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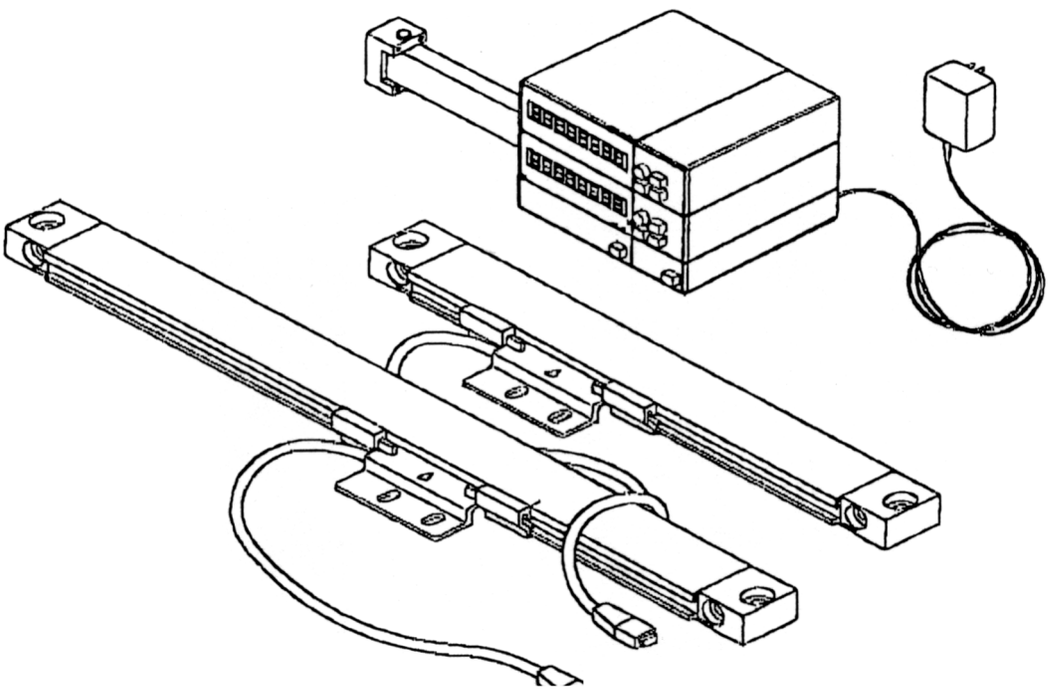
572 Series

Digimatic Scale System



Installation Manual

Mitutoyo

INSTALLATION SAFETY SUMMARY

To obtain the high degree of precision associated with a MITUTOYO linear scale system, the scale system must be installed properly. Fortunately, properly installing the scale is not difficult. The main requirement is to read this manual and follow the instructions carefully. Failure to install the scale properly or improper use will void the warranty.

Manual Conventions

In this manual, the convention for calling out a readout key is to place the key label in all capital letters. For example, "press PRESET" refers to the operator pressing and then releasing the key labeled "PRESET". If it is necessary to hold the key down, the instructions will so indicate.

Safety Summary

WARNING: This product is not designed to be used in a hazardous environment. To avoid an explosion, which may cause severe injury or even death, do not operate this product in an environment where flammable gases or other highly combustible materials (dust, liquids, etc.) are present.

CAUTION: To avoid an electrical shock, use only the power supply provided with this product.

NOTICE: The power supply for this product operates on a 115 VAC power source. Do not use any other power source.

NOTICE: Properly ground the readout to provide maximum protection from electrical noise. Electrical ground to the machine tool is accomplished by connecting the ground wire from the GROUND terminal on the readout to the machine frame. Make sure that the machine tool itself is grounded. See "4.3 Cable Connections" for more information on proper grounding.

Warranty

In the event that the Mitutoyo Digimatic Scale System should prove defective in workmanship or materials within one year from date of purchase for use, it will be repaired or replaced, at our option, free of charge upon its return to us prepaid.

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1. DESCRIPTION

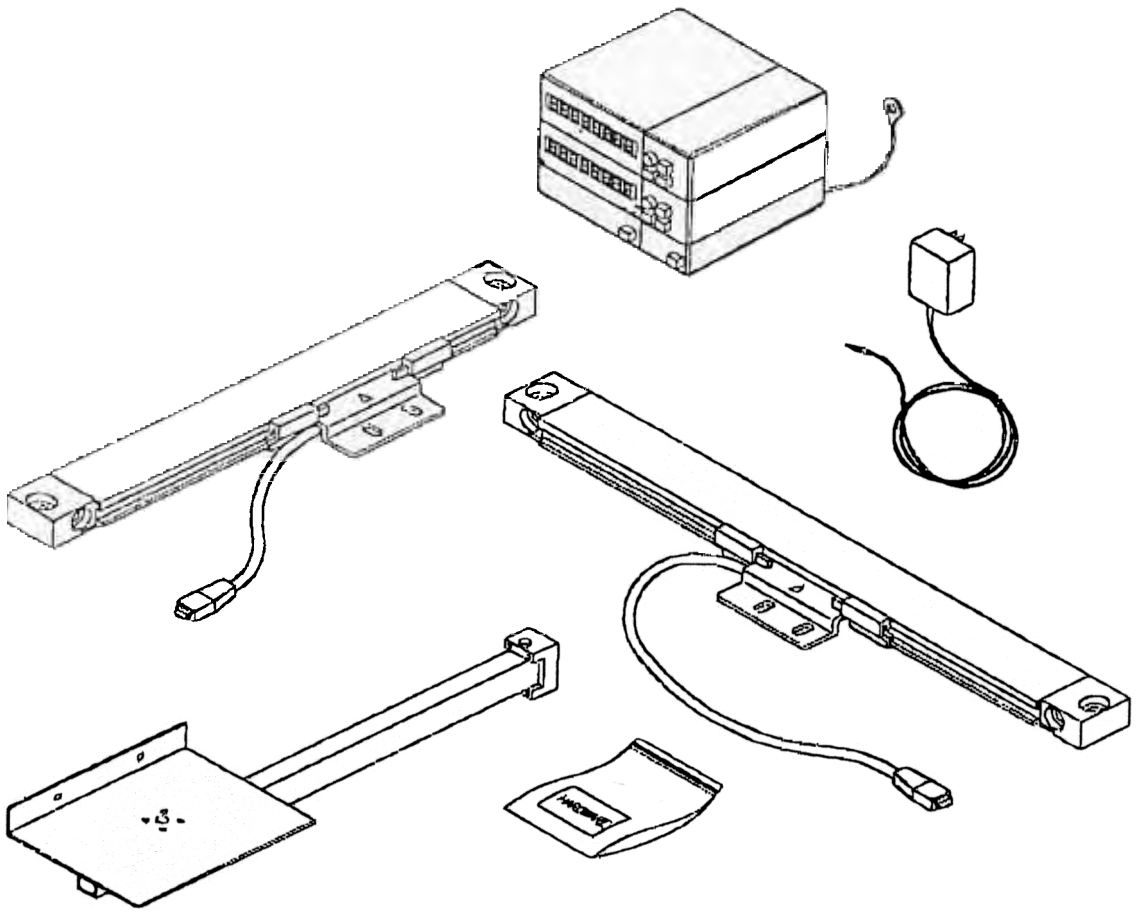


Figure 1. Digimatic Scale System Components

The Digimatic Scale System includes the components listed below. See Figure 1 above for identification.

Component:	Description:
DIGITAL READOUT	The digital readout LED displays indicate the current position of the workpiece for the X and Y axes. The readout allows the input of "presets." All operator interaction with the scales is through the readout. The ground wire is used to ground the readout to the machine.
SCALE	There are two scales: a long one for the X axis and a short one for the Y axis. They attach to the machine tool worktables and measure table movement. Each scale has two major parts: a spar and a reader head:

SPAR	A long, slender, aluminum extrusion with a "scale" inside. At each end of the spar there is an end cap to allow mounting to the machine tool.
READER HEAD	Used to measure movement along the spar. A hardwired signal cable connects the reader head to the readout. The reader head contains two slotted holes for mounting.
MACHINE ARM	Used to mount the readout to the machine tool. The readout is attached to the tray. The machine arm adjusts to allow ease of viewing.
MOUNTING HARDWARE	Clips, shims and fasteners used to install the scale system.
POWER SUPPLY	Converts standard single phase, 115 VAC, 50-60 Hz power to the low voltage DC power used by the scale system. The scales are powered through the readout.
POSITIONING BLOCKS	Keeps the reader head properly aligned with the spar during shipping and installation. **Do not remove before the scale is completely installed.**

2. PLANNING THE INSTALLATION

2.1 Installation Overview

The operations listed below are performed in installing the Digimatic Scale System.

Step:	Description:	Section of Manual:
1	Make sure the scale effective measuring range is not less than the work table range of travel.	2.2 Checking Scale Fit
2	Prepare the machine tool.	2.3 Machine Tool Preparation
3	Design the general layout of the scale system.	2.4 Installation Requirements and Guidelines
4	Make mounting brackets and covers.	2.5 Mounting Bracket and Cover Fabrication
5	Install the scales. Spar first, then the reader head.	3. SCALE INSTALLATION
6	Install the machine arm.	4.1 Machine Arm Installation
7	Attach the readout to the machine arm tray. Also attach the readout ground wire to the machine arm tray.	4.2 Readout Installation
8	Attach the signal cables to the readout, and clip to the machine tool where necessary.	4.3 Cable Connections
9	Plug in the power supply.	4.4 Power Supply Connection
10	Check out the installation, and make any corrections.	5. CHECKOUT
11	Fine tune the readout: count direction and machine error correction.	6. FINE TUNING

2.2 Checking Scale Fit

The *worktable range of travel* is the total amount the worktable moves left and right of center. If a worktable's range of travel is unknown, it can be determined by moving the worktable as far as possible in each direction, and marking the spindle location on the worktable. The worktable range of travel is the distance between the two marks. See Figure 2.

To have the right size scale, the *scale nominal range (L1)* must be equal to or larger than the worktable range of travel. See Figure 8 and its accompanying table for the different scale ranges.

NOTICE: To avoid damaging the reader head and spar, the worktable range of travel must be less than the *scale mechanically permissible range (L4)*. If it is not, modify the machine tool to reduce the worktable range of travel or acquire a longer scale. To limit the worktable range of travel use mechanical stops or other methods. Make sure permanent stops are used. Do not use adjustable stops (if they get changed, damage to the scale is inevitable).

The scale mechanically permissible range (L4) is the maximum distance the reader head can travel in the spar before it hits the scale end caps. The scale mechanically permissible range (L4) is slightly longer than the scale nominal range (L1).

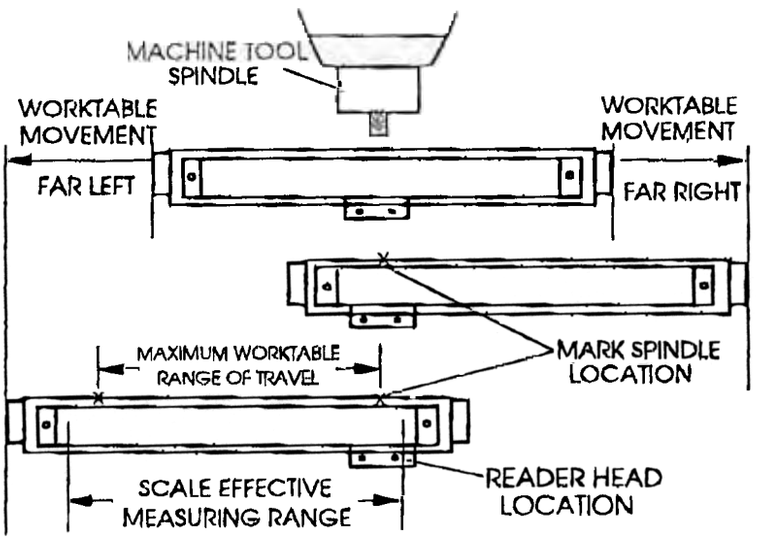


Figure 2. Worktable Range of Travel and Scale Nominal Range (L1)

2.3 Machine Tool Preparation

Machining accuracy not only requires accurate measurement (provided by the Digimatic Scale System), but it also requires that the machine tool be accurately adjusted. For this reason, check the machine tool for play and vibration in moving members such as: worktables, knee, saddle, spindle, etc. As necessary, tighten the gibs, clamps and others, to secure the best possible machining accuracy.

2.4 Installation Requirements and Guidelines

Before installing the scale system, examine the machine tool to determine the best locations to install the scales, machine arm and readout. Figure 3 shows a typical installation of a scale system on a machine tool. Observe the requirements and guidelines which follow:

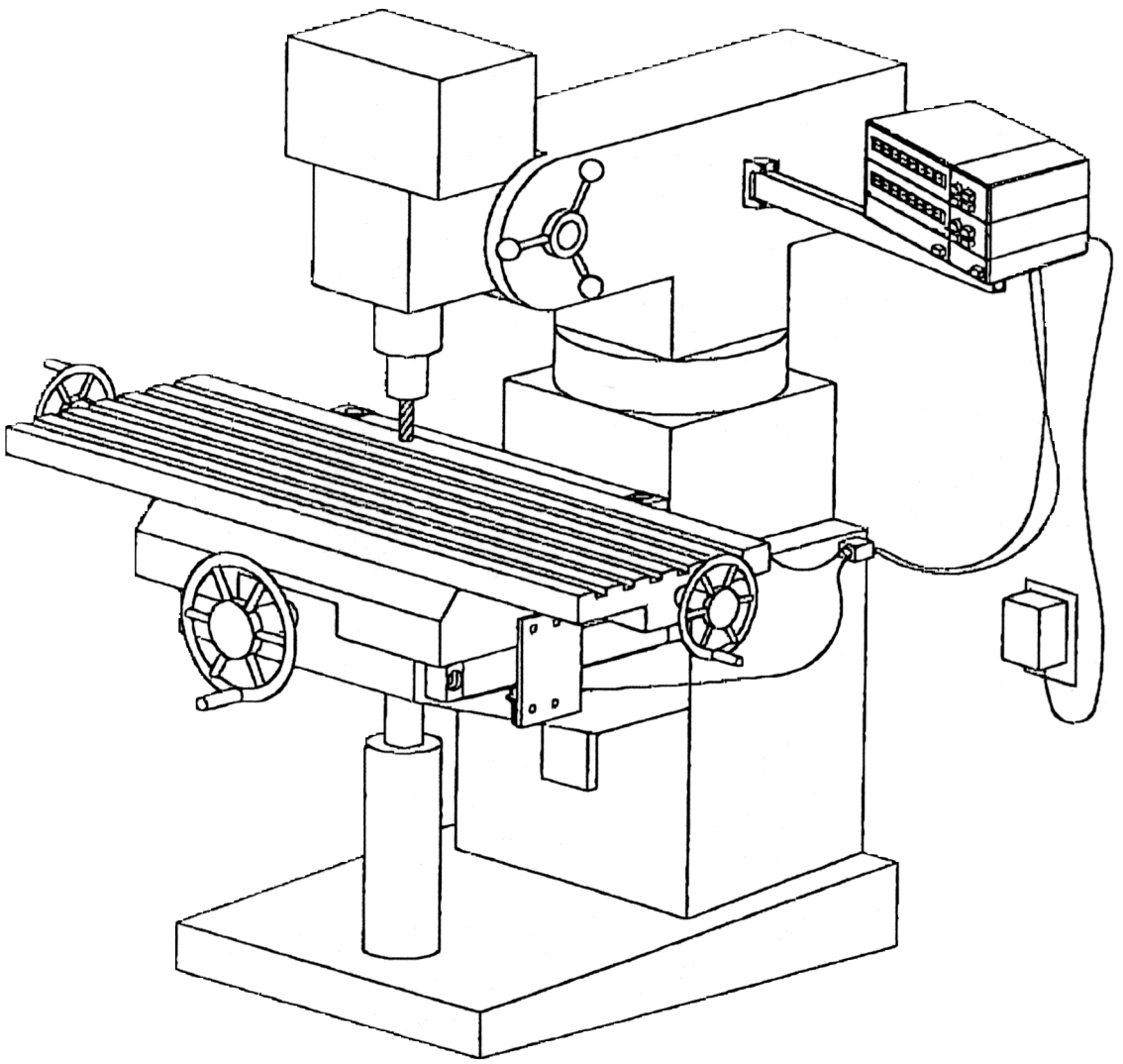


Figure 3. Typical Scale System Layout

Scale Layout:

- One of the scale components (spar or reader head) moves with the worktable and the other is stationary. Keeping the reader head stationary is preferred because then the signal cable does not have to move and can be permanently secured.

  As long as space permits, mount the X axis spar to the worktable and mount the reader head on a stationary part. The Y axis usually has the reader head mounted to the worktable with a mounting bracket and the spar attached to the knee of the machine.

  To prevent bending or damaging the spar, the surface to which the scale is mounted must be machined flat. On most milling machines, the front and back faces (or sides) of the worktable are machined surfaces and are the best places to mount the scales.

  The X axis scale may be mounted on the front (operator side) or back (machine side) of the worktable. An advantage of mounting on the front side is ease of access for mounting and service. A disadvantage of mounting on the front side is that the scale is more likely to be damaged by impact and debris.

  Most X axis scales are mounted on the back side of the worktable. Installation is slightly more difficult, but once installed the scale is better protected.

  In most cases, mounting the scale on the back of the worktable will reduce the available Y axis travel of the worktable by the width of the scale, 0.87 in. (22 mm). So Y axis travel must be limited to prevent the scale from being crushed between the worktable and the rest of the machine tool. Attaching a 1.2 in. (31mm)Table Stopper to the Y axis ways accomplishes the task easily.

- The scale (spar and reader head) must be centered on the worktable length.

- Install the scales as close as possible to the ways of the machine tool. The closer the scale is to the ways, the higher the accuracy of measurement.

- The scale end caps are designed to provide a small clearance between the spar and the machine tool. Either face of the scale can be mounted to the machine tool.

- To prevent the reader head from being directly exposed to chips and cutting fluid, the scale must be installed with the reader head down. See Figure 4. The scale is not designed to be mounted with the reader head mounted up or sideways. See Figure 5.

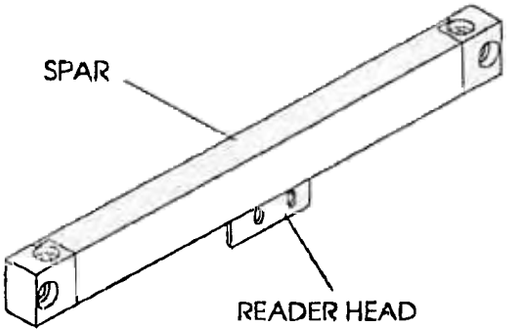


Figure 4. Reader Head Down

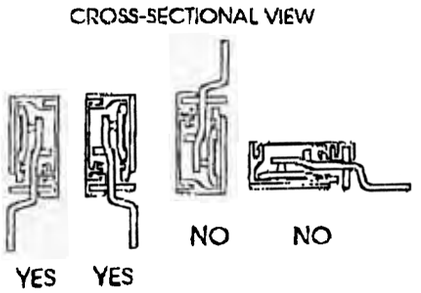


Figure 5. Scale Orientation

A scale cover is recommended. The cover will help protect the scale from coolant, dirt, and dust as well as shocks or blows.

Attach the scales to parts of the machine tool that will not be damaged by the attachment. **Do not mill or drill** additional slots or holes in the scale. **Do not weld** on the scale or the machine tool.

In most cases, mounting brackets will be required to install at least one of the scales. See "2.5 Mounting Bracket and Cover Fabrication" for more details about mounting bracket design.

Machine Arm and Readout Layout:

- Choose a location where the readout keys will be convenient to the operator (for entering origins and presets) and where the display will be easy to read.

- Avoid locations where the readout is exposed to flying chips, cutting oil, or machine oil.

- Avoid exposure to direct sunlight or hot air. Do not place in front of a heater vent.

- Avoid electrical interference. Position the readout at least 0.5 m (20 in.) from a high voltage source, a high current source, or a power relay.

  If it is impractical to avoid environmental exposure, install covers and shields to protect the readout.

- The machine arm is designed to mount to a vertical surface. Mounting to a horizontal surface requires fabrication of a different mounting bracket.

- The readout is electrically grounded to the machine tool through the readout ground wire. Attach the ground wire to a metal part of the machine tool frame which has a path to the machine tool electrical ground.

Signal and Power Cable Layout:

- Check that the signal cable length is sufficient for the planned cable routing. Where the reader head moves, take extra care in routing the signal cable to avoid damaging it as it moves.

  Avoid interference by placing the reader head signal cable and the readout power supply cable at least 40 in. (1 meter) away from any high voltage lines (e.g. the machine tool power line, etc.).

- Never route a signal cable parallel to a high voltage line. If a signal cable must be routed close to a high voltage line, have it cross the line at right angles.

- If possible, provide a dedicated electrical circuit for the scale system. For more details, see "4.4 Power Supply Connection."

2.5 Mounting Bracket and Cover Fabrication

The brackets shipped with the scale system are sufficient for many installations.

However, some installations require additional mounting brackets or scale covers. For example, a mounting bracket may be required to hold the reader head for the Y axis in place. The mounting brackets span from the mounting holes on the spar or reader head to a mounting surface on the machine tool. See Figure 6.

Design and fabricate the mounting brackets before proceeding with the installation. See Figure 8 for scale dimensions. To determine the dimensions and shape of a scale mounting bracket:

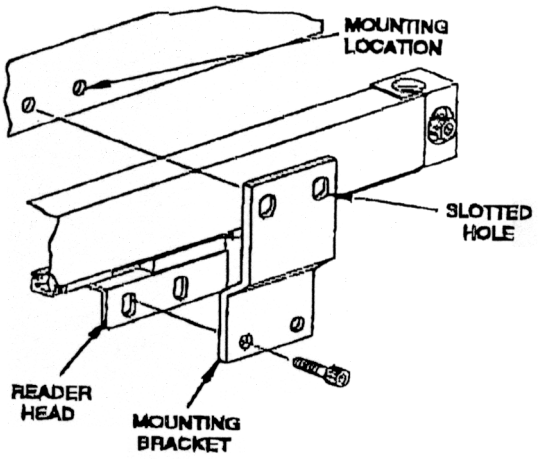


Figure 6. Reader Head and Mounting Bracket

1. Position the worktable at the center of its range of travel.

2. Determine exactly where the scale will be installed. Make sure that the center of scale's measuring range is on the center of the worktable's range of travel and the reader head is centered on the spar when the worktable is at the center of its travel. Position the scale on the worktable. Otherwise, use the dimensions in Figure 8 and its accompanying table. Note that:

To insure proper scale function, use the positioning blocks to keep the reader head properly positioned with respect to the spar. A mounting bracket which will permanently hold the reader head in place must maintain the same reader head alignment.

When the worktable is moving, the spar and reader head must not interfere with any part of the machine tool (lever handle, limit switches, junction box, etc.).

3. The reader head mounting holes provide adjustment in the vertical (up to down) direction. Shimming provides adjustment in the horizontal (in and out) direction.

We reccommend not mounting the scale irregular surfaces due to potential alignment difficulties.

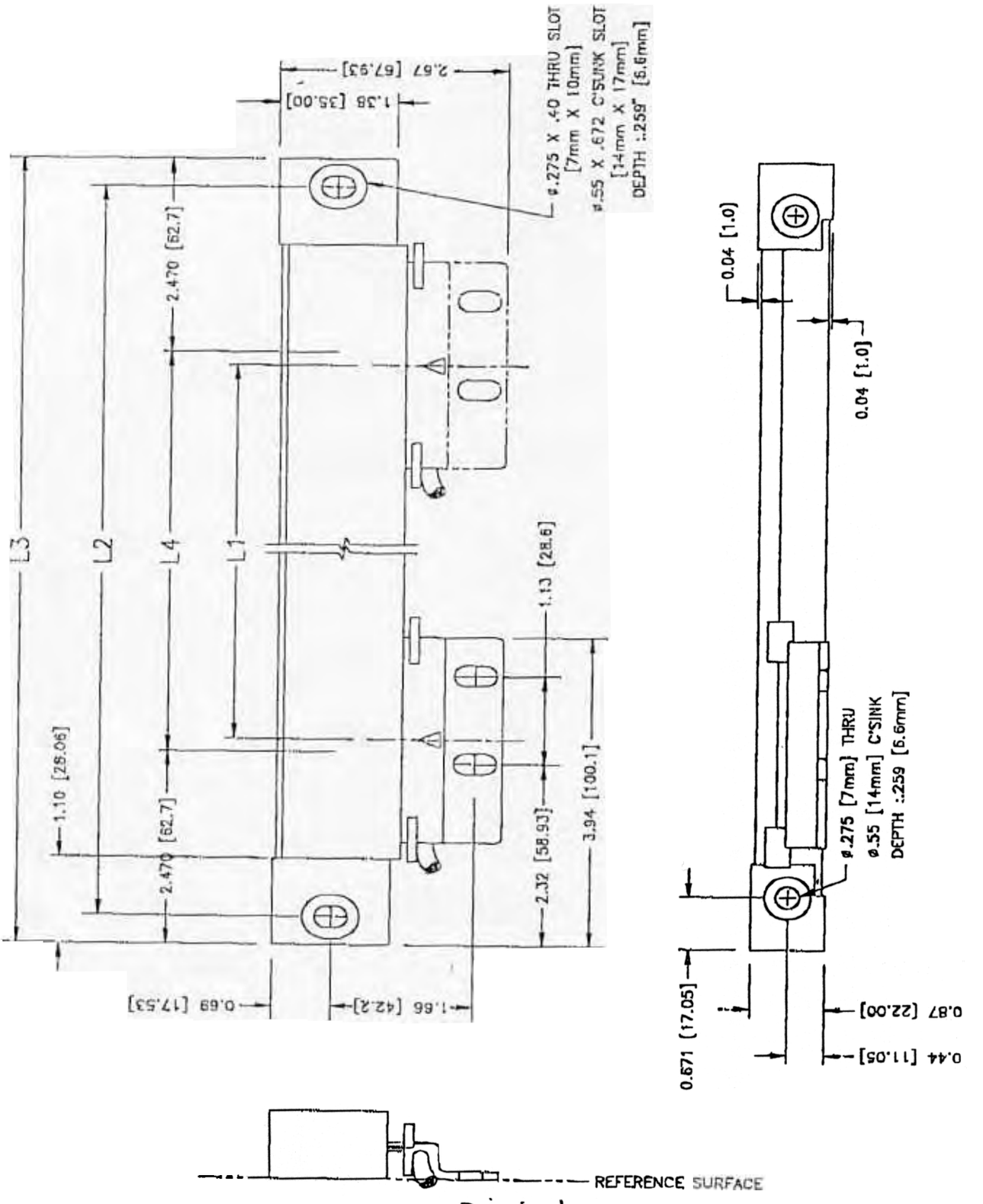


Figure 8. Scale Dimensions

Dimensions: See Figure 8 for the locations of dimensions L1 through L4.

Code No.:	L1* Nominal range (in.)	L2 Distance between mounting holes (in.)	L3 Overall length (in.)	L4 Mechanically permissible range (in.)	Signal Cable Length (feet)
572-125	13	18.250	18.959	14.011	10
572-127	16	21.250	21.959	17.011	10
572-132	30	34.750	35.459	30.511	10
572-134	36	40.437	41.146	36.198	10

*L1: The effective length of the scale over which the reader head can accurately measure distances.

2.6 Mounting Hardware

To facilitate installation, the following items are provided:

Usage:	Qty:	Description:
Mounting the Spars		
Screw (Long Length)	4 (2 per scale)	1/4 - 20 NC, Sckt Hd Cap Screws
Washer	4 (2 per scale)	6 mm
Mounting the Reader head		
Screw (Short Length)	4 (2 per scale)	1/4 - 20 NC, Sckt Hd Cap Screws
Readout to Machine Arm Tray		
Screw	2	10 - 32 NF Screws
Washer	2	No. 10 Lock washer
Cable Clips		
Clips	6	
Screws	6	
Mounting the Pedestal		
Screws (Short Length)	4	1/4 - 20 NC, Sckt Hd Cap Screws
Shims	1 each size	(0.3, 0.4, 0.5, & 0.6 mm thick)

2.7 Recommended Installation Tools

Hand Tools: Power drill, drill bits, screwdriver set, hand tap set, scriber, Allen wrench set, pliers, pincers, center punch, ballpeen hammer, files, magnetic stand (to hold the dial indicator), oil stone and marking pen.

Measuring Tools: Vernier caliper, steel rule, dial indicator, test indicator, and thickness gauge.

Fittings and Fasteners: Shim stock, socket head cap screws and plain and lock washers (in amounts needed for mounting brackets), pan head screws and nuts (for securing scale covers).

3. SCALE INSTALLATION

To obtain the greatest scale accuracy, the scale should be installed and aligned carefully.

3.1 X Axis Installation

In most cases, the X axis scale can be installed without additional mounting brackets using the instructions below. If the mill already has properly positioned and sized scale mounting holes, skip steps 1 and 2 and use the existing holes.

1. Center the worktable in the middle of its range of travel. Hold the scale against the worktable in the approximate location where it will be located. Mark one mounting hole at each end cap. Measuring down from the top of the worktable, the two holes should be vertically within .010 in. (.25 mm) of each other.

2. Drill and tap the two 1/4 - 20 NC holes.

3. Attach the scale to the machine tool. See Figure 9. Use the 1/4 - 20 NC x 7/8 in. socket head cap screws provided.

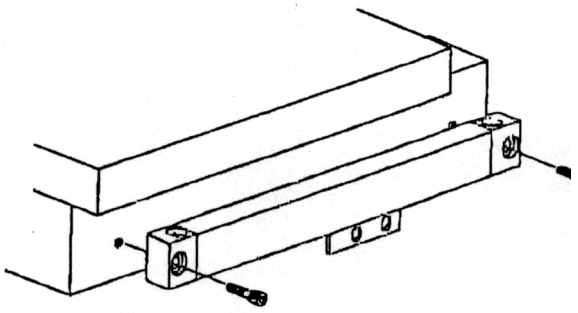


Figure 9. Scale Installation

4. Align the two ends of the spar to the machine tool ways (axis of movement). Align both faces. Align the outside face first, to avoid having to realign the top (or bottom) after shimming one end cap out.

The goal during the alignment of the spar is to align the two ends of the spar (not the end caps) as near as possible to each other and the machine tool ways. Some spars may have slight twists or bends, that are normal, cannot be adjusted out by the installer, and will not significantly affect accuracy.

NOTICE: To avoid binding which will damage the scale and may make it inoperable, align the spar as close as possible to the machine tool axis of movement.

Outside Face: Rigidly mount the indicator with a magnetic stand or similar device to a stationary member (the knee or spindle of the machine tool, or the floor, for example). Manually feed the worktable from one extreme of travel to the other. The desire is to align the two ends of the spar, but since the worktable will not travel that far, use locations on the spar as near as possible to the end caps and close to case joint. See Figure 10.

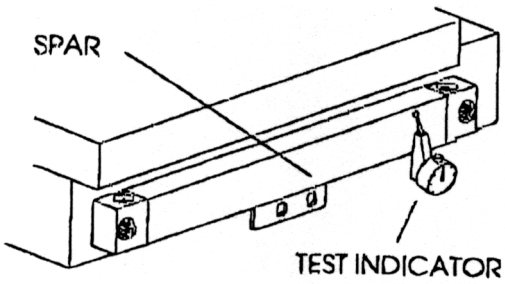


Figure 10. Side Alignment

If the indicator readings at the extremes of travel differ by more than .010 in. (.25 mm), reduce the distance to as close to zero as possible. Do this by shimming and adjusting the attachment at the end caps.

Top (or Bottom) Face: As long as the scale or end caps do not protrude above the top of the worktable, the distance from the top of the spar to the top of the worktable is unimportant. However, the top of both ends of the spar should be the same distance from the top of the worktable.

Check the alignment by laying a flat object across the worktable, and measure the distance between it and the top of the spar next to each end cap with a gauge block, feeler gauge or other measuring device. See Figure 11. If the two ends of the top of the spar are not within .010 in. (.25 mm) of each other, adjust the scale at an end cap until they are.

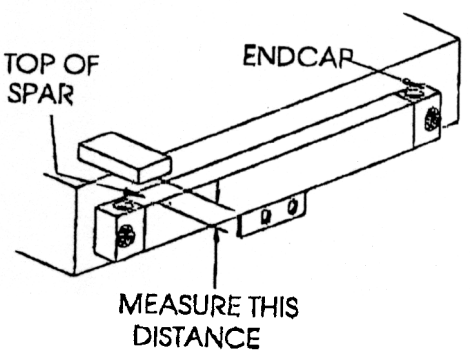


Figure 11. Top Face Alignment

Important: The above procedure assumes the top of the worktable is aligned parallel with the machine tool ways within .005 in. (.13 mm). If in doubt, check the alignment of the worktable at each end cap using a dial or test indicator.

8. Remove the positioning blocks by sliding them away from the reader head tabs (in the directions indicated by the arrows) and pulling them out of the end of the spar. See Figure 13. If the reader head is in the correct mounting location, the positioning blocks should slide off and on the reader head tabs. If they will not slide on and off readerhead tabs, check the detector head alignment.

   Save the positioning blocks for later scale removal and installation, or to return the scale for warranty reasons. They will be required for proper re-alignment of the reader head.

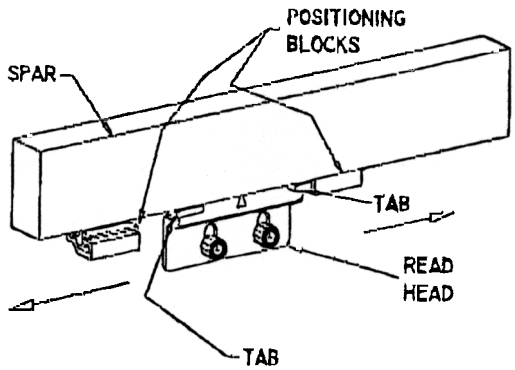


Figure 13. Removal of Positioning Blocks

9. Check the travel of the worktable through its whole range of travel. The reader head should not be able to exceed its recommended travel.

10. Install a worktable stop to protect the scale from being crushed if the Y axis is moved too close to the column of the machine.

3.2. Y Axis Installation (With Bracket)

The following instructions describe the installation of the Y axis scale using the mounting brackets provided with the scale system. The brackets have slotted holes that allow adjustments. See Figure 13A. Most Y axis scales can be mounted this way. If custom mounting brackets are fabricated for the installation, install the scale carefully, observing the guidelines regarding reader head and spar alignment discussed in "3.1 X Axis Installation" above.

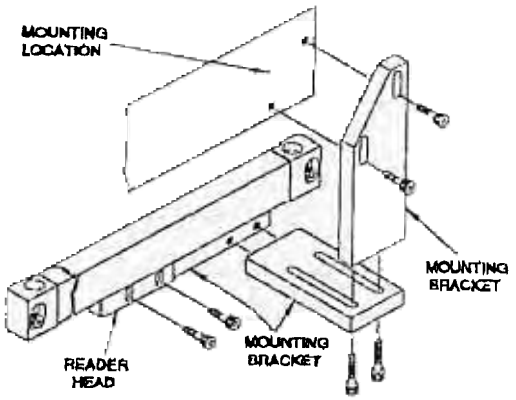


Figure 13A. Y Axis Mounting Hardware

1. Attach the *cross travel bracket* with .200 in. spacers to the right hand side of the knee of the machine tool. Use two of either the 3/8 -16 NC x 1 in. or 1/4 - 20 NC x 1 in. socket head cap screws. If the machine tool does not have pre drilled holes, appropriate holes will need to be located, and then drilled and tapped.

   If necessary, scrape excess paint or scale from the bosses to allow the spacers to fit flush against machine tool.

2. Attach the Y axis scale to the cross travel bracket or knee with two 1/4 - 20 NC x 7/8 in. socket head cap screws and thin washers.

   Important: On some machine tools, the cross travel bracket is not necessary and the scale can be mounted directly on the knee of the machine tool.

3. Align the two ends of the spar to the machine tool ways (axis of movement). See "3.1 X Axis Installation," step 5. After the scale is aligned, tighten the screws to secure the spar permanently.

4. Attach the *reader head bracket* to the *horizontal bracket* with two 10 - 24 NC x 3/4 in. socket head cap screws. Attach the assembled bracket to the reader head with two 1/4 - 20 NC x 1/2 in. socket head cap screws.

5. Locate and attach the *vertical upright bracket* to the holes on the right side of the saddle (underneath the table) with two 1/4 - 20 NC x 1 in. socket head cap screws and flat washers. If the machine tool does not have pre drilled holes, appropriate holes will need to be located, and then drilled and tapped.

6. Move the saddle (Y axis) to middle of its travel and attach the vertical upright bracket to the horizontal bracket of the reader head. Use two 1/4 - 20 NC x 1 in. socket head cap screws and washer. Make sure the brackets are flush with the saddle, and are sitting square on the reader head horizontal bracket. Shim and adjust as necessary. Then, tighten the screws to secure the reader head permanently.

   NOTICE: If the mounting screws are tightened while there is too much clearance or misalignment, the reader head could be damaged. The clearance and misalignment causes the reader head to bind and rub as it slides in the spar, eventually damaging the scale.

7. Remove the positioning blocks by sliding them away from the reader head tabs and pulling them out of the ends of the spar. Save these blocks also.

4. READOUT INSTALLATION

4.1 Machine Arm Installation

Mount the machine arm to a surface of the machine tool with sufficient strength. If the machine arm is attached to a thin member, such as a sheet metal cover, reinforcement may be required to prevent damage to the member. The mounting location must provide electrical ground from the readout to the machine tool.

Drill and tap holes in the machine tool member. Use the machine arm mounting holes as a template to determine the locations of the holes. Use the short 1/4 - 20 NC screws provided or screws of equal or greater strength. See Figure 14 for a typical machine arm installation.

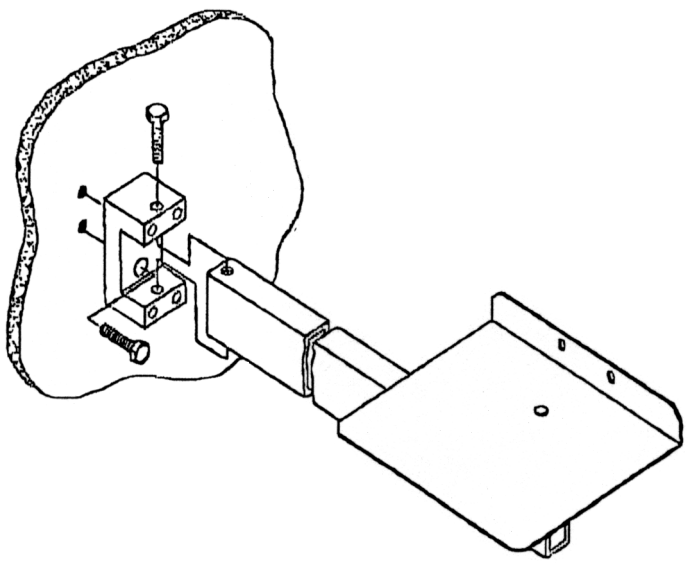


Figure 14. Machine Arm Installation

4.2 Readout Installation

Place the readout on the machine arm tray. Secure the readout by inserting the two 10 - 32 NC screws provided through the tray and into the screw holes on the back of the readout. Attach the ground wire to the machine frame (See Figure 15).

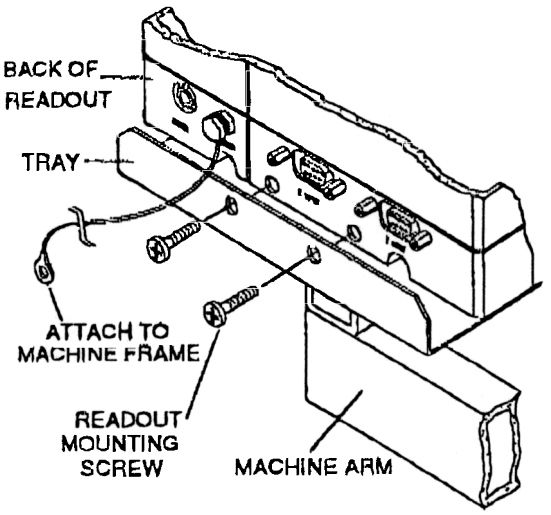


Figure 15. Readout Installation

4.3 Cable Connections

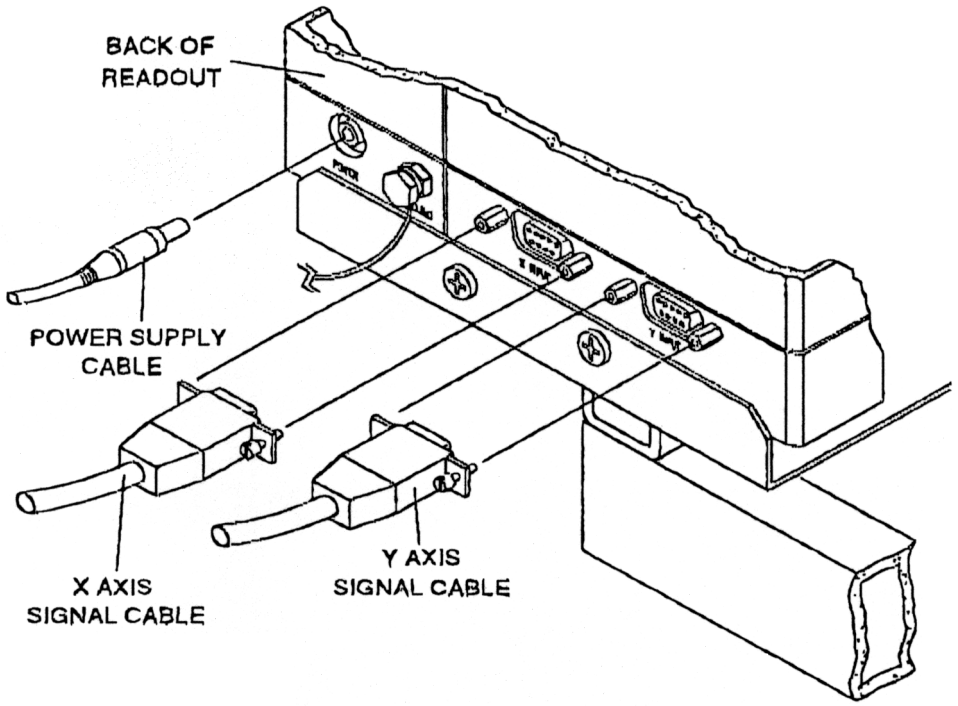


Figure 16. Back of Digital Readout

Cable Routing: When routing the signal cables, observe the requirements and guidelines outlined in "2.4 Installation Requirements and Guidelines."

Use the provided cable clips to fasten the parts of the signal cable that don't need to move. If possible, fasten a clip on the cable near where it enters the reader head. This will avoid undue strain on the reader head if the signal cable is pulled or jerked.

The signal cable is hardwired to the reader head, and if the reader head moves, part of the signal cable will, also. The routing and securing of the signal cable must allow for this "tightening" and "sagging."

Connections to the Readout: The signal cables connect to the back of the readout. See Figure 16. Connect and disconnect the signal cables with the power turned off.

Connect the X axis cable to the X axis socket on the readout. On the front of the readout, the X axis is the top LED display. On a milling machine, the longer axis is considered the X axis and moves left and right as the operator faces the machine.

- Connect the Y axis cable to the Y axis socket on the readout.

Secure the signal cables to the readout by tightening the screws on the cable connectors.

4.4 Power Supply Connection

The readout power supply uses 100 to 132 VAC, 50-60 Hz, single phase electricity and requires a ground connection. **Do not use any other power source.** If possible, provide the readout with a dedicated circuit. If a dedicated circuit is unavailable, avoid lines with a large KVA load (a large motor, welder, etc.), because they cause interference and surges, particularly when the equipment starts and stops.

After plugging the power supply into a wall socket, connect the power supply cable to the back of the readout. See Figure 16 for the location.

5. CHECKOUT

Turn on the readout by pressing the power button,  . Move the worktables and see if the readout counts normally. If an error code ("E1", "E2", "E3" or "E4") or other abnormalities occur, see "5.1 Error Codes" and "5.2 Symptoms, Causes and Solutions."

5.1 Error Codes

The following system status error codes may appear on the LED display.

Error Code:	Error Code Meaning:	How to Clear:	What to Do if It Keeps Recurring:
All 9's	An excessively large preset value has been entered. The readout is unable to display the value of the current position.	Enter a smaller preset value.	N/A.
E1	Program memory checksum failure. A fatal error. Results from a possible failure of an internal electronic component.	Press ZERO.	Contact your authorized Mitutoyo distributor.
E2	Scale data format failure. The information sent over the signal cable had the wrong format. The other axis may still be used.	Press ZERO.	Test for interference due to electrical noise. Hint: Turn on and off any power equipment close to the scales and readout and see if this makes a difference. If electrical noise does not seem to be the problem, a scale may be damaged. Contact your authorized Mitutoyo distributor.
E3	Scale data transfer time-out. The readout had to wait too long for a message from the scale. The other axis may still be used.	Press ZERO.	Test for interference as for error code E2. Check for a damaged signal cable and/or a bad cable connection.
E4	Machine error correction overflow. Non-fatal. The readout is unable to compensate for the large amount of machine error (e.g.: it is larger than +/- 2.0%)	Press ZERO.	Operate without compensation. Repair the machine tool worktable. Common causes of scale distortion are sags or humps in the worktable.

5.2 Symptoms, Causes and Solutions

The following table summarizes installation problems that can commonly be resolved by the user. Contact an authorized Mitutoyo distributor for further assistance.

Symptom:	Cause:	Solution:
The readout display does not light.	Readout power supply not plugged in.	Plug the power supply into the wall outlet. Make sure the power supply is firmly plugged into the back of the readout. Unplug each scale to see if the display will function
	No power at outlet.	Check for a blown fuse or circuit breaker. Check for a damaged outlet with a volumeter tester or a electric appliance that is known to work properly.
	Power supply defective.	Check for a broken wire in the cable of the power supply. Replace the power supply if necessary. Check for low voltage DC power out of the power supply. If there is power at the wall outlet, but no DC power at the connection to the readout, the power supply is probably defective.
Part of the display or an LED fails to illuminate.	Readout is in wrong mode.	Change to correct mode.
	An LED or part of the display is burned out.	Turn the power off, and then turn it back on. During the first 2 seconds, the readout will perform a self-test which will light all segments of both displays and all LEDs. Contact an authorized Mitutoyo distributor if an LED fails to illuminate.
	Scale Defective	Switch X and Y axis Cables to see if the problem follows the scale. If
The display doesn't change when the worktable moves.	Readout is in Preset mode (A digit is flashing).	Switch to Incremental or Absolute mode.
	Reader head is misaligned to the spar.	Review mounting instructions. The positioning spacer should snap and slide back into place easily. If it does not, realign and shim the reader head.
	Scale or readout is not operating properly.	Connect the signal cable for the other axis to the suspect display. If the readout starts displaying, the scale is probably damaged. If the readout still doesn't display, the readout is probably damaged. Contact an authorized Mitutoyo distributor.

Symptom:	Cause:	Solution:
The readout operates intermittently when the worktable is moved. (While the worktable is moving steadily; the readout counts, then stops, then starts, then stops, etc.)	Scale is not parallel to the axis of movement.	Review paralleling instructions. Repeat the alignment procedure.
	Reader head is misaligned to the spar.	Review mounting instructions. The positioning spacer should snap back into place easily. If it does not, realign and shim reader head.
	Scale mounting screws are loose.	Tighten screws. Realign the scale if necessary.
Measurements are not repeatable.	Scale is not parallel to axis of movement, or reader head is misaligned.	See same cause above.
	Scale mounting screws are loose.	See same cause above.
	Something is hitting or pressing on the spar or reader head while it is motion.	Remove or reposition parts as necessary to remove physical interference.
The readout display "floats" or rapidly changes. (Even when the worktable is still)	System is not grounded properly.	Check for proper connection of ground wire to machine arm . Check for proper grounding of machine tool.

5.3 Scale System Repackaging

If it becomes necessary to ship the scale:

1. Slide the positioning blocks on both ends of the spar, push them on to the reader head tabs, and secure with tape.
2. If the positioning blocks are lost, firmly secure the spar and reader head with tape.
3. Use the box(s) the scale system came in, if available. Otherwise, use a strong box, of sufficient size, and fill it with packing chips.
4. If the scale system is being shipped back to a distributor, attach a sheet describing the symptoms or problems in detail.

6. FINE TUNING

The Digimatic Scale System can be fine tuned in two areas: (1) count direction and (2) scale correction.

6.1 Count Direction

The count direction defines the direction of scale movement for increasing count (0,1,2,3) as opposed to a decreasing count (0,-1,-2,-3). For each axis, the readout contains an internal slide switch which controls the count direction. Move the X axis and Y axis worktables, and observe the readout count direction. To reverse the count direction for one or both of the axes:

1 Turn the readout off and unplug the power supply from the wall.

2. Remove the two screws attaching the readout to the machine arm tray.

3. Remove the two screws on the bottom front of the readout. See Figure 17.

4. Carefully rotate the bottom of the front panel out a few inches. It is held in place by two tabs at the top. Lay the cover "keypad side" down. A ribbon cable attaches the cover to the circuit board inside the readout.

5. The two slide switches are located at the front of the board, near the right side. Each switch is labeled. The X axis is on the left. The Y axis is on the right. Move the slide switch from right to left, or vice versa, to change the count direction for that axis.

6. Insert the front panel tabs back in place, rotate the cover down and re-install the two screws. Remount the readout to the machine arm tray, making sure the ground wire is connected to the tray.

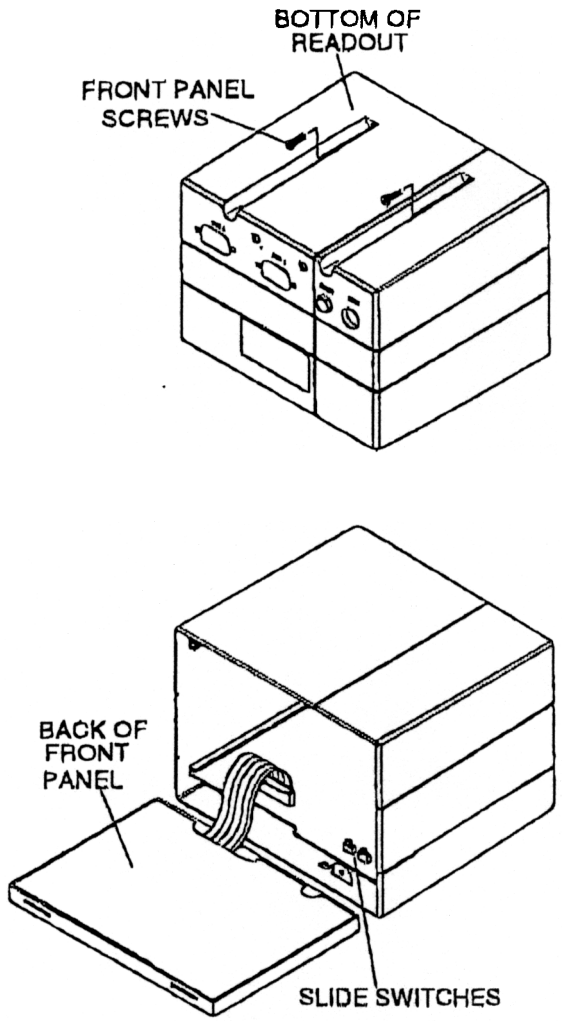


Figure 17. Changing Count Direction

6.2 Scale Correction

The readout can be adjusted to compensate for machine error on each axis. Machine error is often caused by humps or sags in the worktable. The humps or sags cause the worktable/scale to move a distance that is different than the distance moved on the workpiece (See Figure 18). The difference is usually very small, but if not corrected may make it difficult to hold tight tolerances. A machine error appears as an apparent multiplication of the real position by a factor close to, but not equal to, 1.

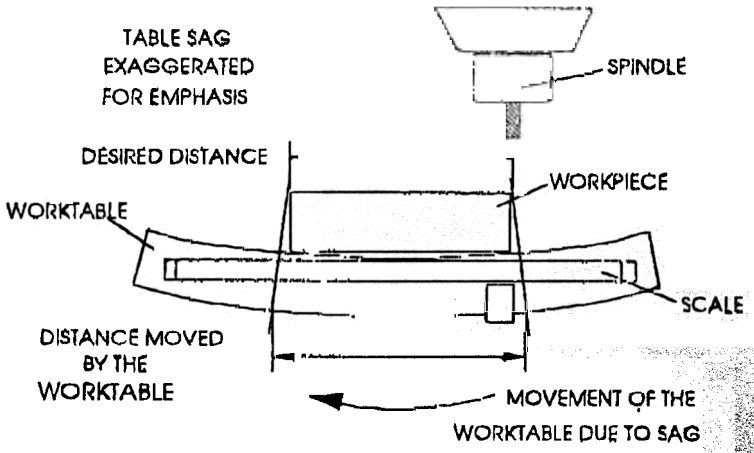


Figure 18. Machine Error

Compensate for machine error by entering a scale correction factor. The scale correction factor is a constant by which the readout multiplies the distance moved by the worktable/scale. The scale correction factor may be entered in either in. or mm.

The correction is linear proportional to the movement of the worktable. For example, if the scale correction factor is 1.01, and the worktable/scale moves 10 mm, the readout displays 10.1 mm.

If the worktable/scale had moved 20 mm, the readout would display 20.2 mm.

To determine if an axis has machine error:

1. Use a known good measurement reference.

2. Move the worktable to the first reference point. Put the axis in Absolute mode. Press ZERO. (If the INC (for Incremental mode) LED is illuminated, press ABS/INC to change to Absolute mode. See the *Operation Manual* for more information.)

3. Move the worktable to the second movement over a known distance. If the readout displays a different value than the known distance from the reference, a machine error is present.

To store a scale correction factor:

1 Enter the Machine Error Correction mode:

Press both the ▲ key and the ZERO key and hold down for 2 seconds. Then release the keys.

2. Enter the correct measurement on the screen that appears. The readout uses the correct measurement, and the distance displayed on the readout before entering Machine Error Correction mode, to calculate a scale correction factor. The right digit will be flashing. The flashing digit can be edited.

To change the value of the flashing digit, press ▲ as many times as it takes for the desired number to appear. The numbers recirculate like those on a digital watch. For the sign digit, pressing ▲ toggles between "-" (minus) and "P" (positive).

To select another digit for editing, press PRESET. Each time PRESET is pressed, the next digit to the left becomes the flashing one. The 8th digit is the sign digit. Pressing PRESET at the sign digit exits Machine Error Correction Mode.

3. Exit Machine Error Correction mode:

To save the entered scale correction factor:

Depress PRESET until the sign ("-" or "P") flashes, then press PRESET one more time. Or press PRESET and hold for 2 seconds.

If the machine error is so great that it is outside the compensation limits of the readout, an error code "E4" will display. The limits of compensation are ± 2% which is equivalent to multiplying by a scale correction factor between .98 and 1.02. See "5.1 Error Codes." To continue after the error, press ZERO. The display returns to Absolute mode without a scale correction factor. The position shown on the readout display will be the same as before entering Machine Error Correction mode.

Press ZERO to exit Machine Error Correction mode without saving the scale correction factor. The scale correction factor will be set to 1 (no correction). This is a convenient way to remove a scale correction factor.

After leaving Machine Error Correction mode, the readout displays the compensated location, calculated by multiplying the scale correction factor by the position on the scale. See also the example which follows.

Example: Entering a Scale Correction Factor.

Determine if there is machine error on the X axis. If there is machine error, enter a scale correction factor. In the example below, the underlined digit will flash on the LED Position Display. The Y axis is not included in this example, although it could be corrected also.

a) A reference with a known measurement of 5.0000 in. between two features is clamped up on the X axis of the worktable. This known distance will be measured using the scale and readout to determine if there is machine error.

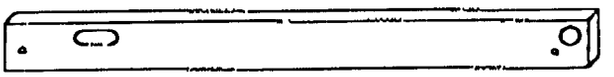
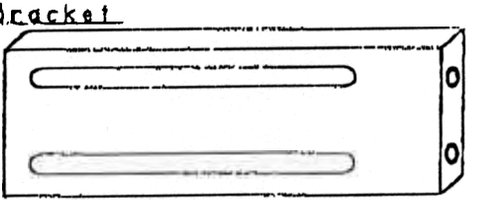
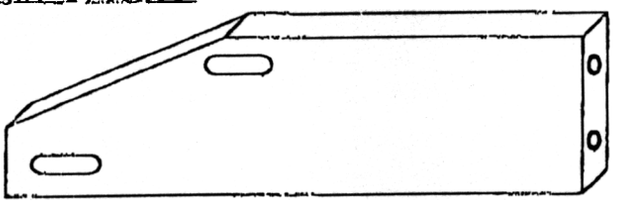
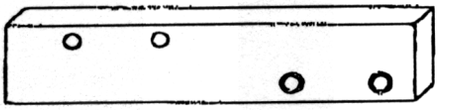
Operation:	Keys:	Position Display:	Mode LED:
Move the worktable to the first reference point. Make sure the Absolute origin is active. (INC LED is not illuminated). Then set the origin.	Press ZERO	X: 0.0000	
Move the worktable to the second reference point, which is known to be 5.0000 in. away.		X: 5.0140 (For example)	
A machine error of approximately .003 in. per in. is present.			

b) Leave the worktable at its current position with the readout in Absolute mode. Have the readout calculate a scale correction factor by entering the correct position of the worktable (5.0000 in.).

Operation:	Keys:	Position Display:	Mode LED:
Enter Machine Error Correction mode. The current location of the worktable appears with the far right digit flashing (underlined).	Press both the ▲ and the ZERO keys and hold down for 2 seconds. Release the keys.	X: 005.0140	
Advance one digit to the left.	Press PRESET	X: 005.0140	
Change the active digit to "0".	Press ▲ until "0" is displayed as the flashing digit	X: 005.0100	
Advance one digit to the left.	Press PRESET	X: 005.0100	
Change the active digit to "0".	Press ▲ until "0" is displayed as the flashing digit	X: 005.0000	
Save the correct position, and have the readout calculate a scale correction factor by exiting Machine Error Correction mode.	Press PRESET and hold for 2 seconds.	X: 005.0000	

REVISION DATE: 2-7-95

BRACKET KIT: 53AAA014	NAME :DIGIMATIC BRACKET KIT FOR BRIDGEPORT Y-AXIS (572-151,572-152)

NO	Description	PART NO.	Qty	Remarks
1	Cross Travel Bracket 		1	Black Anodize PART # 53AAA011
2	Horizontal Bracket 		1	Black Anodize PART # 053107
3	Upright Bracket 		1	Black Anodize PART # 53AAA010
4	Reader Head Bracket 		1	Black Anodize PART # 53AAA009
5	Spacer .2	053111	2	Black Oxide
6	S.H.C. 10-24 x 3/8	53AAA103	6	
7	S.H.C. 10-24 x 3/4	53AAA104	2	
8	S.H.C. 1/4-20 x 1/2	53AAA105	4	
9	S.H.C. 1/4-20 x 1	53AAA107	10	
10	S.H.C. 3/8-16 x 1	53AAA111	2	
	S.H.C. 5/16-18 x 1 1/4	53AAA112	1	
		053147	1	
13	Cable Ties	53AAA118	5	
14	Cable Clips AT-11	53AAA119	6	
15	Spacer Set DIGIMATIC	53AAA041	1set	
16	FLAT WASHER 6mm	53AAA114	14	
17	LOCK WASHER 1/4	53AAA116	4	

INSTALLATION MANUAL

BRACKET KIT: { # 572-151 / # 572-152 } FOR: BRIDGEPORT MILLING MACHINE Y-AXIS (572-125)

DATE: -- 06

Using ⑩ Socket-Head Cap Screws (3/8-16x1) install ① Cross Travel Bracket and ⑤ Spacer to the two 3/8-16 tapped holes which are located on the right side of the machine knee.

2. Install the 572-125 using ⑨ S.H.C. Screws (1/4-20x1), ⑥ Washer(1/4) to the ① Cross Travel Bracket. Align the 572-125 top and front reference surfaces to within 0.005" of saddle travel axis.

3. Assemble the ③ Upright Bracket on ② Horizontal Bracket using ⑨ S.H.C. Screws (1/4-20x1), ⑥ Washer(1/4) then assemble ④ Readinghead Bracket on ② Horizontal Bracket by using ⑦ S.H.C. Screws (10-24x3/4).

4. To mount the ③ Upright Bracket, Located Right side of the saddle, mark it, drill and tap it for ⑨ S.H.C. Screws (1/4-20x1). Mount the ③ Upright Bracket using ⑨ S.H.C. Screws (1/4-20x1) and ⑥ Washers(1/4) and ⑦ Lock Washer.

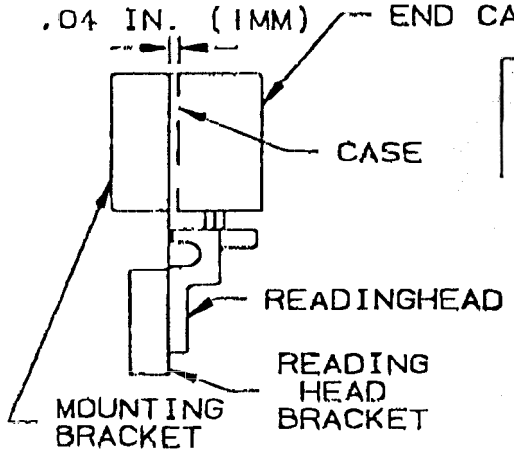
5. Carefully traverse machine saddle to align holes of the Readinghead with the bracket. THE MOUNTING SURFACE OF THE READINGHEAD SHOULD BE IN THE SAME PLANE AS THE MOUNTING BLOCKS OF THE SCALE AND OR THE FRONT SURFACE OF THE CROSS TRAVEL BRACKET (OR .040" BEHIND THE ALUMINUM CASE) SEE DETAIL "A". See detector head alignment instructions in manual page 13. If alignment is necessary use ⑮ Adjust Spacers (Provided in accesory pack for Scale) should be added between the mounting surface of the Readinghead and the bracket's surface. If it is apparent that the side of the Readinghead will touch the ③ Upright Bracket, loosen ⑨ S.H.C. Screws (1/4-20x1) of the ② Horizontal Bracket and readjust until the Readinghead mounting surface and the bracket's surface are properly aligned.

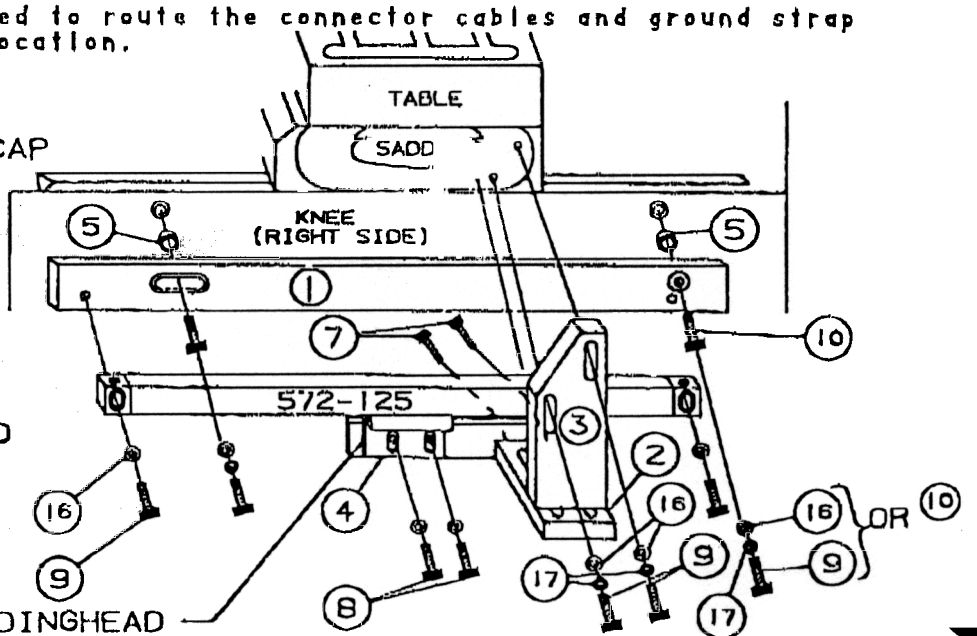
6. Mount Readinghead to Bracket using ⑧ S.H.C. Screws (1/4-20x1/2) ⑥ Washers(1/4). See instructions on Readinghead Alignment. DO NOT MOVE machine until next step.

7. Remove positioning plates. Save the positioning plates in case it is necessary to remove the 572-127 at a later time. THE POSITIONING PLATES SHOULD INSURE READINGHEAD ALIGNMENT BUT NOT ELIMINATE PRELIMINARY ALIGNMENT OF THE READINGHEAD BRACKET.

8. Cable clamps are furnished to route the connector cables and ground strap to the digital counter location.

DETAIL "A"





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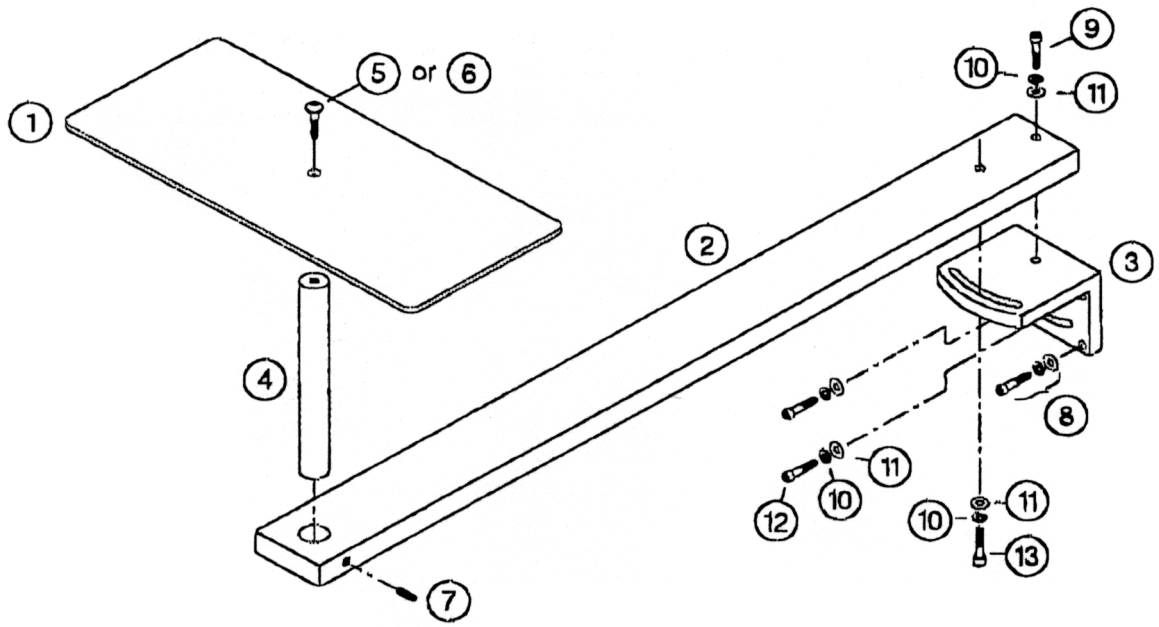
No. 53AAB744

INSTRUCTION SHEET

DISPLAY ARM KIT FOR DIGIMATIC

1. Determine location for mounting bracket (3) on the machine, then drill and tap holes 0.9" apart vertically.
2. Mount mounting bracket (3) to the machine using (11), (12) and (13) screws and washers.
3. Use (8) and (9) set screws as necessary for securing and adjusting mounting bracket (3) to the machine.
4. Attach machine arm (2) to mounting bracket (3) using (11), (12) and (13) screws and washers.
5. Attach counter tray (1) to machine arm pole (4) using (5) or (6) screws.
6. Insert machine arm pole (4) into machine arm (2) and fasten with (7) screw.
7. Fasten machine arm (2) position with (11), (12) and (13) screws and washers.



No.	DESCRIPTION	PART NUMBER	QTY	DESCRIPTION
1	COUNTER TRAY	53AAA004	1	
2	MACHINE ARM	53AAB749	1	BLACK ANODIZED
3	MOUNTING BRACKET	53AAB750	1	BLACK ANODIZED
4	MACHINE ARM POLE	53AAB748	1	BLACK ANODIZED
5	1/4-20 X 1/2" BUTTON HEAD SCREW	53AAA114	1	
6	3/8-16 X 1/2" BUTTON HEAD SCREW	53AAA229	1	
7	1/4-20 X 5/8" SOCKET HEAD SCREW	53AAA356	1	
8	1/4-20 X 3/4" SET SCREW	53AAB751	4	
9	1/4-20 X 1 1/4" SOCKET HEAD SCREW	53AAA174	1	
10	1/4" LOCK WASHER	53AAA116	4	
11	6mm FLAT WASHER	53AAA237	4	
12	1/4-20 X 1" SOCKET HEAD SCREW	53AAA107	2	
13	1/4-20 X 7/8" SOCKET HEAD SCREW	53AAA173	1	

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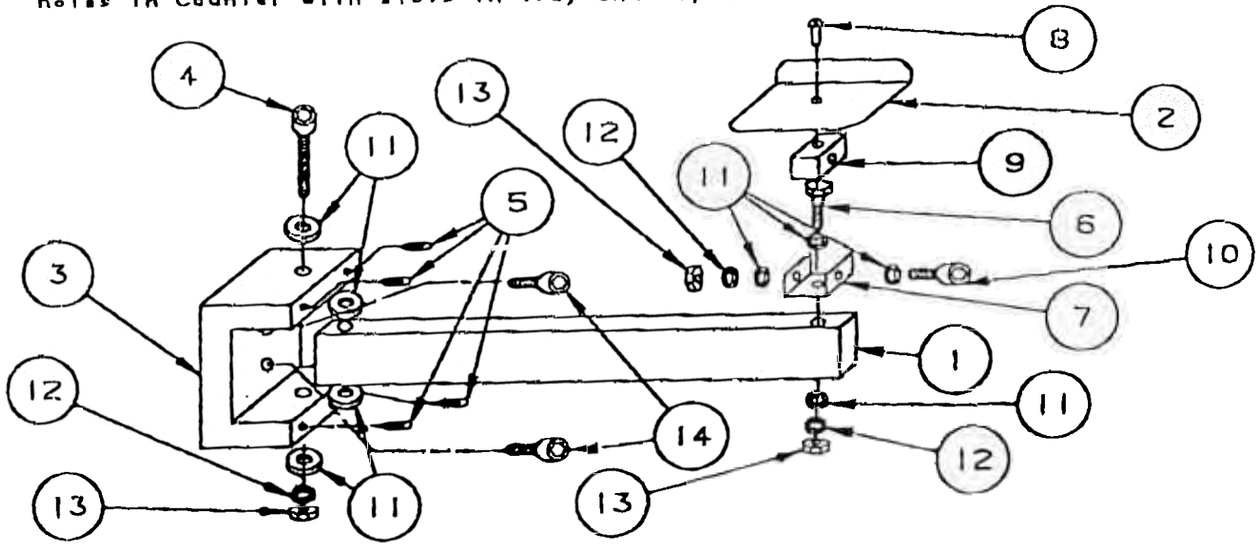
MANUAL NO. 453AAAC
94627

INSTALLATION MANUAL

DIGITAL DRO MACHINE ARM KIT

1. Install 10-24 set screws (5) in mounting bracket (3) drill and tap holes .9" apart for 1/4 S.H.C. screws (14) in machine. Using 1/4 S.H.C. screws (14) secure mounting bracket to the machine.
2. Using the 1/4 S.H.C. screw (4) 1/4 lock washer (12) 1/4 flat washer (11) 1/4 nut (13) insert 2 (11) washers between machine arm and mounting bracket and assemble arm and mounting bracket and tighten the bolt.
3. Bolt the U-Base (7) to the Machine Arm (1) using 1/4 Bolt (6) 1/4 Lock Washer (12) and washer (11) and Nut (13) tighten the Bolt.
4. Insert Swivel Block (9) in the U-Base (7). Bolt together with 1/4 S.H.C. Screw (10) 1/4 Flat Washers (11) 1/4 Lock Washer (12) and 1/4 Nut (13) Tighten the Bolt.
5. Attach Counter Tray (2) to the Swivel Block (9) using 1/4 Button Head Screw (8).
6. Remove Screws from the bottom of counter. Place Counter in Tray. Align holes in Counter with slots in Tray and replace the Screws.



NO	DESCRIPTION	PART NUMBER	QTY	DESCRIPTION
1	MACHINE ARM	53AAA005	1	BLACK ANODIZE
2	COUNTER TRAY	53AAA004	1	ENAMEL COAT
3	MOUNTING BRACKET	53AAA006 B	1	
4	1/4-20 X 2 3/4" SHCS	53AAA110	1	
5	10-24 X 1/2" SET SCREW	53AAA113	4	
6	1/4-20 X 2" SHCS	53AAA109	1	
7	U-BASE	53AAA007	1	BLACK ANODIZE
8	3/8-16 X 1/2" BUTTON HEAD SCREW	53AAA229	1	
9	SWIVEL BLOCK	53AAA002	1	BLACK ANODIZE
10	1/4-20 X 1-1/2" SHCS	53AAA108	1	
11	1/4 FLAT WASHER	53AAA237	8	
12	1/4 LOCK WASHER	53AAA116	3	
13	1/4-20 HEX NUT	53AAA117	3	
14	1/4-20 X 3/4" SHCS	53AAA106	2	

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