MAGTROL

FOURAX-700

MULTI-AXIS POSITIONER

USER MANUAL

www.magtrol.com

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PURCHASE RECORD

Please record all model numbers and serial numbers of your Magtrol equipment, along with the general purchase information. The model number and serial number can be found on either a silver identification plate or white label affixed to each unit. Refer to these numbers whenever you communicate with a Magtrol representative about this equipment.

Model Number : _____

Serial Number : _____

Purchase Date : _____

Purchased From : _____

1st English Edition rev. A | September 2025

SAFETY PRECAUTIONS

WARNING

WARNING! IN ORDER TO MINIMIZE RISKS, IT IS OF UTMOST IMPORTANCE TO RESPECT THE CURRENT SAFETY STANDARDS WHEN PLANNING, CONFIGURING AND OPERATING THE FOURAX-700 MULTI-AXIS POSITIONER.

CAUTION

CAUTION! OPERATE THE FOURAX-700 MULTI-AXIS POSITIONER WITH GREAT CAUTION! THE FOURAX-700 MAY BE IRREVERSIBLY DAMAGED IF IMPACTED MECHANICALLY (FALL), CHEMICALLY (ACIDS) OR THERMALLY (HOT AIR, VAPOR).

1. Make sure that the FOURAX-700 is earth-grounded, to guarantee personal safety and proper operation.

WARNING

THE PLATFORM IS NOT ELECTRICALLY CONNECTED TO THE REST OF THE MACHINE AND MUST BE GROUNDED SEPARATELY TO PROVIDE PROTECTION. SEE GROUNDING SECTION IN THIS DOCUMENT FOR FURTHER INFORMATION.

2. Check line voltage before operating equipment.
3. Do not open the FOURAX-700 with AC power connected. If you must open the device, unplug the power cord.
4. Do not allow the FOURAX-700 to become wet or excessively contaminated by conductive dust or chips, as this may cause a shock hazard.
5. Keep hands, fingers, and other body parts clear of the FOURAX-700 when the power is on. Switch off the AC power switch if you are performing work where unexpected motion of the machine could harm you or others.
6. Make sure that all rotating parts are equipped with appropriate safety guards.
7. Periodically check all connections and attachments.
8. Always wear protective glasses when working close to rotating elements.
9. Never wear a necktie or baggy clothes when standing close to rotating elements.
10. Never stand too close or bend over the rotating drive chain.

QUALIFIED PERSONNEL

Persons in charge of installing and operating the FOURAX-700 Multi-Axis Positioner must have read and understood this user manual, paying extra close attention to all safety-related information.

This FOURAX-700 must be handled by qualified personnel according to the technical requirements and the above-mentioned safety instructions. This is also true when using dynamometer accessories.

Before using the FOURAX-700 in your application, operate the device without equipment attached, to familiarize yourself with the moving parts.

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PREFACE

PURPOSE OF THIS MANUAL

This manual contains all the information required for the setup, connection and general use of Magtrol's FOURAX-700 Multi-Axis Positioner. To achieve maximum capability and ensure proper use, please read this manual in its entirety before operating the unit. Keep the manual in a safe place for quick reference whenever a question should arise.

WHO SHOULD USE THIS MANUAL

This is written for operators who are going to use the FOURAX-700 Multi-Axis Positioner in conjunction with any Magtrol Hysteresis, Eddy-Current or Powder Brake Dynamometer, Magtrol In-Line Torque Transducer, or auxiliary instrumentation.

MANUAL ORGANIZATION

This section gives an overview of the structure of the manual and the information contained within it. Some information has been deliberately repeated in different sections of the document to minimize cross-referencing and to facilitate understanding through reiteration.

The structure of the manual is as follows:

Chapter 1: INTRODUCTION – Contains the technical data sheet for the FOURAX-700 Multi-Axis Positioner, which describes the unit and provides its technical characteristics.

Chapter 2: INSTALLATION – Provides unpacking and setup instructions.

Chapter 3: FOURAX-700 C1 SOFTWARE – Provides instructions to use the control software.

Chapter 4: OPERATION – Provides detailed mechanical setup instructions and operating tips.

Chapter 5: TROUBLESHOOTING & FAQ - Solutions to common problems encountered during setup and operation. Also, provides answers to frequently asked questions about the FOURAX-700.

CONVENTIONS USED IN THIS MANUAL

The following symbols and type styles may be used in this manual to highlight certain parts of the text:

NOTICE

Indicates information considered important but not hazard related.

This is intended to draw the operator's attention to complementary information or advice relating to the subject being treated. It introduces information enabling the correct and optimal function of the product.

CAUTION

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.

THIS IS ALSO USED TO DRAW THE OPERATOR'S ATTENTION TO INFORMATION, DIRECTIVES, PROCEDURES, ETC. WHICH, IF IGNORED, MAY RESULT IN DAMAGE TO THE MATERIAL BEING USED. THE ASSOCIATED TEXT DESCRIBES THE NECESSARY PRECAUTIONS TO TAKE AND THE CONSEQUENCES THAT MAY ARISE IF THESE PRECAUTIONS ARE IGNORED.

WARNING

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

DANGER

INDICATES A HAZARDOUS SITUATION THAT, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY. THE SIGNAL WORD «DANGER» IS TO BE LIMITED TO THE MOST EXTREME SITUATIONS.

THIS INTRODUCES DIRECTIVES, PROCEDURES, PRECAUTIONARY MEASURES, ETC. WHICH MUST BE EXECUTED OR FOLLOWED WITH THE UTMOST CARE AND ATTENTION, OTHERWISE THE PERSONAL SAFETY OF THE OPERATOR OR THIRD PARTY MAY BE AT RISK. THE READER MUST ABSOLUTELY TAKE NOTE OF THE ACCOMPANYING TEXT, AND ACT UPON IT, BEFORE PROCEEDING FURTHER.

The safety symbol may subsequently vary depending on the source of the hazard. Below are examples:

Various safety pictograms according to ISO 7010

1. INTRODUCTION

The Magtrol FOURAX-700 positioner is a parallel-kinematic, multi-axis system designed specifically for mechanical test labs. Providing 4 axes of motion in one integrated device, the FOURAX-700 can fully position a line or axis in 3-dimensional space, so is well-suited to the alignment of rotary equipment.

Designed for durability and high-capacity as well as precision, the FOURAX-700 can accommodate a wide variety of payloads on the mounting platform. Difficult-to-fixture items can be aligned precisely with the FOURAX-700, eliminating frustrating, time-consuming work with shims, and/or expensive custom fixtures. The FOURAX-700 features a robust aluminum platform with 10mm T-slots.

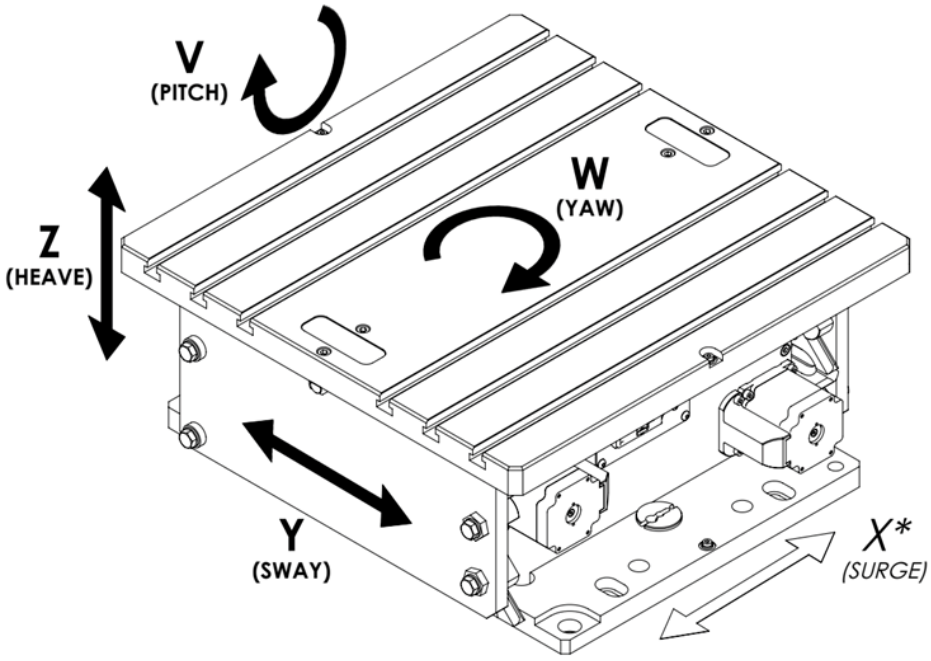


Fig.1-1 FOURAX-700 motion axes

1.1 FEATURES OF THE FOURAX-700

- Powered Y, Z, V, W motion (sway, heave, pitch and yaw). Optional manual X-Axis (surge).
- High-accuracy and repeatability.
- High payload capacities.
- Built-in electronics.
- FOURAX C1 software for control, with unit conversion, saved positions, and rotation point.
- T-Slot mounting platform.

1.2 DIAGRAM

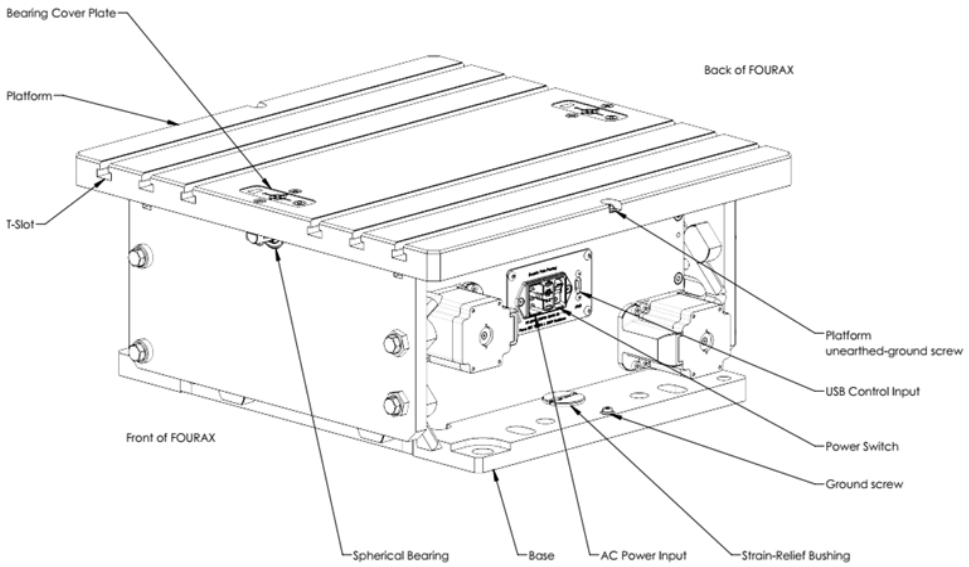


Fig.1-2 FOURAX-700 diagram

1.3 DATASHEET

FOURAX-700
MULTI-AXIS POSITIONER

FEATURES

- 4 axes of motion: Y, Z, Yaw, Pitch
- Compact
- High-payload
- Precise and stable
- Durable
- Easy-to-use
- 10mm T-slot mounting platform, standard
- No external electronics required: (Included FOURAX-C1 software runs on PC)

Fig.1 : FOURAX-700 Multi-Axis Positioner

DESCRIPTION

Magtrol FOURAX positioners are parallel-kinematic, multi-axis systems designed specifically for mechanical test labs. Providing 4 axes of motion in one integrated device, the FOURAX can fully position a line in 3-dimensional space, so is well-suited to the alignment of rotary equipment.

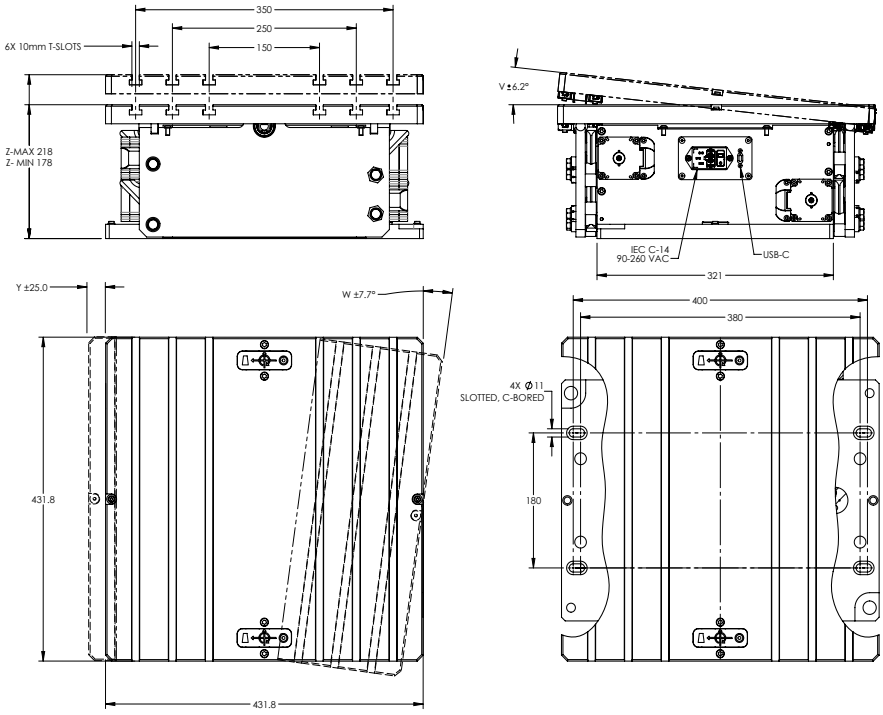
Designed for durability and high-capacity as well as precision, the FOURAX can accommodate a wide variety of payloads. Difficult-to-fixture items can be aligned precisely with the FOURAX, eliminating frustrating, time-consuming work with shims, and/or expensive custom fixtures. The FOURAX-700 features a robust aluminum mounting platform with 10mm T-slots in its standard configuration.

Fig.2 : FOURAX-700 Multi-Axis Positioner with table and dynamometer

The FOURAX does not require any special external electronics or cords. Required connections are one standard USB-C cable, and one standard AC power cord- just like a printer. The easy-to-use FOURAX-C1 software runs on any PC (PC must support LabVIEW™ runtime environment). All common measurement units are supported. Positions may be saved for later recall.

Fig.3 : FOURAX C1 Software

DIMENSIONS



SPECIFICATIONS

RATINGS

Travel Ranges (maximum) [a]	Y	*SWAY*	±24 mm
	Z	*HEAVE*	±20 mm
	θY(V)	*PITCH*	±6.2 deg
	θZ(W)	*YAW*	±7.7 DEG
Minimum Incremental Motion	Y		13 µm
	Z		13 µm
	θY(V)		70 µrad
	θZ(W)		70 µrad
Backlash, (typical)	Y		50 µm
	Z		50 µm
Stiffness, (typical)	Y		5 N/µm
	Z		5 N/µm
Maximum Payload, Centered [b]		100 KG	
Mounting Platform	Width		432 mm
	Length		432 mm
	T-Slots (6)		10 mm
Connections	Power	IEC C14, 90-260 VAC	
	Control	USB-C	

a) Maximum values where other axes are centered. Range of motion is shared between axes.

b) Recommendation may vary by usage & dynamic loads present.

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ISO 9001 BUREAU VERITAS Certification

FOURAX-700 - US 09/2025

2. INSTALLATION

2.1 UNPACKING THE FOURAX-700 MULTI-AXIS POSITIONER

Your FOURAX-700 was packaged in reusable, shock resistant packing material that will protect the instrument during normal handling.

Make sure the carton contains the following:

- FOURAX-700 Multi-Axis Positioner
- Left-angle line cord
- USB-C cord
- 10 mm, M8x1.25 T-Slot nets (4X)

Inspect the contents for any evidence of damage in shipping. In the event of shipping damage, immediately notify the carrier and Magtrol's Customer Service Department

2.1.1 LIFTING THE FOURAX-700

Lift the FOURAX-700 from the sides underneath the Mounting Platform. This is a two-person lift.

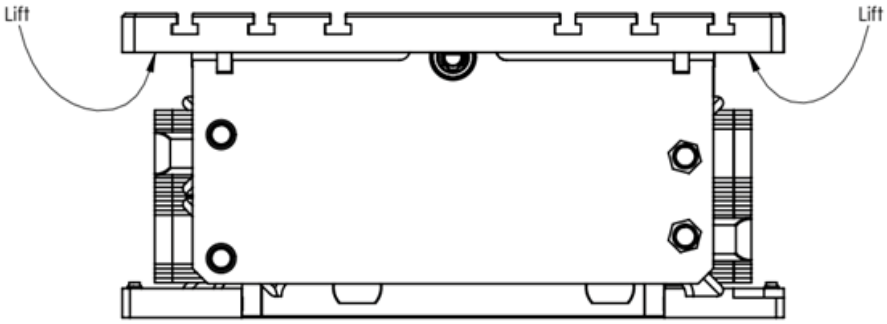


Fig.2-3 Lifting the FOURAX-700

2.2 ENVIRONMENTAL REQUIREMENTS

2.2.1 LOCATION

The FOURAX-700 is intended to be used indoors.

2.2.2 TEMPERATURE

Operate the FOURAX-700 at temperatures between 0°C and 40°C. (32°F to 104°F).

2.2.3 HUMIDITY AND MOISTURE

Avoid exposure to fluids to prevent electrical safety hazards and damage to equipment. Humidity of operation should be between 5% and 85%, non-condensing.

2.3 MECHANICAL INSTALLATION

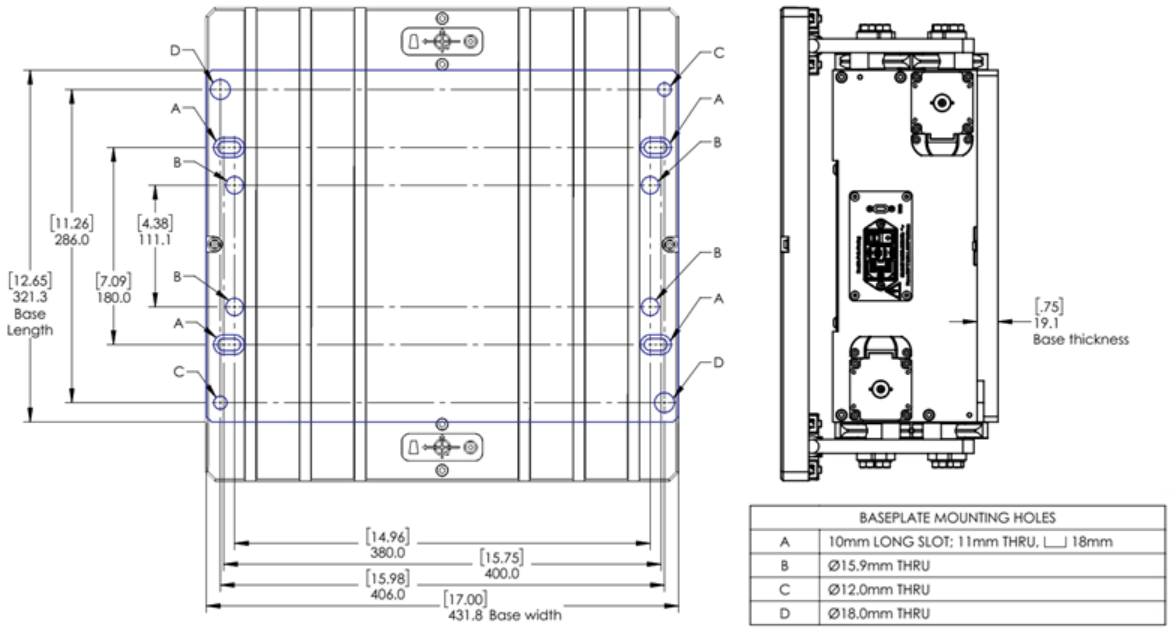


Fig.2-4 Installing the FOURAX-700

2.3.1 MOUNTING HOLES

Secure the FOURAX to a stable surface using one of the following methods:

- Secure the 4 slotted, counterbored holes (A). Recommended fasteners: M10 or 3/8" socket-head cap screws. To ease installation, install screws with ball-end hex driver. **(Recommended method)**
- Secure the 4 circular holes (B). Recommended fasteners: M12 or ½" fasteners, with washers.
- Secure the outside holes (C, D) are precision connections for the optional X-axis. While these can be used as mounting holes, care should be taken to avoid damaging the interior surfaces of these holes, to preserve the ability to add the X-axis attachment later.

Ensure that the surface is flat. Shim if necessary. Do not clamp the FOURAX down to an uneven surface as this could impart twisting forces on the structure.

Ensure that the surface is stable, balanced, and well-supported.

2.3.2 OPERATIONAL CLEARANCES

CAUTION REFER TO FIGURE BELOW FOR THE MAXIMUM RANGE OF MOTION OF THE FOURAX-700. ENSURE THAT AT MINIMUM, YOUR INSTALLATION WILL NOT RESULT IN A COLLISION AT ANY OF THESE MAXIMUM POSITIONS.

If you are using the FOURAX-700 for the first time, we recommend that you familiarize yourself with how the machine moves by operating the FOURAX on an open tabletop or floor, before installation into a constrained space.

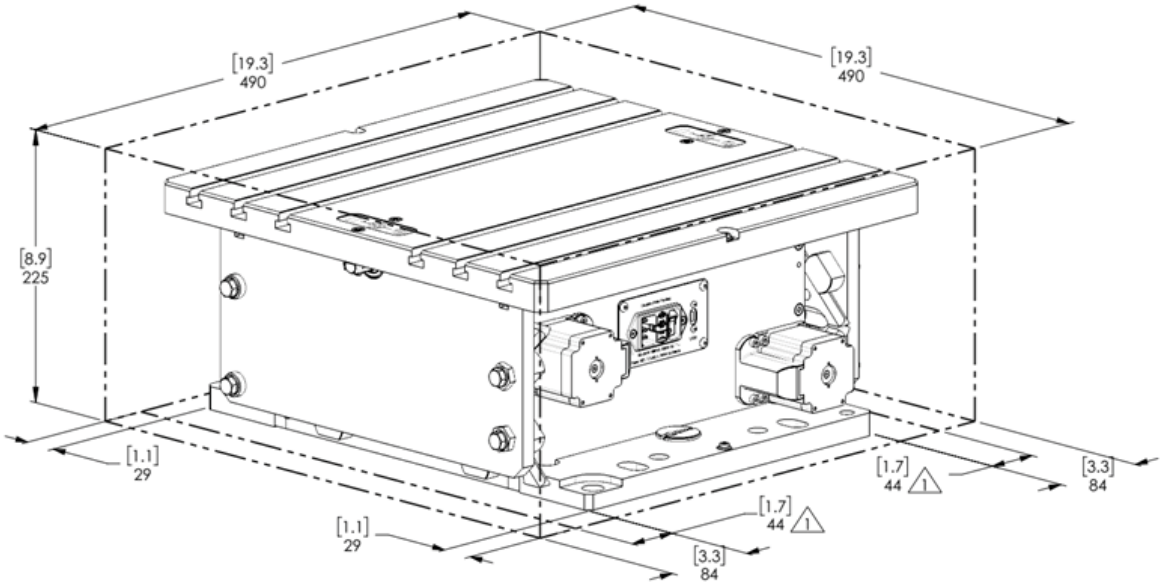


Fig.2-5 Dimensions

2.4 ELECTRICAL INSTALLATION

The FOURAX-700 electrical connections are made on the side of the machine.

- Line power input: IEC320 C-14, 85-264 VAC, 50/60 Hz. The FOURAX-700 consumes less than 2A during operation. It is equipped with 2.5A, double-pole fuses.
- USB-C connector

NOTICE Connect the USB cable to your PC before loading the FOURAX C1 software.

Optionally, the two cables may be run down through the baseplate vertically, using the included strain-relief bushing.

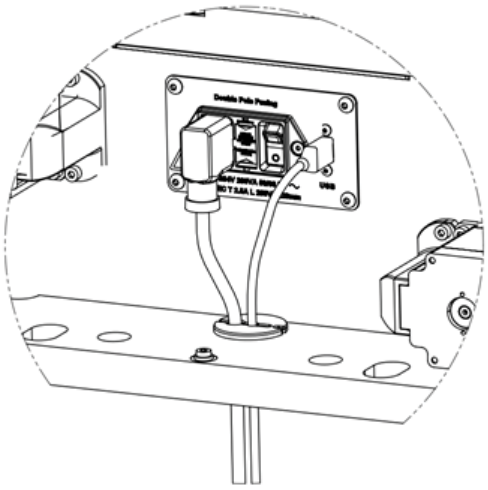


Fig.2-6 Electrical connections

CAUTION Use only high-quality, electrically-shielded USB cables suitable for data transfer.

2.4.1 GROUNDING

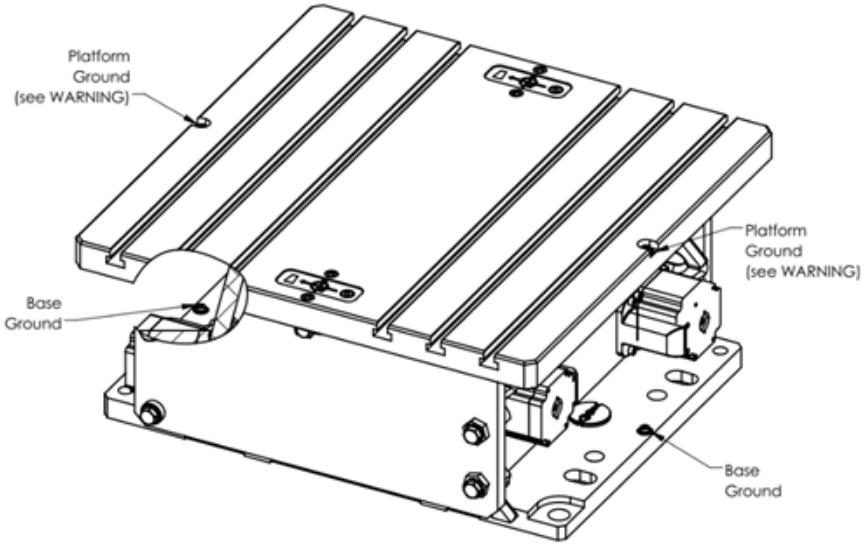


Fig.2-7 Grounding the FOURAX-700

There are 4 grounding points on the FOURAX-700: 2 on the baseplate, and 2 on the platform.

The grounding points are M4x0.7 screws with anodizing removed under the screw head.

The two grounding points on the Base are electrically connected with the ground tab of the IEC-C13 power input.

The two grounding points on the Platform are electrically isolated from the rest of the machine.

WARNING **THE PLATFORM IS SUPPORTED BY MULTIPLE NON-CONDUCTIVE BEARING SURFACES, AND IS THEREFORE ELECTRICALLY ISOLATED FROM THE BASE. THIS MEANS THAT GROUNDS TO THE PLATFORM ARE NOT PROTECTIVE-EARTH GROUNDS. IF YOU WISH TO GROUND THE PLATFORM, USE THE GROUND POINTS ON THE PLATFORM TO CONNECT THE PLATFORM TO EARTH GROUND. USE WIRE SUITABLE FOR FLEX USE.**

3. FOURAX C1 SOFTWARE

3.1 ABOUT FOURAX C1 SOFTWARE

FOURAX C1 Software is the control interface for the FOURAX-700 positioner. It allows powered 4-axis motion, saved positions, and supports most common unit systems.

The software is written in NI LabVIEW® and will run on any modern PC that supports the NI runtime environment. The FOURAX-700 positioner uses Trinamic® (Analog Devices® subsidiary) stepper controllers, which communicate using their "TMCL" language. The FOURAX C1 Software communicates with the Trinamic® TMCM stepper controller over USB by sending TMCL commands.

3.2 INSTALLING FOURAX C1 SOFTWARE

3.2.1 SYSTEM REQUIREMENTS

FOURAX C1 requires Windows 10 or later. It also requires a PC capable of supporting LabVIEW® Runtime engine 2024, Q3.

3.2.2 USB MEDIA INSTALLATION

Plug the USB drive into your target computer. Open the file "Magtrol.exe" and follow the instructions to install FOURAX C1 Software.

3.2.3 INSTALLATION FROM WEB SOFTWARE DOWNLOAD

The installer package can be downloaded from the Magtrol Internet Site:

https://www.magtrol.com/software-downloads/

Navigate inside the USB flash drive or download folder to find install.exe. Then Run install.exe.

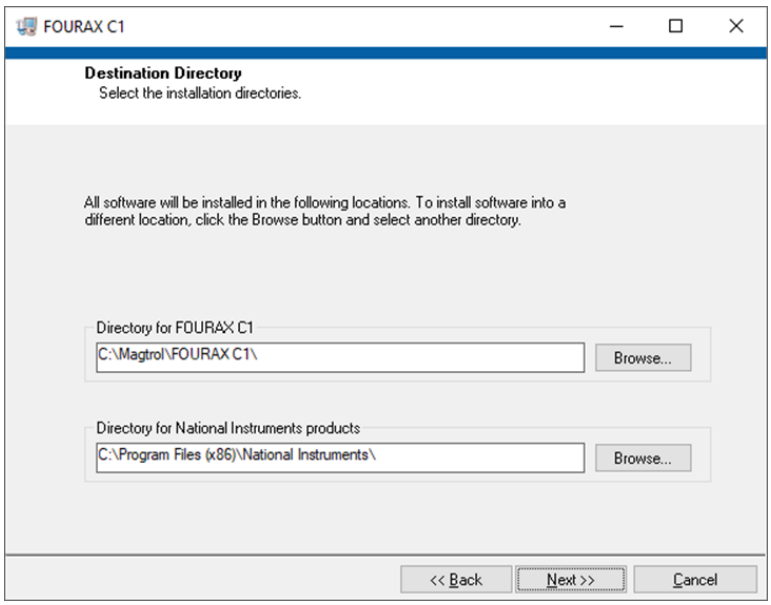


Fig.3-1 FOURAX C1 download

3.2.4 PAIRING THE PC TO THE FOURAX

Open the FOURAX C1 Software using the icon on your desktop.

Fig.3-2 FOURAX-700 C1 Desktop icon

When FOURAX C1 starts, it will show a grayed-out screen with the message “TMCM Not Found”. (TMCM is the Stepper-driver model).

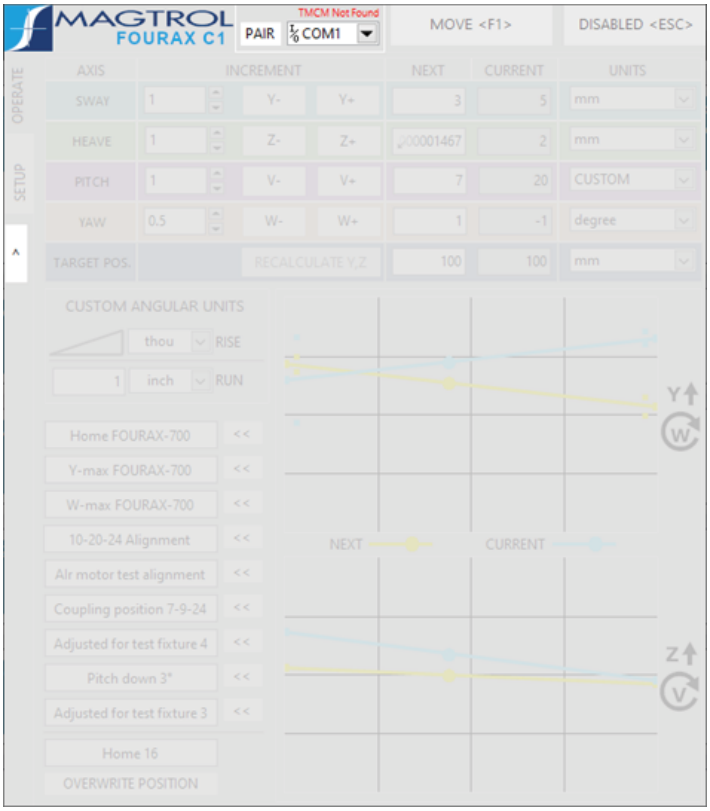


Fig.3-3 TMCM not found screen

Click the drop-down menu and select the COM port to which the FOURAX is connected.

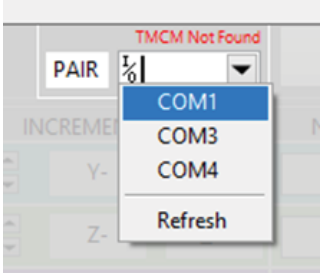


Fig.3-4 COM port selection drop down menu

NOTICE If you have a large number of COM ports in this list, identify the correct port by going to your device manager and selecting view ports. The FOURAX will appear as a “USB Serial Device."

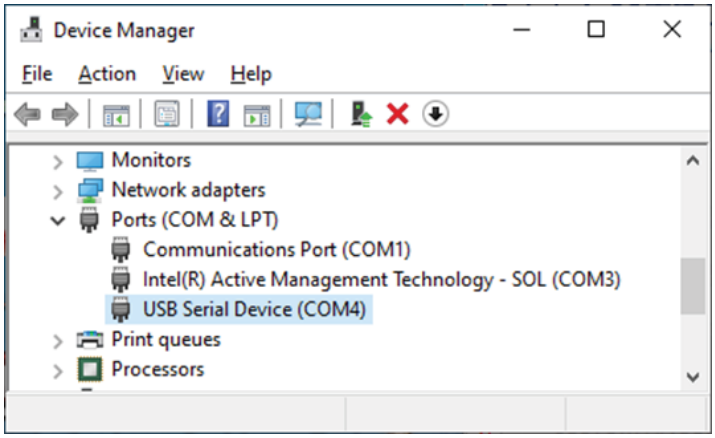


Fig.3-5 Device manager screen

With the correct COM port selected, click and release “PAIR”.

The FOURAX is now connected, has power and is ready to use.

NOTICE You can have the power connected when Pairing the FOURAX-700; the software will just go directly to the screen below:

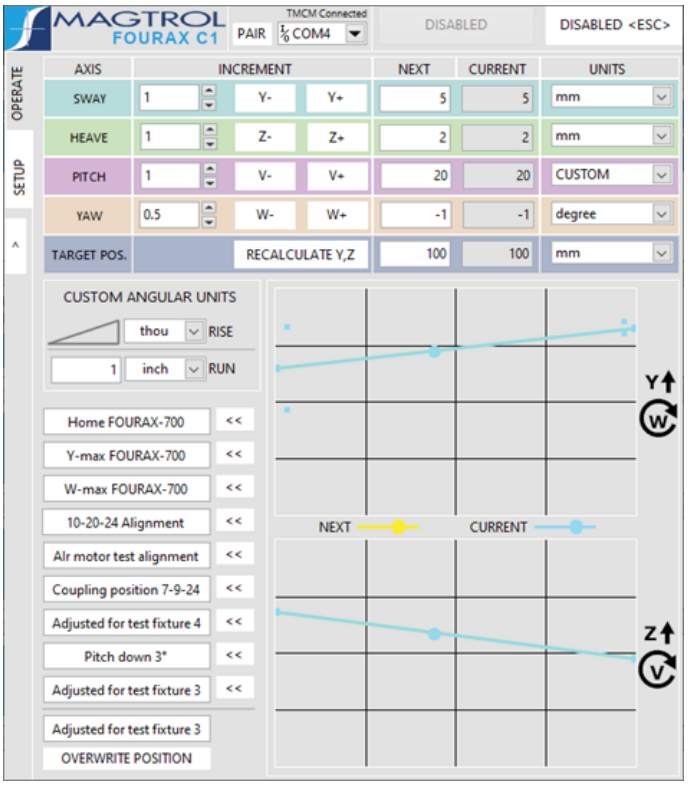


Fig.3-6 FOURAX C1 TMCM connected with power screen

When the FOURAX-700 successfully connects, but the screen remains grayed-out, it means that the software has located the FOURAX-700, but the FOURAX-700 does not have power. Check that the power switch is on and the device is plugged in. (The software will not let you do much without AC power, because the stepper driver card cannot load any values into operational memory without power).

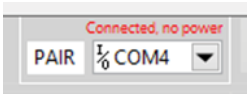


Fig.3-7 FOURAX C1 TMCM connected without power screen

When you supply power, your will see a warning message about a power supply interruption:

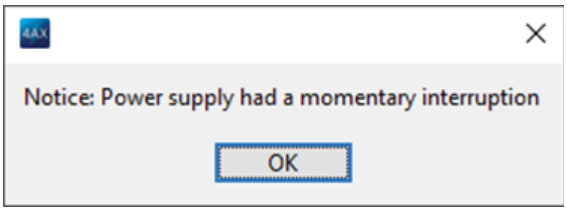


Fig.3-8 Power supply interruption screen

Click “OK” and the software will continue loading the device and then the screen in Fig.3-6 will appear.

If the message remains “TMCM Not Found”. This means either you tried the wrong COM port, or the PC is not detecting the device.

Fig.3-9 FOURAX-700 TMCM pair not found screen

Try the other COM ports. If none of the listed COM ports work, try closing the software, reconnecting the USB cable, and then reloading the software.

NOTICE It is OK to switch power off the FOURAX while the software is running. (Always wait until the FOURAX has stopped moving; the Status Display should say “At Position” or “Disabled”).

NOTICE The software periodically communicates with the FOURAX to verify that power is supplied, and USB communication exists. A moment after switching off power, the software will detect that it was removed, and it will disable the screen. This will also occur if the USB connection is lost. Similarly, a moment after restoring power, the software will detect this and re-enable.

NOTICE If the USB cable had been unplugged, you will need to PAIR the FOURAX again.

3.3 NAVIGATION

3.3.1 TOP BAR

Fig.3-10 FOURAX C1 Software top bar

The Top Bar is visible and accessible both within the OPERATE tab and the SETUP tab.

3.3.1.1 COMMUNICATION SECTION

This section contains the COM port selector and PAIR button. This is used to select the COM port and Pair the FOURAX C1 Software to the FOURAX-700 hardware. It also displays the current state of USB communication and power supply.

3.3.1.2 MOVE BUTTON/STATUS DISPLAY

When clicked, this button initiates the MOVE command to the NEXT position. This also indicates the operating status of the FOURAX-700.

STATUS	DESCRIPTION
DISABLED	Moves are not possible due to the ENABLE/DISABLE button setting or the USB communication, or the AC power, is not available.
AT POSITION	The CURRENT and NEXT values are the same. Completed moves end with this message.
MOVE <F4>	This indicates that the FOURAX-700 is ready to move to the NEXT position (This is the only status where this button can be clicked on/activated). F4 key will also activate MOVE.
OUT OF RANGE	This means that the NEXT position is outside of the range of motion for the FOURAX-700, so the move cannot be made.
MOVING	A move is currently underway.
HOMING	The homing sequence is currently underway.
ENABLED <ESC>	When Enabled, this button is RED. This is a warning that a move may be initiated. This button may be clicked during a move. If this is done, the FOURAX will interrupt the move (stop). ESC key also activates ENABLE/DISABLE.
DISABLED <ESC>	When Disabled, this button is WHITE. When Disabled, a move cannot be initiated, although NEXT values may still be updated. The MOVE button will be grayed-out with the text “DISABLED”. This button may be clicked during a move. If this is done, the FOURAX will interrupt the move (stop). ESC key also activates ENABLE/DISABLE.

3.3.1.3 ENABLE/DISABLE BUTTON/STATUS DISPLAY

STATUS	DESCRIPTION
ENABLED <ESC>	When Enabled, this button is RED. This is a warning that a move may be initiated. This button may be clicked during a move. If this is done, the FOURAX will interrupt the move (stop). ESC key also activates ENABLE/DISABLE.
DISABLED <ESC>	When Disabled, this button is WHITE. When Disabled, a move cannot be initiated, although NEXT values may still be updated. The MOVE button will be grayed-out with the text “DISABLED”. This button may be clicked during a move. If this is done, the FOURAX will interrupt the move (stop). ESC key also activates ENABLE/DISABLE.

DANGER **DO NOT RELY ON THE ENABLE BUTTON AS AN EMERGENCY STOP. USB COMMUNICATION IS NOT SUITABLE FOR SAFETY-CRITICAL PURPOSES. IF YOU MUST PERFORM WORK ON OR NEAR THE FOURAX-700 WHERE AN UNCONTROLLED MOVE COULD CAUSE INJURY, REMOVE POWER FROM THE FOURAX-700.**

3.3.2 OPERATE TAB

The Operate Tab is the primary tab used in the FOURAX C1 Software.

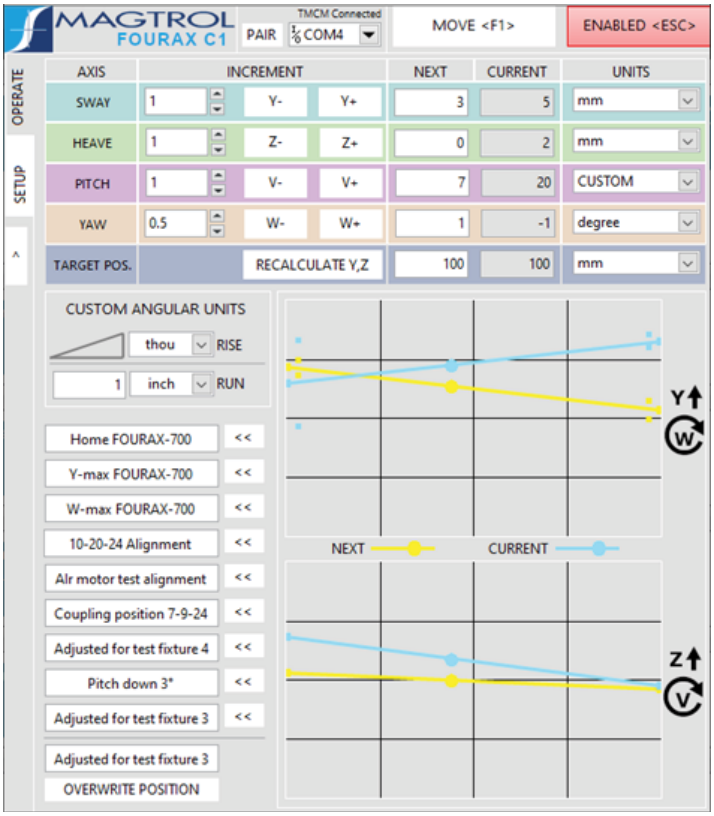


Fig.3-11 Operate tab

3.3.2.1 AXES GRID

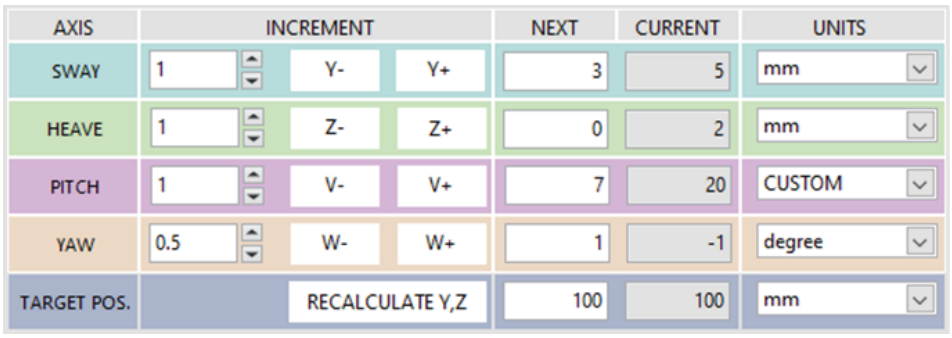


Fig.3-12 Axes grid

This grid has five rows; one for each axis of control, and one for setting the T-position. It is subdivided into the following sections:

AXIS - The name of each axis.

INCREMENT - As an alternative to entering the NEXT value directly, values may be incremented by set amounts. This can be useful if you wish to "nudge" a position by a small amount.

Increment Value Boxes - These numerical boxes show the current Increment Value for each axis. Each axis can have a different Increment Value. In addition, the Increment Value for each axis is unique for every system of units on the axis.

For example, you could choose your default Y increment to be 0.1mm when operating in millimeters, 0.005" when operating in inches.

Increment +/- Buttons - These apply the Increment Value to the NEXT value for that axis.

NOTICE Increment values are automatically stored on the PC, in the FOURAX C1 CONFIG.ini file.

NEXT - Input the desired position for the FOURAX-700.

The NEXT value may be incremented by the keyboard directly (See Fig.X-X Keyboard Reference):

(d):Y+ (a):Y-

(w):Z+ (s):Z-

(c):W+ (z):W-

(e):V+ (q):V-

CURRENT - The current position of the FOURAX-700.

UNITS - These drop-down menus select the system of units for each axis (and for the T-position). When changing units, the CURRENT and NEXT values are automatically converted.

NOTICE Selected units are stored on the PC, in the FOURAX C1 CONFIG.ini file.

TARGET POSITION - The Target Position is the point in space around which V and W rotations occur. It is also the point in space where the Y and Z position is determined. See Section 4.4 Measuring Target Position for instructions on how to physically measure this in your setup. The CURRENT and NEXT values may be entered directly, and the units changed.

RECALCULATE T BUTTON - The definition of where the machine is in X and Y is based on the T-position. Consider that if V or W are non-zero (the FOURAX-700 is at some angle), then as you move the T-position along the centerline, the Y and/or Z position will also change. See Section 4.4 Measuring Target Position .

When changing the T Position, the software can do one of two things:

1. The FOURAX-700 can move in Y and Z so that the new T position is located in the same Y and Z position as the previous T position.
2. The software can redefine your Y and Z position based on your new T position, without actually moving the machine.

   RECALCULATE T button causes the software to perform (2.). Usually, this is the preferable way to change T.

3.3.2.2 PREVIEW GRAPHS

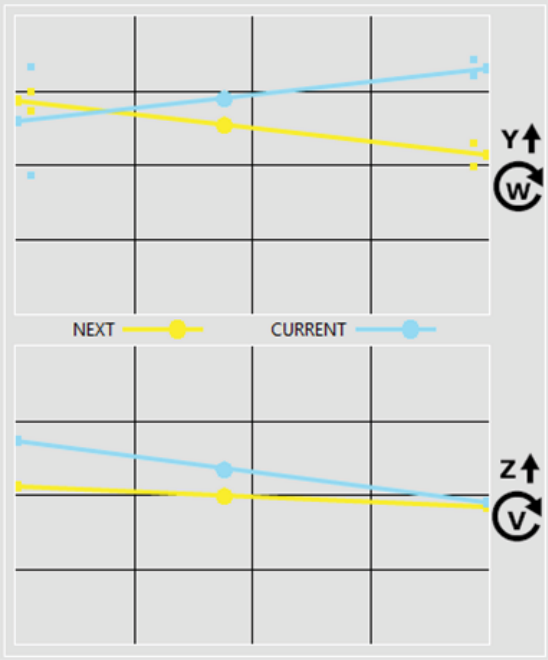


Fig.3-13 Preview graph section

These graphical views provide a visual preview of the CURRENT and NEXT positions. They are intended to help you visualize how the FOURAX-700 will move.

CURRENT information is shown in blue, and NEXT position is shown in yellow.

In each graph, the T-position is shown as a large circular dot.

NOTICE The graphs are not to scale.

XY VIEW: TOP

The top graph displays the SWAY (Y) and YAW (W). You can visualize this as looking down at the FOURAX-700 from directly above, with the left side of the graph being the Front of the FOURAX-700.

This view also shows two small circular dots at the front and two at the back. These are indications of each of the four motor's positions.

NOTICE If a dot goes off the screen, the motor is out of its range.

XZ VIEW: SIDE

The lower graph displays the HEAVE (Z) and PITCH (V). You can visualize this as looking at the FOURAX-700 from the side, with the left side of the graph being the Front of the FOURAX-700.

3.3.2.3 CUSTOM ANGULAR UNITS

In addition to many common units of angular measurement, FOURAX C1 provides a user-definable angular unit, in the form of RISE/RUN.

The RUN is defined in the X-direction (surge, or front-to-back). The RISE is either Y or Z offset along that distance.

Units for RISE and RUN are individually definable.

Purpose of Custom Angular Units

The Custom Units provide a convenient way of correcting misalignment using common measurement techniques. By measuring the Y or Z offset over a specific X distance, the offset can be directly deducted from the Yaw or Pitch value to correct the misalignment.

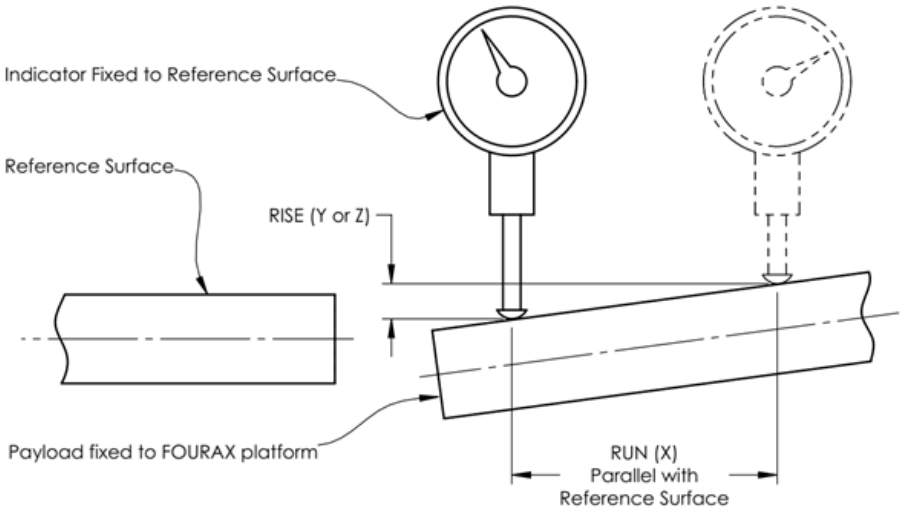


Fig.3-14 Custom angular units example

As an example, let us take the case of correcting misalignment of a motor that is to be connected to a dynamometer. The motor is secured to the FOURAX-700 platform. A dial indicator, with the units of µm, is fixed to the frame that supports the dynamometer. The dial indicator is used to measure the top of the motor shaft at two locations, 15mm apart. (The measurement is done in a direction parallel with the dynamometer shaft, “Reference Surface” in the diagram).

We could set the Custom Angular Units to use µm for RISE, and 15mm for RUN. (Our units are now in terms of µm-per-15mm). If the indicator was to read a 134µm difference between the measurement points, we could set our units for PITCH to “CUSTOM” and simply increase our NEXT Pitch (V) position by 134 to correct the misalignment.

In this example, we could complete the angular alignment of the motor by rotating the Indicator 90° to measure the side of the motor shaft, and performing the same measurement to correct Yaw (W).

3.3.2.4 SAVED POSITIONS

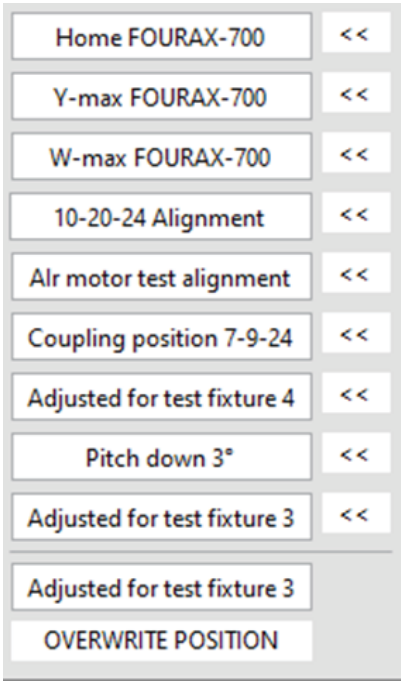


Fig.3-15 Saved positions section

FOURAX C1 provides the ability to quickly recall a number of saved Positions. Nine quick-recall rows are provided. Each row can be set to any of 50 saved Positions. Each position saves the Y, Z, V, W and T value, and the name of the position.

To change the Position for the row, click on the name of the position and select from the list.

The buttons to the right of the position name will load that position's values (including the T value) into the NEXT column.

Saving New Positions

At the bottom there is a position selector for updating. Here you choose the position you wish to overwrite. The selected position will be overwritten with whatever NEXT values that are currently input. Click "OVERWRITE POSITION" and you will see a prompt to name the position. The position will be given that name, and the Y, Z, V, W, X values will be updated.

Saved positions are stored on the PC, in the **FOURAX C1 SAVED POSITIONS.ini** file.

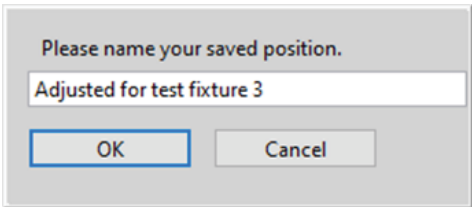


Fig.3-16 Name your saved position dialog box

If that position is already selected in one of the quick-recall rows, you will see the name update.

Minimize Button

If you need to save space on your PC screen, this button truncates the display to hide the Saved Positions and Preview Graphs.

Fig.3-17 Minimize button

3.3.3 SETUP TAB

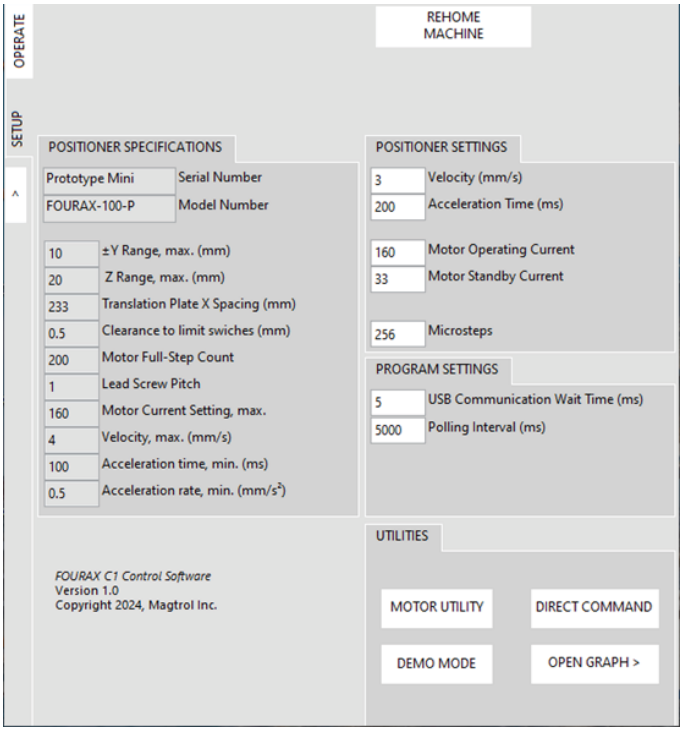


Fig.3-18 Setup Tab

The SETUP tab is used for settings and maintenance operations on the FOURAX-700.

3.3.3.1 REHOME MACHINE

This button initiates the homing sequence. In this process, the four motors move towards their minimum values until encountering their limit switches. The software then redefines “zero” for each motor.

Homing should always be done if there was a crash or an overload. Homing should also be performed when the machine is first set up.

Homing Sequence:

1. Click “REHOME MACHINE”.
2. A warning message will appear that the machine will begin to move. (Note that “zero” corresponds to low-Yaw (W) position). Click “OK” or “Cancel” after considering the message.
3. The FOURAX-700 will begin to seek the limit switches. As each motor reports that it has found its limit switch, the motors will stop. When all have found their limits, the software redefines “zero” for each motor.

4. The homing sequence is complete.

NOTICE The FOURAX-700 machine does not automatically return to the position it was in before homing. The NEXT positions are retained during homing, so you may use these to quickly return with a MOVE command.

3.3.3.2 POSITIONER SPECIFICATIONS

This is read-only display of the FOURAX-700 hardware specifications. This information is stored in the FOURAX-700 hardware itself, on the EEPROM of the Stepper-driver.

- **Serial Number** – A unique identifying number for your machine
- **Model Number** – The model name of the FOURAX
- **±Y range** – Limits of Y motion, either direction, from 0
- **Z range** – Limits of Z motion, total
- **Translation Plate X Spacing** - The distance between the front and rear spherical bearings.
- **Clearance to limit switches** - A safety margin distance between the allowable maximum motor positions, and the actual activation of the limit switches. This is to avoid triggering the limit switches except when homing.
- **Motor Full-Step Count** – The number of steps per revolution of the motors.
- **Lead screw pitch**
- **Motor Current Setting, max.** - This is a relative number between 0-255 used in the Stepper-driver that determines the current sent to the motors. This is the maximum allowable value for this FOURAX model.
- **Velocity, max.** - Maximum allowed velocity for this FOURAX model.
- **Acceleration time, min.** - Minimum allowed time to accelerate, for this FOURAX model.
- **Acceleration rate, min.** – Minimum acceleration rate allowed. (This avoids driver hangups).

3.3.3.3 POSITIONER SETTINGS

Here, settings changes to the FOURAX-700 operation can be made. Other than Velocity, most of the parameters should usually be left at the default values. This information is stored in the FOURAX-700 hardware itself, on the EEPROM of the Stepper-driver.

- **Velocity** - How quickly the FOURAX will move. It cannot be set higher than the listed maximum.
- **Acceleration Time** - Lower values result in faster acceleration. It cannot be set lower than the minimum.
- **Motor Operating Current** - During motion, the relative current to be sent to the motors. This cannot be set higher than the listed maximum. Too low a value may cause stalling.
- **Motor Standby Current** - The Stepper-driver has the ability to reduce current when the motors are not moving. This can reduce motor heat buildup.
- **Microsteps** - The Stepper-driver can operate in various microstepping modes. Usually it operates best with high microstep counts. Note that microstepping is mainly relevant for smooth motor operation, not resolution- the FOURAX-700 has 1mm pitch lead screws and 200-step-per-revolution motors, so 1 full-step equates to only 5µm (0.0002").
- **Load Velocity Adjust Slope, Load Velofity Adjust Intercept, Steady-State Truncation** - See "Load Monitoring" section, below.

3.3.3.4 PROGRAM SETTINGS

These settings affect how the FOURAX C1 software behaves. These settings are stored on the PC, in the FOURAX C1 CONFIG.ini file. The

- USB Communication Wait Time- Communication Wait Time is a parameter that affects how the PC communicates with the Stepper-driver over USB. Some delays are necessary in the software to avoid serial communication errors. This should only be adjusted if there are communication problems.
- Polling Interval- This adjusts how frequently the FOURAX C1 Software polls the Stepper-driver for status on power and the status of USB communication. Generally a few thousand ms is appropriate (a few seconds). Too short a value can cause communication dropouts.

3.3.3.5 FOURAX-700 DEFAULT SETTINGS

POSITIONER SETTINGS (ON FOURAX EEPROM)	
Velocity (mm/s)	2
Acceleration Time (ms)	500
Motor Operating Current	255
Motor Standby Current	79
Microsteps	256
Load Velocity Adjust Slope	-0.1909
Load Velocity Adjust Intercept	8.1654
Steady-State Truncation	1.1
PROGRAM SETTINGS (ON PC .INI FILE)	
USB Communication Wait Time (ms)	5
Polling Interval (ms)	5 000

3.3.3.6 MOTOR UTILITY

This is maintenance tool. Normally, you should never need to use this tool. It allows direct, individual operation of each motor.

When activated, a screen appears with (±) buttons for each motor, and a speed control.

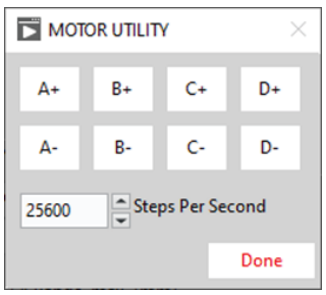


Fig.3-19 Motor utility

CAUTION In this utility there are no safety checks or limits of motion imposed - it is entirely possible to exceed the motor position limits when using this tool. In addition, motions performed in this tool are not saved in the driver - that is, the software does not update the current positions of the motors based on movements done here. **If you use this tool to move the motors, you must REHOME MACHINE.**

3.3.3.7 MOTOR DESIGNATIONS

In the FOURAX, each motor A, B, C, D is located as shown below:

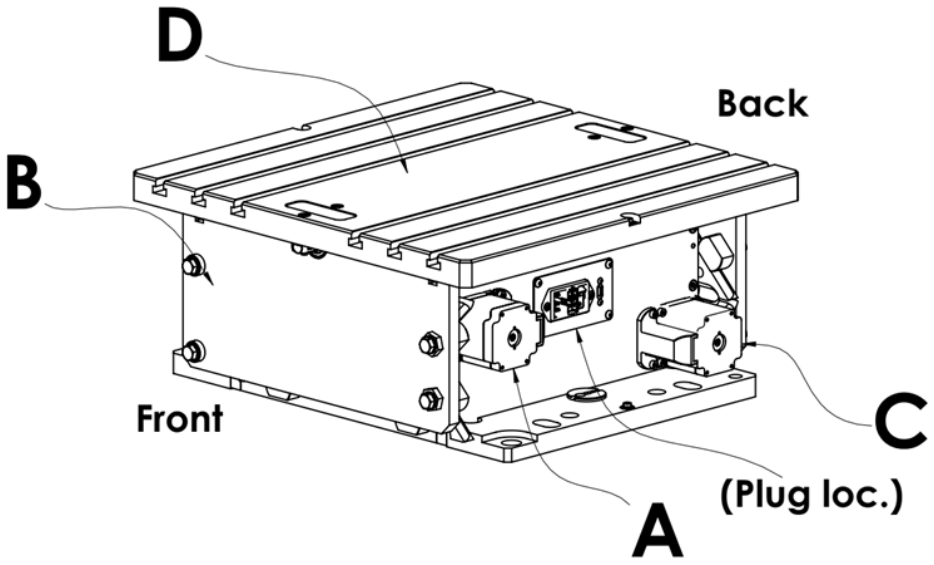


Fig.3-20 Motor designations

3.3.3.8 DIRECT COMMAND

This is a maintenance utility for sending TMCL commands to the Stepper-driver.

The FOURAX-700 uses a Trinamic® TMCM stepper controller, and this is controlled with commands from the FOURAX C1 Software. This tool allows any command to be directly sent to the stepper controller, and has some shortcuts for constructing commonly-used command types for the FOURAX-700.

CAUTION This tool should only be used under consultation with Magtrol, Inc. Engineering, as there are many ways in which improper use could create problems.

3.3.3.9 LOAD MONITORING

Load monitoring is accessed by the “OPEN GRAPH >” button in the UTILITES section of the SETUP tab.

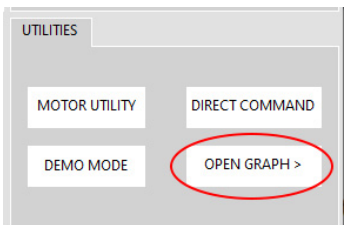


Fig.3-21 Utilites section

When activated, the screen will expand to include a graph and some additional parameters.

NOTICE Load monitoring does not affect operation; it is a display for informational purposes only.

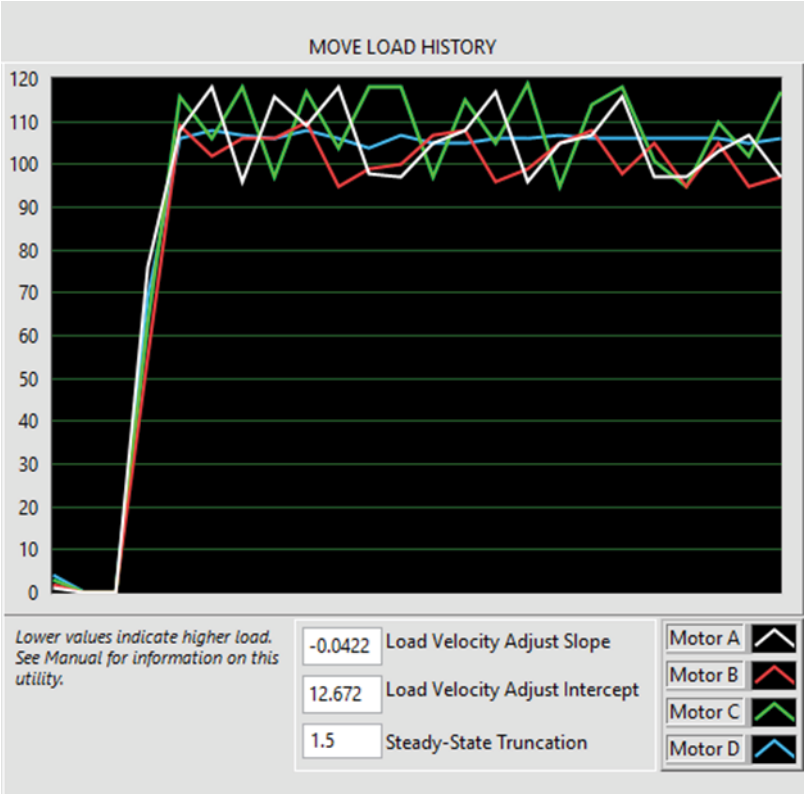


Fig.3-22 Load monitoring graph

When the graph is visible, the FOURAX-700 will gather load information during Moves, and update the graph with the load information when the Move is complete. This data is an interpretation of back-EMF sensing from the stepper driver.

There are 3 parameters that are adjustable here: Load Velocity Adjust Slope & Intercept are used to construct a linear compensation for motor speed in interpreting motor load. The driver's back-EMF detection is extremely sensitive to speed variation, which is the reason behind these numbers - the FOURAX-700 moves each motor at a different speed, during most angular moves.

Steady-State Truncation reduces the data collection to remove acceleration and deceleration phases, which can produce erratic results. A value of 0 will gather all data, including startup and slowdown data, which is less useful. A value of 1.0 will generally capture mainly the steady-state portion of the move. A value slightly higher than 1.0 can reduce spikes during the start and end of the move. (Note that for very short moves where steady-state is not reached, no data is collected).

These three parameter values are stored on the EEPROM of the stepper-driver hardware.

Purpose of Load Monitoring

The load chart results should not be overly interpreted. There are limitations on the accuracy of the back-EMF detection. Despite some level of compensation, speed still strongly affects the load detection. The back-EMF detection is also sensitive to other parameters including the motor current settings, temperature, etc. As a result, the driver values often may show erratic jumps and spikes that do not indicate any actual problem.

The load monitor is included in the software because it can be a useful diagnostic tool when used with linear motion: Y-only or Z-only moves. In these moves, where all motors are moving at the same speeds, the tool can be useful for comparative evaluation of the motors. Even in these cases, some variation between motors is expected.

3.3.3.10 DEMO MODE

Demo Mode will continuously move the FOURAX-700 through the 9 positions selected in the quick-recall rows. The mode is existed by pressing “ENABLED”, or the ESC key.

NOTICE Because it is possible to save out-of-range positions, Demo Mode checks all the quick-recall positions before starting. If any are out of range, Demo Mode will not run, and will notify you of the “offending” positions.

CAUTION Please keep in mind that the FOURAX-700 is intended for momentary and intermittent motion. Do not run Demo Mode for extended time periods, especially with high motor current settings.

3.3.4 DATA STORAGE

The Trinamic® Stepper-driver has both volatile operating RAM and non-volatile EEPROM. Some information is stored on the Stepper-driver EEPROM, and is read back from the FOURAX C1 software. Other information is stored on the PC.

Stored in TMCM Stepper-driver EEPROM, inside the FOURAX machine itself:

- Current positions of all motors A, B, C, D, (from which Y, Z, V, W is derived, along with T).
- Target Position (T)
- Positioner Specifications (see “Positioner Specifications” in “SETUP TAB”)
- Positioner Settings (see “Positioner Settings” in “SETUP TAB”), including Load monitor parameters

Stored on the PC, in the **FOURAX C1 CONFIG.ini** file:

- Unit selections
- Custom angular units
- Increment values
- Program Settings (see “Program Settings” in in “SETUP TAB”)
- Last COM selection
- Saved-position row selections

Stored on the PC, in the **FOURAX C1 SAVED POSITIONS.txt** file:

- Saved position values

3.3.4.1 NATIVE UNITS

The “native” operating units the software uses are (mm) for distances and (mm/mm) for angle. Stored values are in these units. The FOURAX C1 Software retrieves and converts to other units during operation.

When Data is Saved:

- Data stored on the EEPROM is saved whenever a Move is completed, or when a Positioner Setting is changed.
- Data stored on the PC in the .ini file is written to the .ini file on program close.
- Data stored on the PC in the .txt file (saved positions) is written when a Saved Position is modified.

3.3.4.2 KEYBOARD REFERENCE

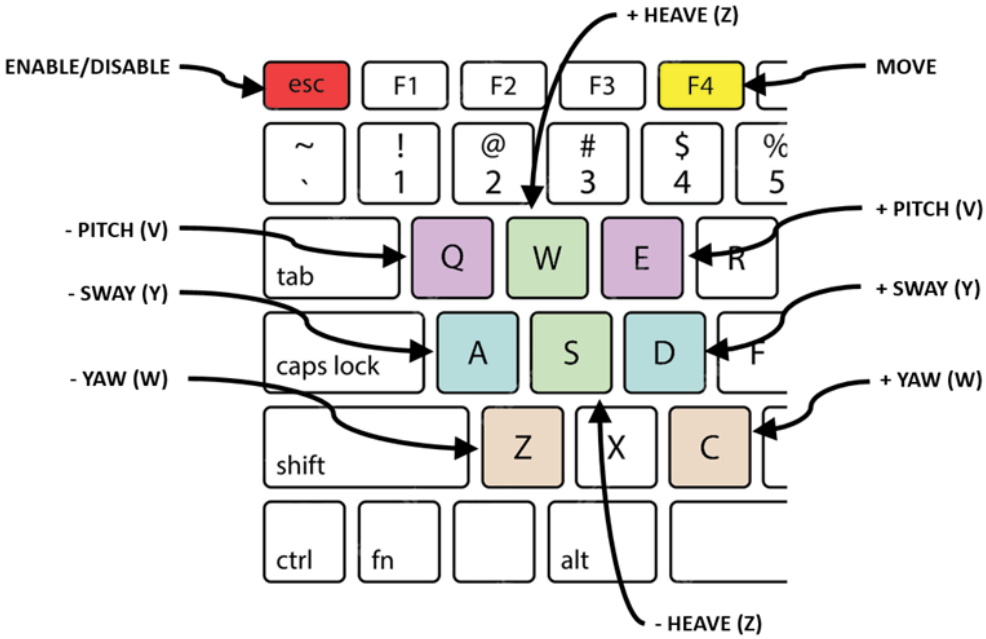


Fig.3-23 Keyboard references

4. OPERATION

4.1 PAYLOAD CAPACITY

The FOURAX-700 will operate with up to 100kg payload, (centered), on the platform.

Torque, imposed by uncentered loading or by the equipment's operation (such as motors), should not exceed 100Nm in any direction.

The **advisable** capacity of the machine depends on many factors, including:

- Mass of payload
- Balancing and centeredness of payload
- How well the payload can be secured to the platform
- Type of payload (active motor or actuator, or passive object)
- Magnitude of vibration that may be present
- The potential consequences of a failure

As a general rule-of-thumb, the FOURAX-700 is designed to handle the typical equipment that would be used with Magtrol's HD-Series Dynamometers, and WB/PB Dynamometers up to size 65. This corresponds to equipment up to about 12kW and 50Nm. Please contact Magtrol for questions on the suitability of the FOURAX-700 for your application.

4.2 SECURING EQUIPMENT

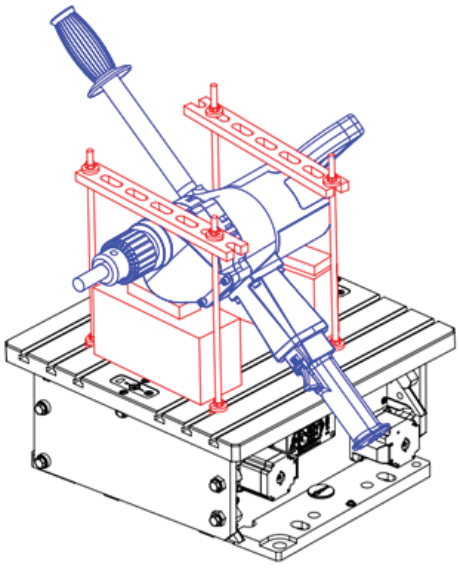


Fig.4-1 Securing your equipment example

A primary purpose of the FOURAX-700 is to allow the alignment of awkwardly-shaped test articles. If you can securely clamp the object in approximate position, the FOURAX-700 will allow you to move the object into precision alignment.

4.2.1 T-SLOTS

The FOURAX-700 includes (6) T-slots intended for 10mm T-Slot nuts. These nuts are commonly available with M8 and M6 threads. It is also possible to use 3/8" T-Slot nuts, typically threaded 5/16" or 1/4" UNC.

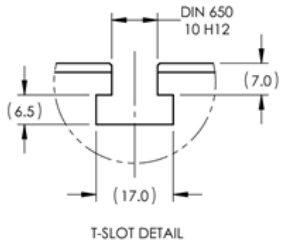


Fig.4-2 T-Slot detail

NOTICE There are infinite ways of securing equipment to the T-Slotted platform. For example, aluminum T-slot framing is a versatile way of constructing clamping fixtures.

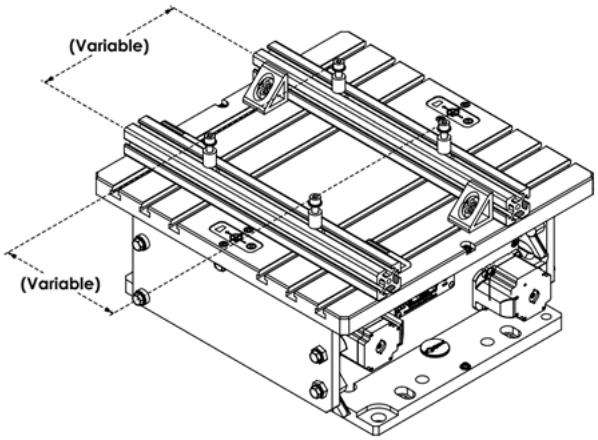
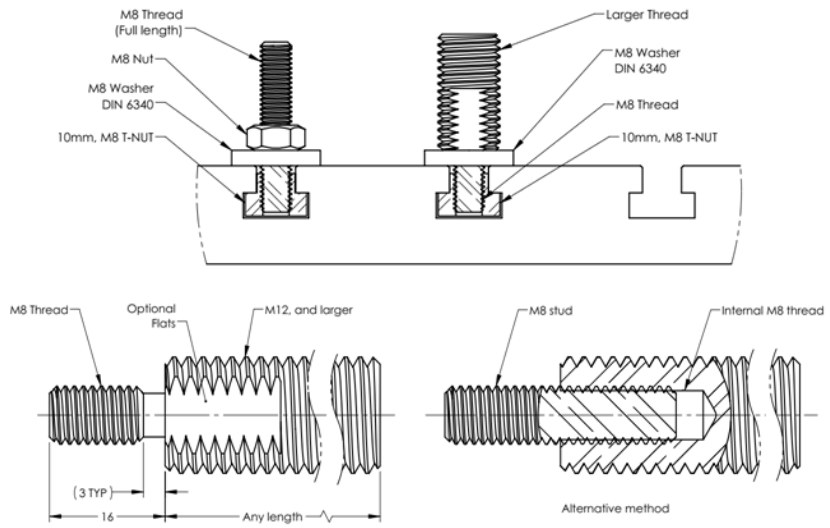


Fig.4-3 T-Slot with aluminum framing

4.2.2 THREADED ROD ASSEMBLIES (TREES)

If you typically use "trees" (threaded rod assemblies) to clamp your equipment, here are some suggestions:

- If M8 threaded rod is sufficiently rigid for your setup, then you may simply use M8 rod with 10mm T-nuts.
- If you need to use larger sizes, you may turn the end down and externally thread to M8. Alternatively, you may wish to drill and tap the end of the larger rod, and thread-in a short M8 stud.
- Another option is to bolt an existing tapped-hole plate to the FOURAX-700 platform.



4.2.3 CONNECTING COUPLINGS

Usually when connecting rotating equipment, the shafts must be aligned before connecting the coupling. However, once aligned, there may be no space to install the coupling.

4.2.3.1 USING SAVED POSITIONS TO ASSIST COUPLING

1. Mount your test payload to the Platform
2. Use the FOURAX-700 to align the shafts, and SAVE your aligned position
3. Adjust the FOURAX-700 to a position that provides clearance for coupling installation.
4. Slide your coupling onto one of the shafts, installing the coupling farther in than normal to leave space for the other shaft to swing into place.
5. Send the FOURAX-700 back to your saved, aligned position.
6. Slide the Coupling forward onto the test article shaft, and clamp the coupling to both shafts.

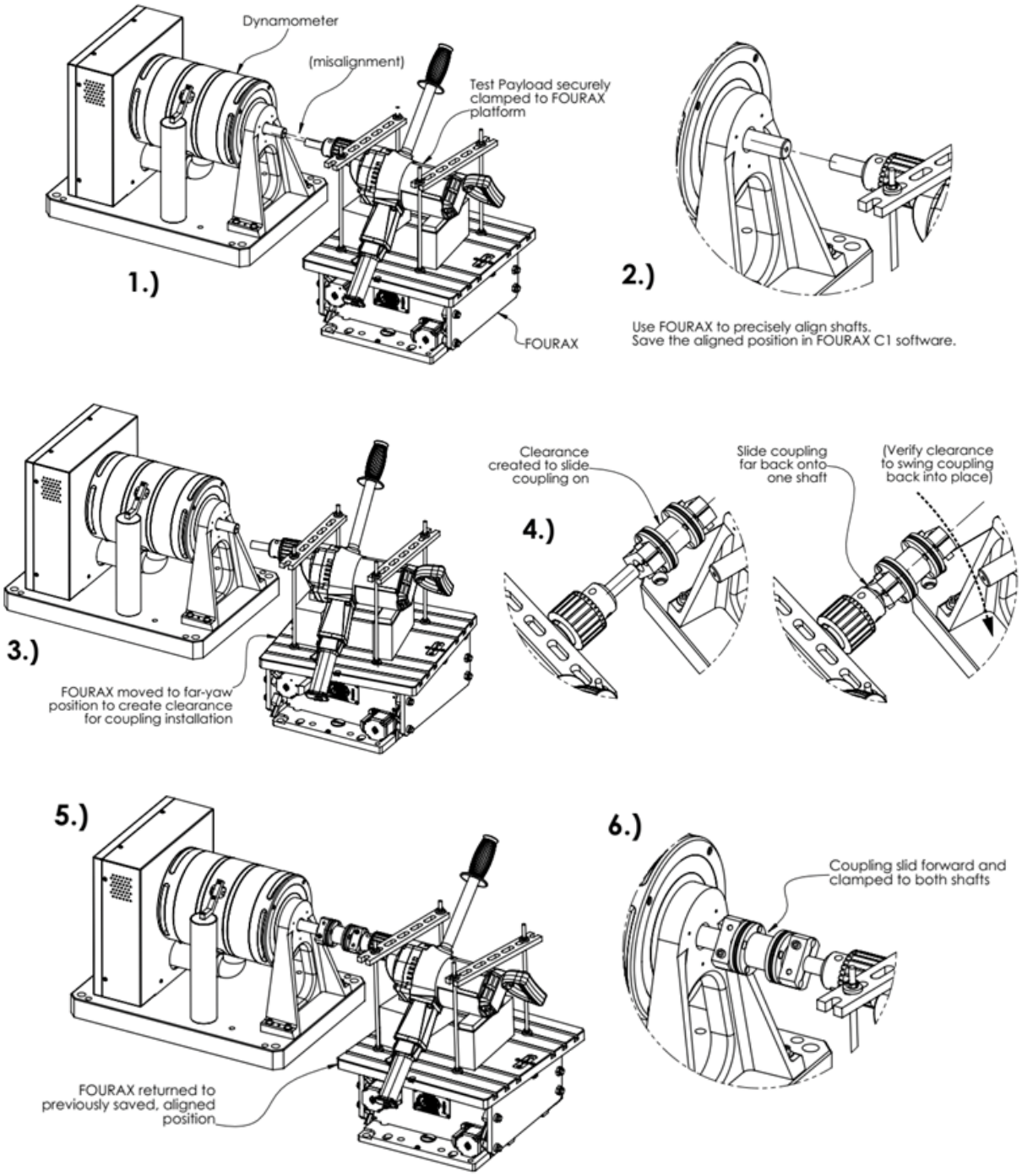


Fig.4-4 Coupling installation

4.2.3.2 ADDITIONAL COUPLING OPTIONS

Other ways to accommodate coupling connections after aligning shafts include:

- Use split, 2-piece couplings that can be installed radially.
- Mount your dynamometer or other testing device on keyways, T-slots, or slides, to allow it to slide in the X-direction, in parallel with its connecting shaft.
- Use the optional X-AXIS attachment, (Magtrol P/N 260060) which provides a manual X-adjustment for the FOURAX-700. This attachment is available integrated into a dynamometer table. (Magtrol P/N TAB FOURAX-700-XM)

4.3 DIRECTIONAL REMINDER GRAPHIC

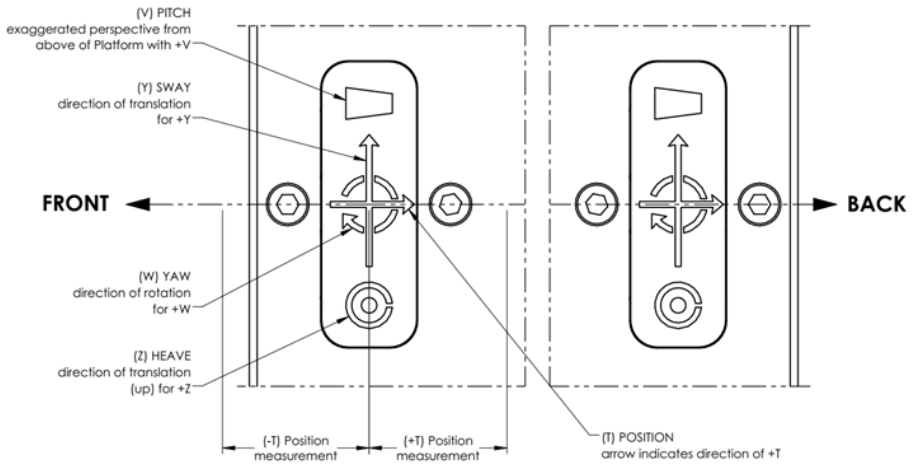


Fig.4-5 Directional reminder graphic

The FOURAX-700 includes a graphical reminder of the positive directions of motion on the Bearing Cover Plate.

4.4 MEASURING TARGET POSITIONS

The Target Position (T-position) is measured by starting at the width-wise line on the Bearing Cover Plate and measuring backwards. Note that T values may be negative if the position is in front of the front Bearing Cover Plate.

The Target Position is a theoretical point in space for which the Y and Z values are determined. Geometrically, the T-position actually falls in a line defined by the front and rear spherical bearings. Rotational motion (Pitch and Yaw) will occur around the T-position. Setting the T-position can reduce the amount to which undesired translation will occur during rotations.

NOTICE In practice, a Yaw (W) rotation will be easier to approximate around a desired point, as you may be able to locate your target item in-line with the spherical bearings, (as viewed from above). Please be aware that Pitch (V) rotation will generally result in Surge (X) translation as well, as your actual point of interest is likely to be significantly above the line between spherical bearings.

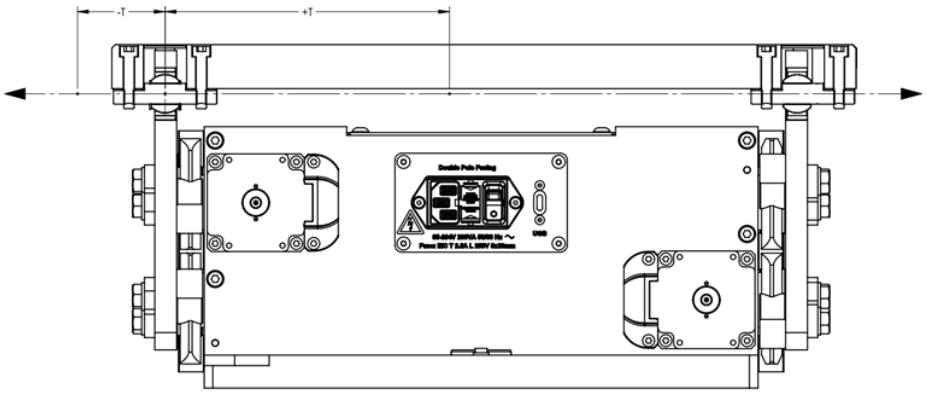


Fig.4-6 Mesuring target position

4.5 SEQUENCE OF ALIGNMENT

Usually it is easier to correct angular alignment (V, W) before correcting parallel alignment (Y, Z). This is because it can be difficult to measure parallel misalignment when there is also angular misalignment.

4.6 TESTING WITH INTENTIONAL MISALIGNMENT

One application of the FOURAX-700 is testing the performance of rotating equipment under a known, controlled misalignment. For example, this could be done to understand the effect of side-load on motor bearings.

Using Saved Positions can be helpful when performing repeated testing under different alignment conditions.

When adjusting intentional angular misalignment, it is best to keep the Pitch value (V) fixed and properly aligned, and use Yaw (W) as the variable. Your motor shaft should be mounted close to the centerline of the Platform to allow you to place your T-position near the central flex point of your coupling.

5. TROUBLESHOOTING & FAQ

5.1 TROUBLESHOOTING

The software will not Pair to the FOURAX

- Usually this is a problem with the USB communication. First, try restarting FOURAX C1 SOFTWARE. If this does not solve the problem, close the software, and reconnect the USB cable. Verify that your PC is recognizing the FOURAX-700 as a “USB Serial Device” in the Windows Device Manager.
- If you are using a different USB cable that the one supplied with your machine, try another type. Not all USB cables are of equivalent quality.

The software is stuck on “MOVE”, and never reports “AT POSITION”, even though the FOURAX-700 has stopped moving.

- There was probably a communication glitch. Press “ENABLED” (esc) and see if you can carry on from that point. If not, restart the FOURAX C1 software.

5.2 FAQ

How do I know if the FOURAX-700 is adjusted correctly?

- When adjusted correctly, there should be no discernable play or looseness to the platform. If you detect play, it is possible that the gibs need adjustment. Contact Magtrol, Inc.

Should I lubricate the FOURAX-700?

- No. The gibs and lead screws are all self-lubricating. Do not apply any lubricants to the FOURAX-700.

SERVICE INFORMATION

RETURNING MAGTROL EQUIPMENT FOR REPAIR AND/OR CALIBRATION

When returning equipment to MAGTROL INC. (United States) or MAGTROL S.A. (Switzerland) for repair and/or calibration, a completed **Return Material Authorization (RMA) form is required.**

Please visit the «Services/Return and Calibration» section on our web site www.magtrol.com.

Depending on where the equipment is located and which unit(s) will be returned, you will be directed to either ship your equipment back to MAGTROL, INC. in the United States or MAGTROL S.A. in Switzerland.

RETURNING EQUIPMENT TO MAGTROL INC. (UNITED STATES)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure. Complete the RMA form online and submit.
2. An RMA number will be issued to you via e-mail. Include this number on all return documentation.
3. Ship your equipment to: **MAGTROL, INC.**
   70 Gardenville Parkway
   Buffalo, NY 14224 | USA
   Attn: Repair Department
4. After Magtrol's Repair Department receives and analyzes your equipment, a quotation listing all the necessary parts and labor costs, if any, will be e-mailed to you.
5. After receiving your repair estimate, provide Magtrol with a P.O. number as soon as possible. A purchase order confirming the cost quoted is required before your equipment can be returned.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL INC.

After Sales, Repair & Calibration Services

phone +1 716 668 5555 ext. 115
fax +1 716 668 3162
e-mail service@magtrol.com

RETURNING EQUIPMENT TO MAGTROL S.A. (SWITZERLAND)

1. Visit the «Services/Return and Calibration» section of Magtrol's web site www.magtrol.com to initiate an RMA procedure; complete the RMA form online and submit.
2. After your request has been reviewed, you will receive an email containing an RMA number and dedicated return instructions including specifics about shipping details. The RMA number will be a Magtrol SA internal repair order (SR-xxxx) reference.

   Any **shipment sent without an RMA risks delays and possible rejection,** so please wait until you receive the email with the details you will need to properly return your equipment.

   Any **equipment returned for credit must be approved** prior to return and is subject to a re-stocking fee.

CONTACT FOR AFTER SALES SERVICE AT MAGTROL S.A.

After Sales, Repair & Calibration Services

phone +41 26 407 30 00
fax +41 26 407 30 01
e-mail repair@magtrol.ch

REVISIONS TO THIS MANUAL

The contents of this manual are subject to change without prior notice. The latest updated versions of our manuals are available and downloadable at any time on Magtrol's website www.magtrol.com in the « SUPPORT » section.

To ensure that you have the latest version, compare the issue date (on the back of this manual) with the last updated document available on our website.

The table of revisions below lists the significant updates that have been made.

REVISION DATES

DATE	EDITION	CHANGES	SECTION(S)
09/09/2025	1st Edition	Release	All

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FOURAX-700 | User Manual | 1st English Edition | 09 / 2025