

ES-50

Series



Elevation Stage Reference Manual (Open and Closed Loop Versions)

ES-50

Elevation Stage

Reference Manual

Rev 3.05

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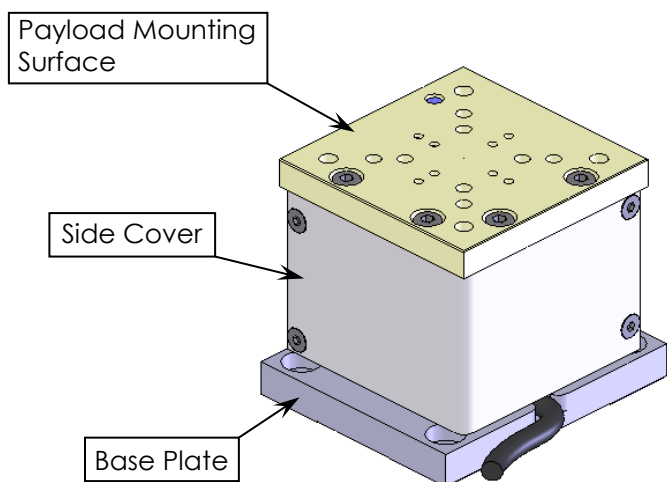
1. Introduction

1.1 Product Description

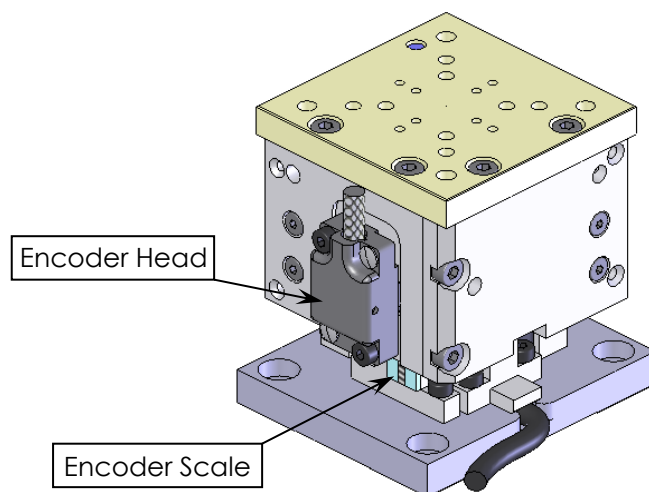
The ES-50 is a compact elevation stage designed for limited space applications. The ES-50 stage is driven by 2-phase stepper motor and is equipped with two mechanical switches. Two steel pre-loaded ball bearings allow for loads up to 1 kg while providing high stiffness and smooth travel up to 10 mm. The ES-50 allows for a highly rigid XZ or XYZ setup without the need for adapter brackets when combined with the VT-50 series of linear stages. Versions capable of operation in vacuum (10^{-6} mbar) are available. An optional linear encoder provides the user with sub-micron repeatability.

Features:

- Travel range of 10 mm
- Load capacity up to 1 kg
- Integrated mechanical limit switches
- Optional linear encoder with 50 nm resolution



ES-50 Open Loop Version
(Shown at minimum travel)



ES-50 Closed Loop/Encoder Version
(Shown at maximum travel)

1.2 Recommended Controllers

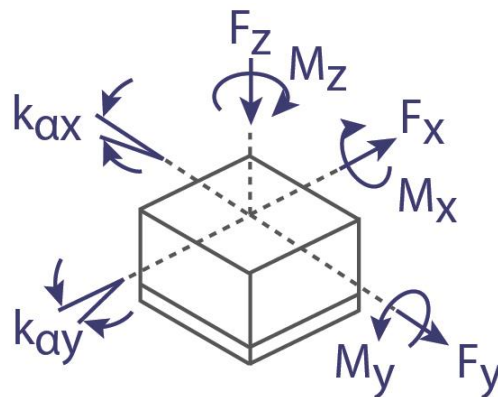
The following controllers are available from MICRONIX USA:

- MMC-200

1.3 Technical Data

Motor	SM-001
Pitch (μrad)	± 300
Speed Max. (mm/sec)	5
Resolution Typical (μm)	0.5 (Open Loop); 0.05 (Closed Loop); 0.5 (Low Cost Closed Loop)
Bi-directional Repeatability (μm)	± 2 (Open Loop); ± 0.2 (Closed Loop); ± 1 (Low Cost Closed Loop)
Uni-directional Repeatability (μm)	0.5 (Open Loop); 0.2 (Closed Loop); 1 (Low Cost Closed Loop)

1.4 Load Characteristics



Load Characteristics	$F_{X(N)}$	$F_{Y(N)}$	$F_{Z(N)}$	$M_{X(Nm)}$	$M_{Y(Nm)}$	$M_{Z(Nm)}$	k_{ax} [$\mu\text{rad/Nm}$]	k_{ay} [$\mu\text{rad/Nm}$]
2 Phase-018	5	5	10	1	1	1	-	-

2. Model Configurations

2.1 ES-50 Order Numbers

Order No.	ES-50-	1	1	1	
SM-001.....	1				
10 mm.....	1				
Open Loop.....	0				
Analog(1Vpp), 50nm*.....	2				
Digital(RS-422), 50nm*.....	3				
Digital Low Cost(RS-422),	4				
Mechanical Limits.....	1				
Non-vacuum.....	0				
Vacuum prepared, 10 ⁻⁶ mbar.....	6				

* Other resolutions available upon request.

Contact MICRONIX USA for custom versions and stacking configurations.

3. Preparing to Install the ES-50

3.1 **Installation Preparation**

When mounting the stage, it is important to consider the flatness of the mounting surface, as the stage will conform to the shape of that mounting surface. A surface that is not flat can adversely affect the performance and structural integrity of the stage.

The stage is calibrated and guaranteed to be within specification at 20°C ±5°C. Be sure to use the stage under the following conditions:

- Mount to a clean and flat surface which is free of debris, burrs or dings
- An indoor atmosphere free of corrosive gasses, and condensation
- Temperature range of 0-40°C
- Relative humidity between 20-80%
- Locate away from water, heat, and electrical noise

3.2 **Package Contents**

If product is damaged or there are missing components, contact MICRONIX USA immediately. Do not discard product packaging in case of return shipment.

Package Should Contain:

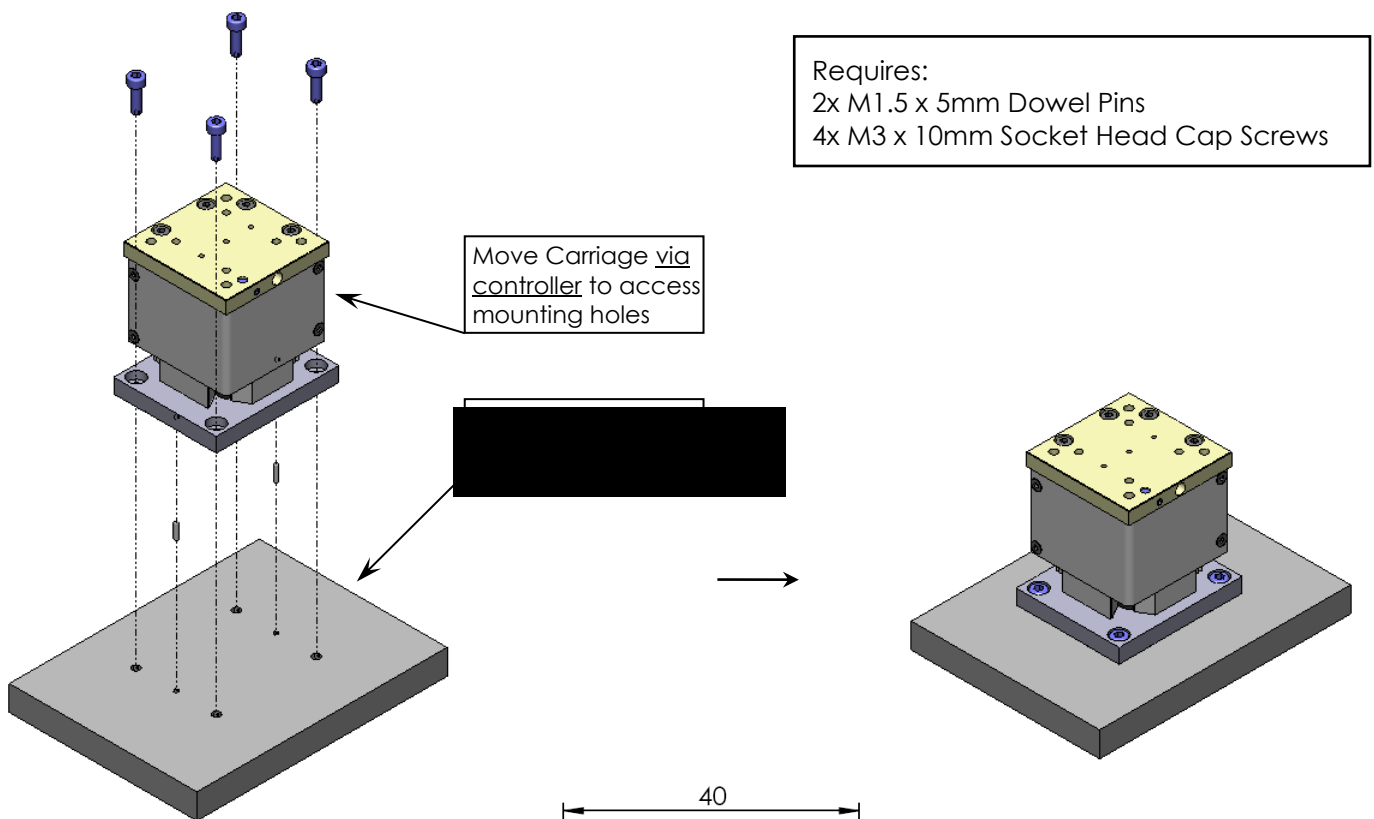
- ES-50 Elevation Stage
- 15 to 9 pin Dsub Connector Cable (closed loop only)
- Reference Manual
- Any other previously agreed upon components such as a controller and cable

4. Installing the ES-50

4.1 ES-50 10mm Installation

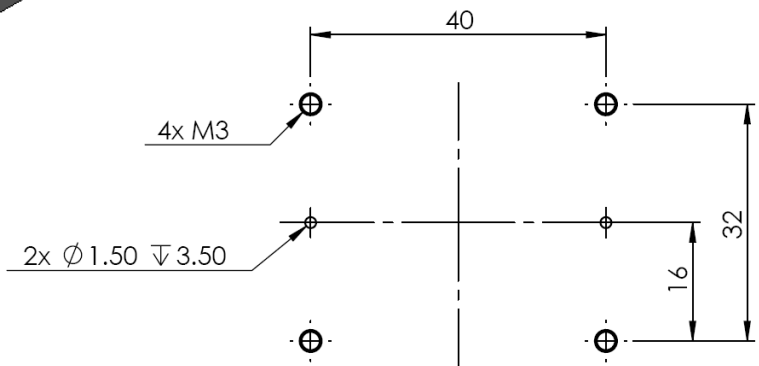
4.1.1 Base Mounting

Base Mounting requires M3 socket head cap screws for mounting and M1.5 x 5mm dowel pins for precision alignment. It may be necessary to move the carriage via the controller in order to access the base mounting holes. Additional brackets may be needed for custom applications.



Requires:
 2x M1.5 x 5mm Dowel Pins
 4x M3 x 10mm Socket Head Cap Screws

Move Carriage via controller to access mounting holes



5. Connecting the ES-50 Base Mounting Pattern

5.1 Atmospheric Environments

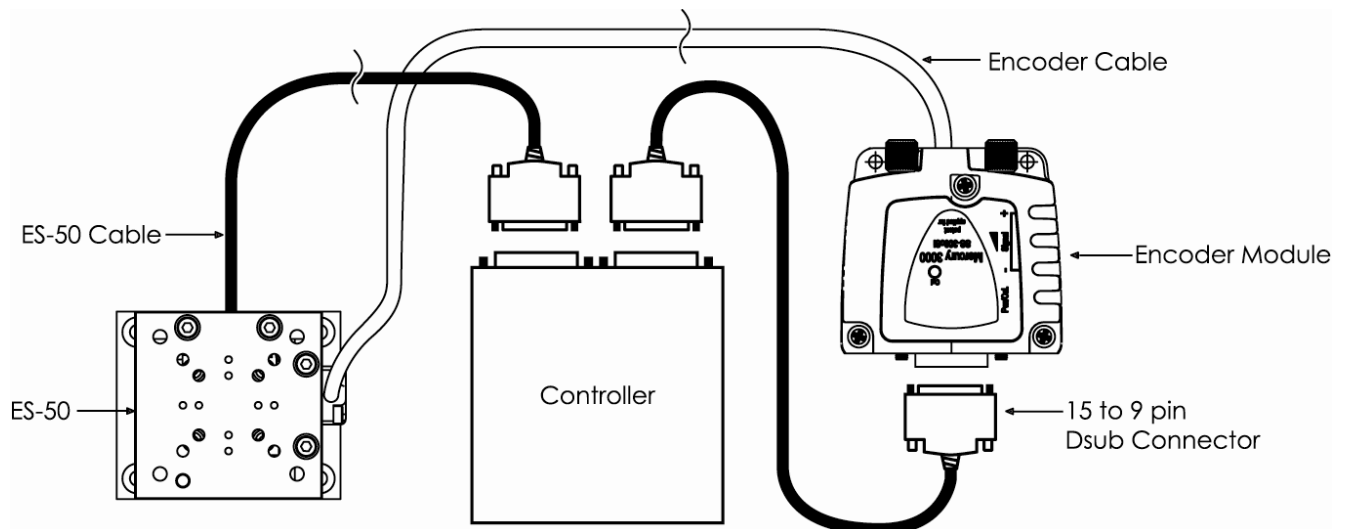
The ES-50 is black anodized for atmospheric environments. This allows for a harder surface finish and greater durability over the life of the stage.

5.1.1 Open Loop Installation

Connecting the ES-50 in an open loop only requires that the motor cable be connected to a compatible controller. No other cables or components are needed.

5.1.2 Closed Loop Installation & Wiring Diagram

Using the ES-50 stage with an encoder requires a closed loop compatible controller that recognizes encoder feedback. Connect the stage as shown below using the supplied 15 to 9 pin cable to connect the Encoder Module to the Controller.



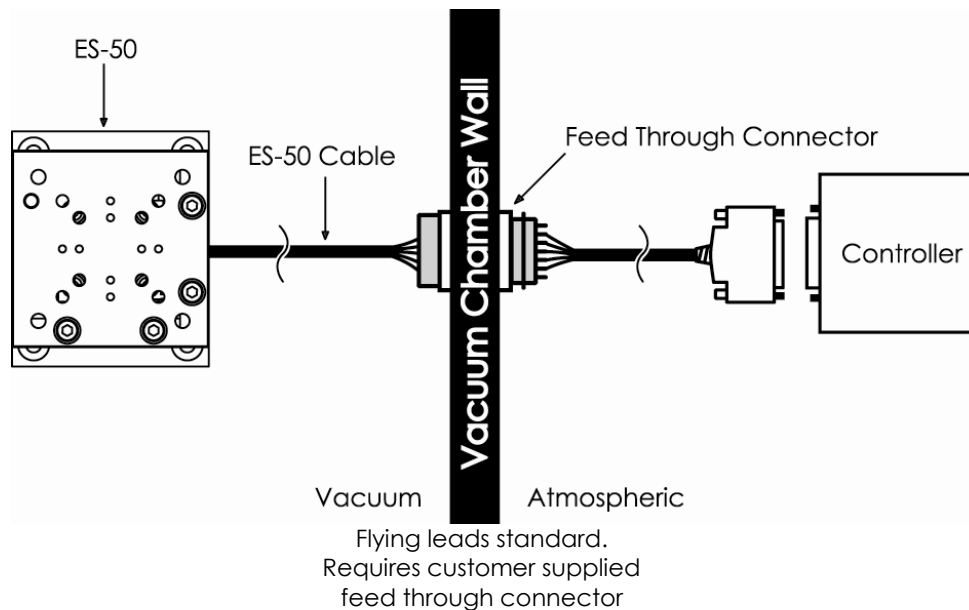
5.2 Vacuum Environments

5.2.1 Handling and Preparation

The vacuum version of the ES-50 is non-anodized and prepared for use in vacuum environments. Take the necessary precautions (such as wearing gloves, clean room clothing, etc.) when handling the stage as to avoid any contaminants. The connectors that ship with the stage are for testing use only and should be replaced with permanent connectors prior to installation.

5.2.2 Open loop Installation & Wiring Diagram

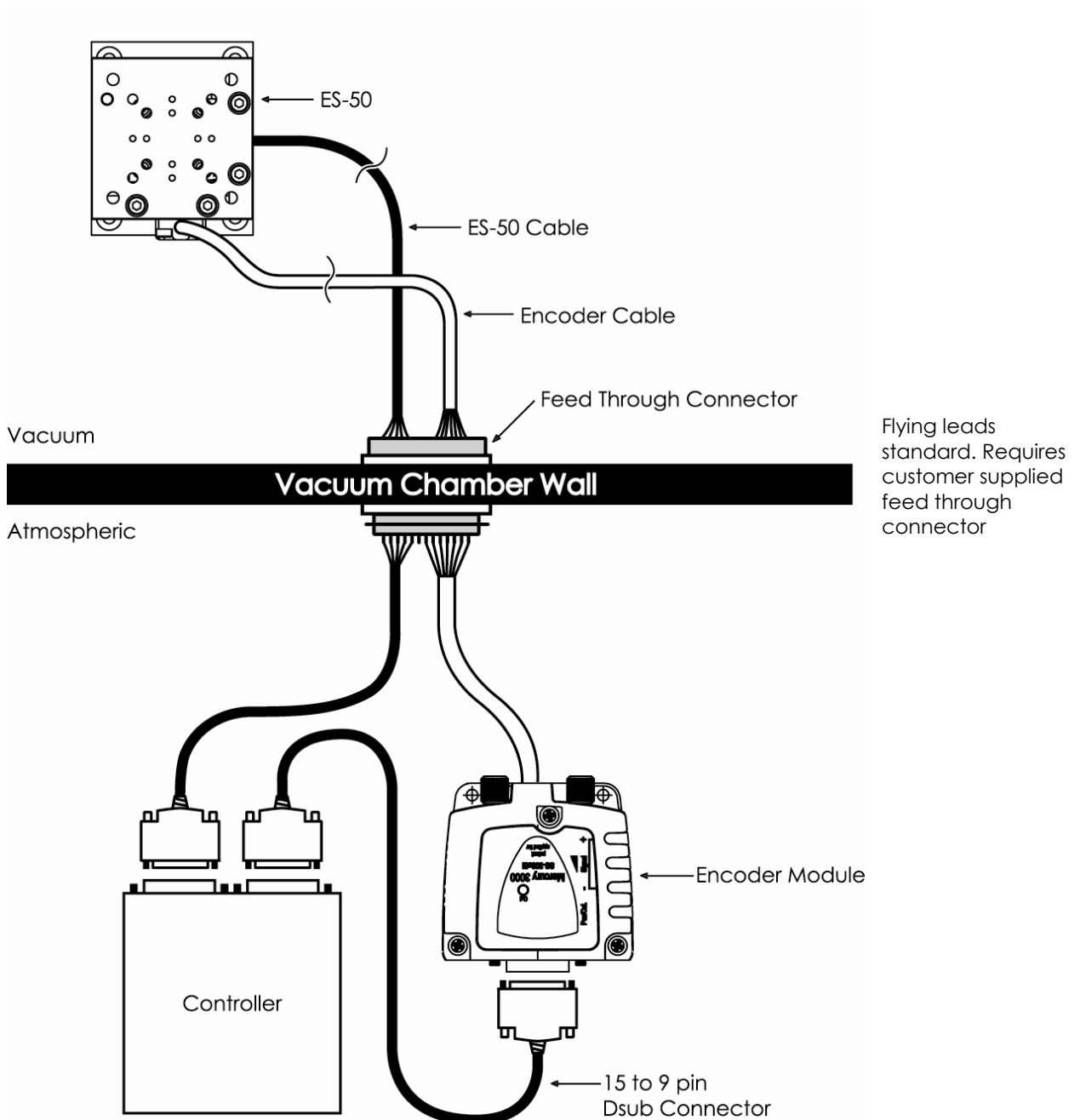
Connecting the ES-50 in an open loop requires the use of a feed through connector at the vacuum chamber wall. Match wire colors when passing the ES-50 motor cable through the feed through connector.



5.2.3 Closed Loop/Encoder Installation & Wiring Diagram

Closed loop installation of the ES-50 stage in vacuum environments requires an intermediate feed through connector at the vacuum chamber wall that can accommodate both the motor cable, and the encoder cable.

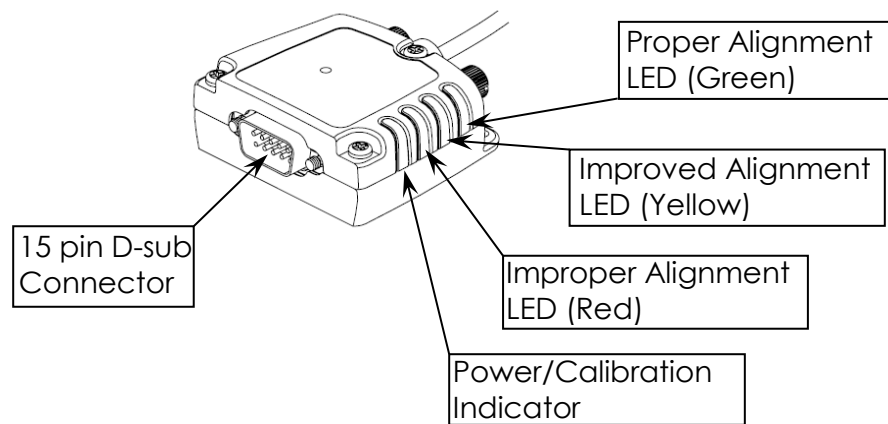
Important: Match wire colors when connecting the Encoder Head (vacuum side) to the Encoder Module (atmospheric side). Also, connect the shield of the Encoder Head to the shield of the Encoder Module through the feed through connector.



5.3 Using the Encoder Module

When connected in a closed loop, the Encoder Module should display two green LED's indicating a power source and proper encoder alignment. A Red or Yellow LED indicates misalignment of the Encoder Head, if this occurs contact MICRONIX USA. Do not manually adjust the Encoder Head or scale. For more information refer to MicroE Systems Mercury Encoders.

5.3.1 Encoder Module Overview



5.3.2 Encoder Module Pinout

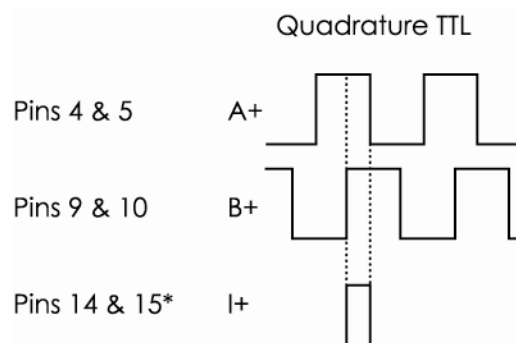
Pin	Description	Pin	Description
1	Reserved	9	B-
2	Transmit*	10	B+
3	Receive*	11	Alarm*
4	A-	12	+5V
5	A+	13	Ground
6	Reserved	14	Index +
7	Reserved	15	Index -
8	Reserved		

*Note: Proprietary pins reserved for manufacturer programming, not required to be connected to controller.

5.3.3 Operating and Electrical Specifications

Power Supply	5VDC \pm 5% @ 330mA (30mA for sensor)
Operating Temperature	0 to 70°C
Humidity	10 - 90% RH non-condensing

5.3.4 Output Signals







*Note: The index pulse may be aligned with A- or B- at some interpolation values.

6. General Technical Specifications

6.1 Electrical Connections

6.1.1 Motor Pinout & Cable

Pin	Wire Color		Description
	Non-Vacuum	Vacuum Prepared	
1	 Green/White	 Green/White	Motor Phase A+
2	 Green	 Green	Motor Phase A-
3	 Red/White	 Red/White	Motor Phase B+
4	 Red	 Red	Motor Phase B-
5	 Brown	 Brown	Limit Switch Common
6	 White	 White	Limit Switch – (near base)
7	 Purple	 Purple	Limit Switch + (away from base)
8	Not used		Not Used
9	Not used		Not Used

- ◆ For vacuum prepared wiring, blue may be substituted for green/white, and black for red/white.
- ◆ Limit Switch Common (pin 5) is connected to ground in MICRONIX USA controllers

6.1.2 Encoder Pinout

Pin	Function	Analog
1	A+/Cos+	Brown
2	B+/Sin+	Yellow
3	Index+	Violet
4	GND	Black & Inside shield
5	+5V	Red
6	A-/Cos-	Orange
7	B-/Sin-	Green
8	Index-	Blue
9	N/A	N/A
Shield	GND	Outside Shield

6.1.3 Stepper Motor

Motor Type	2 Phase Bipolar
Phase Current	0.24 A max.
Step Angle	1.8 °
Steps	200
Coil-Resistance	20.4 Ohms
Coil-Inductance	5 mH
Pitch	0.5 mm/rev
Resolution/Full step	2.5 μm

6.2 Limit Switches

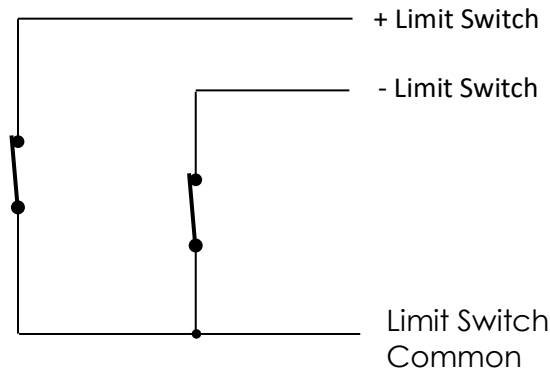
The limit switches are normally closed (when not activated) and should be connected to a compatible controller that recognizes these settings. Failure to properly set up the limit switches in the controller will result in physical damage to the switches themselves. A hard stop is designed into the ES-50 body which will prevent the carriage from running away should the limit switches fail.

The limit switches are factory calibrated to ensure advertised travel length and cannot be adjusted by the customer. For custom travel lengths, please contact MICRONIX USA.

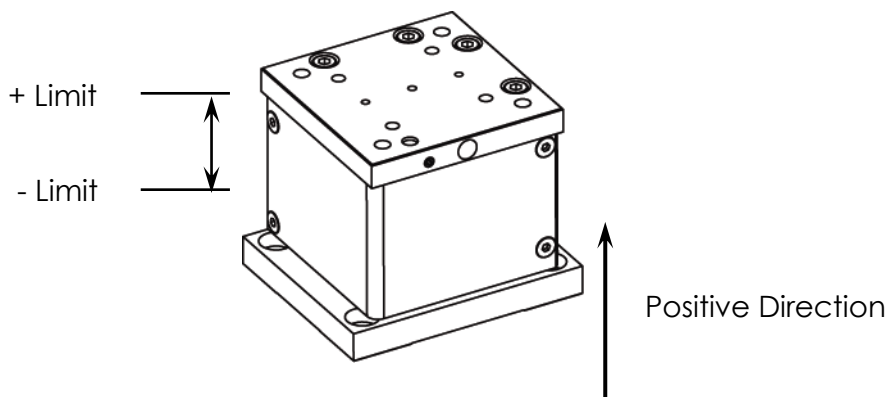
6.2.1 Mechanical Limit Switches

Contact Rating	100 mA @ 30 V
Contact Type	Normally Closed
Operating Temperature	-25 to +70 °C

6.2.2 Limit Switch Schematic



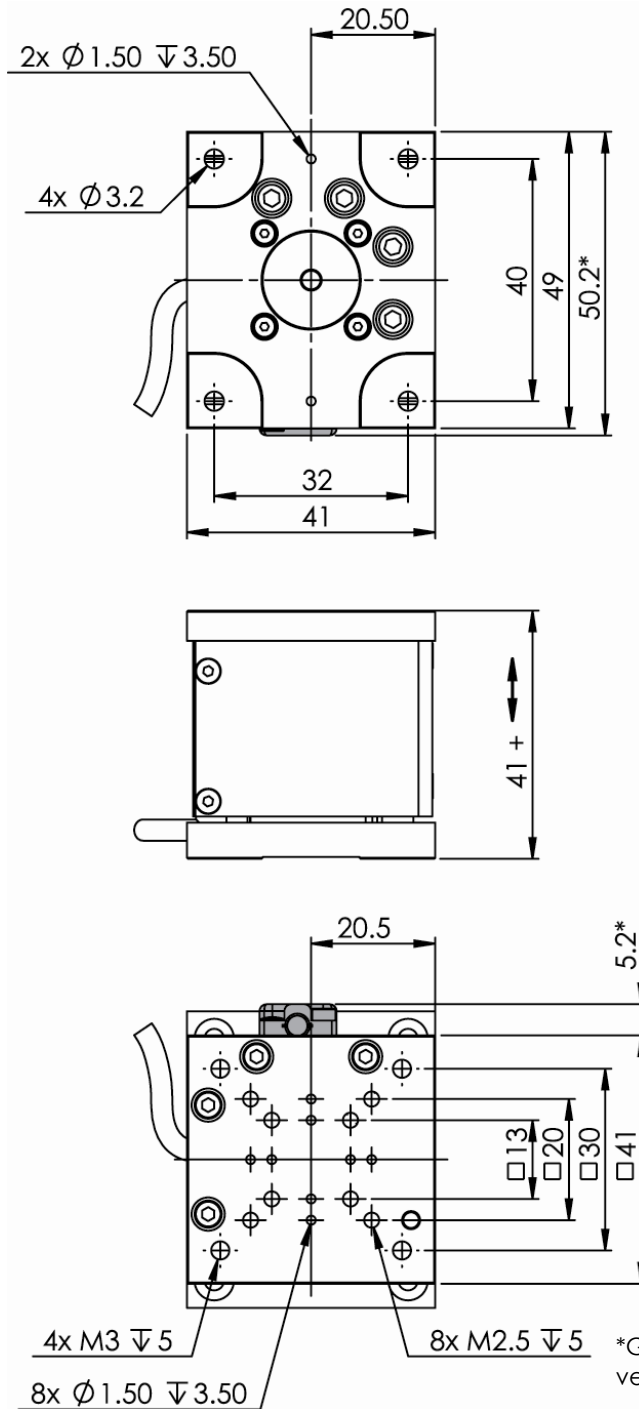
6.2.3 Direction of Motion



6.3 Dimensions

ES-50 shown in retracted position

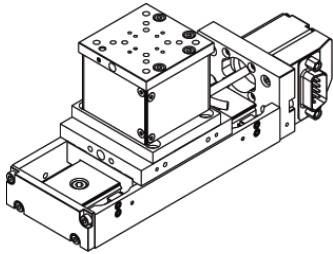
6.3.1 ES-50 10mm



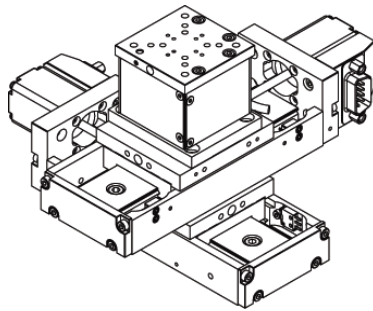
7. Stacking Configurations

7.1 Possible Configurations

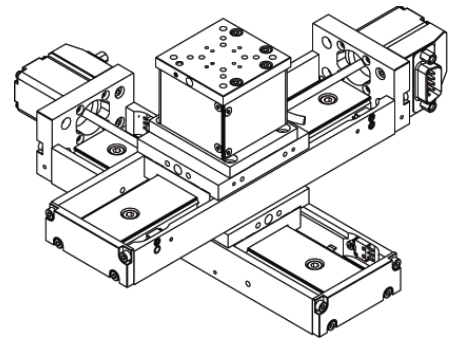
Using the ES-50 Elevation Stage and VT-50 Linear Stage



X-Z 55x10 mm

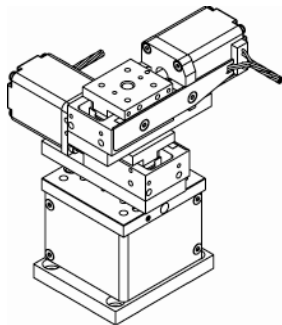


X-Y-Z 55x55x10 mm

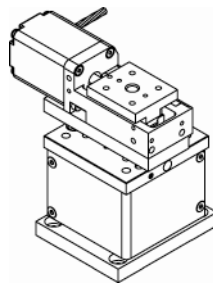


X-Y-Z 100x100x10 mm

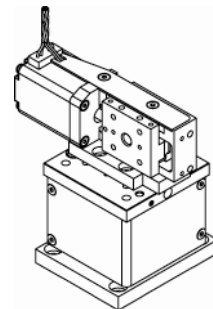
Using the ES-50 Elevation Stage and VT-21 Linear Stage



Z-X-Y 10x10x10 mm



Z-X 10x10 mm



Z-X (side) 10x10 mm

8. Supplementary Information

8.1 Maintenance

- The ES-50 elevation stage is a delicate mechanical device and should be handled with care. Do not drop or mishandle the stage.
- Keep hands clear of all moving parts while the stage is in motion to avoid personal injury.
- Follow the *Installation Preparation* requirements and use proper cable management to ensure a clean and safe operating environment.
- Properly wire the feedback to the controller before powering on the stage. Failure to do so can result in damage to the stage.
- Allow for easy access to the stage in case of servicing.

8.2 Units and Conventions

All measurements in this document are in the metric system of units.

Metric Unit	English Unit
1 millimeter	0.0394 inches
1 micron	0.0000394 inches
1 Newton	0.2248 lbs.
1 Newton-meter	8.85 in-lbs.