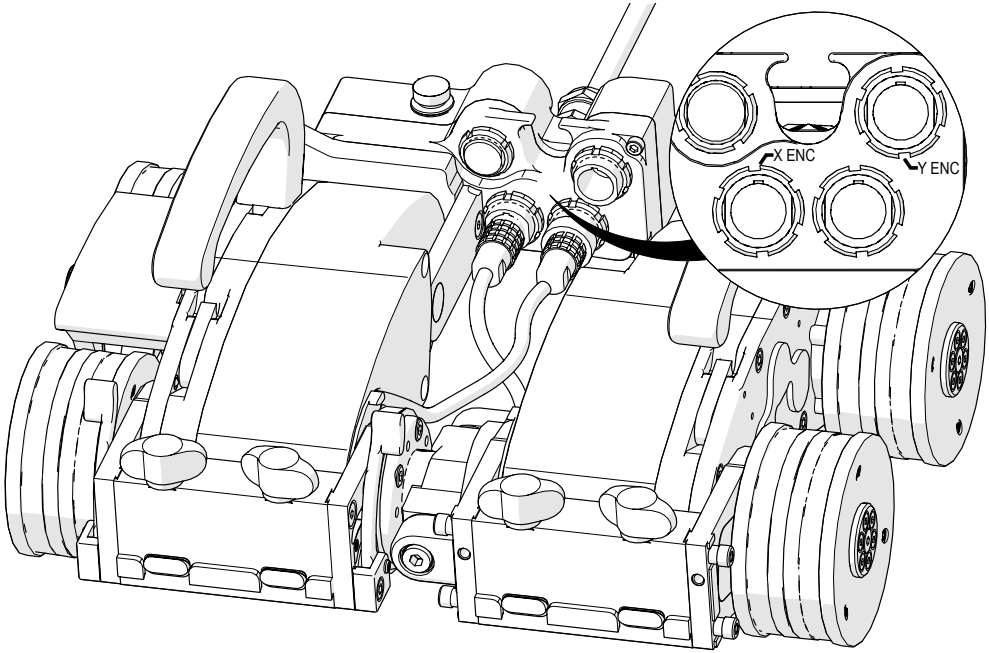


Fig. 96 - Left drive module encoder connection

To output the motor encoder's signal, plug the left drive module's connector into the umbilical's **X-ENC** socket *(Fig. 96)*. Plug the right drive module's connector into the remaining socket.

5.3.3. Handle

(see "Handle" on page 47)

5.3.4. 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.*

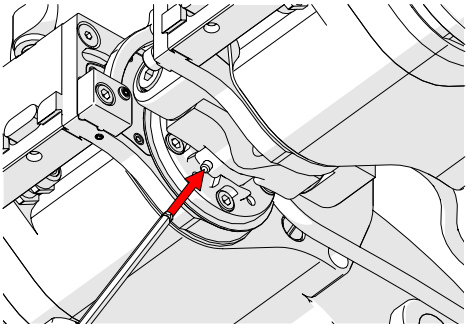


Fig. 97 - Press release pin

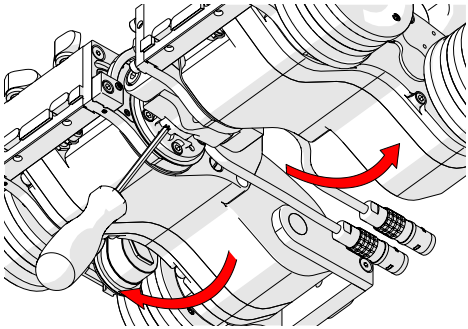


Fig. 98 - Press pin and rotate modules

1. Locate the release pin at the bottom of the **NAVIC** *(Fig. 97)*. Using the supplied 3 mm hex driver, press the pin while rotating the two modules *(Fig. 98)*.

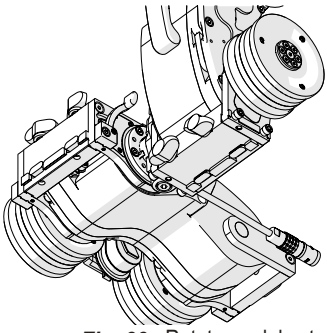


Fig. 99 - Rotate modules to 90°

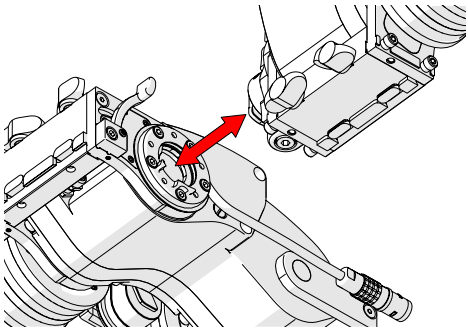


Fig. 100 - Pull modules apart

2. Once the two modules are 90° perpendicular *(Fig. 99)*, gently pull the two modules apart *(Fig. 100)*.
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 25 cm *(10 in)* away.

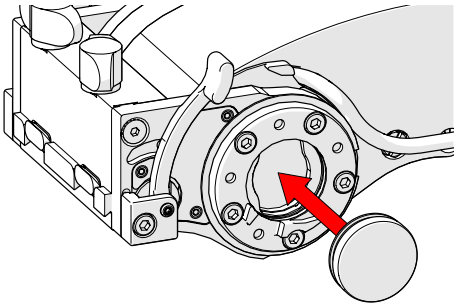


Fig. 101 - Use cap on connection pivot

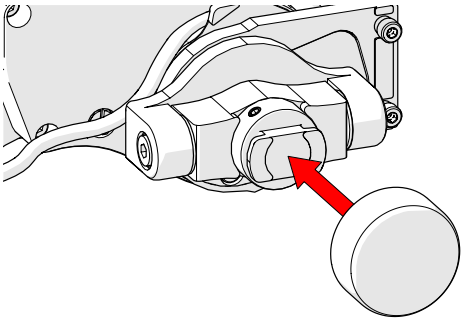


Fig. 102 - Use cap on connection pivot

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.*

5.4. Raster Arm Module

The motorized raster arm adds two axis automated scan capabilities to the **NAVIC**.

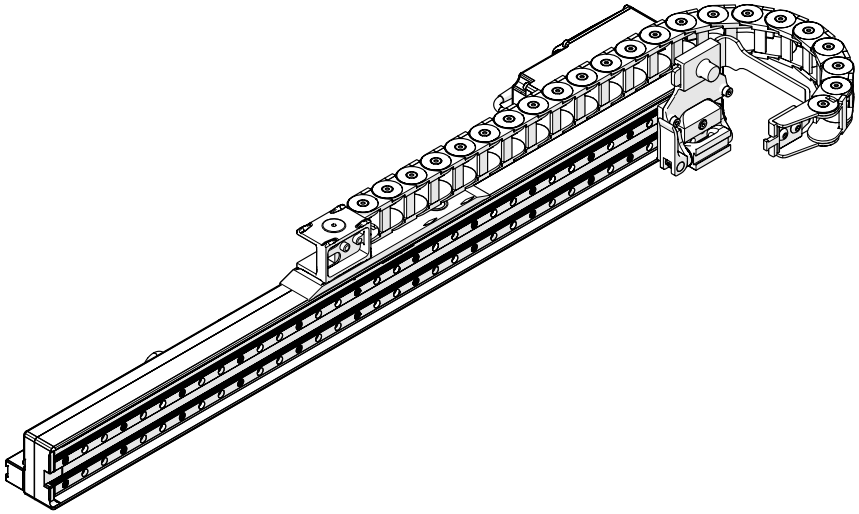


Fig. 103 - Raster arm module

The raster arm can carry many different probes for various types of corrosion scans, including conventional 0° transducers, phased array probes *(e.g. Olympus HydroFORM™)* and more. The **NAVIC** controller is used to setup all the parameters of the scan *(see Two Axis Scan Mode on page 30 for additional details)*.

5.4.1. Mounting a Raster Arm

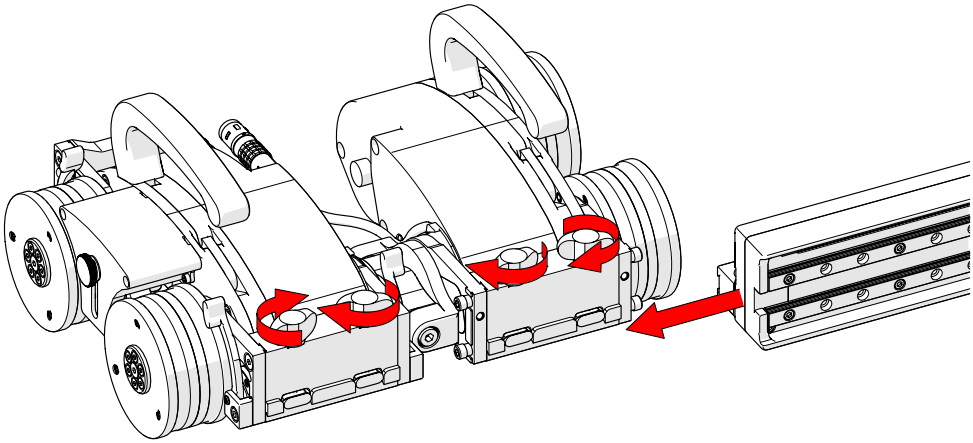


Fig. 104 - Slide onto one swivel mount

> ***TIP:*** *This mounting process can be completed from either side of the crawler.*

1. Loosen all four black wing knobs on both modules. Slide the raster arm's mounting rail onto the dovetail jaws of one of the modules *(Fig. 104)*.

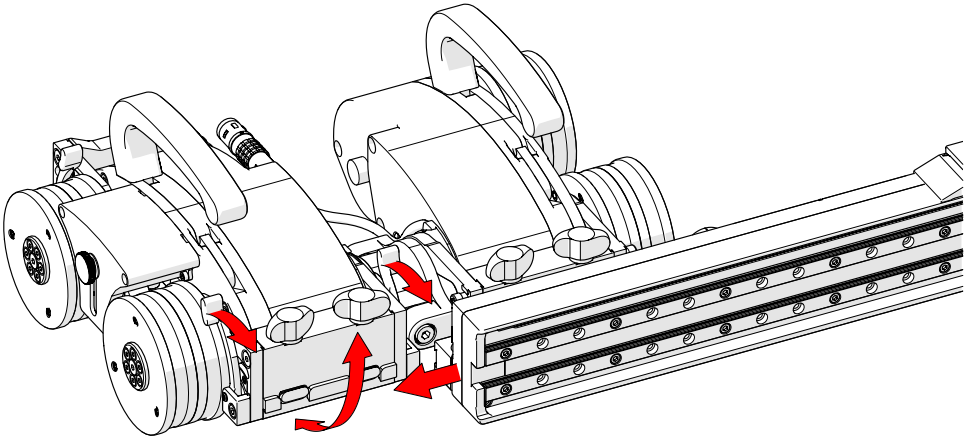


Fig. 105 - Slide onto second swivel mount

2. Release the swivel mount levers and pivot the swivel mount to align with the mounting rail of the raster arm *(Fig. 105)*. Slide the raster arm on to the remaining module's swivel mount and tighten all four black wing knobs.

5.4.2. Attaching a Cable Tray

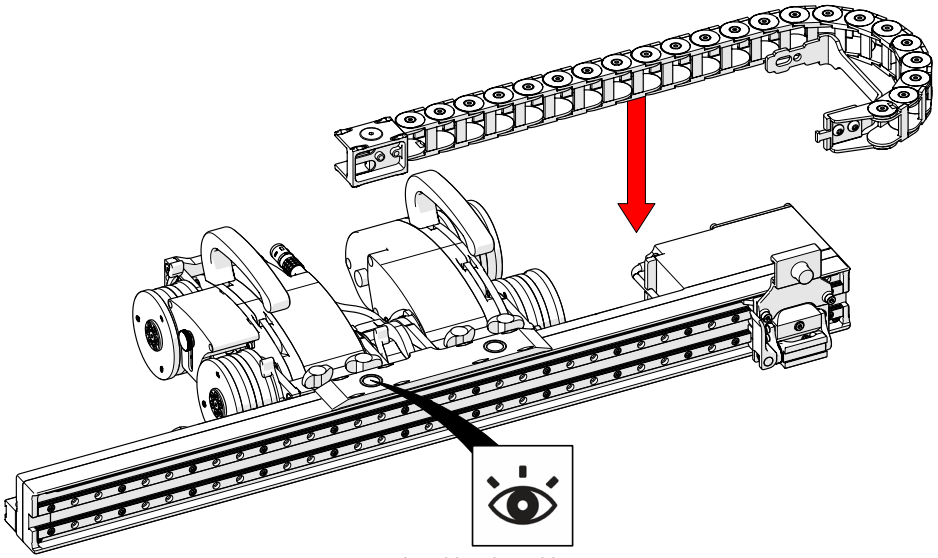


Fig. 106 - Attaching the cable tray

1. Attach the cable tray's magnetic end to the magnetic base on the raster arm. Ensure the four divots are aligned with notches on the magnetic end *(Fig. 106)*.

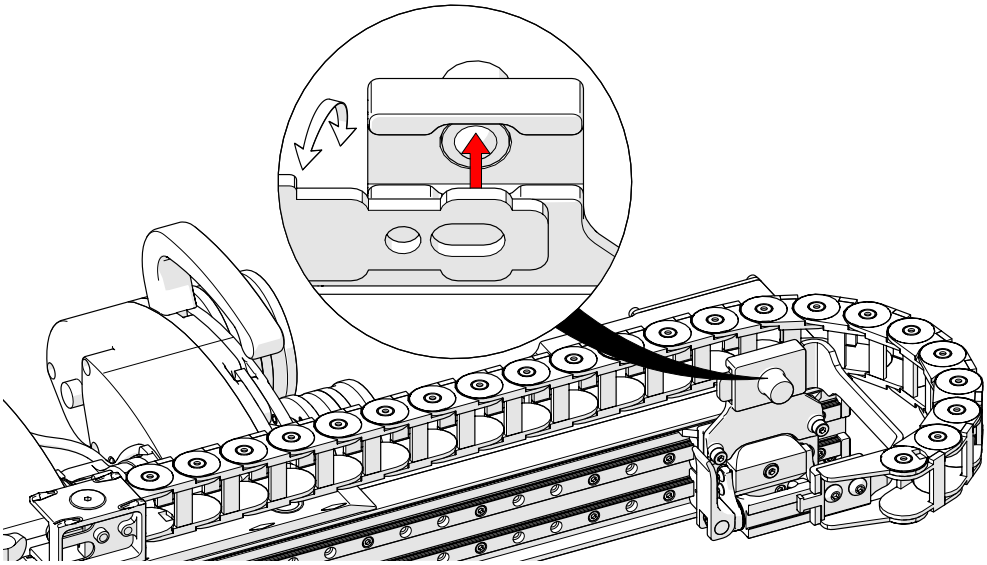


Fig. 107 - Press bracket to carriage

2. Press the cable tray bracket into the rear of the carriage bracket *(Fig. 107)*.

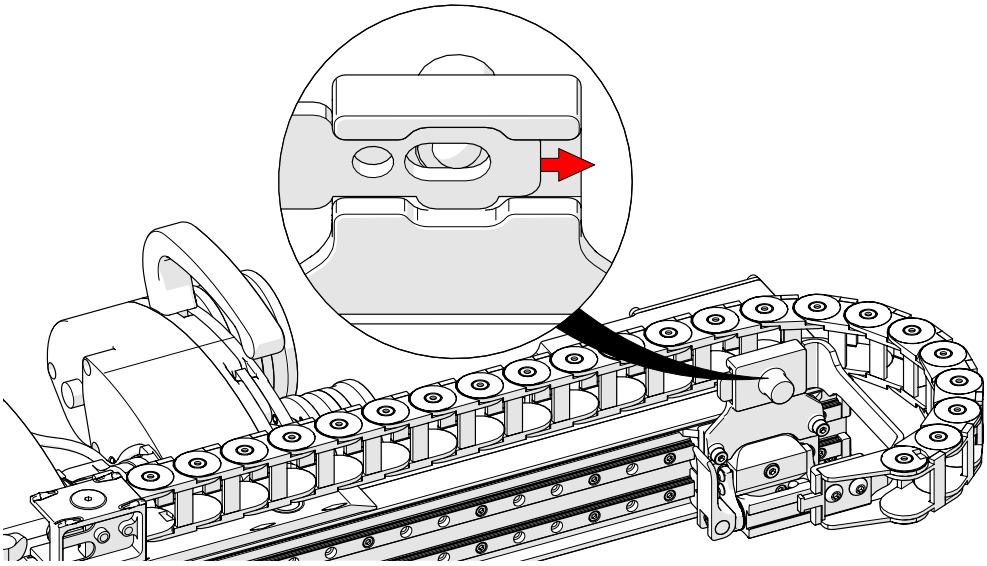


Fig. 108 - Slide bracket attaching to carriage

3. Slide the cable tray bracket until it locks in place *(Fig. 108)*.

> ***TIP:*** *The cable tray can be flipped over and reversed to switch which side of the raster arm the cable tray protrudes.*

5.4.3. Using the Cable Tray

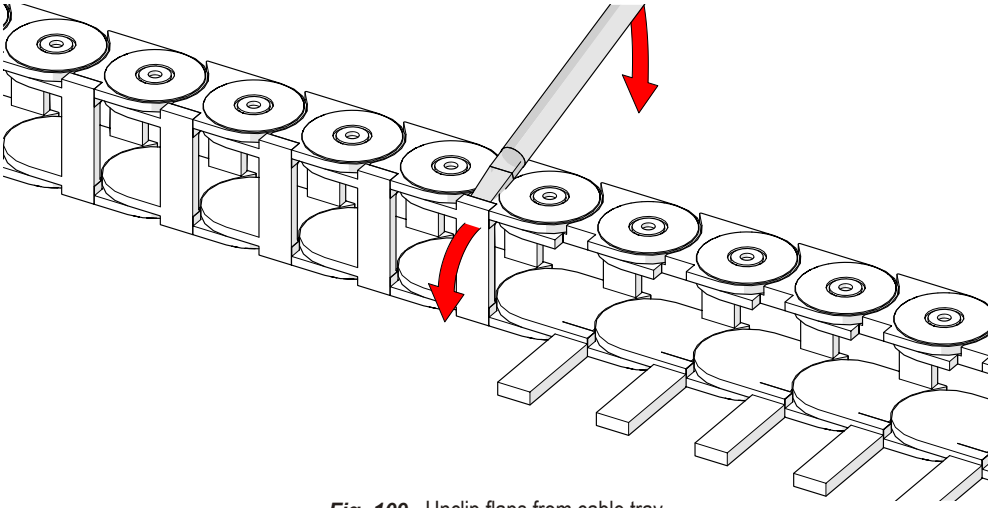


Fig. 109 - Unclip flaps from cable tray

1. Using the supplied 3 mm flat driver *(Fig. 3)*, unclip the flaps of the cable tray *(Fig. 109)*.

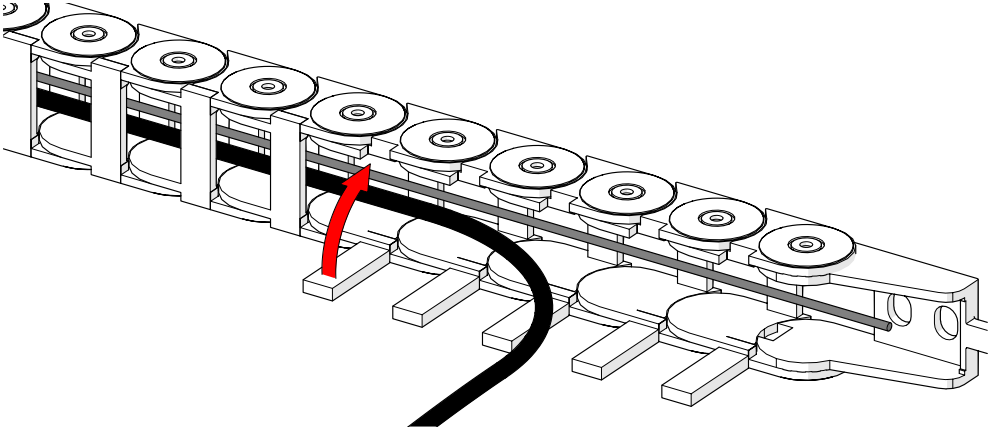


Fig. 110 - Route cabling and close flaps

2. Route all hoses and cables into the cable tray. Clip the flaps to trap the cables in the cable tray *(Fig. 110)*.

> ***TIP:*** *Cable routing can be made more convenient. Removal of several flaps every few inches can ease the cable routing process.*

5.4.4. Raster Arm Cable Setup

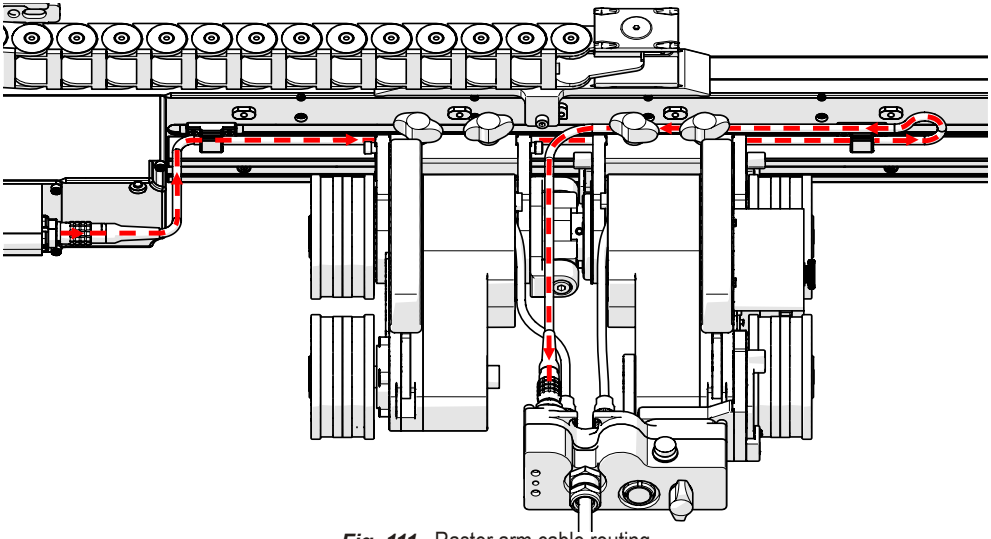


Fig. 111 - Raster arm cable routing

1. Plug the supplied raster arm cable into the raster arm's connector *(Fig. 111)* located on the raster arm encoder housing. Pinch the cable into the first cable bracket on the side of the raster arm encoder housing.

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

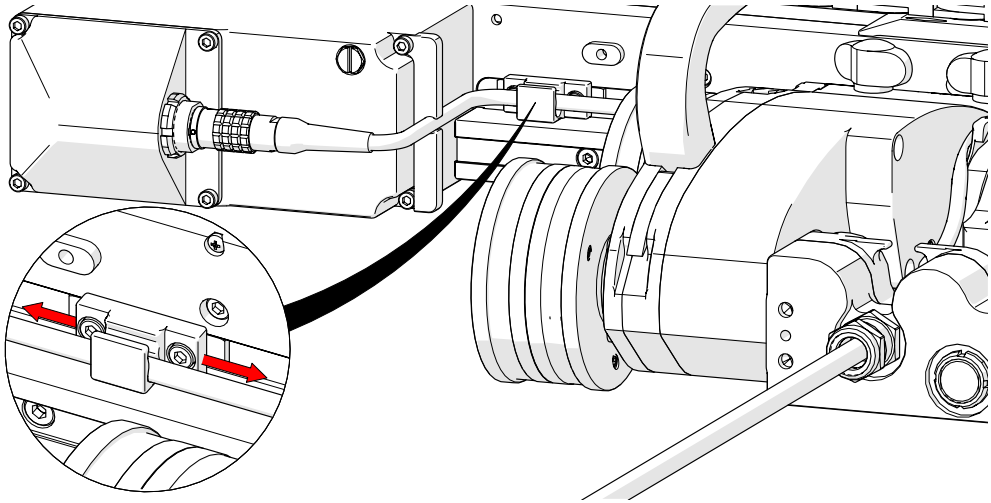


Fig. 112 - Adjustable cable clips

2. Route the cable through the adjustable clips on the raster arm *(Fig. 112)*. These clips slide along the raster arm allowing the raster arm cable to be positioned as required.

> ***TIP:*** *Do not tighten or loosen the clip screws. These clip screws have been specially torqued by the manufacturer to allow for friction movement.*

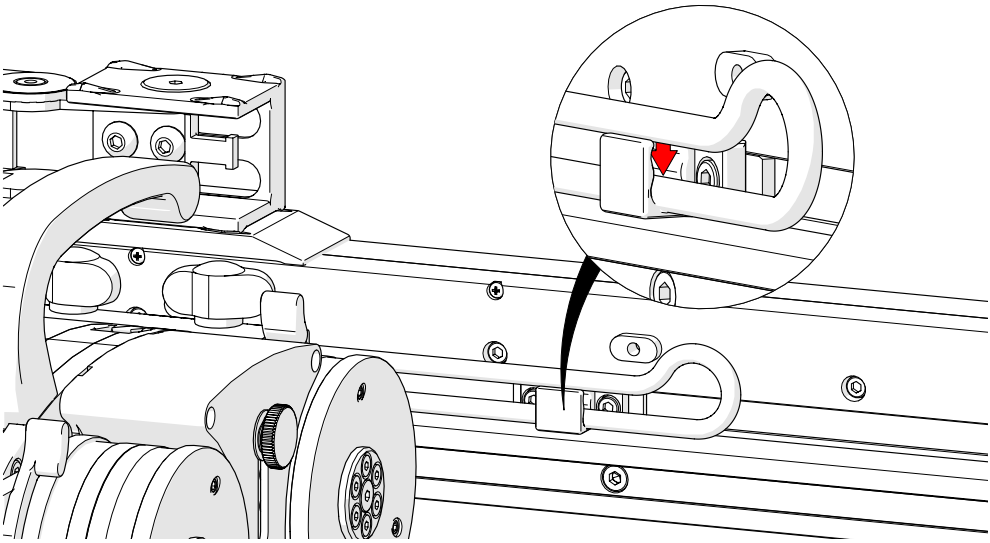


Fig. 113 - Route cable through the clip twice

The clips have the ability to accommodate two cables when necessary to route excess cabling *(Fig. 113)*.

5.4.5. Mounting Probe Holders

(see Vertical Probe Holder on page 74 for additional details)

5.5. Probe Holder Attachments

5.5.1. HydroFORM™ Probe Holder

Designed to function with the Olympus HydroForm™ scanner *(not provided)*. To utilize this probe holder, follow these steps:

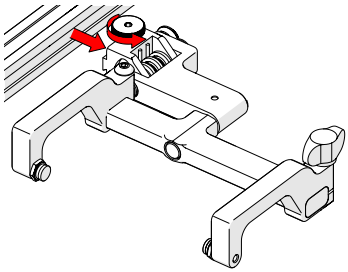


Fig. 114 - Attach probe holder

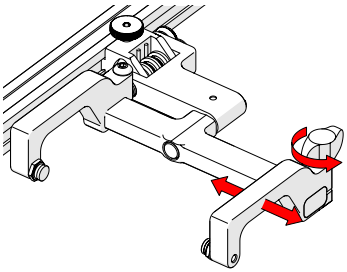


Fig. 115 - Arm adjustment

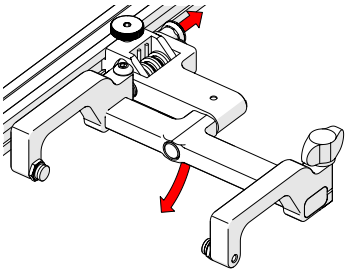


Fig. 116 - Lift and pull latch

1. Rotate the probe holder adjustment knob *(Fig. 114)* and attach the probe holder to a pivot mount of a raster arm or frame bar. Tighten the probe holder adjustment knob.
2. The probe holder arm adjustment knob can be rotated *(Fig. 115)*, this allows placement of the HydroFORM™ by positioning the probe holder arm accordingly.
3. Lift the probe holder slightly and pull the latch to release the probe holder's spring tension *(Fig. 116)*.

5.5.2. 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

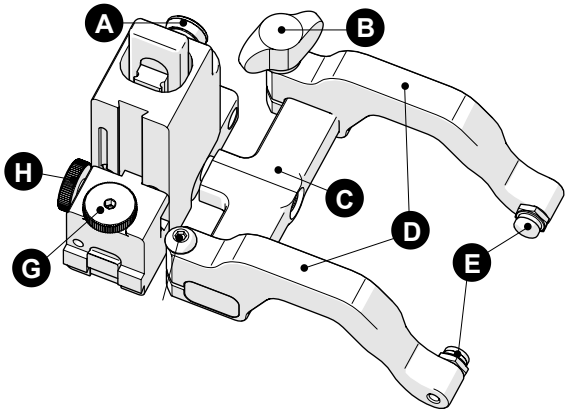


Fig. 117 - Heavy duty vertical probe holder

5.5.2.1 Probe Holder Setup

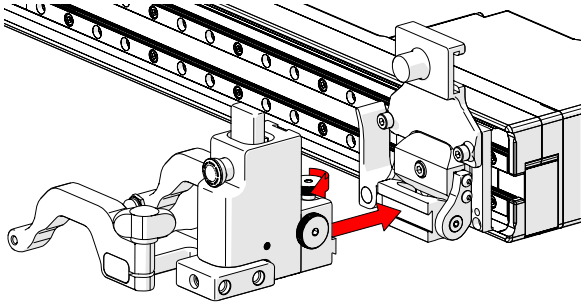


Fig. 118 - Mount probe holder to carrier

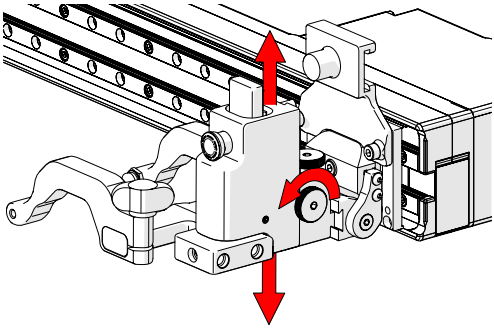


Fig. 119 - Vertical adjustment

1. Loosen the probe holder adjustment knob *(Fig. 118)* and mount the heavy duty vertical probe holder's dovetail jaw to the carrier.
2. The vertical adjustment knob *(Fig. 119)* allows the heavy duty vertical probe holder's height adjustment. This adjustment also controls the probe holders spring tension.

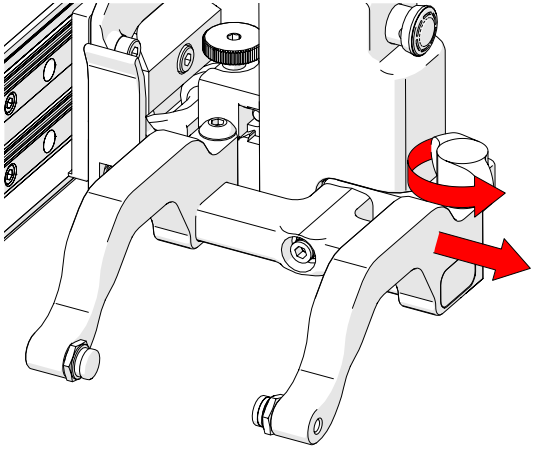


Fig. 120 - Remove outer arm

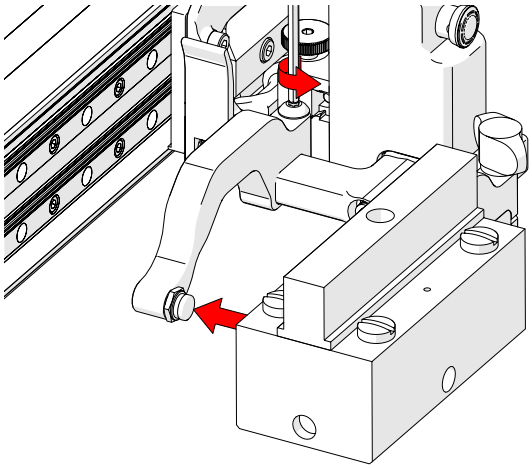


Fig. 121 - Adjust inner arm

3. Loosen the probe holder adjustment knob and remove the outer probe holder arm *(Fig. 120)*.
4. Loosen the arm clamp screw *(Fig. 121).*
5. Place the wedge on the pivot button of the inner probe holder arm *(Fig. 121).*

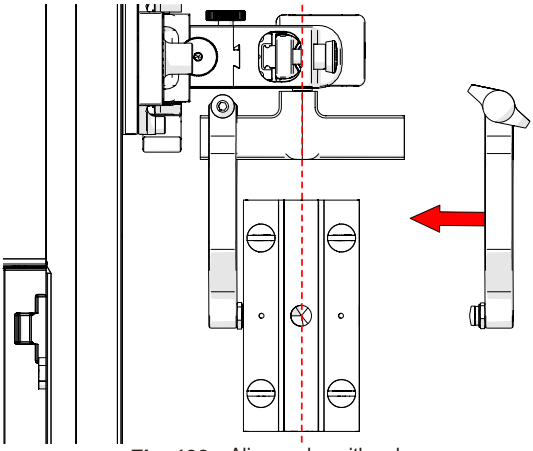


Fig. 122 - Align probe with yoke

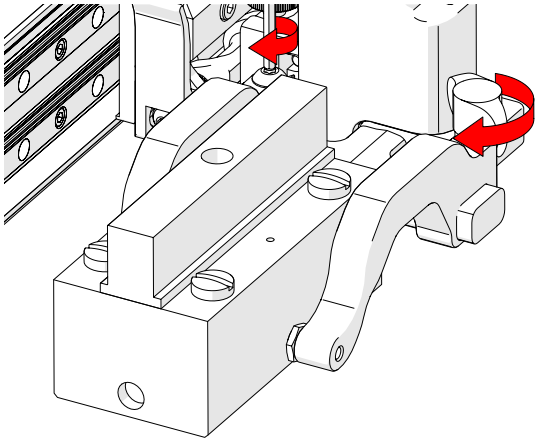


Fig. 123 - Tighten knob and screw

6. Align the middle of the wedge with the centre of the yoke *(Fig. 122).*
7. Tighten both the probe holder adjustment knob and the arm clamp screw *(Fig. 123)* while ensuring the wedge remains centred with the yoke.

5.5.2.2 Probe Holder Vertical Adjustment

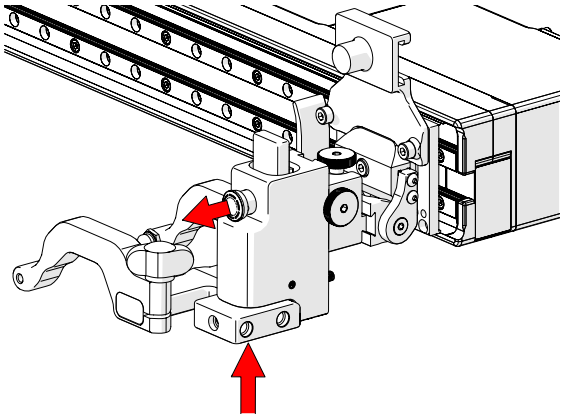


Fig. 124 - Press up and pull latch

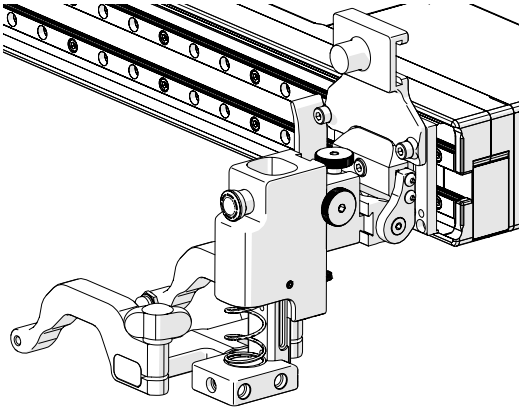


Fig. 125 - Lowered toward scan surface

1. Gently lift the heavy duty vertical probe holder and simultaneously pull the latch *(Fig. 124)*. This action will unlock the probe holder. Slowly lower the probe holder towards the scan surface *(Fig. 125)*.

5.5.2.3 Probe Holder Left/Right Conversion

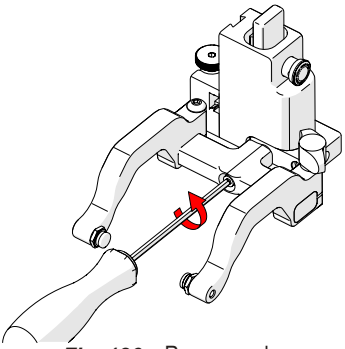


Fig. 126 - Remove yoke

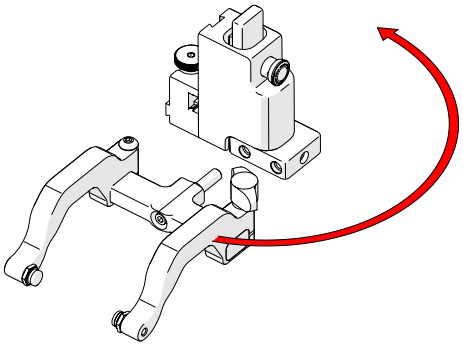


Fig. 127 - Orient to opposite side

1. Using the supplied 3 mm driver, unscrew the yoke *(Fig. 126)*.
2. Position the yoke and arms to the opposite side of the probe holder *(Fig. 127)*.

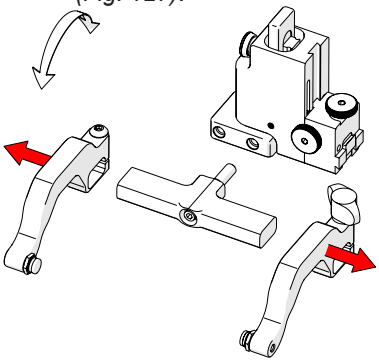


Fig. 128 - Remove probe holder arms

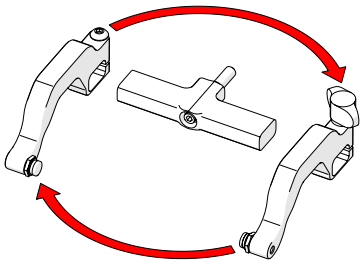


Fig. 129 - Reverse position around yoke

3. Loosen the arm clamp screw and probe holder arm adjustment knob allowing removal of the probe holder arms *(Fig. 128)*.
4. Position removed arms to opposite sides of the yoke *(Fig. 129)*.

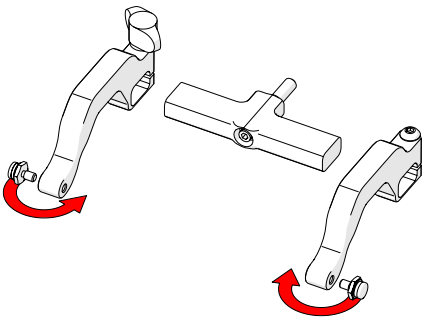


Fig. 130 - Position pivot buttons

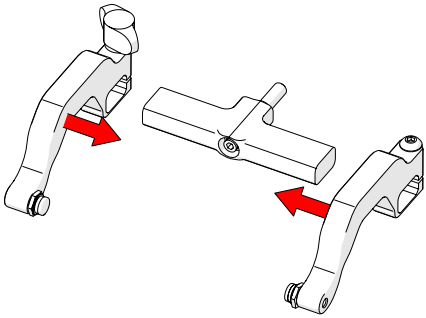


Fig. 131 - Place arms back onto yoke

5. Position the pivot buttons to the inside of the probe holder arms *(Fig. 130)*.
6. Place the probe holder arms on the yoke and tighten the arm clamp screw and probe holder adjustment knob *(Fig. 131)*.
7. Screw the yoke to the probe holder *(Fig. 132)*.

> ***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.*

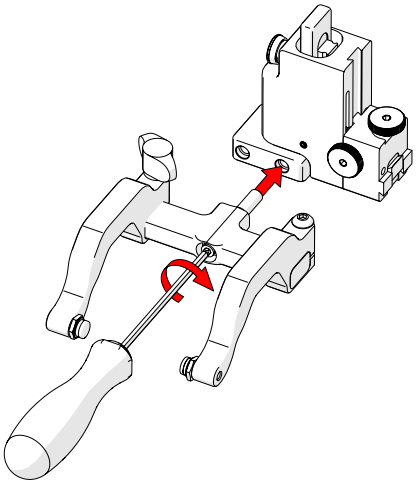


Fig. 132 - Screw into threaded hole

5.5.2.4 Probe Holder 90° Adjustment

1. Remove the yoke using the supplied 3 mm hex driver *(Fig. 126).*
2. Orient the yoke to the front of the probe holder and screw the yoke into the threaded hole provided *(Fig. 133)*.

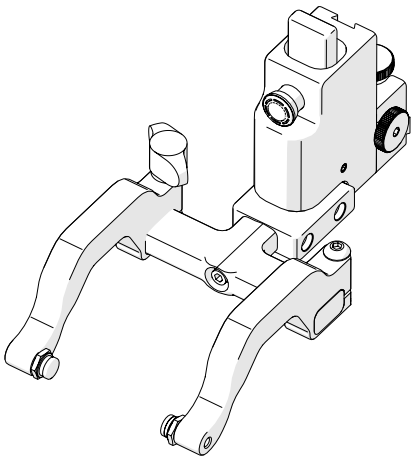


Fig. 133 - 90° probe holder positioning

5.5.3. Corrosion Thickness Probe Holder

Follow these steps when using the corrosion thickness probe holder with a raster arm.

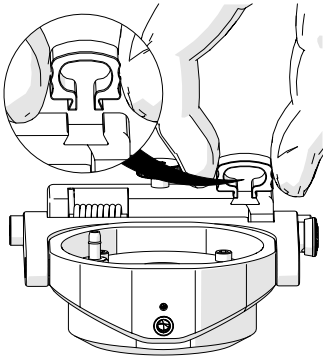


Fig. 134 - Cable clip

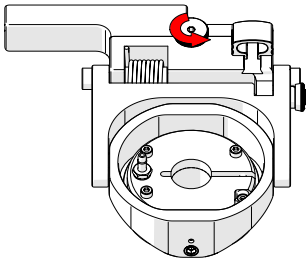


Fig. 135 - Loosen knob

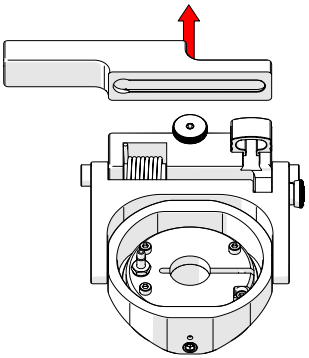


Fig. 136 - Remove bracket

1. The supplied cable clip *(Fig. 134)* is offered as a means of cable management. Pinch the clip for removal and installation. The cable clip is not typically used in conjunction with the raster arm setup.

> ***NOTE:*** *It is necessary to remove the mounting bracket of the corrosion thickness probe holder if attached.*

2. Rotate the probe holder adjustment knob *(Fig. 135)*.
3. If attached, remove the mounting bracket *(Fig. 136)*.

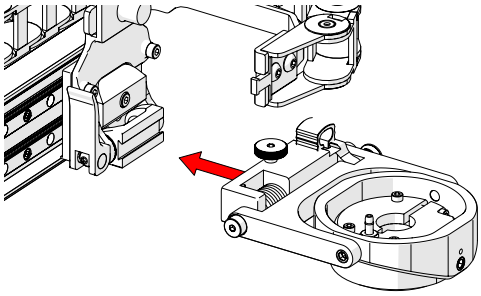


Fig. 137 - Attached to dovetail jaw

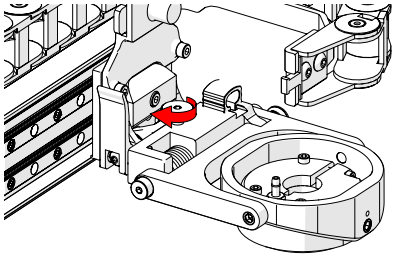


Fig. 138 - Tighten knob

4. Align the dovetail jaw of the corrosion thickness probe holder *(Fig. 137)* and the pivot mount of the raster arm.
5. Tighten the probe holder adjustment knob *(Fig. 138)*.

5.5.4. Two Probe Raster Arm

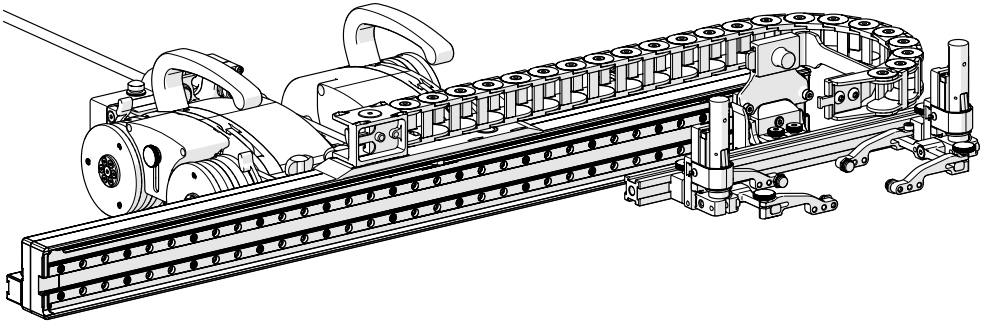


Fig. 139 - Raster arm with 2 probe holders

To mount 2 probe holders to the raster arm, follow these steps:

> ***NOTE:*** *Do not mount in excess of 2 probe holders to the front of the raster arm.*

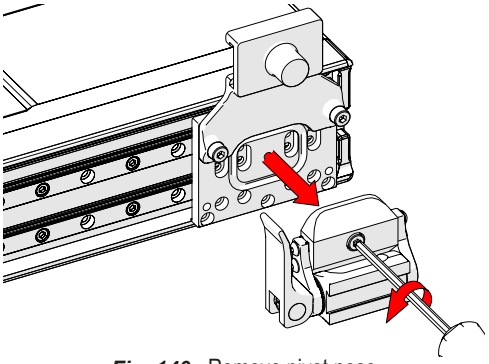


Fig. 140 - Remove pivot nose

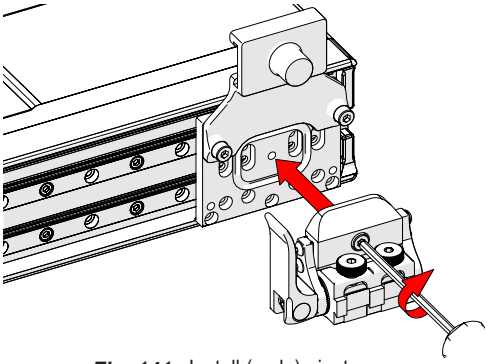


Fig. 141 - Install (male) pivot nose

1. Remove the cable tray *(see "Attaching a Cable Tray" on page 53)*.
2. Using the supplied 3 mm hex driver, remove the raster arm pivot nose of the raster arm *(Fig. 140)*.
3. Mount the *(male)* pivot nose *(sold separately)* to the raster arm *(Fig. 141)*.

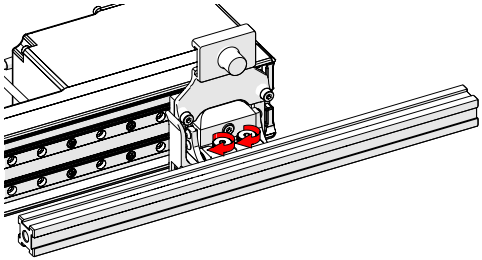


Fig. 142 - Mount frame bar

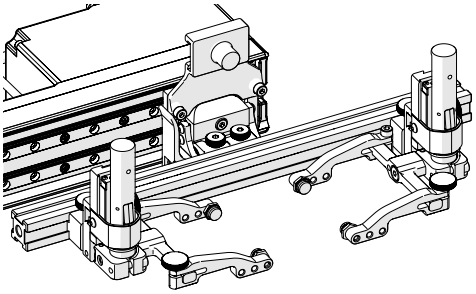


Fig. 143 - Mount probe holders

4. Mount a frame bar to the pivot nose *(Fig. 142)*.
5. Follow the steps *(see "Probe Holder Setup" on page 80)* to mount and setup the vertical probe holders *(Fig. 143)*.

5.5.5. Pivoting the Raster Arm

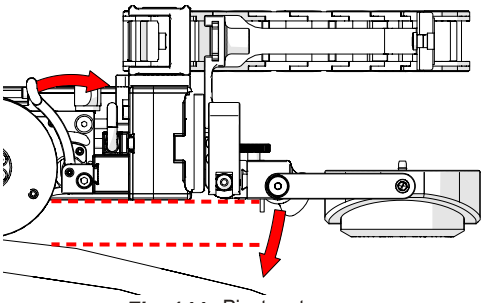


Fig. 144 - Pivot raster arm

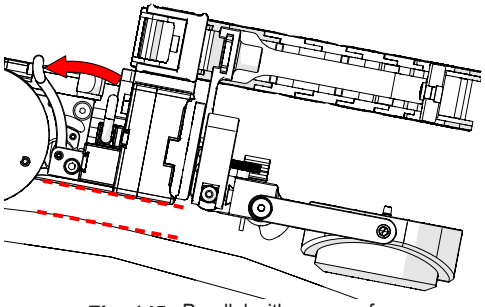


Fig. 145 - Parallel with scan surface

Adjust the raster arm pivot *(Fig. 144)* to align the raster arm parallel with the tangent of the scan surface *(Fig. 145)*.

5.5.6. Pivot Nose

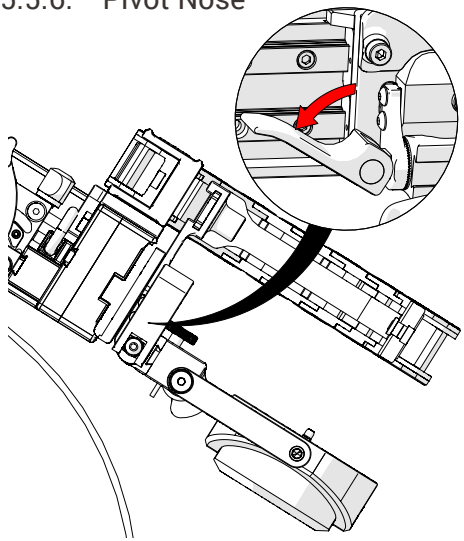


Fig. 146 - Pivot nose

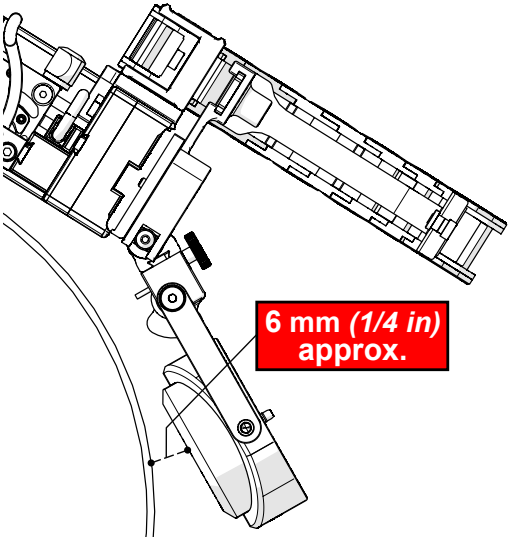


Fig. 147 - Parallel with scan surface

Release the pivot nose latch and angle the probe holder towards the inspection surface. Lower the probe holder to approximately 6 mm *(¼ in)* above the scan surface *(Fig. 147)*, latch the pivot nose at this position.

5.5.7. Raster Arm Cable

The raster arm cable connects the raster arm module to the umbilical. The cable provides the 36 VDC and network connections to the raster arm module as well as transmits the raster arm encoder signals to the umbilical.

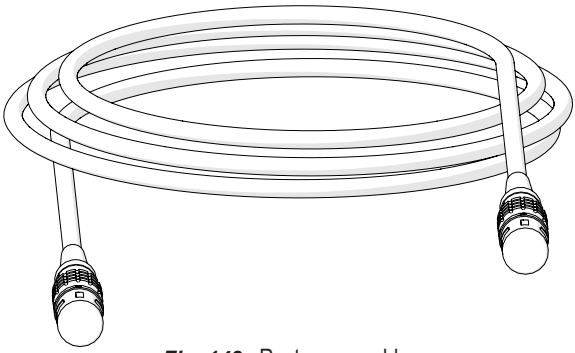


Fig. 148 - Raster arm cable

Both raster arm cable connectors are identical and interchangeable. Plug one end of the cable to the raster arm and the opposite end is connected to the crawler umbilical breakout. Typically, the raster arm cable is connected to the **Y-ENC** port of the crawler umbilical breakout to supply its encoder as the 2nd encoder signal down the umbilical through the encoder cable to the user's instrument.

The raster arm cable may be connected to any of the other 8-pin receptacles on the umbilical for troubleshooting or non-standard configurations.

(see "Raster Arm Cable Setup" on page 56)

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

5.6. Battery Powered Optical Guide

WARNING! LASER RADIATION. Do not view directly with optical instruments. Class 1M laser product.

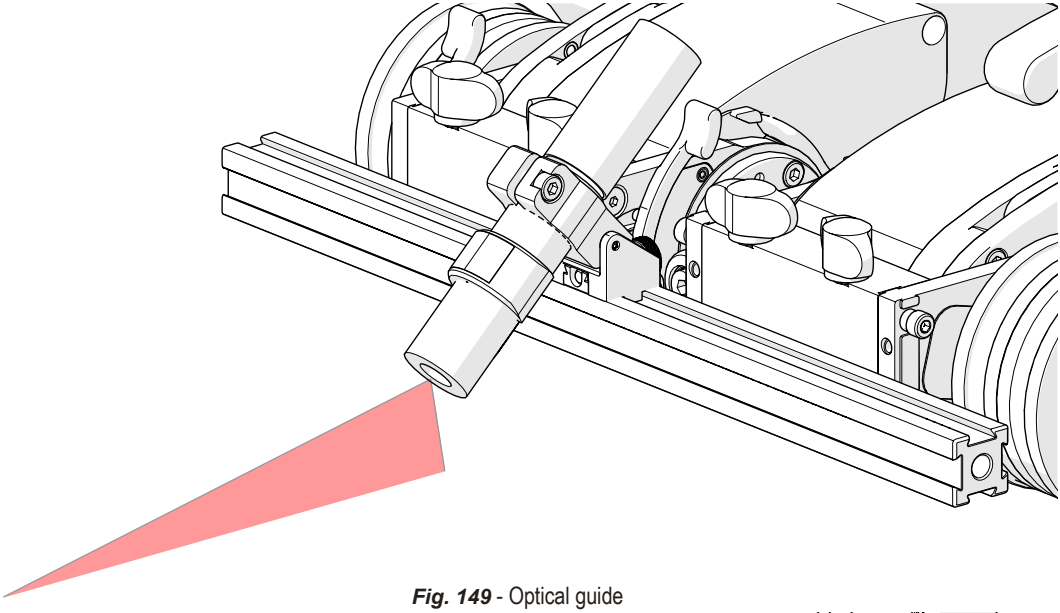


Fig. 149 - Optical guide

The battery powered optical guide provides a reference point useful for a aligning the **NAVIC** too a given path *(i.e. a weld)*. The battery powered optical guide may be installed and setup as follows:

1. Loosen the optical guide knob.
2. Mount the optical guide to the frame bar, tighten the optical guide knob *(Fig. 150)*.
3. Adjust the optical guide's friction pivot aiming the beam at the inspection surface *(Fig. 151)*.
4. Loosen the optical guide knob to adjust the side-to-side position as required. Retighten the optical guide knob.

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

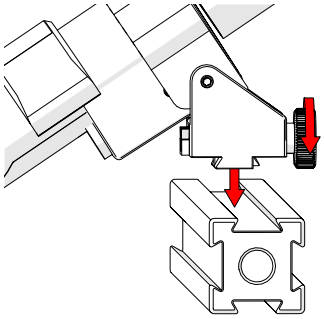


Fig. 150 - Mount on frame bar

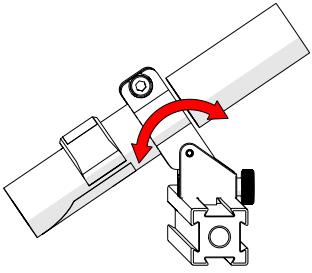


Fig. 151 - Aim guide

5.7. Power Supply

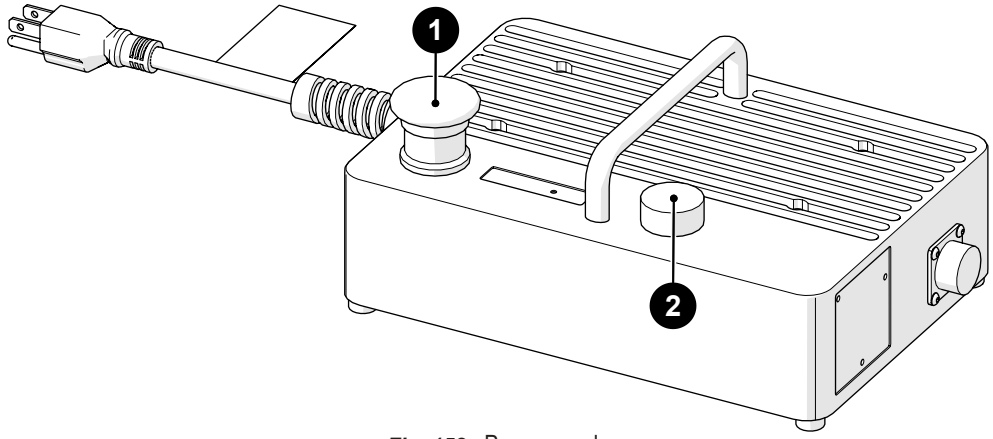


Fig. 152 - Power supply

The **NAVIC** power supply converts power from a 90-270 VAC, 45-65Hz, 5A power source to 36VDC, 11.1A. A start/stop safety circuit and physical **ON** and **OFF** push-buttons are integrated into the supply.

Activate power to the **NAVIC** by pressing *(and releasing)* the green button *(Fig. 152-2)*.

The red stop button *(Fig. 152-1)* 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.

In the event of a break in the stop circuit *(the stop circuit runs through the power supply 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 supply should not be used if visible damage is present. Use of damaged components may be a safety hazard.*

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

Only use the power supply with a properly grounded source. The safety of the power supply 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.*

The power cord of the power supply is used to connect the power supply to a suitable 90-270VAC, 45-65Hz grounded power source capable of supplying a minimum of 5 amps.

5.8. Power Supply Cable

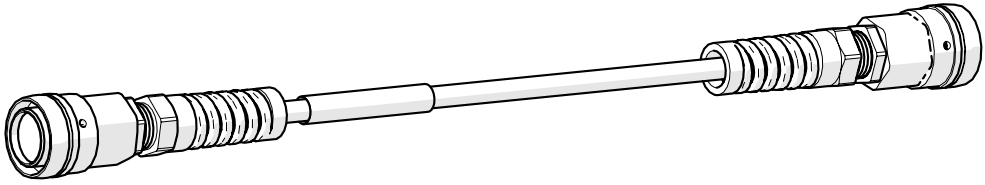


Fig. 153 - Power supply cable

The power supply cable is available in various lengths *(3 m standard)*. This cable is used to connect the power supply to the umbilical. The cable provides the main 36VDC power, E-Stop control circuit and system grounding connections.

NOTE: *Before use, always inspect the cable and connectors for damage. Do **NOT** use if any damage is evident. Use of a damaged cable may be a safety hazard.*

5.9. Umbilical

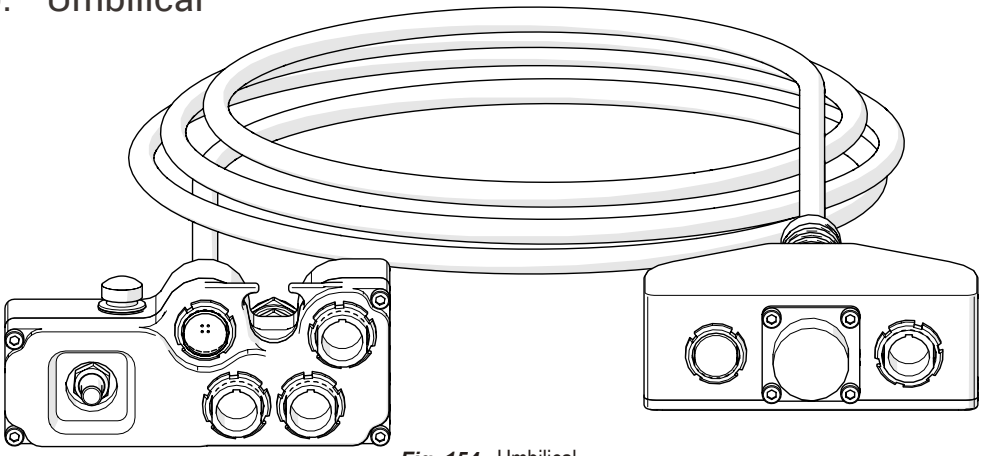
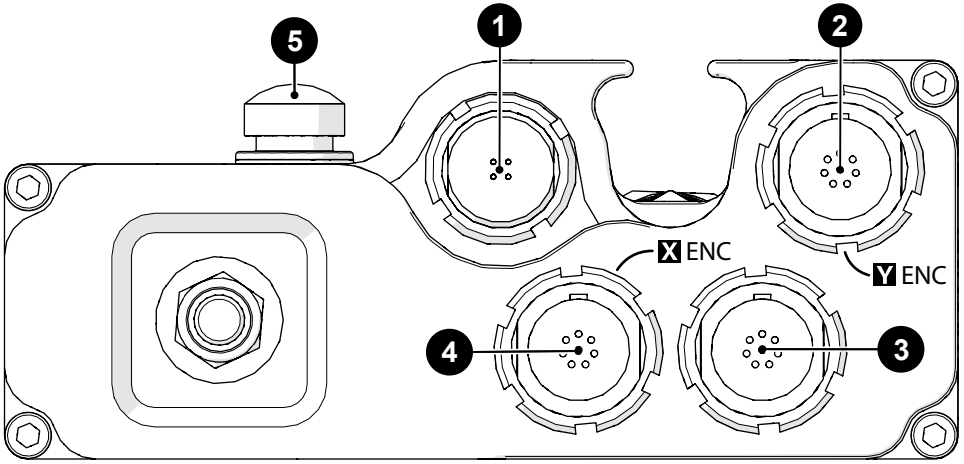


Fig. 154 - Umbilical

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 user's instrument, power supply and the crawler. Various umbilical lengths are available from 5 m to 30 m *(16.4 ft to 98.4 ft)* long.



BOM ID	Description
1	4-Pin Expansion Connector
2	8-Pin Expansion Connector *(Encoded Aux. Module)*
3	8-Pin Connector - Left Drive Module *(Non-Encoded Drive Module)*
4	8-Pin Expansion Connector - Right Drive Module *(Encoded Drive Module)*
5	Emergency Stop

Fig. 155 - Crawler umbilical breakout *(crawler side)*

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 **X** *(Fig. 155-4)* or secondary **Y** *(Fig. 155-2)* encoder axis. The third unlabeled receptacle *(Fig. 155-3)* contains no encoder wiring.

ID	Description
1	4-Pin Expansion Connector

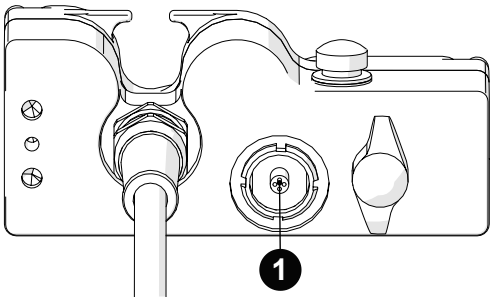


Fig. 156 - Crawler umbilical breakout *(cable side)*

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. 158 - Emergency off

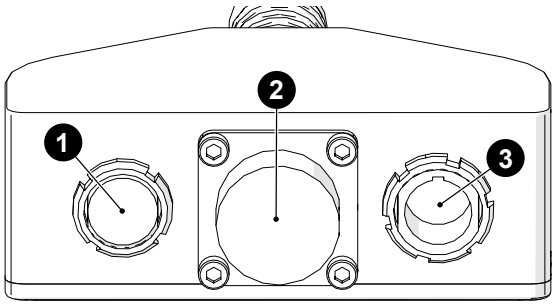
The red button *(Fig. 155-5)* located on the umbilical provides an emergency off button to the entire system. When pressed, all power to the **NAVIC** system will disengage.

To restore system power, it is necessary to press the green power button located on the power supply *(see "Power Supply" on page 68).*

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

All modules connect using the umbilical.

- The power supply connects to the 12-pin bayonet *(Fig. 157-2)* using the power cable.
- The user instrument is connected to the 10-pin Lemo® *(Fig. 157-3)* using the encoder cable.
- The controller is connected via the controller cable to one of the 4-pin receptacles on either the user umbilical breakout *(Fig. 157-1)* or the crawler



BOM ID	Description
1	Controller Connector
2	Power Connector
3	Encoder Output Connector

Fig. 157 - User umbilical breakout

umbilical breakout *(Fig. 156-1)*.

- The motorized left and right modules connect to any of the 8-pin Lemo® receptacles on the crawler umbilical breakout *(Fig. 155)*.
- The module connected to the **Y-ENC** 8-pin Lemo® will transmit encoder signals through the umbilical as the 2nd encoder axis. Typically, the raster arm is connected to the **Y-ENC** receptacle.
- The module that is connected to the **X-ENC** 8-pin Lemo® transmits encoder signals through the umbilical as the 1st encoder axis. Typically, the right drive module is connected to the **X-ENC** receptacle.

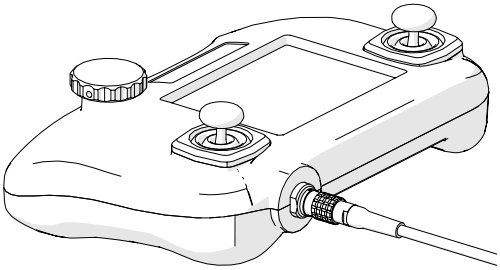


Fig. 159 - Controller cable connected

- The unlabeled 8-pin Lemo® does not support encoder signals. Typically, the left drive module is connected to the unlabeled receptacle.
- In the event of an auxiliary encoder failure with the right drive module, the right and left drive modules connectors may be swapped. This transmits encoder signals from the left drive module through the umbilical.

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.

> ***NOTE:*** *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 crawler umbilical breakout 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.

> ***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.*

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

5.10. Controller Cable

The controller cable connects the controller to the umbilical. 36VDC and network signals are used in the cable.

Both controller cable connectors are identical and interchangeable. The cable may be plugged into the 4-pin receptacle on the crawler umbilical breakout or the user umbilical breakout.

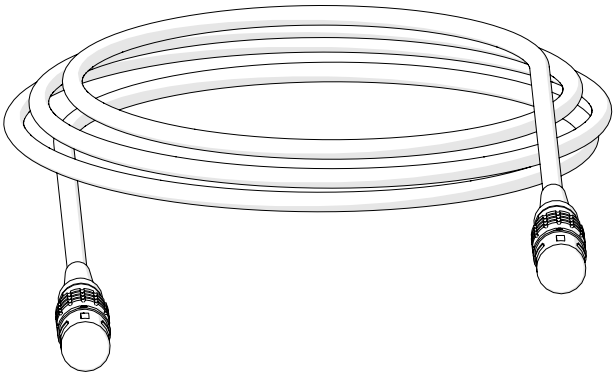


Fig. 160 - Controller cable

> ***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.*

5.11. Encoder Cable

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

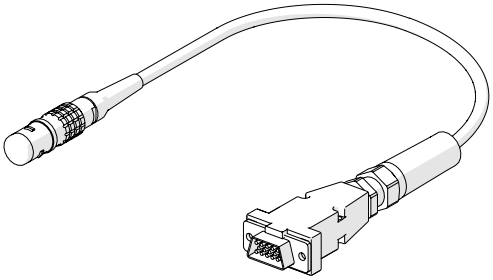


Fig. 161 - Encoder cable

Different encoder cables are available for various instruments.

Connect the 10-pin receptacle to the user umbilical breakout while plugging the opposite cable end to the supplied instrument.

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

5.12. 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

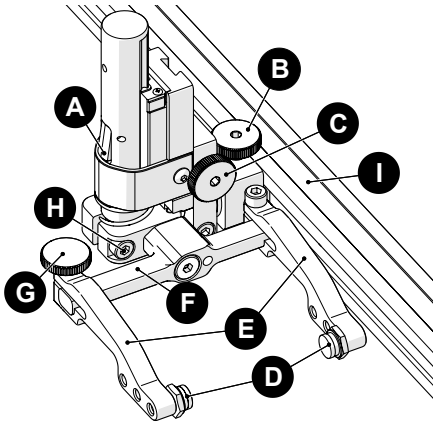


Fig. 162 - Vertical probe holder

5.12.1. Probe Holder Setup

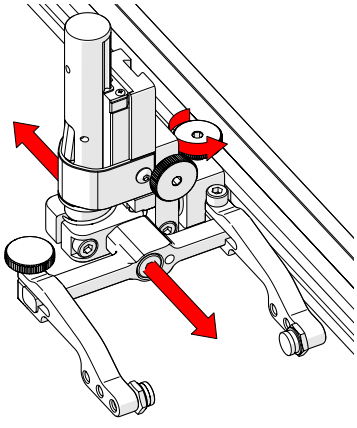


Fig. 163 - Adjust on frame bar

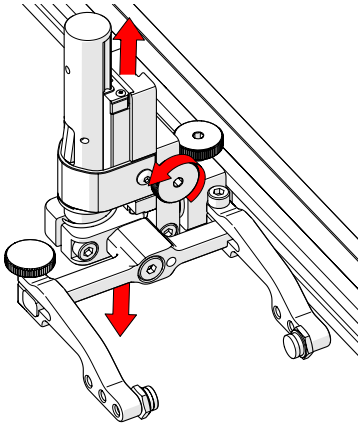


Fig. 164 - Vertical adjustment

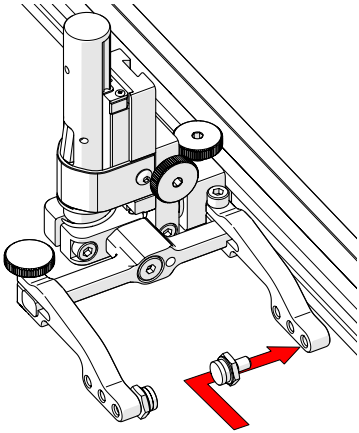


Fig. 165 - Place buttons

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. 163)*.
2. Vertical adjustment knob allows the vertical probe holder height adjustment *(Fig. 164)*.
3. Position the pivot buttons where necessary. When a narrow scanning footprint is required, use the pivot button holes closet to the yoke *(Fig. 165)*.

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

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

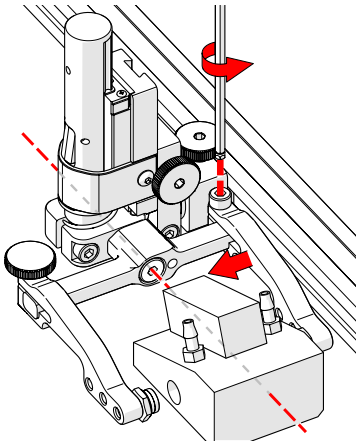


Fig. 166 - Adjust inner arm

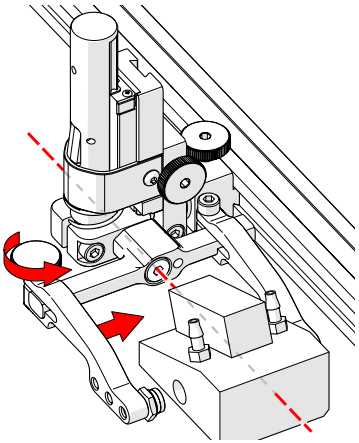


Fig. 167 - Adjust outer arm

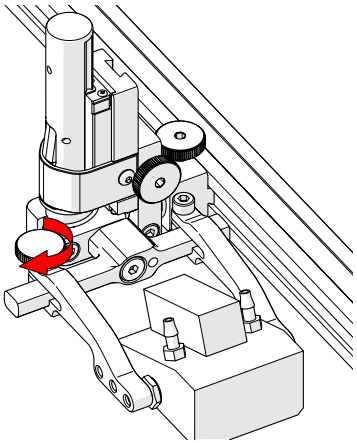


Fig. 168 - Tighten arm knob

4. Position the wedge on the inner probe holder arm *(Fig. 166)*.

> ***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. 166) using the supplied 3 mm hex driver (Fig. 1).*

5. Loosen the probe holder arm adjustment knob *(Fig. 167)* and slide the probe holder arm along the yoke pinching the wedge in place.
6. Tighten the probe holder arm adjustment knob *(Fig. 168)*.

5.12.2. Probe Holder Vertical Adjustment

To adjust the probe holder vertically, follow these steps:

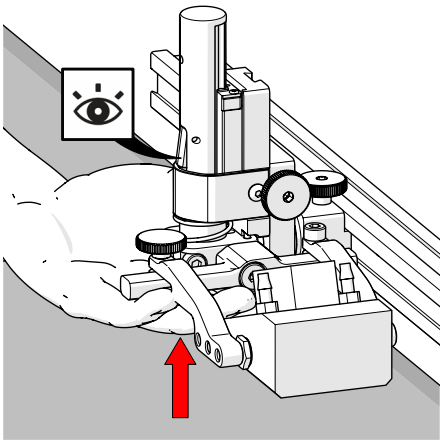


Fig. 169 - Latch probe holder

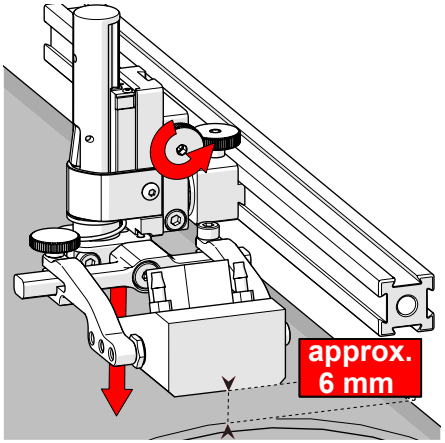


Fig. 170 - Lower toward scan surface

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. 169)*.
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. 170)*.

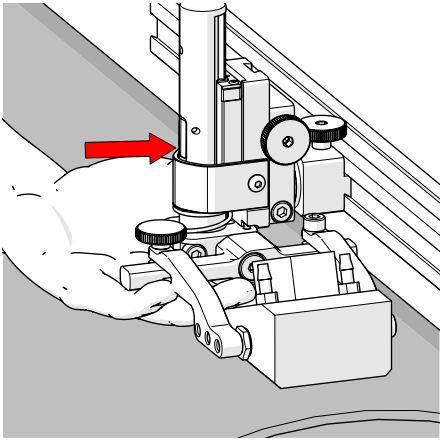


Fig. 171 - Press latch button

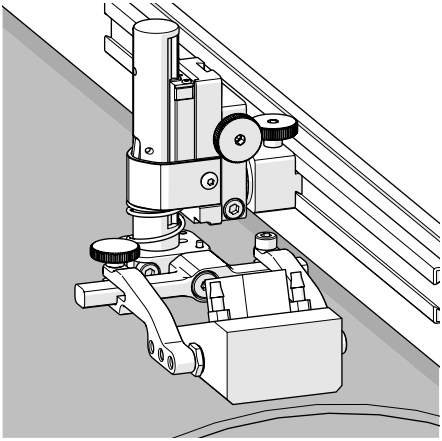


Fig. 172 - Lower toward scan surface

4. Lift the yoke slightly and press the latch button *(Fig. 171)*, then slowly lower towards scanning surface to apply spring pressure to the wedge *(Fig. 172)*.

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

5.12.3. Probe Holder Transverse Adjustment

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

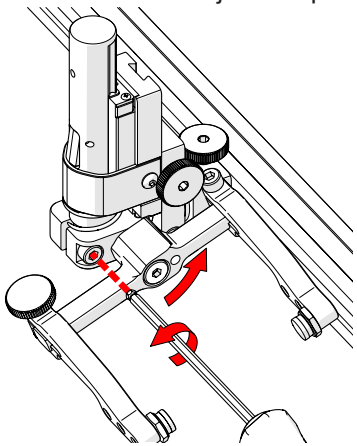


Fig. 173 - Loosen 3 mm screw

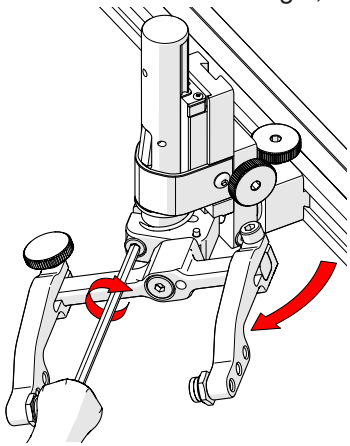


Fig. 174 - Rotate and tighten

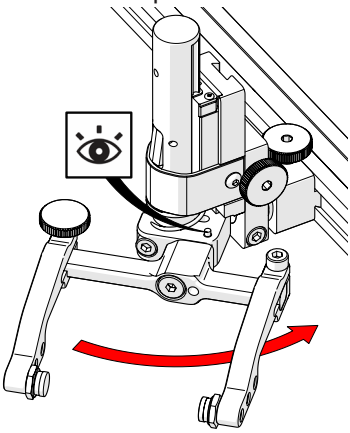


Fig. 175 - Stop post locates 90°

1. Ensure the probe holder is in latched, upper position *(Fig. 169).*
2. Using the supplied 3 mm hex driver loosen the transverse adjustment screw *(Fig. 173)* and rotate the yoke about the vertical shaft achieving the desired angle.
3. Tighten the transverse adjustment screw *(Fig. 174)*.

To return the transverse adjustment to neutral (90°). The probe holder must be in the latched, upper position *(Fig. 169).* Rotate the yoke until the stop post contacts the base of the probe holder *(Fig. 175).* Then tighten the transverse adjustment screw.

5.12.4. Probe Holder Longitudinal Adjustment

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

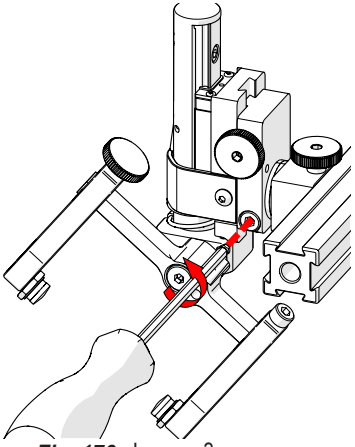


Fig. 176 - Loosen 3 mm screw

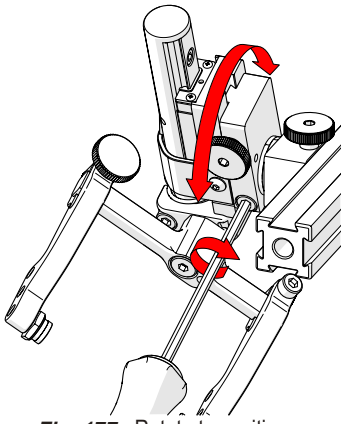


Fig. 177 - Rotate to position

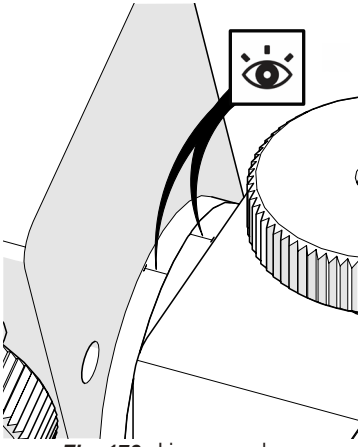


Fig. 178 - Line up markers

1. Ensure the probe holder is in latched, upper position *(Fig. 169).*
2. Using the supplied 3 mm hex driver *(Fig. 1)*, loosen the longitudinal adjustment screw *(Fig. 176).*
3. Rotate the main body of the probe holder until it is at the desired angle *(Fig. 177)*.
4. Tighten the longitudinal adjustment screw *(Fig. 177).*

To return the longitudinal adjustment to neutral (90°). Line up the longitudinal adjustment indicator markers *(Fig. 178).*

5.12.5. 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. 4) is required.*

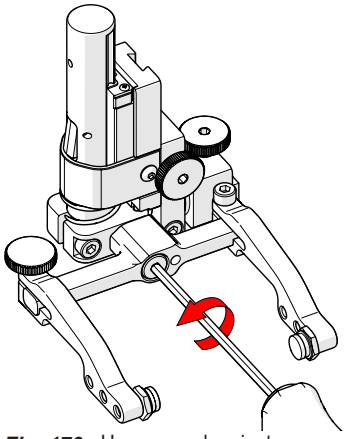


Fig. 179 - Unscrew yoke pivot screw

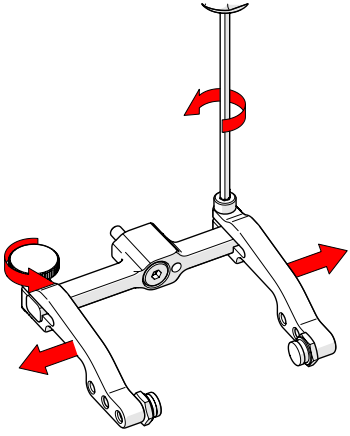


Fig. 180 - Remove probe holder arms

1. Ensure the probe holder is in latched, upper position *(Fig. 169)*.
2. Using the supplied 3 mm hex driver *(Fig. 1)*, unscrew the yoke pivot screw and remove yoke *(Fig. 179)*.
3. Loosen the probe holder arm adjustment knob and the arm clamp screw. Slide the probe holder arms off the yoke *(Fig. 180)*.

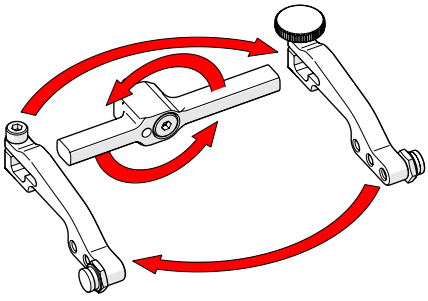


Fig. 181 - Flip yoke and reverse arms

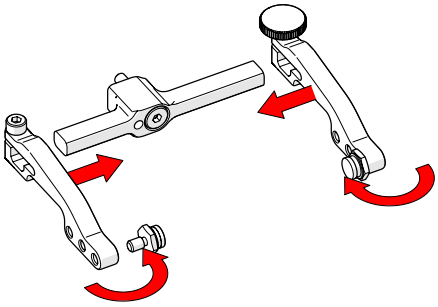


Fig. 182 - Attach arms & move buttons

4. Flip the yoke 180° and reverse the probe holder arms *(Fig. 181)*.
5. Place the pivot buttons on the inside of the probe holder arms *(Fig. 182)* using a 3/8 in wrench *(Fig. 2)*.

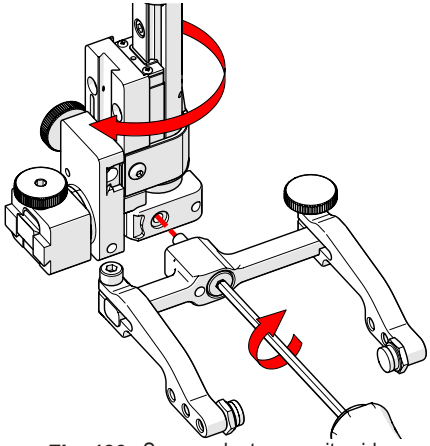


Fig. 183 - Screw yoke to opposite side

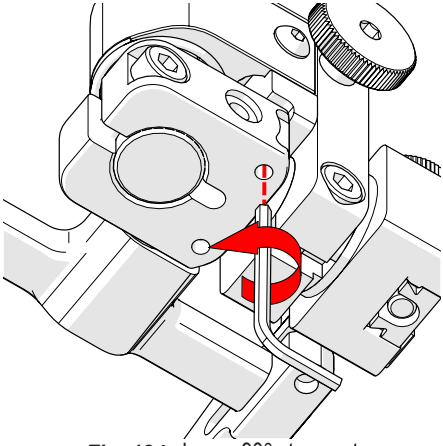


Fig. 184 - Lower 90° stop post

6. Mount the yoke to the opposite side of the base using the supplied 3 mm hex driver *(Fig. 183)*.

> ***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. 184)*.

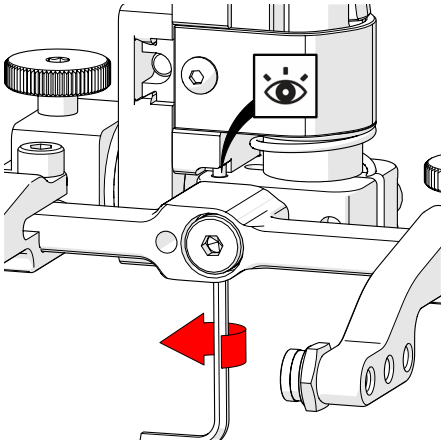


Fig. 185 - Raise opposite 90° stop post

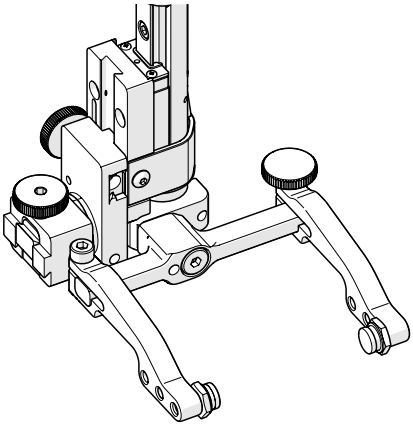
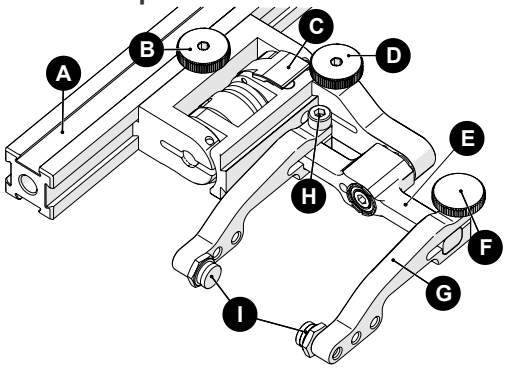


Fig. 186 - Reversed probe holder

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. 185)*.

5.13. 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. 187 - Slip Joint Probe Holder

5.13.1. Probe Holder Setup

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

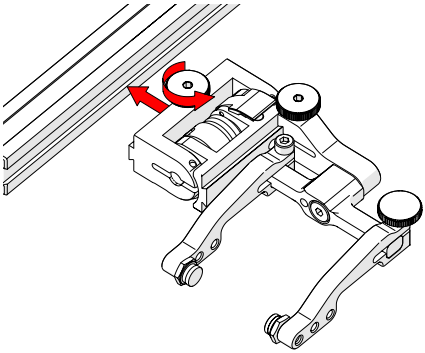


Fig. 188 - Attach to frame bar

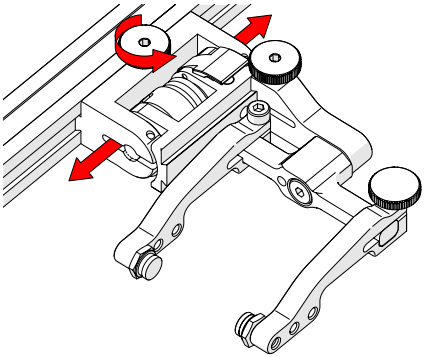


Fig. 189 - Adjust on frame bar

1. Rotate the probe holder adjustment knob and attach probe holder to a frame bar *(Fig. 188)*.
2. Use the probe holder adjustment knob to position the probe holder along the frame bar *(Fig. 189)*.

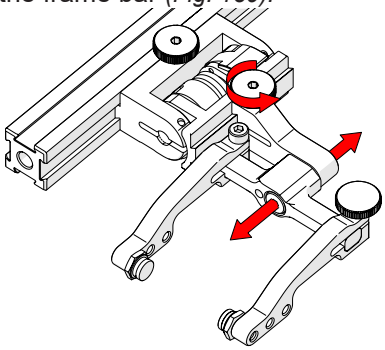


Fig. 190 - Adjust swing arm

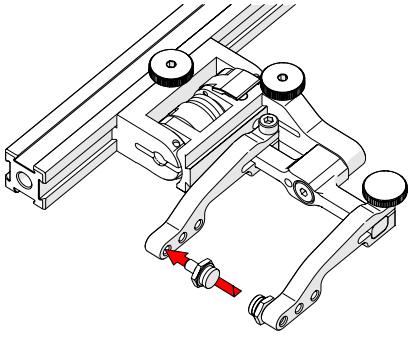


Fig. 191 - Place pivot buttons

3. Use swing arm knob to position the swing arm *(Fig. 190)*.

> ***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. 2)*, place the pivot buttons *(Fig. 191)* 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.*

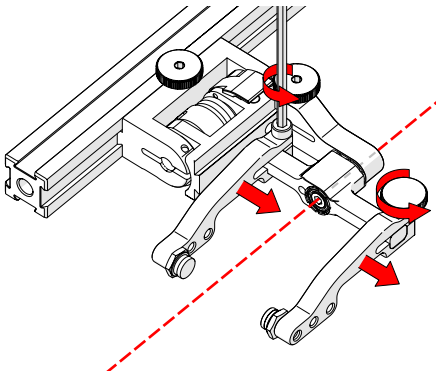


Fig. 192 - Adjust probe holder arms

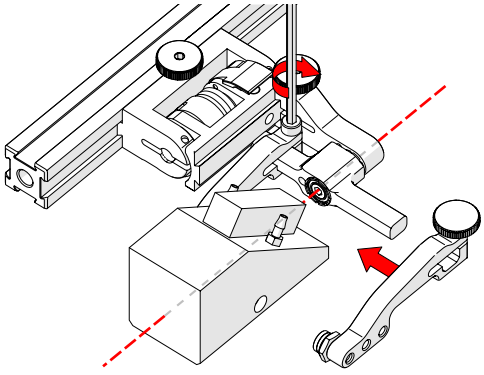


Fig. 193 - Place wedge

5. Loosen the probe holder arm adjustment knob *(Fig. 192)* 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. 192)*.

> ***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. 193).*

7. Position the wedge on the inner probe holder arm *(Fig. 193)*.
8. Slide outer probe holder arm along the yoke pinching the wedge in place.
9. Tighten probe holder arm adjustment knob *(Fig. 194)*.

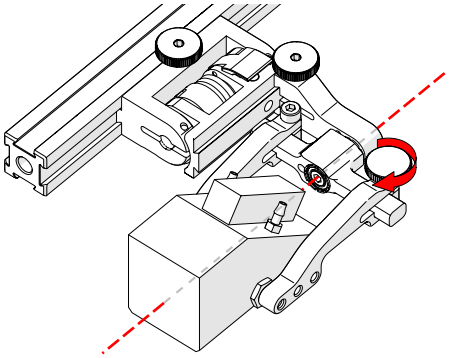


Fig. 194 - Pinch wedge with arm

5.13.2. Probe Holder Adjustment

To adjust the probe holder, follow these steps:

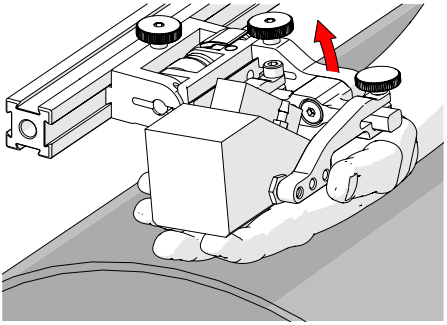


Fig. 195 - Lift to Latched position

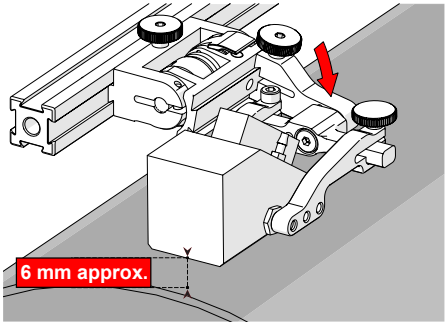


Fig. 196 - Lower to scanning surface

1. Ensure probe holder is in latched, upper position *(Fig. 195)*. 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 inspection surface until the wedge is approximately 6 mm *(¼ in)* above the inspection surface *(Fig. 196)*.

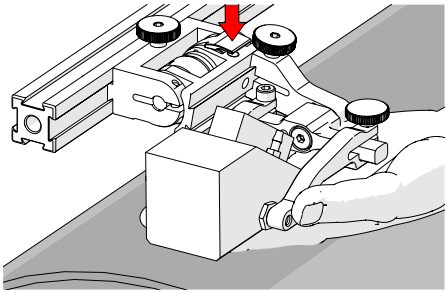


Fig. 197 - Lift and press latch button

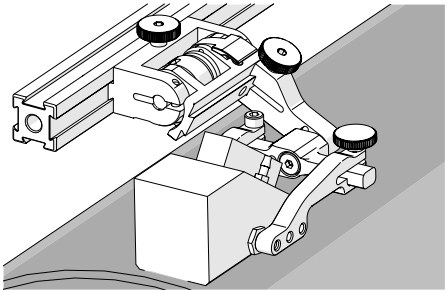


Fig. 198 - Spring loaded scan position

3. Lift probe slightly and press latch button *(Fig. 197)* to apply spring pressure to the wedge.
4. Gently lower probe holder and wedge to the scanning surface *(Fig. 198)*.

5.13.3. 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. 5) and 3 mm hex wrench (Fig. 7) 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.*

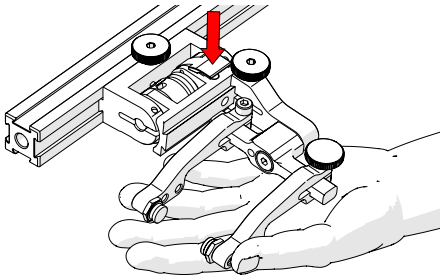


Fig. 199 - Lift slightly and press Latch

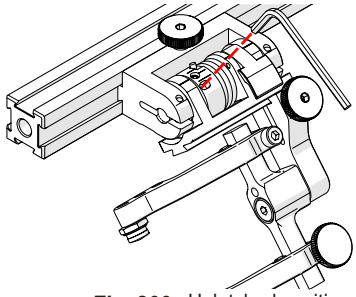


Fig. 200 - Unlatched position

1. Ensure the probe holder is in the upright latched position *(Fig. 199).*
2. Lift probe holder slightly and press the latch button *(Fig. 199)* 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. 200).*

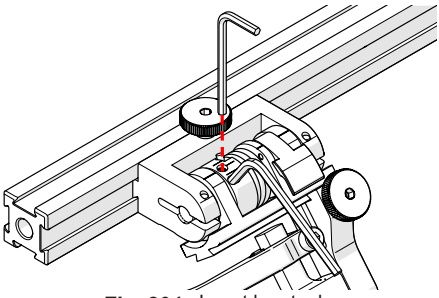


Fig. 201 - Insert hex tools

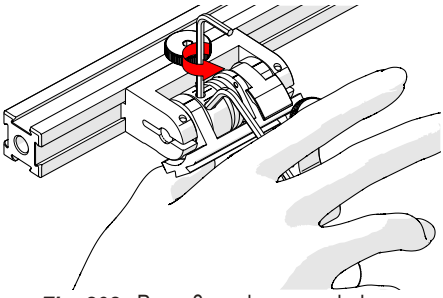


Fig. 202 - Press 3 mm hex wrench down

4. Place the 2 mm hex wrench into the force adjustment screw *(Fig. 201).*
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. 202).*

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. 203)*.

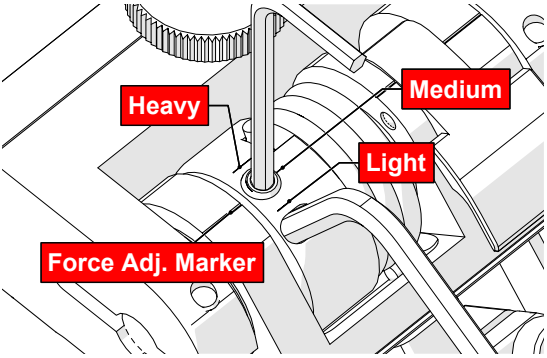


Fig. 203 *- Choose desired tension*

5.13.4. Slip Joint Probe Holder Left/Right Conversion

To reverse the probe holder, follow these steps:

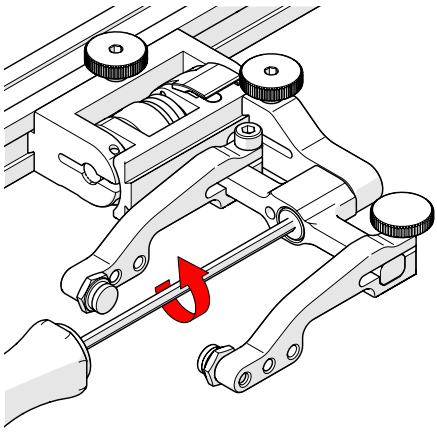


Fig. 204 - Unscrew yoke pivot screw

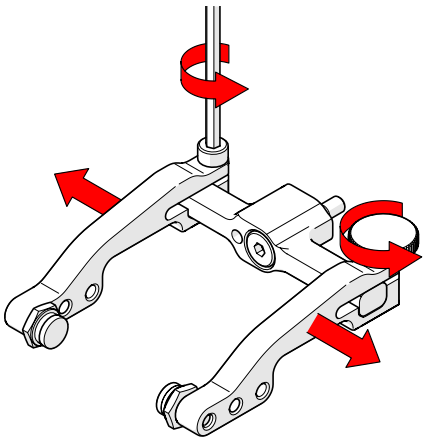


Fig. 205 - Remove arms

1. Unscrew the yoke from the swing arm *(Fig. 204)*.
2. Loosen the probe holder arm adjustment knob and arm clamp screw. Slide the arms from the yoke *(Fig. 205)*.

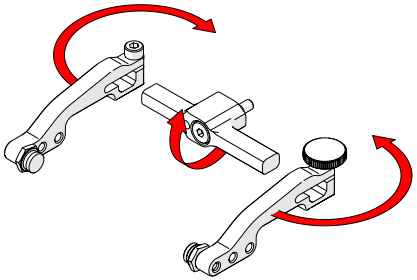


Fig. 206 - Flip yoke and reverse arms

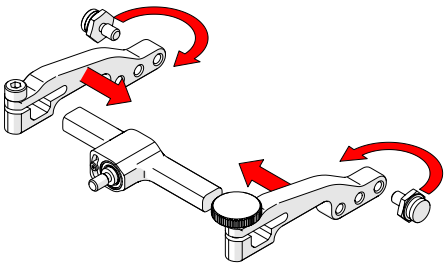


Fig. 207 - Attach arms and move buttons

3. Flip the yoke 180° and reverse the probe holder arms *(Fig. 206)*.
4. Place the pivot buttons on the inside of the probe holder arms *(Fig. 207)* 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.

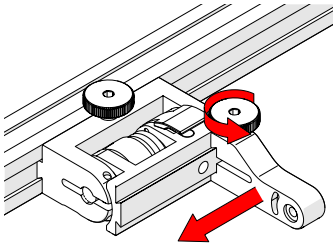


Fig. 208 - Position swing arm

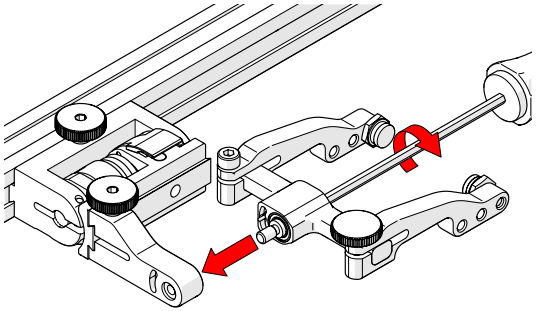


Fig. 209 - Install yoke to swing arm

5. Loosen the swing arm knob and slide the swing arm to the opposite end of the probe holder bracket *(Fig. 208)* 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. 209)*. Ensure the yoke is level to avoid issues with the plunger/set screw.

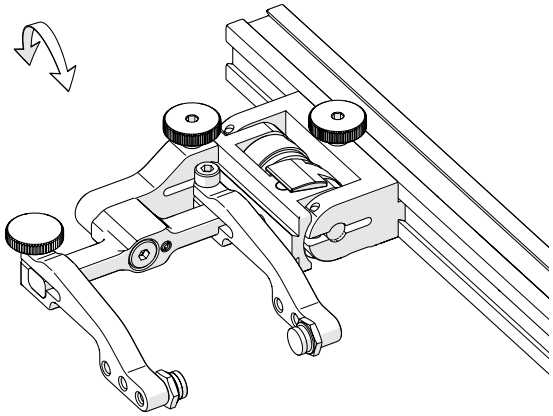


Fig. 210 - Reversed probe holder

5.14. Low Profile Probe Holder Frame

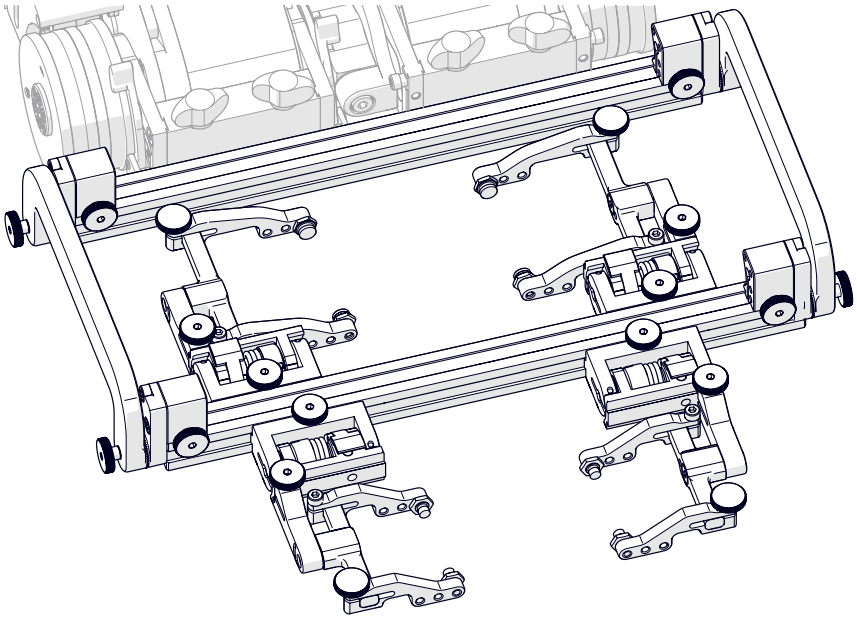


Fig. 211 - Low profile probe holder frame

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.

5.14.1. Low Profile Probe Holder Frame Setup

1. Attach the wedges to the probe holders that are to be used *(see Probe Holder Setup on page 74 for additional details).*

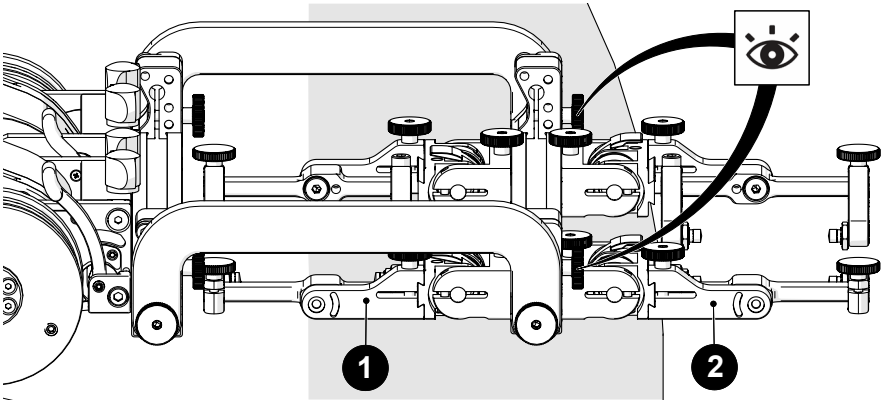


Fig. 212 - Position primary and secondary probe holders

2. Affix the probe holders *(with attached wedges)* to the low profile probe holder frame. On the frame bar, place the secondary probe holders at the front *(Fig. 212-2)* and the primary probe holders at the rear *(Fig. 212-1)*.

> ***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 48 for additional details)*. When mounting the low profile frame, ensure the attachment knobs *(Fig. 212)* are at the front *(non crawler side)*.

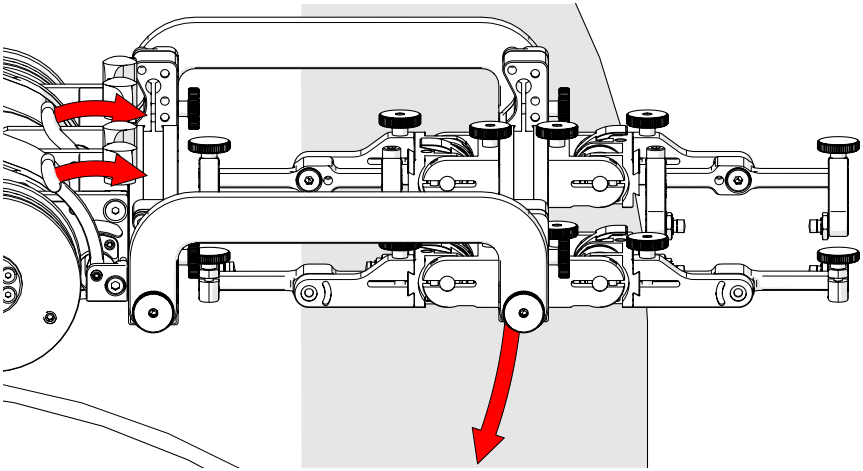


Fig. 213 - Align swivel mount with scan surface

4. Release the two swivel mount levers *(Fig. 213)* to position the swivel mount parallel to the scan surface *(Fig. 214)*. When alignment with scan surface is achieved, lock the crawler swivel mount levers.

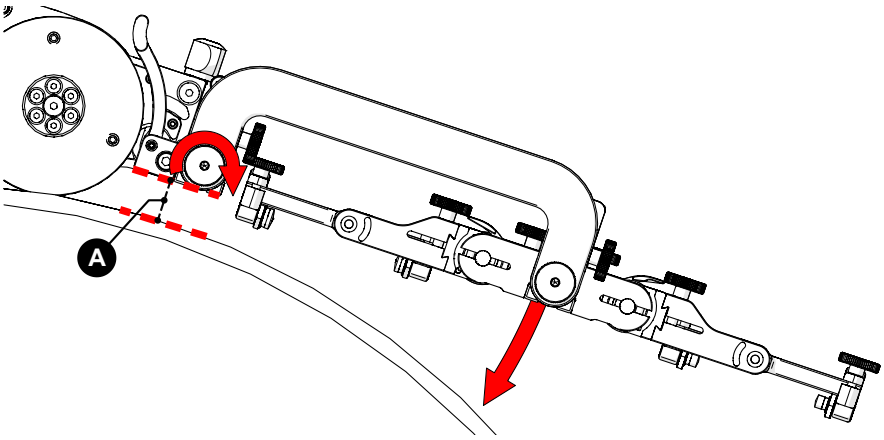


Fig. 214 - Set rear rotational adjustment knob

5. Loosen the rear rotational adjustment knob to lower the front frame bar of the low profile frame towards the inspection surface *(Fig. 214)*.

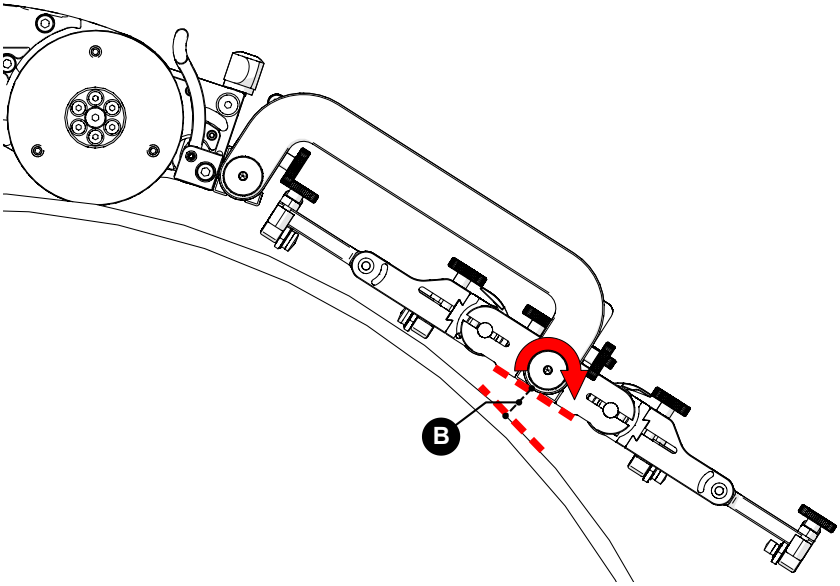
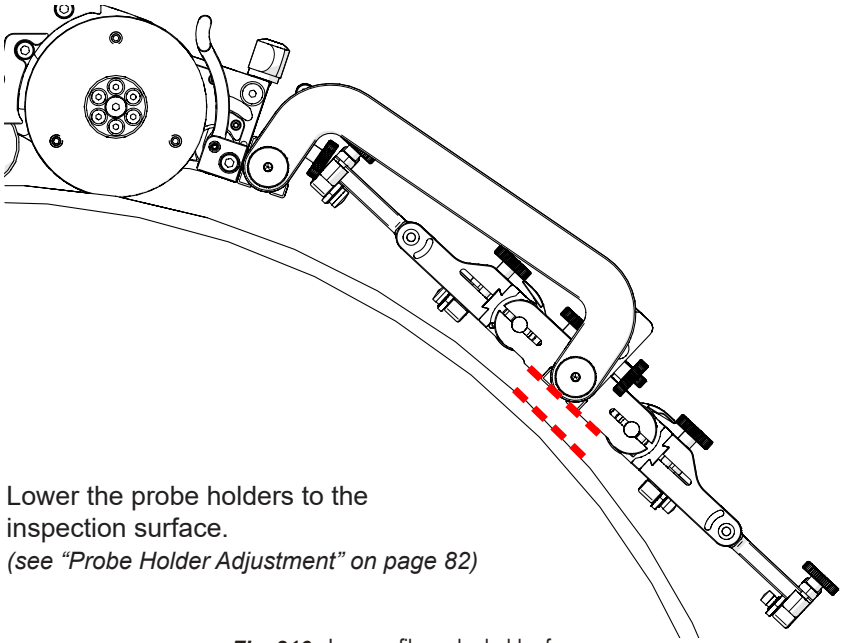


Fig. 215 - Align probe holder tangent with scan surface

6. Loosen the front rotational adjustment knob *(Fig. 215)* to align the frame bar parallel with the scan surface *(Fig. 216)*.



7. Lower the probe holders to the inspection surface.
(see "Probe Holder Adjustment" on page 82)

Fig. 216 - Low profile probe holder frame

5.15. Probe Holder Frame

The 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 eight probes to be used *(contact Jireh Industries Ltd. on page 131)*.

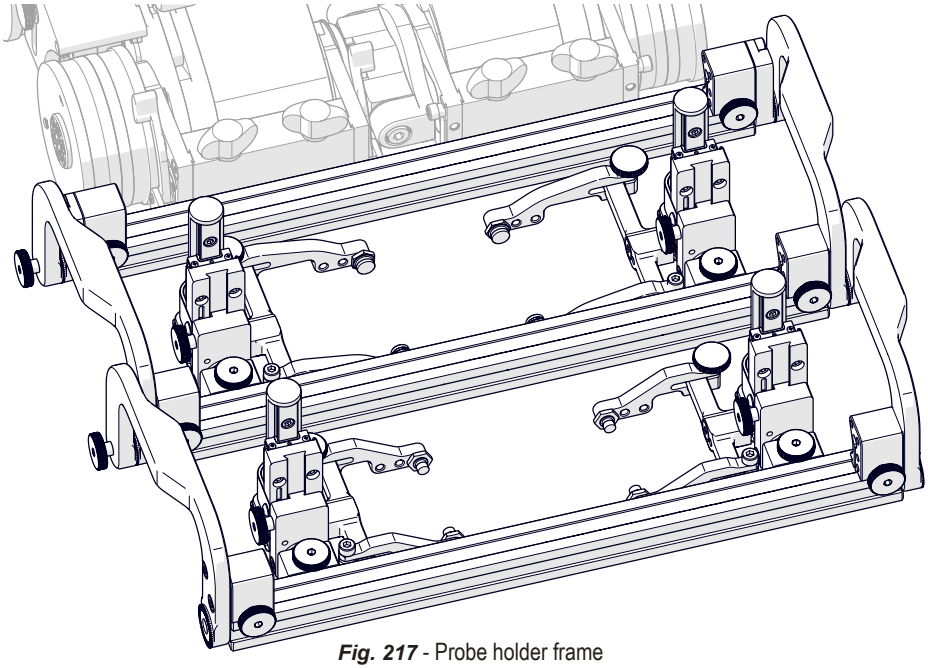


Fig. 217 - Probe holder frame

5.15.1. Probe Holder Frame Setup

1. Attach the wedges to the probe holders that will be used *(see Probe Holder Setup on page 74 for additional details).*

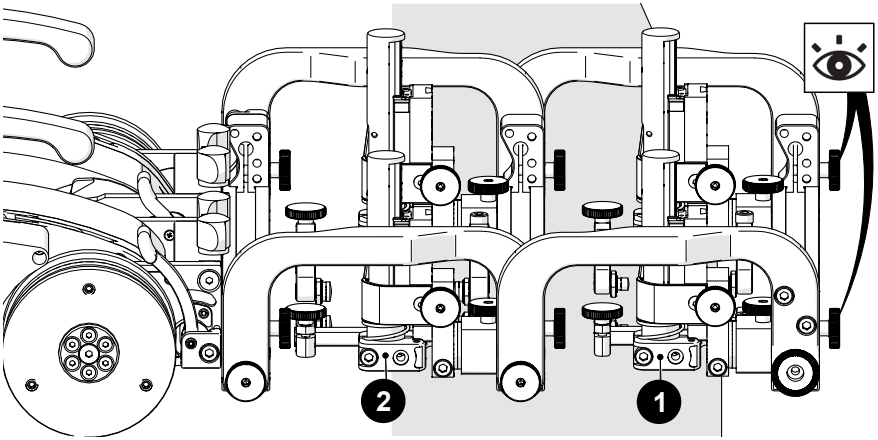


Fig. 218 - Position primary and secondary probe holders

2. Affix the probe holders *(with attached wedges)* to the probe holder frame. Place the secondary probe holder at the front of the frame *(Fig. 218-1)* and place the primary probe holders at the rear of the frame bar *(Fig. 218-2)*.

> ***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 48 for additional details)*. When mounting the probe holder frame, ensure the attachment knobs *(Fig. 218)* are at the front *(non crawler side)*.

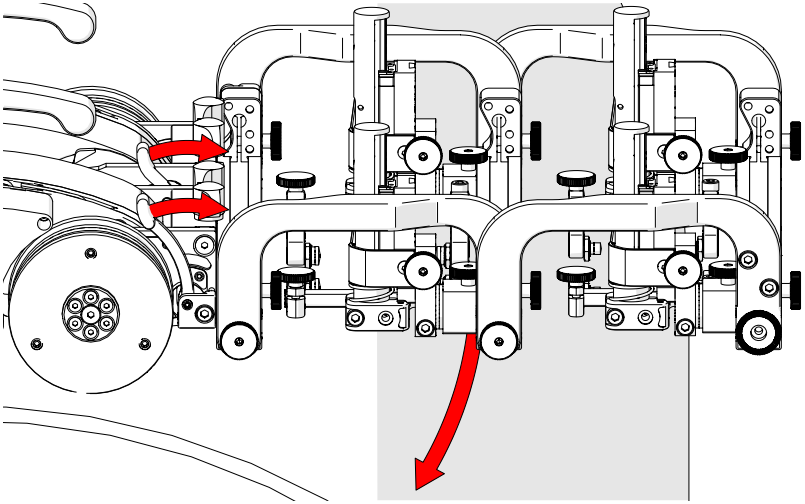


Fig. 219 - Align swivel mount with scan surface

4. Release the two swivel mount levers *(Fig. 219)* to position the swivel mount parallel to the scan surface *(Fig. 220-A)*. When alignment with scan surface is achieved, lock the crawler swivel mount levers.

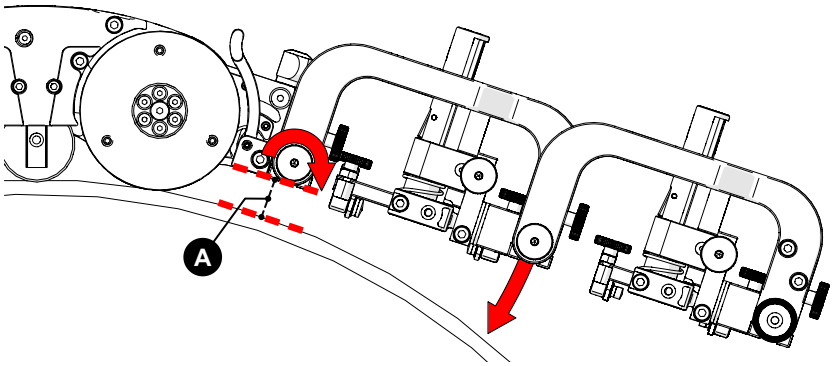


Fig. 220 - Set rear rotational adjustment knob

5. Loosen the rear rotational adjustment knob to lower the weld scan frame

towards the inspection surface *(Fig. 220)*.Ensure gap *(Fig. 220-B)* is no smaller than gap *(Fig. 220-A)*

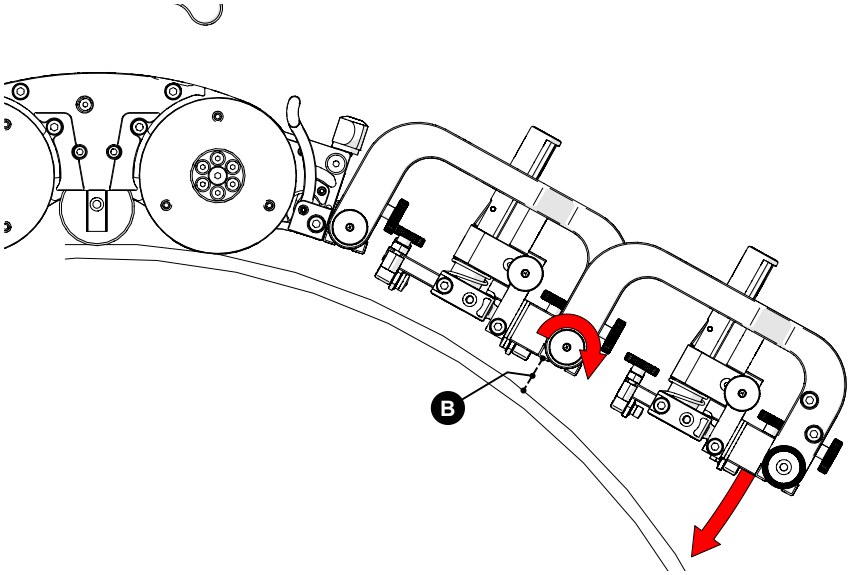


Fig. 221 - Set front rotational adjustment knob

6. Loosen the front rotational adjustment knob *(Fig. 221)* to lower the weld frame towards the inspection surface while ensuring gap *(Fig. 222-C)* is no smaller than gap *(Fig. 220-A)*.

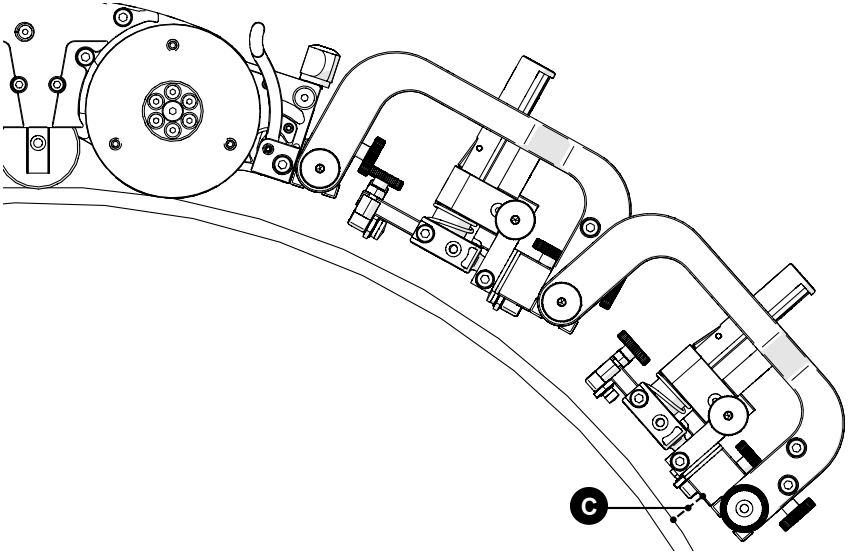


Fig. 222 - Align probes with the scan surface tangent

5.16. Pivoting Probe Holder Frame

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

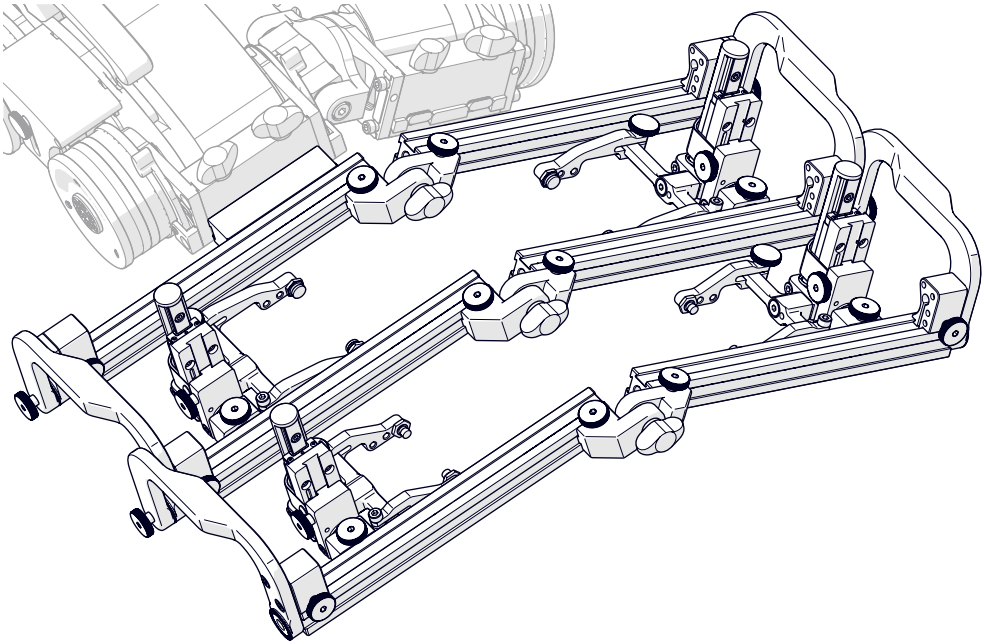


Fig. 223 - Pivoting Probe Holder Frame

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

5.16.1. Mounting a Pivoting Probe Holder Frame

1. Attach the wedges that are to be used with the probe holders *(see Probe Holder Setup on page 74 for additional details).*

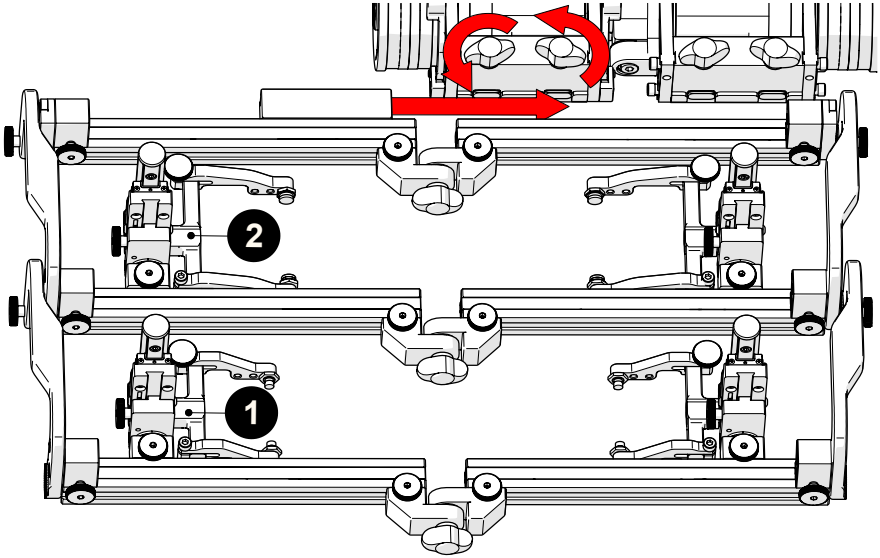


Fig. 224 - Connect frame to right drive module

2. Affix the probe holders *(with attached wedges)* to the probe holder frame. Place the secondary probe holders at the front of the frame *(Fig. 224-1)* while placing the primary probe holders at the rear of the frame system *(Fig. 224-2).*

> ***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 48 for additional details).*

5.16.2. Pivoting Probe Holder Frame Setup

5.16.2.1 Longitudinal Scanning

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

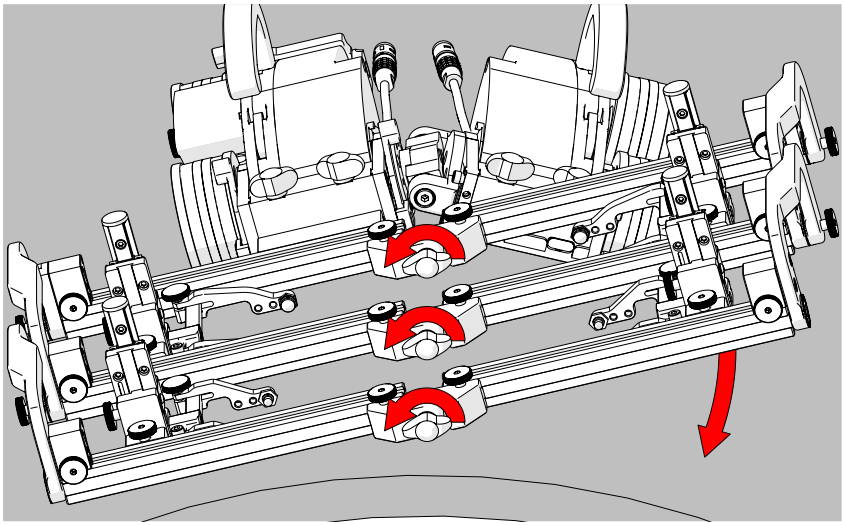


Fig. 225 - Loosen pivot wing knobs

> ***NOTE:*** *The swivel mount must be in a horizontal position during longitudinal scanning (see "Swivel Mount" on page 44).*

1. Loosen the pivot wing knobs at the centre of the frame system *(Fig. 225).* Lower the left side of the frame system to align with the tangent of the scan surface. Tighten the pivot wing knobs.

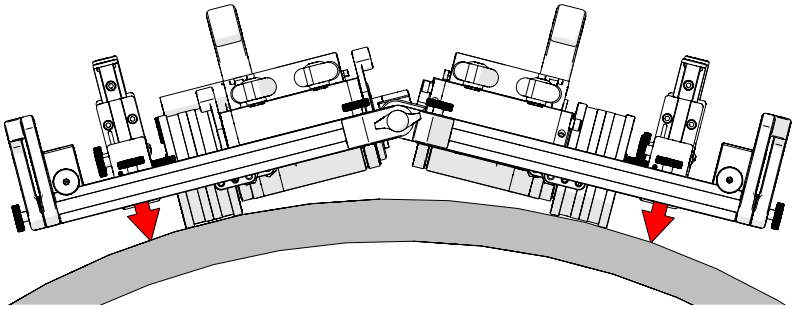


Fig. 226 - Tighten pivot wing knobs

2. Lower the vertical probe holders *(see "Probe Holder Vertical Adjustment" on page 75).*

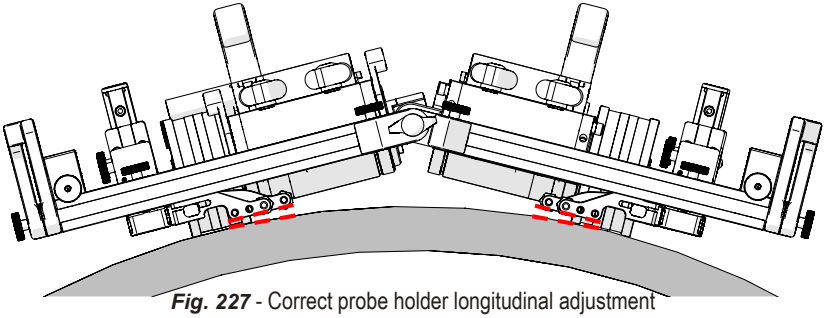


Fig. 227 - Correct probe holder longitudinal adjustment

3. Ensure probe holder arms are parallel to the scan surface *(see "Probe Holder Longitudinal Adjustment" on page 77).*

5.16.2.2 Circumferential Scanning

(see Probe Holder Frame Setup on page 89 for additional details)

5.16.2.3 Flange Scanning

> ***NOTE:*** *The optical guide pivot mount can not be utilized within the following configuration (see Battery Powered Optical Guide on page 67 for additional details).*

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

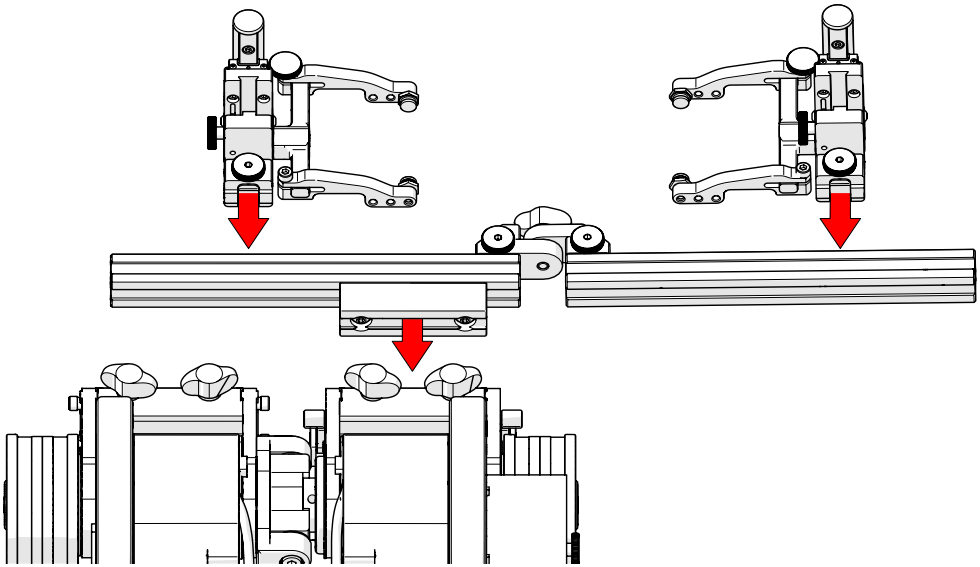


Fig. 228 - Configure assembly and mount to NAVIC

1. Disassemble the pivoting probe holder frame to achieve the setup shown *(Fig. 228)*. 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.*

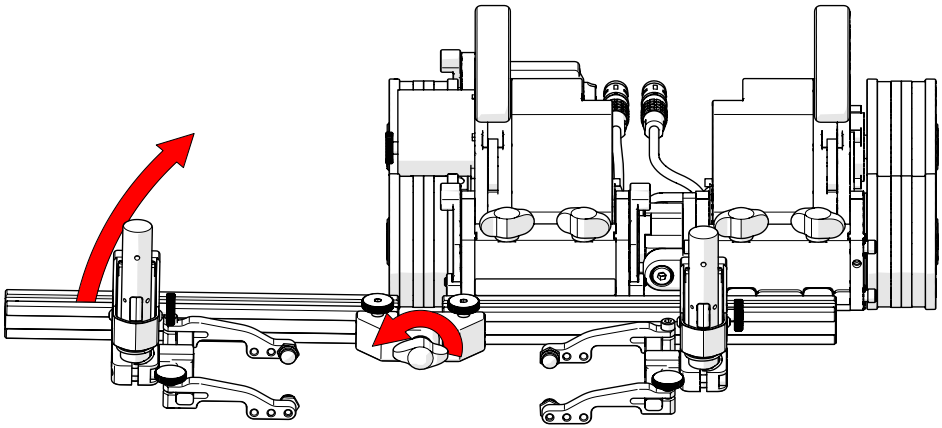


Fig. 229 - Lift frame bar to avoid interference

2. Loosen the pivot wing knob and raise the frame bar to an angle greater than the surface to be scanned *(Fig. 229)*. Tighten the pivot wing knob and place crawler on scan surface *(see "Placement of Crawler on Inspection Surface" on page 24)*

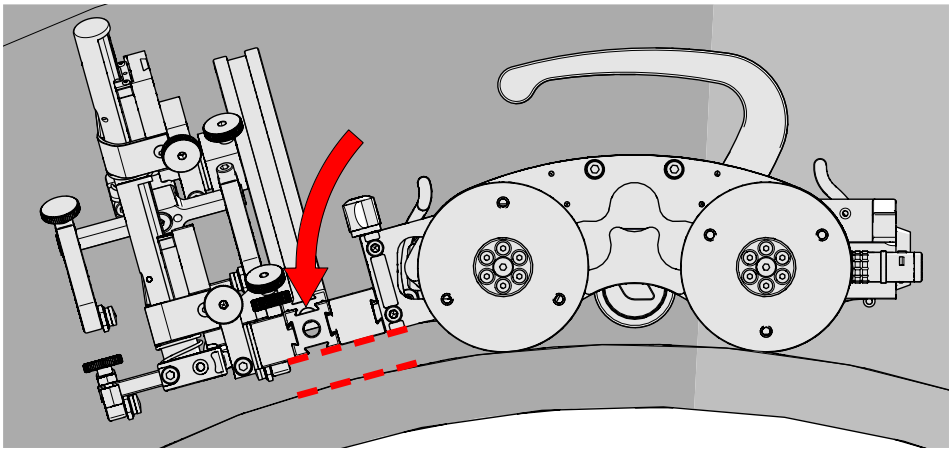


Fig. 230 - Align swivel mount with scan surface

3. Release the front swivel mount adjustment levers to align the swivel mount parallel to the scan surface *(Fig. 230)*.

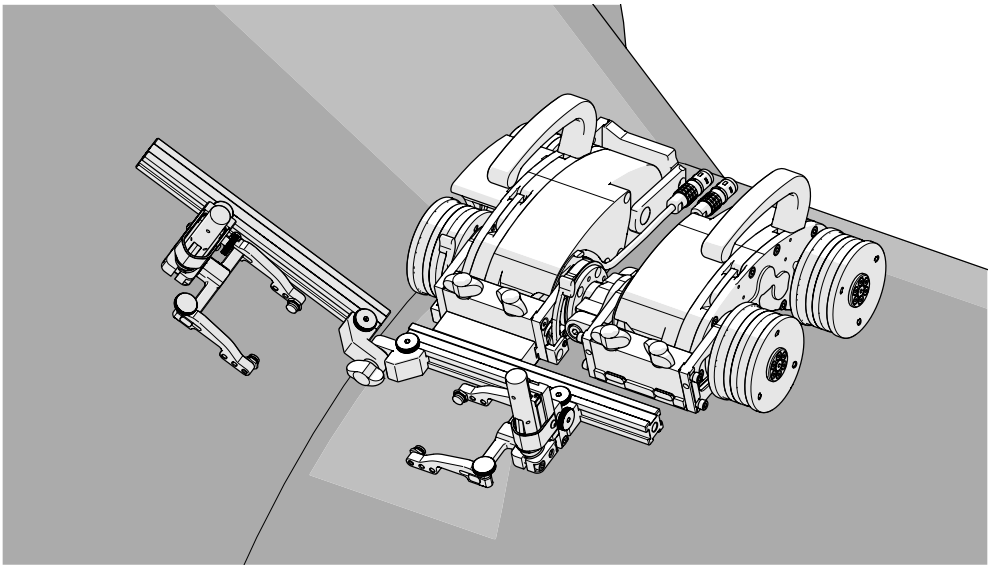


Fig. 231 - Align frame bar with flange scan surface

4. Loosen the pivot wing knob and align the frame bar parallel with the scan surface *(Fig. 231)*.

5.16.3. Optical Guide Pivot Mount

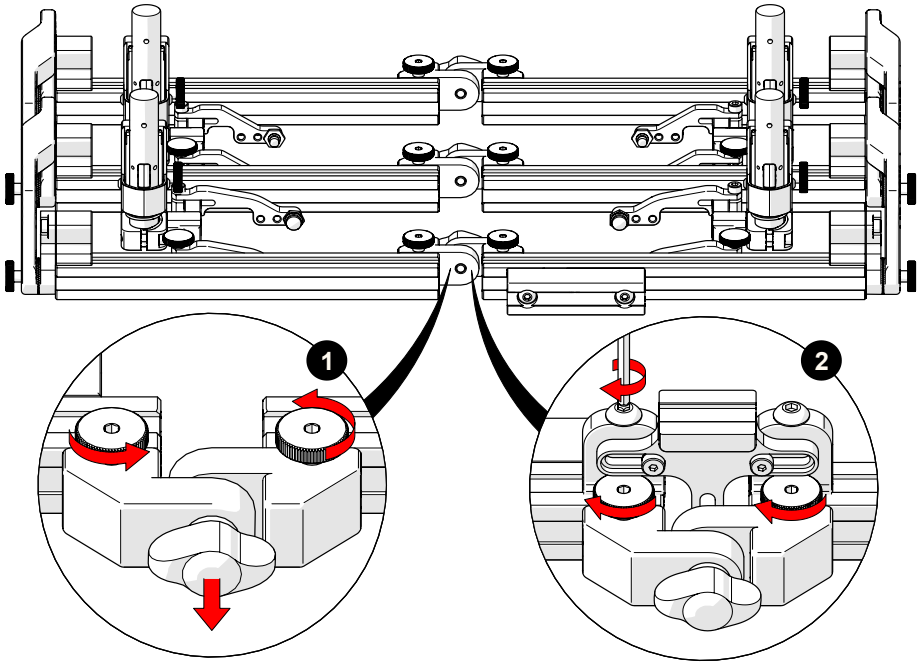


Fig. 232 - Correct probe holder longitudinal adjustment

An optional mounting point for the optical guide *(see "Battery Powered Optical Guide" on page 67)* is available. To install the pivot mount, see these following instructions:

1. Remove the dovetail bar pivot from one of the sets of frame bars *(Fig. 232-1)*. The choice of which dovetail bar pivot to remove is at the user's discretion.
2. Attach the optical guide pivot mount to the frame bars *(Fig. 232-2)*, 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. Mount the optical guide *(see Battery Powered Optical Guide on page 67 for additional details).*

5.17. Cable Management

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

5.17.1. Mounting a Zipper Tube

To attach a zipper tube for cable management, follow these steps:

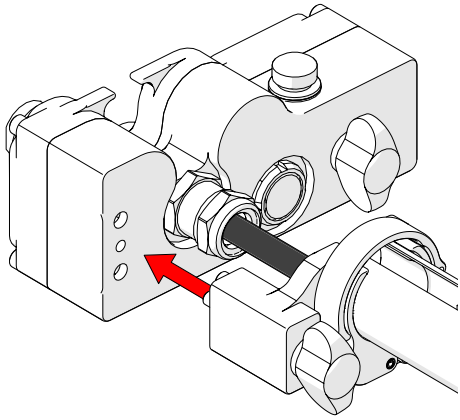


Fig. 233 - Align with umbilical

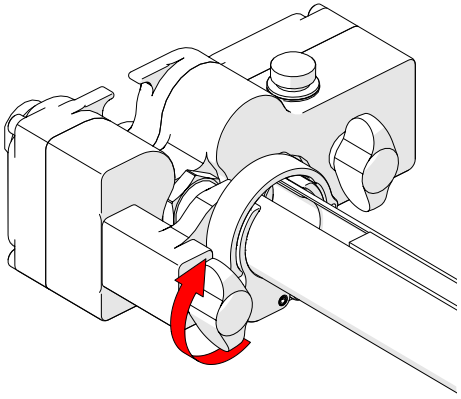


Fig. 234 - Tighten wing knob

1. Align the zipper tube clamp with the appropriate mounting position on the user umbilical breakout *(Fig. 233)*.
2. Tighten the zipper tube clamp wing knob *(Fig. 234)*.

5.17.2. Zipper Tube Setup

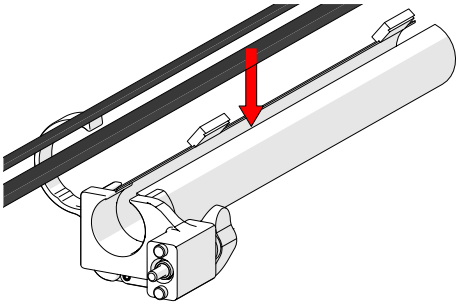


Fig. 235 - Insert cables and hoses

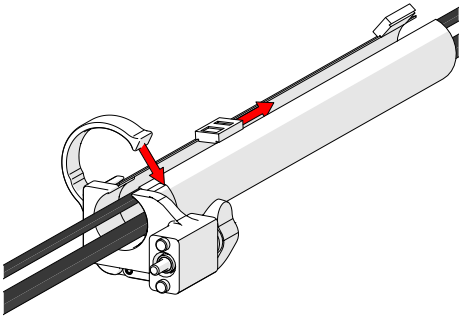


Fig. 236 - Zip to close

1. Open the zipper tube. Begin at the clamp end and start placing the cabling in the tube *(Fig. 235)*.
2. Follow the cable placement zipping the tube closed *(Fig. 236)*.

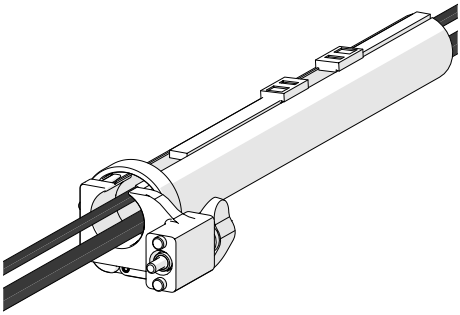


Fig. 237 - Zip opposite end

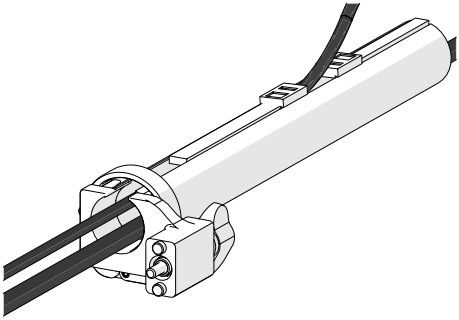


Fig. 238 - Flexible routing

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.

5.17.3. Clamp Setup

In the event the tube becomes disconnected from the zipper tube 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 zipper tube mount *(Fig. 239)*. Align the zipper opening and the zipper tube clamp opening.

Slide the clamp over the tube and zipper tube mount pinching the tube in between *(Fig. 240)*.

Tighten the clamp screw *(Fig. 241)*.

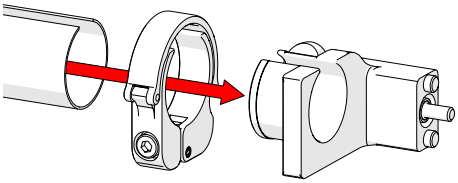


Fig. 239 - Slide tube around mount

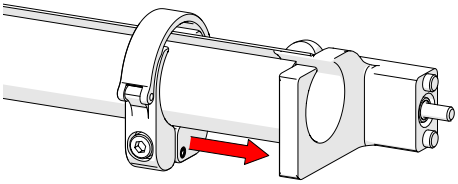


Fig. 240 - Slide clamp onto mount

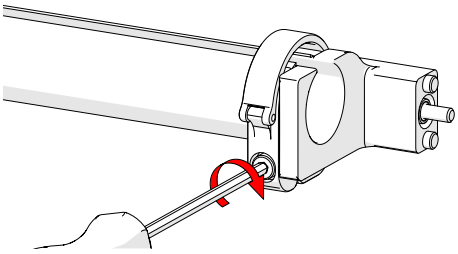


Fig. 241 - Tighten clamp screw

5.18. Backpack

The **NAVIC** backpack allows the crawler to carry various accessories. To install the backpack, see the following steps:

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

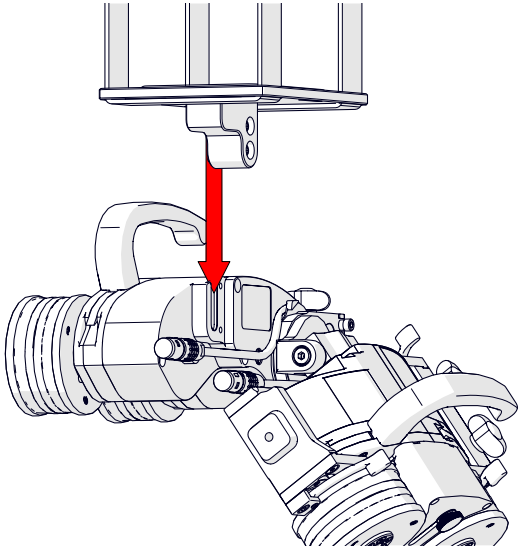


Fig. 242 - Pivot and insert dovetail nut

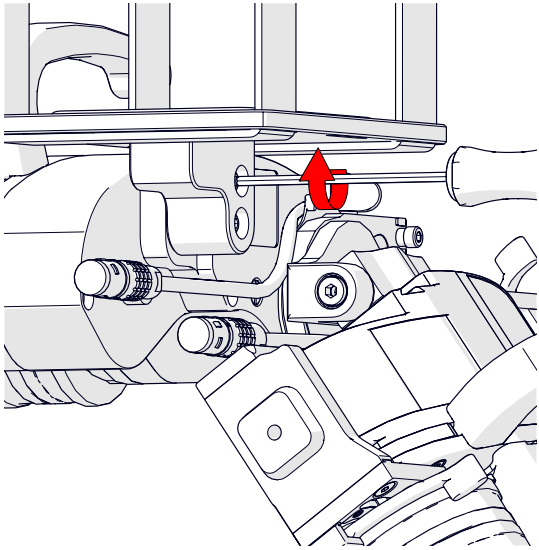


Fig. 243 - Tighten screws

1. Allow the Navic crawler to pivot exposing the inside of the left drive module *(Fig. 242)*.
2. Slide the dovetail nuts of the backpack into the accessory dovetail groove *(Fig. 242)*.
3. Tighten the two backpack screws using the supplied 3 mm hex driver*(Fig. 243)*.
4. Pull the velcro straps tight around the item on the backpack *(Fig. 244)*.

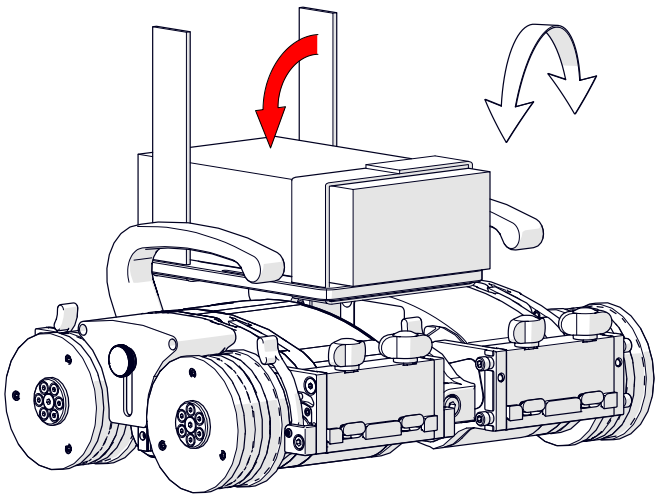


Fig. 244 - Use velcro straps

5.19. Preamp Bracket

The preamp bracket mounts to any dovetail groove to hold a preamp. Compatible with most standard preamps, use the adjustable screw mounting channel on the bottom of the bracket to attach a preamp. The preamp bracket may also be ordered with velcro straps which are used to hold the preamp.

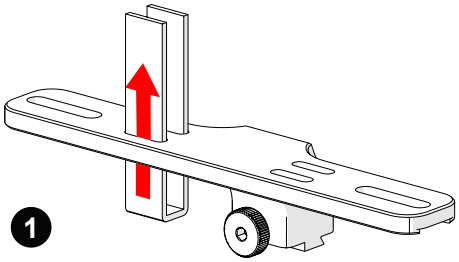


Fig. 245 - Insert velcro straps

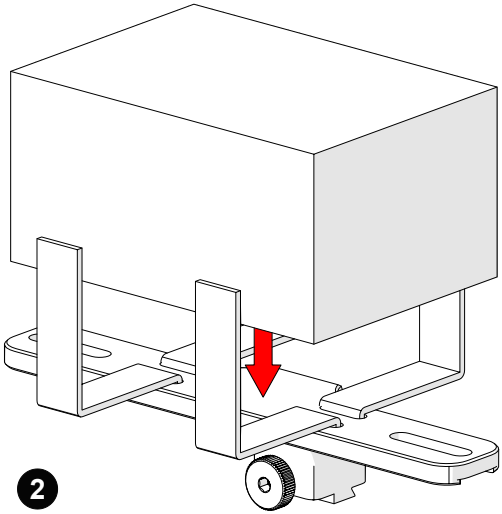


Fig. 246 - Place preamp and wrap velcro

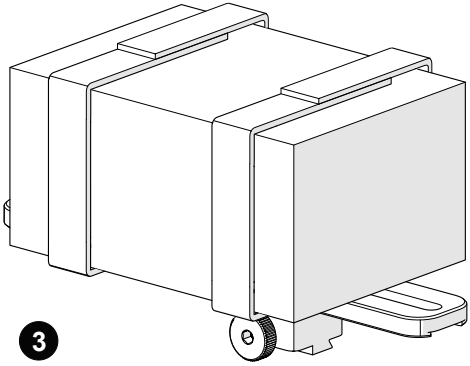


Fig. 247 - Mount bracket on a frame bar

6.1. Safety Precautions Before Maintenance

WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the power supply when servicing the equipment. The power supply 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 25 cm *(10 ft)* away at all times.

WARNING! MAGNETIC MATERIAL. The installation/removal mat *(Fig. 28 on page 14)* contains magnetic material. People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

The magnetic base of the raster arm cable tray contains magnetic material. People with pacemakers or ICD's must stay at least 10 cm *(4 in)* away.

6.2. Maintenance Schedule

General cleaning of all components is important to keep the system working properly. All components that do not have 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 that all connectors are free of water and moisture.

TIP: *All components with wiring, cables or electrical connections are splash proof but not submersible.*

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

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

MAINTENANCE ITEM	FREQUENCY
Inspect safety apparatus This includes: ● All components of tether system. Replace damaged components as necessary. ● Lifting sling on crawler. If the lifting sling shows signs of damage *(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.	
Inspect cables and connectors Inspect the umbilical cable, the control cable and the power supply 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.	

7.1. Startup Issues

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

7.1.1. Joystick Off Center

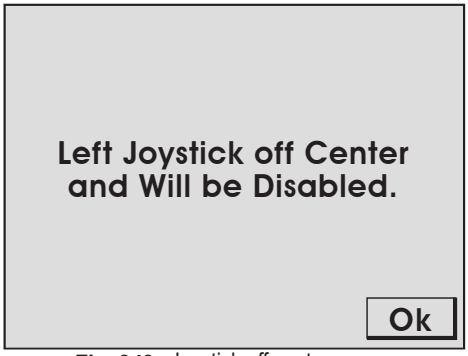


Fig. 248 - Joystick off centre screen

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 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 41)*

7.1.2. Checking Network

Fig. 249 - 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.*

7.2. Startup Override

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

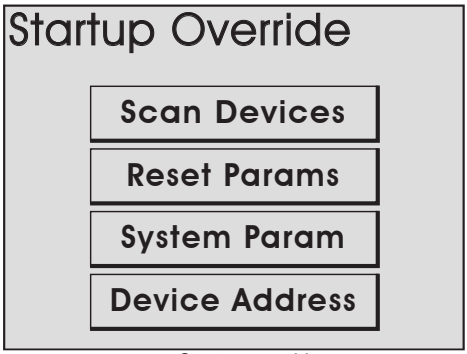


Fig. 250 - Startup override screen

7.2.1. 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.

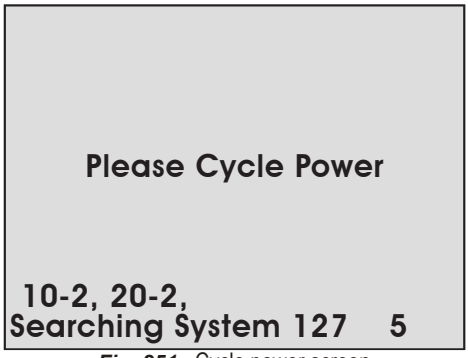


Fig. 251 - Cycle power screen

Common addresses	
Right Module	10
Left Module	20
Raster Module	30

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.*

7.2.2. 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.

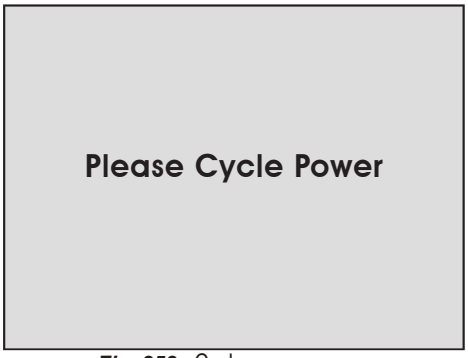


Fig. 252 - Cycle power screen

7.2.3. 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.

7.3. Additional Issues

PROBLEM	POSSIBLE CAUSE	SOLUTION
Controller display does not activate	Input power requirements not met.	Ensure input power meets requirements. *(see "Power Requirements" on page 6)*
	Controller not plugged into umbilical	Plug 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 22)*
	Damaged components in controller, crawler, power supply or cabling.	Contact manufacturer. *(see "Jireh Industries Ltd." on page 131)*
Controller display is activated, yet crawler does not drive	Controller is not in correct mode for driving.	*(see Operation on page 26 for additional details)*.
	Damaged components in controller, crawler, power supply or cabling.	Contact manufacturer. *(see "Jireh Industries Ltd." on page 131)*
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 110)*
Crawler does not steer properly	A drive module is dead	Contact manufacturer. *(see "Jireh Industries Ltd." on page 131)*
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 2)*.

For technical assistance *(see "Technical Support" on page 111)*

7.4. Retrieval of a Stranded Crawler

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

Should the **NAVIC** crawler become inoperative while out of reach, attempt first, the solutions offered in this manual *(see "Troubleshooting" on page 105)*

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 turning 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 assist the crawler in overcoming the obstacle.

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

SERVICE AND REPAIR

WARNING! ELECTRICAL SHOCK HAZARD. Disconnect the power supply when servicing the equipment. The power supply 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 25 cm *(10 ft)* away at all times.

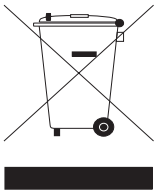
8.1. Technical Support

For technical support contact Jireh Industries *(see "Jireh Industries Ltd." on page 131)*

8.2. 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.

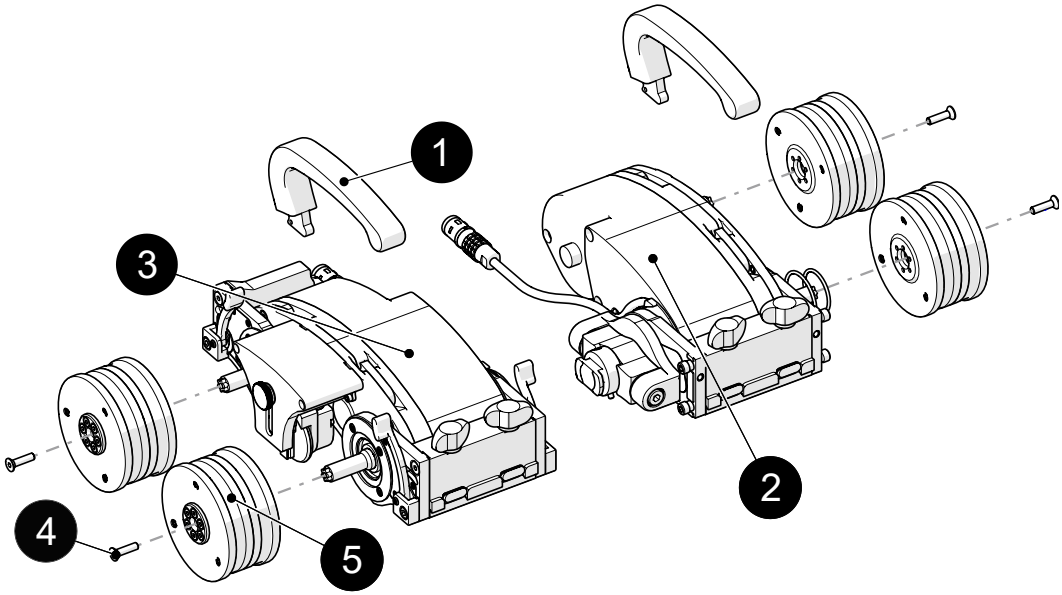


SPARE PARTS

To order accessories or replacement parts for your **NAVIC** system.
(contact Jireh Industries Ltd. on page 131)

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

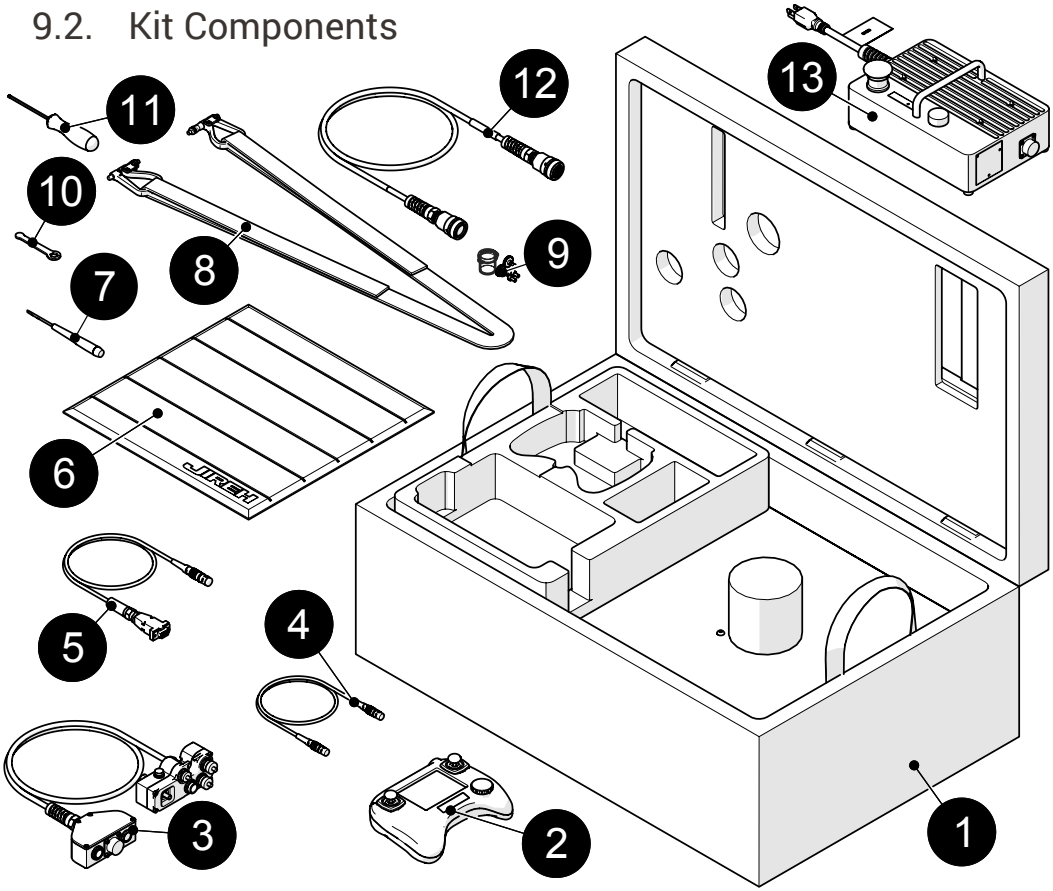
9.1. Crawler



BOM ID	Part #	Description
1	CX0061	Handle
2	CXS049-R	Right Drive Module
3	CXS049-L	Left Drive Module
4	MD029-016	Screw, M4 X 16 mm
5	CXS048	Magnetic Wheel

Fig. 253 *- Crawler parts*

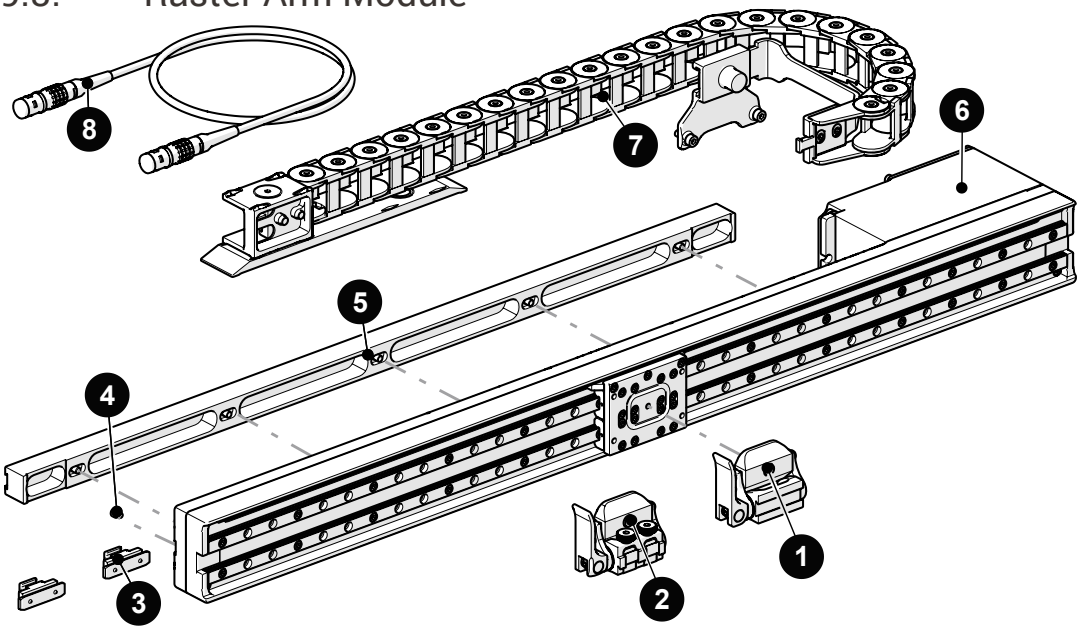
9.2. Kit Components



BOM ID	Part #	Description
1	CXA011	Navic Case
2	DMA001	Handheld Controller
3	UMA015-05	Umbilical *(10 m, 15 m, 30 m available)*
4	UMA017-06	Controller Cable
5	UMA016-X-05	Encoder Cable *(see Encoder Connector Type)*
6	AAS061	Installation/Removal Mat
7	EA480	3 mm Flat Driver
8	CXA009	Sling
9	PHG014	Probe Holder Spare Parts Kit, 2 Probe
10	EA470	3/8 in Wrench
11	EA414	3 mm Hex Driver
12	UMA018-03	Power Cable
13	CXA004	Power Supply

***Fig. 254** - Kit components*

9.3. Raster Arm Module



BOM ID	Part #	Description
1	CWS007	Raster Arm Pivot Nose *(female)*
2	CWS019	Raster Arm Pivot Nose *(male)*
3	CWS011	Cable Management Clip
4	MD049-004	SHCS, M3x0.5 x 4 mm, SST
5	*See Mounting Rail*	
6	*See Base Raster Arm*	
7	*See Cable Tray*	
8	UMA020-0.84	Raster Arm Cable

***Fig. 255** - Raster arm parts*

9.3.1. Mounting Rail

Part #	Length
CWS008-1160	1160 mm *(45 in)*
CWS008-0900	900 mm *(35 in)*
CWS008-0600	600 mm *(24 in)*
CWS008-0300	300 mm *(12 in)*

***Fig. 256** - Raster arm mounting rails*

9.3.2. Base Raster Arm

Part #	Length	
CWA006-1160	1160 mm *(45 in)*	
CWA006-0900	900 mm *(35 in)*	
CWA006-0600	600 mm *(24 in)*	
CWA006-0300	300 mm *(12 in)*	

Fig. 257 *- Raster arm cable trays*

9.3.3. Cable Tray

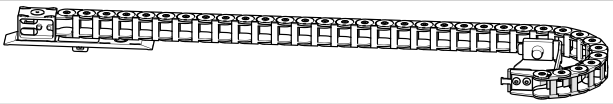
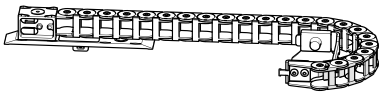
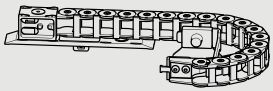
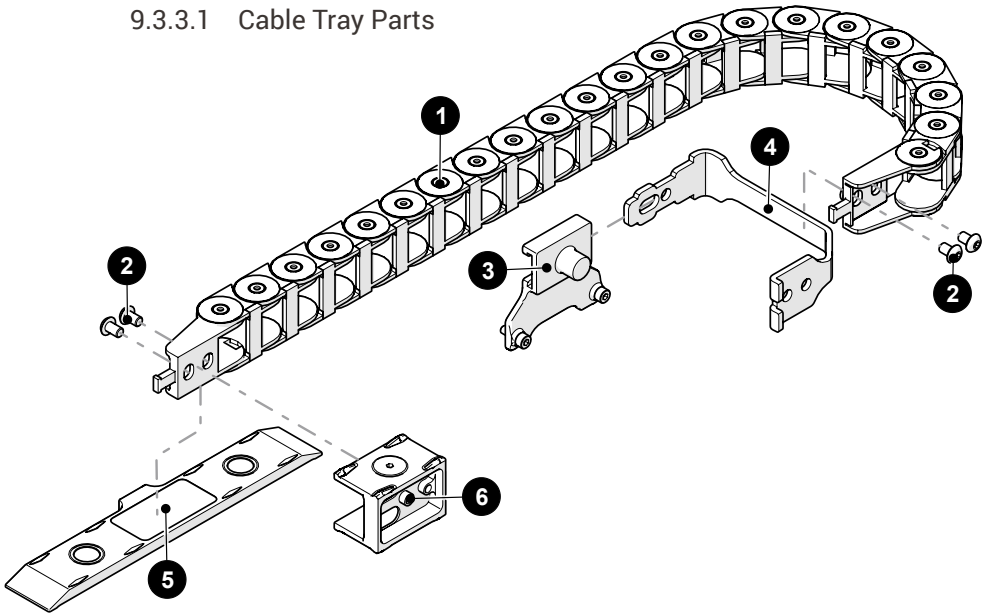
Part #	Length	
CWS018-1160	1160 mm *(45 in)*	
CWS018-0900	900 mm *(35 in)*	
CWS018-0600	600 mm *(24 in)*	
CWS018-0300	300 mm *(12 in)*	

Fig. 258 *- Raster arm cable trays*

9.3.3.1 Cable Tray Parts



BOM ID	Part #	Description
1	*See Cable Carrier*	
2	MD074-008	BHCS, M5x0.8 x 8 mm, SST
3	CWS014	Carriage Bracket
4	CWS015	Cable Tray Bracket
5	CWS016	Magnetic Base
6	CWS017	Magnetic End

Fig. 259 *- Cable tray parts*

9.3.3.2 Cable carrier

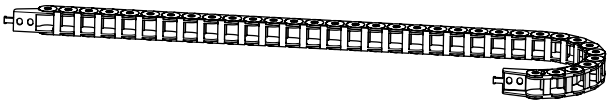
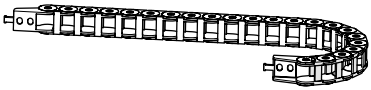
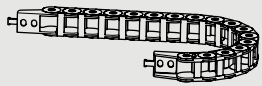
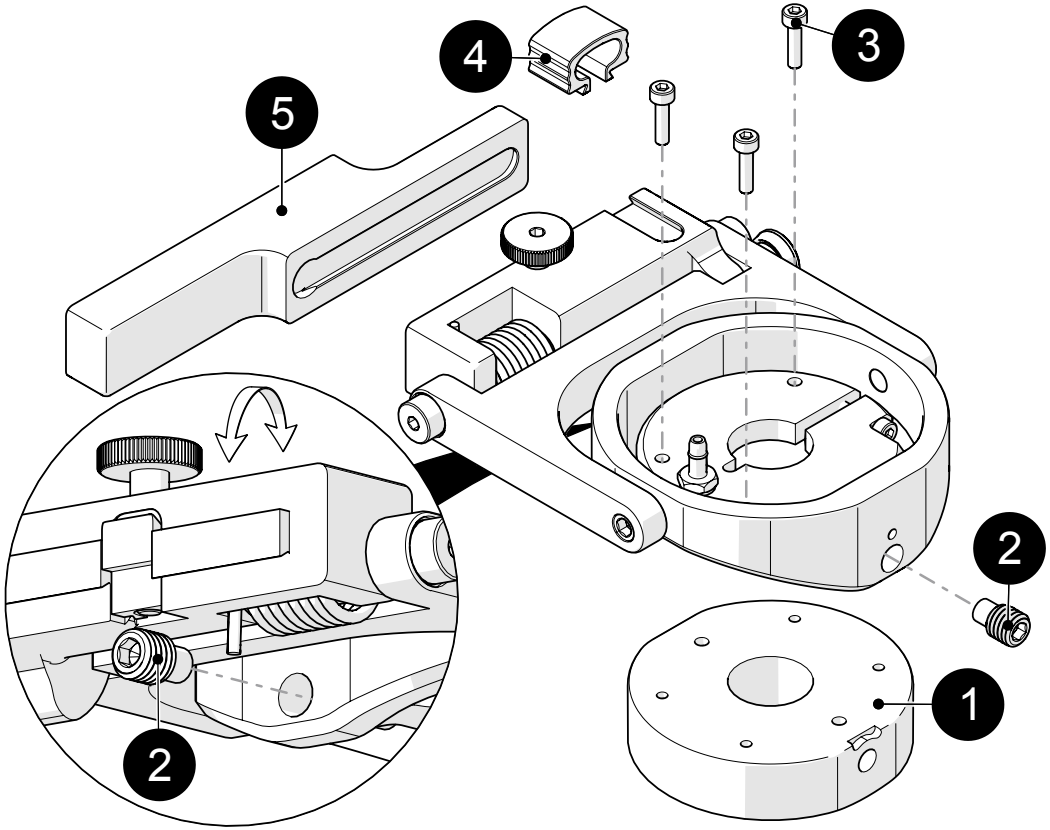
Part #	Length	
GA048	1160 mm *(45 in)*	
GA046	900 mm *(35 in)*	
GA041	600 mm *(24 in)*	
GA043	300 mm *(12 in)*	

Fig. 260 *- Cable carrier lengths*

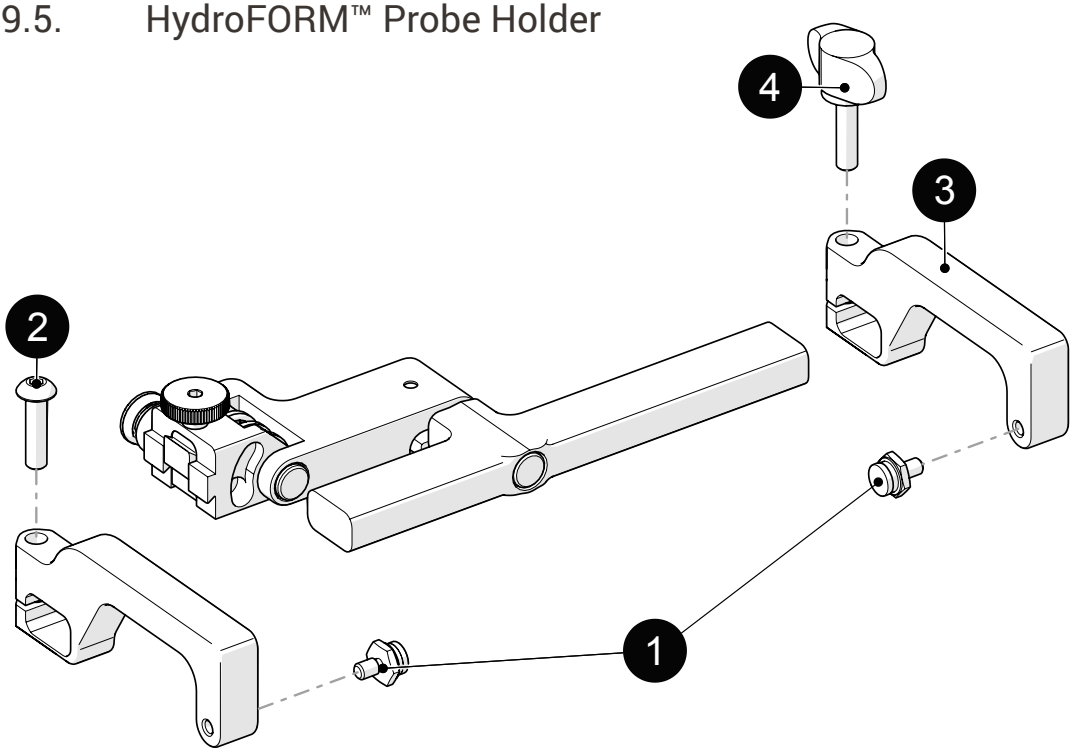
9.4. Corrosion Thickness Probe Holder



BOM ID	Part #	Description
1	PH0178	Corrosion Thickness Probe Holder Slider
2	MA264	Screw, M8x12 mm Dog Point *(∅5.5x4.3 mm)* Set, SST
3	MD049-012	SHCS, M3x0.5 X 12 mm, SST
4	BG0091	Cable Clip
5	PH0181	Mounting Bracket

Fig. 261 *- Corrosion thickness probe holder parts*

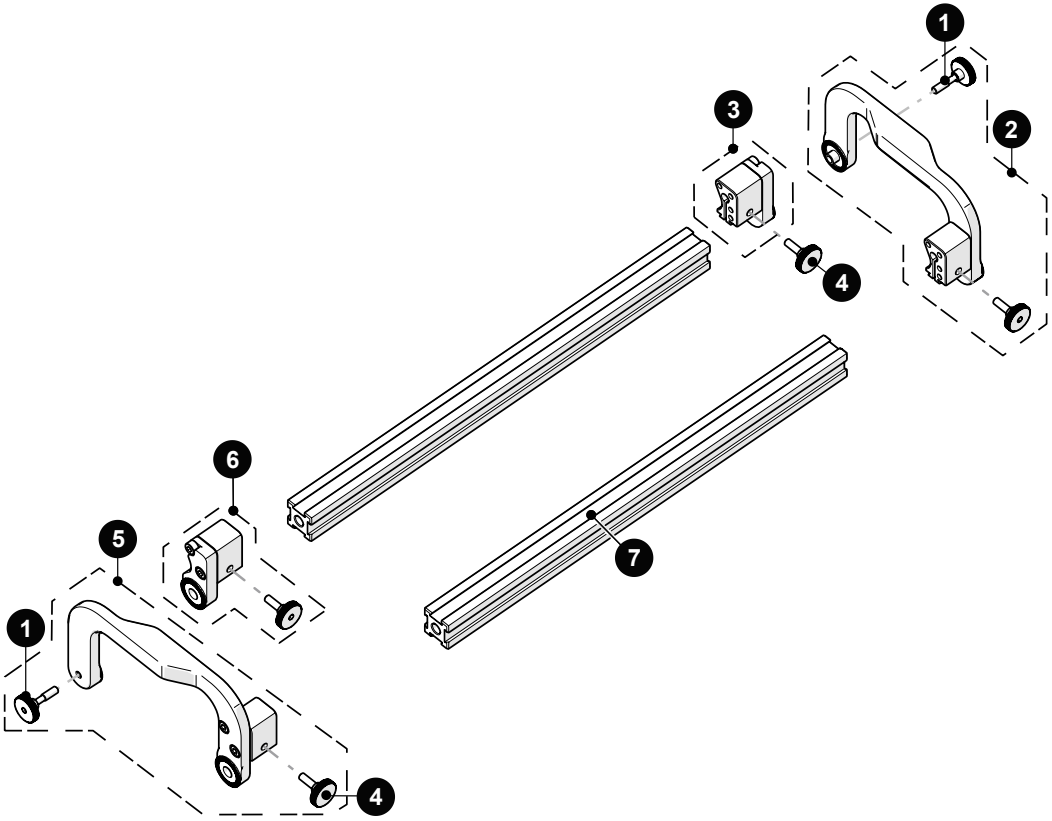
9.5. HydroFORM™ Probe Holder



BOM ID	Part #	Description
1	PH0011-X	Pivot Button Style *(see Pivot Button Style)*
2	MD074-020	Arm Clamp Screw, BHCS, M5x0.8 x 20 mm, SST
3	PH0157	HydroFORM™ Probe Holder Arm
4	EA154	Probe Holder Arm Adjustment Knob

***Fig. 262** - HydroFORM™ probe holder parts*

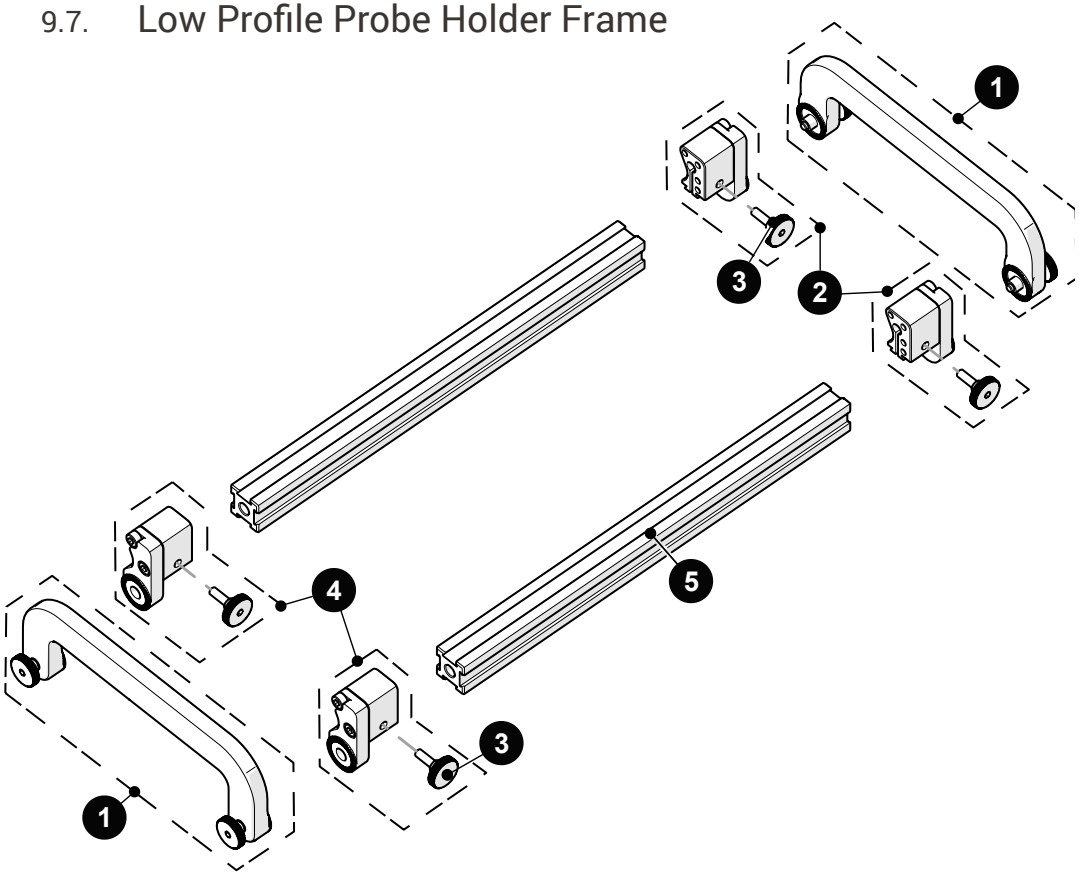
9.6. Probe Holder Frame



BOM ID	Part #	Description
1	CX0125	Knob, M4 x 16 mm
2	CXS043	Vertical Probe Holder Side Arm, Left
3	CXS072-L	Arm Mount Block, Left
4	CX0126	Knob, M4 x 0.7 x 11.5 mm
5	CXS072-R	Arm Mount Block, Right
6	CXS042	Vertical Probe Holder Side Arm, Right
7	BG0038-X	Frame Bar *(see Frame Bar)*

***Fig. 263** - Probe holder frame parts*

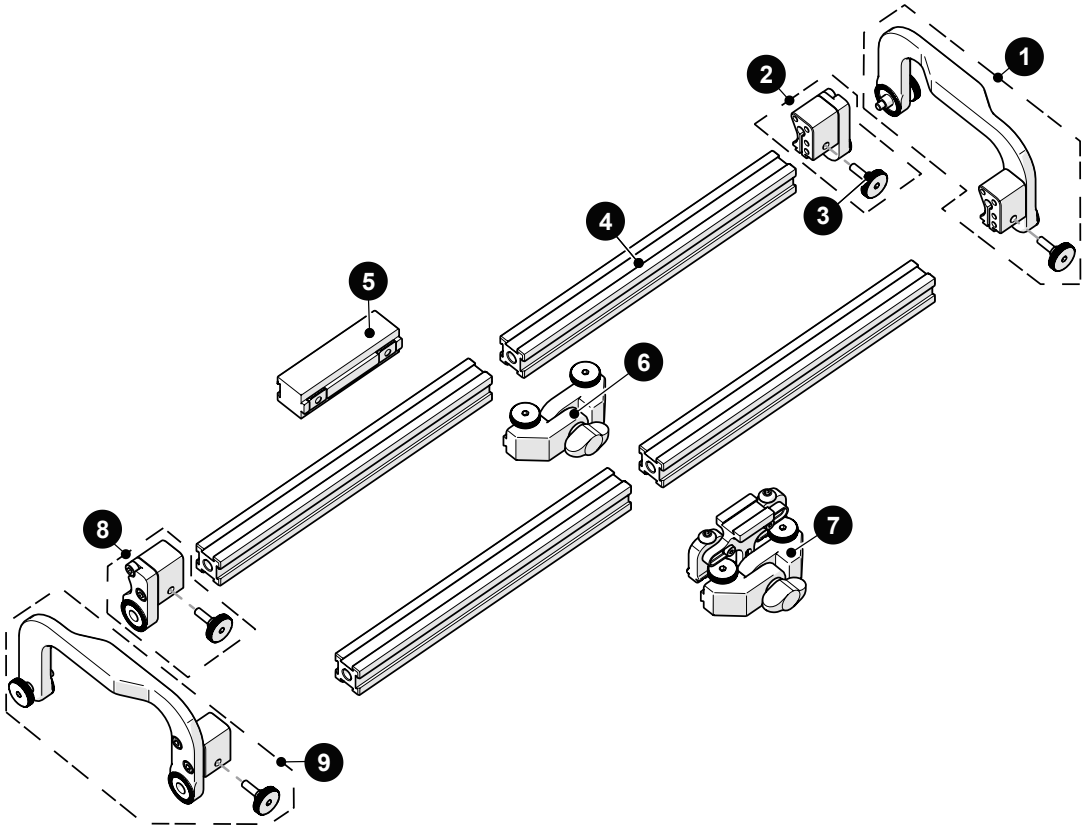
9.7. Low Profile Probe Holder Frame



BOM ID	Part #	Description
1	CXS023	Low Profile Side Arm
2	CXS072-L	Arm Mount Block, Left
3	CX0126	Knob, M4 x 0.7 x 11.5 mm
4	CXS072-R	Arm Mount Block, Right
5	BG0038-X	Frame Bar *(see Frame Bar)*

***Fig. 264** - Low profile probe holder frame parts*

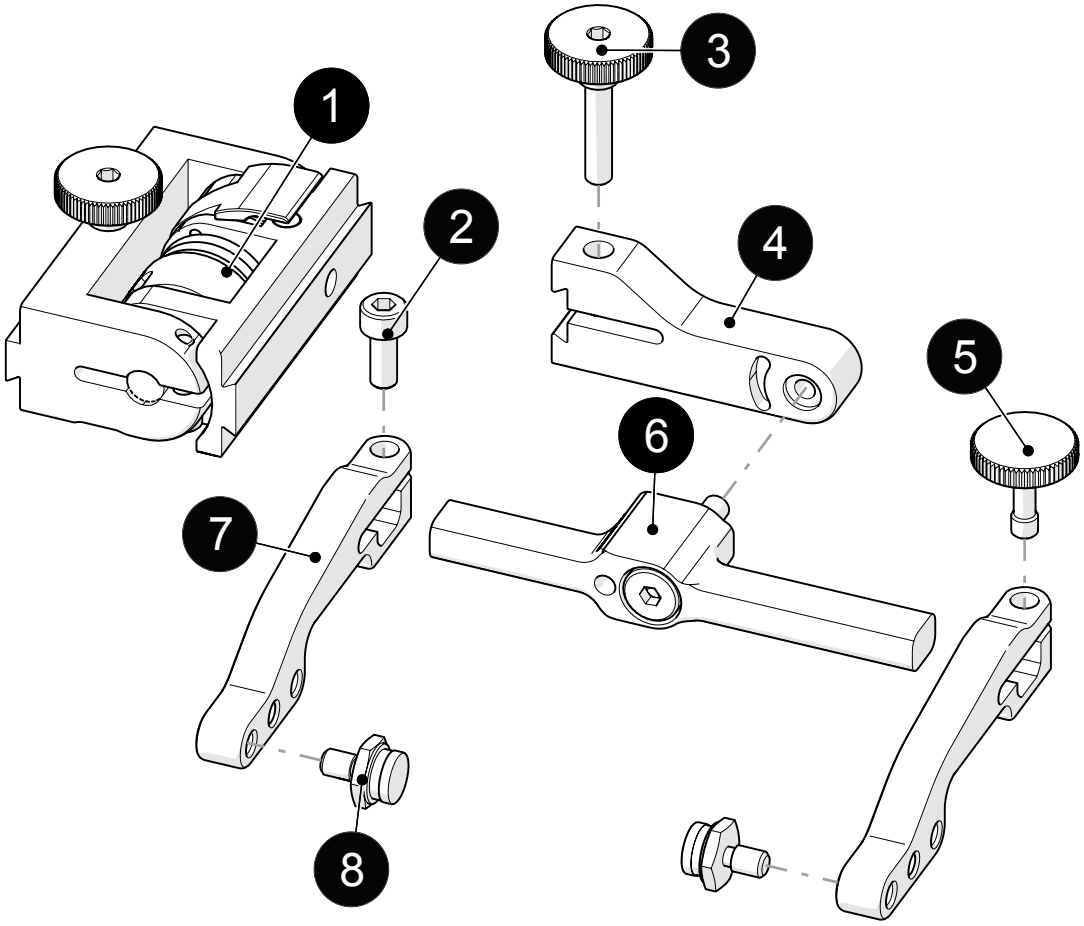
9.8. Pivoting Probe Holder Frame



BOM ID	Part #	Description
1	CXS043	Vertical Probe Holder Side Arm, Left
2	CXS072-L	Arm Mount Block, Left
3	CX0126	Knob
4	BG0038-X	Frame Bar *(see Frame Bar)*
5	CXS064	NAVIC Front Spacer Mount
6	CXS055	Frame Bar Pivot
7	CXS059	Optical Guide Pivot Mount
8	CXS072-R	Arm Mount Block, Right
9	CXS042	Vertical Probe Holder Side Arm, Right

***Fig. 265** - Pivoting probe holder parts*

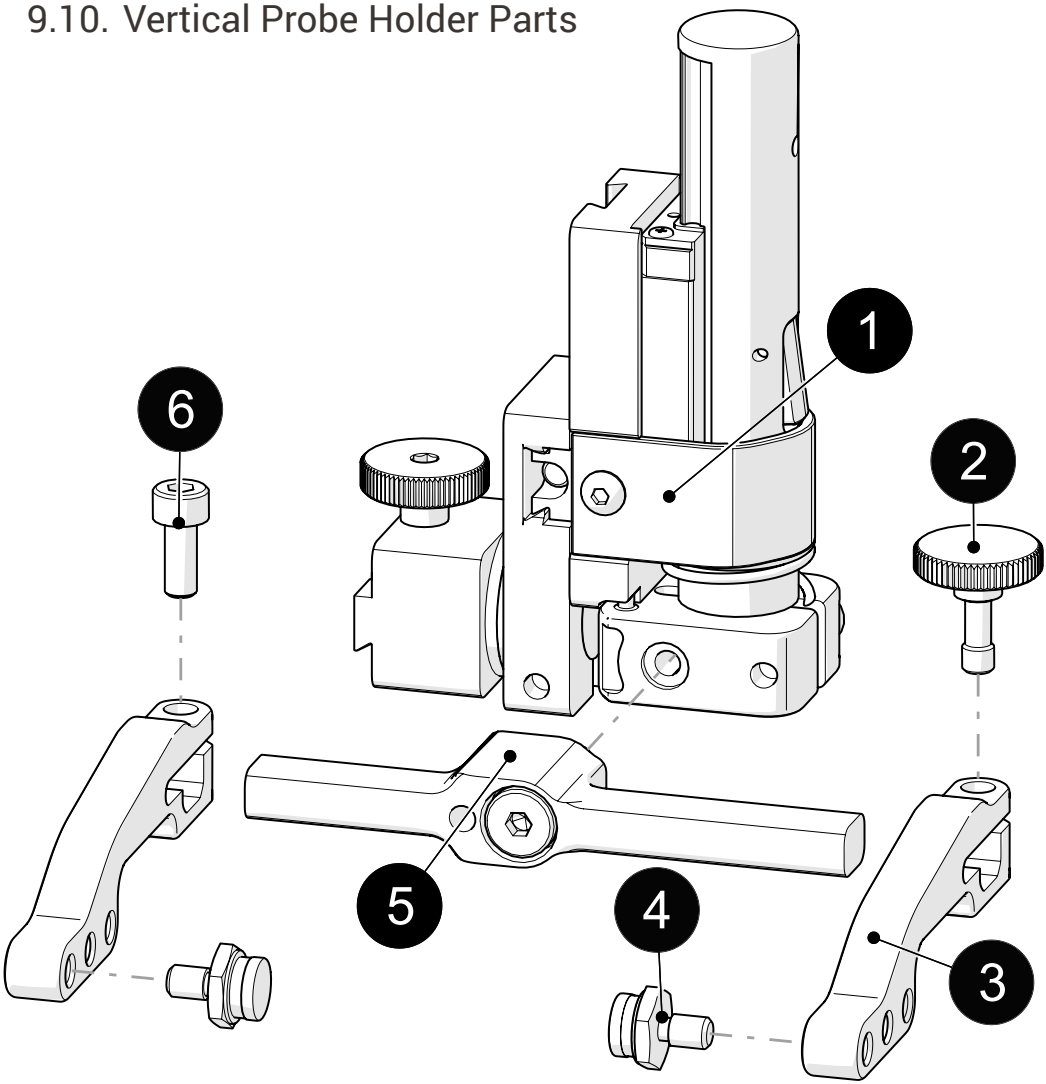
9.9. Slip Joint Probe Holder Parts



BOM ID	Part #	Description
1	PHS022	Slip Joint Probe Holder Subassembly
2	MD050-010	Arm Clamp Screw, SHCS, M4x0.7 X 10 mm, SST
3	PH0104	Swing Arm Knob
4	PH0100	Swing Arm
5	PH0082	Probe Holder Arm Adjustment Knob
6	*See Yoke Style*	
7	*See Arm Style*	
8	PH0011-X	Pivot Button Style *(See Pivot Button Style)*

***Fig. 266** - Slip joint probe holder parts*

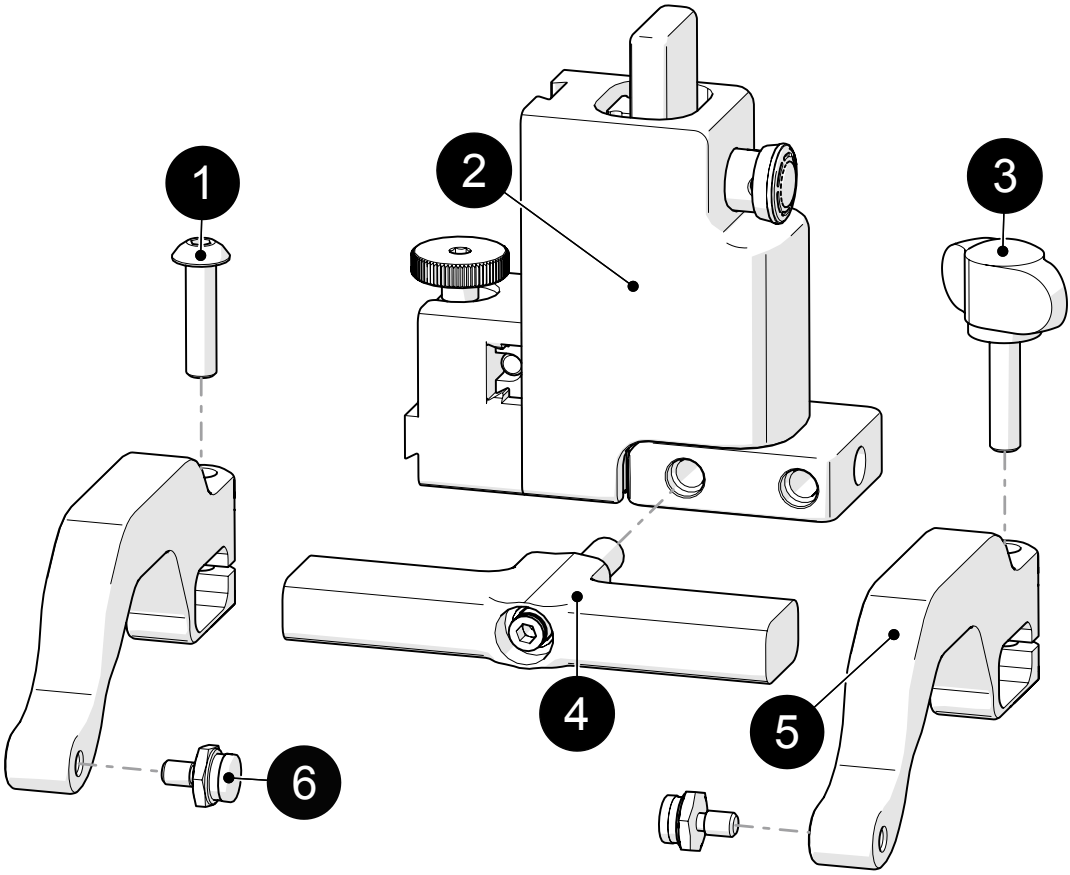
9.10. Vertical Probe Holder Parts



BOM ID	Part #	Description
1	PHS028	Vertical Probe Holder Subassembly
2	PH0082	Probe Holder Arm Adjustment Knob
3	*See Arm Style*	
4	PH0011-X	Pivot Button Style *(See Pivot Button Style)*
5	*See Yoke Style*	
6	MD050-010	Arm Clamp Screw, SHCS, M4x0.7 X 10 mm, SST

Fig. 267 *- Vertical probe holder parts*

9.11. Heavy Duty Vertical Probe Holder



BOM ID	Part #	Description
1	MD074-020	Arm Clamp Screw, BHCS, Metric SST
2	PHS049	Heavy Duty Probe Holder Subassembly
3	EA154	Probe Holder Arm Adjustment Knob
4	*See Heavy Duty Yoke Style*	
5	PH0165	Probe Holder Arm
6	PH0011-X	Pivot Button Style *(See Pivot Button Style)*

***Fig. 268** - Heavy duty vertical probe holder parts*

9.12. Probe Holder Components

9.12.1. 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. 269** - Probe holder arm selection*

9.12.2. 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. 270** - Probe holder yoke selection*

9.12.3. 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. 271** - Heavy duty yoke selection*

9.12.4. Pivot Button Style

	Pivot Hole Size	Wedge Type			Pivot Hole Size	Wedge Type	
01	8.0 mm *(0.32 in)*	Olympus PA		**02**	5.0 mm *(0.20 in)*	Olympus TOFD	
03	2.7 mm *(0.11 in)*	Sonatest DAAH PA		**04**	9.5 mm *(0.38 in)*	-	
06	3.0 mm *(0.12 in)*	-		**07**	2.3 mm *(0.09 in)*	-	
08	Conical Head	-		**09**	5 mm *(0.20 in)* Internal	Zetec PA/TOFD	

***Fig. 272** - Pivot button selection*

> ***NOTE:** Additional probe holder pivot button types available. (contact Jireh Industries Ltd. on page 131)*

9.13. Variable Components

9.13.1. 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)*

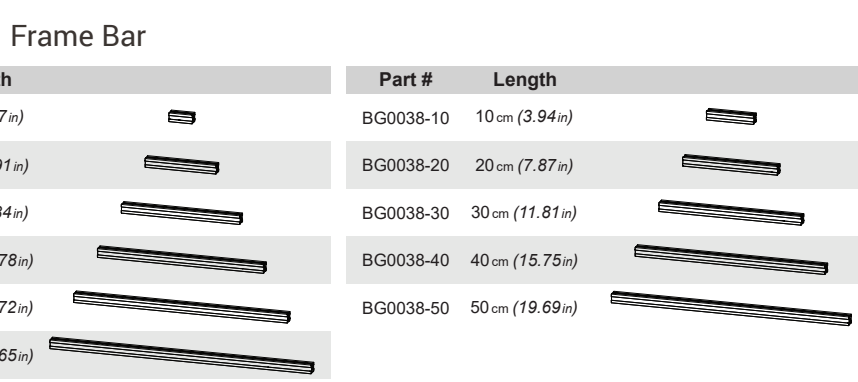
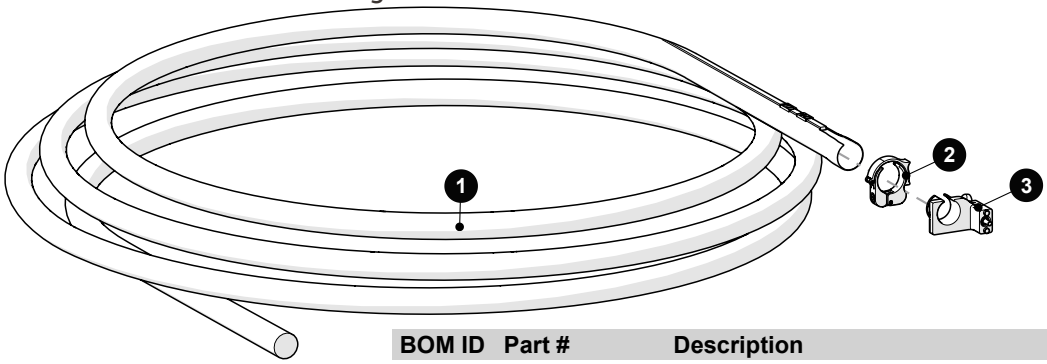


***Fig. 273** - Frame bar selection*

9.13.2. Cable Management



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

***Fig. 274** - Cable management parts*

9.13.2.1 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)*

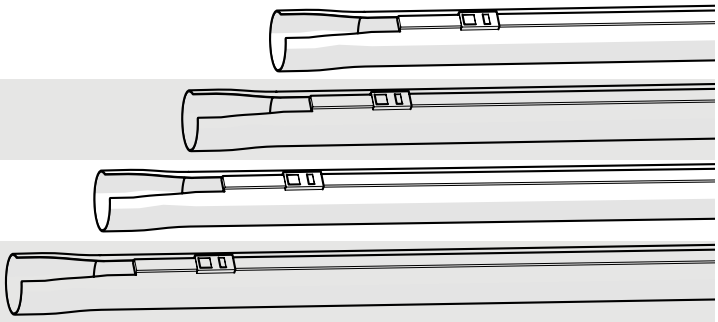


***Fig. 275** - Cable management sleeving*

9.14. Encoder Connector Type

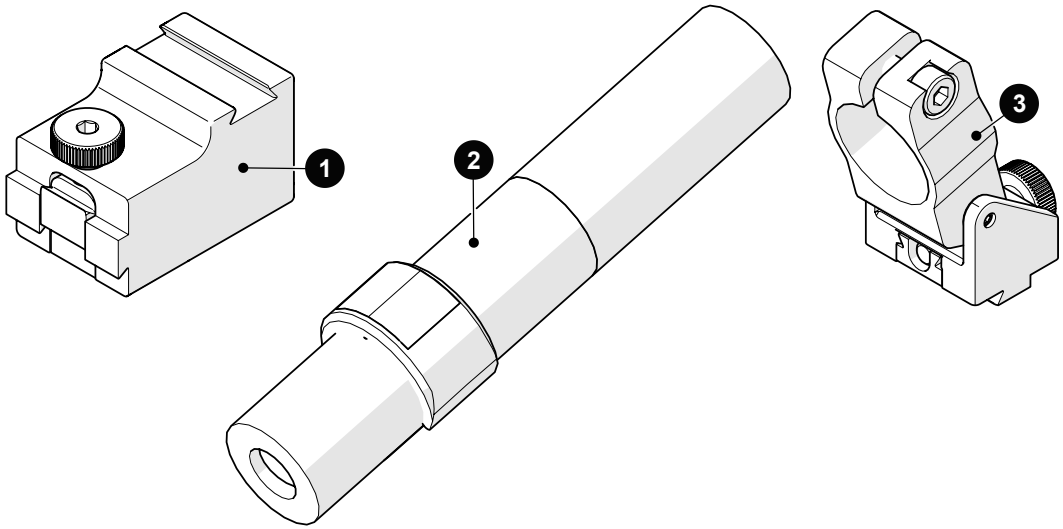
Connector Type	Company/Instrument	Connector Type	Company/Instrument
B	Olympus - OmniScan MX / Zetec - ZIRCON, TOPAZ	**G**	Sonotron - Isonic
C	Olympus - Focus LT / Zetec Z-Scan / Eddyfi Ectane 2	**M**	GE - USM Vision
D	Olympus - OmniScan MX2, OmniScan SX	**U**	Sonatest - VEO, PRISMA
F	TD - Focus Scan, Handy Scan, Pocket Scan	**V**	Pragma PAUT 16/128, PragmaLite / Pragma UT400

***Fig. 276** - Encoder connector type*

> ***NOTE:** Additional encoder connector types available.*
> *(contact Jireh Industries Ltd. on page 131)*

9.15. Accessories

9.15.1. 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. 277** - Battery powered optical guide parts*

9.15.2. Preamp Bracket

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

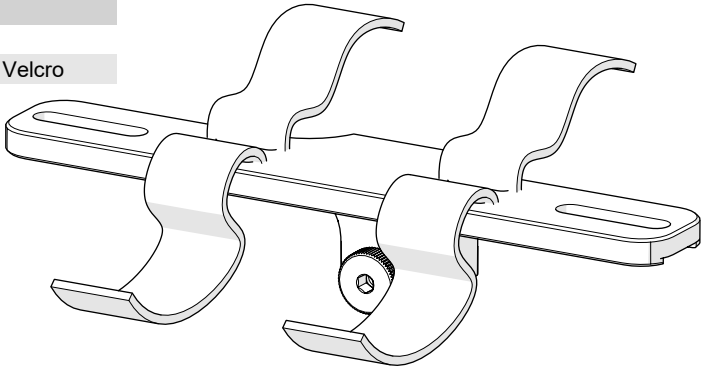


***Fig. 278** - Preamp bracket parts*

9.15.3. NAVIC Backpack

Part #	Description
CXS077	Backpack with Velcro
CXS063	Velcro Strap

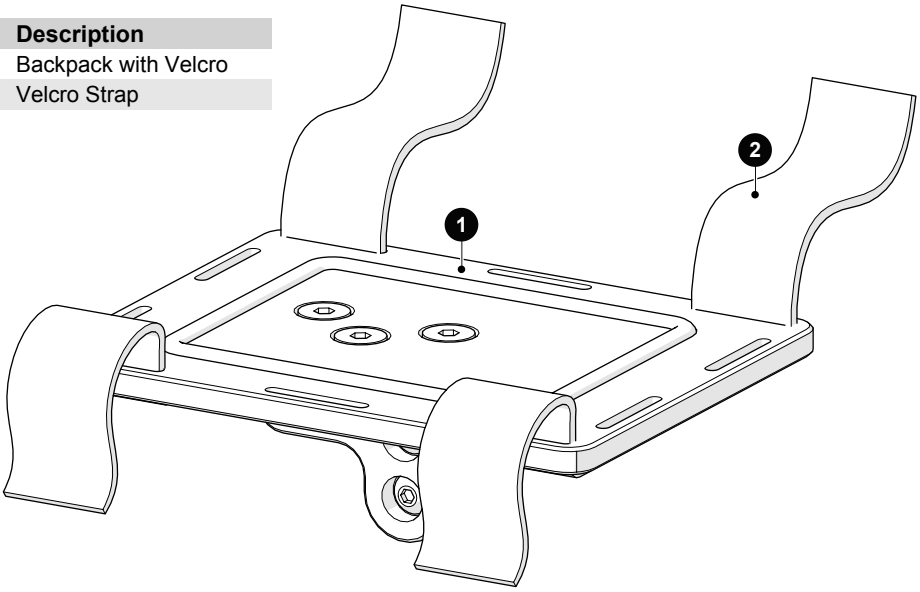


***Fig. 279** - NAVIC backpack*

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.

Jireh Industries Ltd.
53158 Range Rd 224
Ardrossan AB T8E 2K4
Canada

Phone: 780-922-4534
Fax: 780-922-5766

jireh.com

HydroFORM™ is a trademark of Olympus

Kopr-Kote® is a registered trademark of Jet-Lube, Inc.

Lemo® is a registered trademark.

All brands are trademarks or registered trademarks of their respective owners and third party entities.

Changes or modifications to this unit or accessories, not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

All specifications are subject to change without notice.

DISTRIBUTOR:

MANUFACTURER:

Jireh Industries Ltd.

53158 Range Road 224
Ardrossan, Alberta, Canada
T8E 2K4

Phone: 780.922.4534
Fax: 780.922.5766

jireh.com

JIREH

SCANNING TECHNOLOGY FOR NDT

Jireh Industries Ltd.
53158 Range Road 224
Ardrossan, Alberta
Canada
T8E 2k4

780-922-4534

jireh.com