SECTION IV

Procedures - Installation and Operation

A - PROCEDURE FOR MOUNTING A TRAV-A-DIAL

Step 1 Choose an Installation Area.

The installation area for the machine has the following:

- A good place to install a bracket.
- A good running surface for the Gage Wheel is present or may be installed.

Choose the installation area so that these conditions are met:

- The Trav-A-Dial may be seen and used.
- The Trav-A-Dial is not in the way of the workpiece or tools.
- The Trav-A-Dial is kept away from excessive chips and coolant.
- The Trav-A-Dial is not a safety hazard.
- The Trav-A-Dial does not limit machine travel.

If unsure about the Installation Area, it is often helpful to assemble the Trav-A-Dial, M-5 Mounting Base and Bracket, and present to the machine to verify that there is enough room and that there will be no interference with machine operation.

Step 2 Choose the Running Surface for the Gage Wheel.

The Running Surface allows the formation of the Gage Wheel "Micro-Rack-and-Pinion-System."

The best Running Surface is a part of the machine itself, for example, the table of a milling machine or the way of a lathe.

If part of the machine is not usable, a Run Bar must be installed (See Section III E).

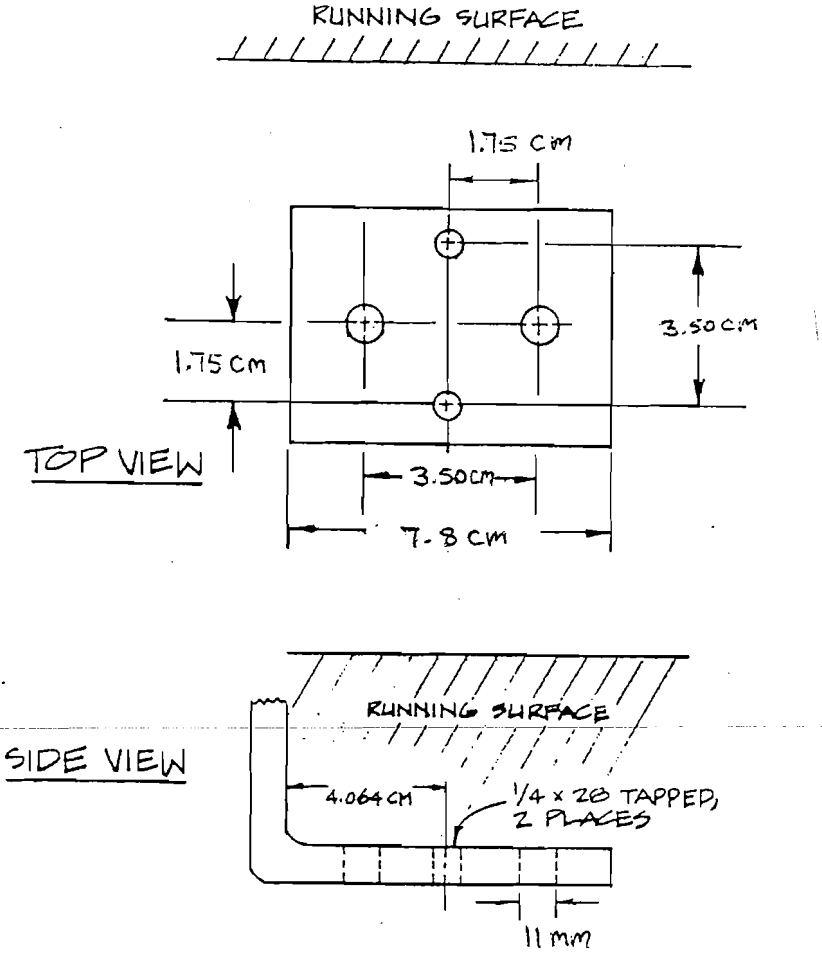
The Running Surface should have the following characteristics:

- Is parallel to the direction of travel (within 0.5mm)
- Has no twist
- Hardness below 30C Rockwell (45C maximum)
- Has no paint
- Is machined (not rough)
- Made of steel or cast iron, *not* aluminum or brass

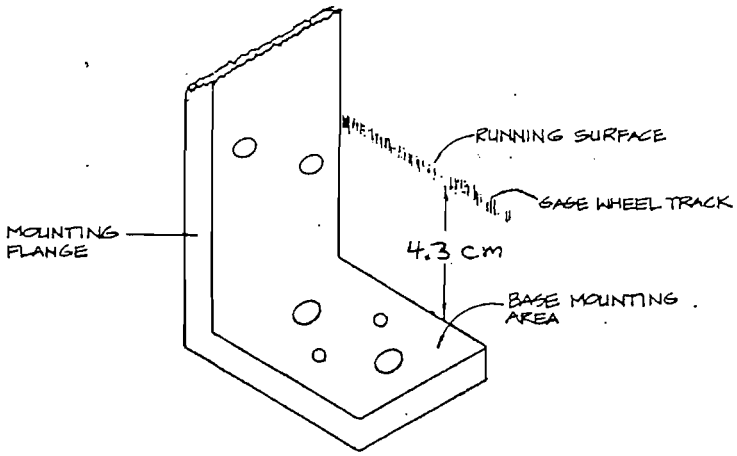
Step 3 Install the Bracket.

For details about Bracket Designs see Section III-D.

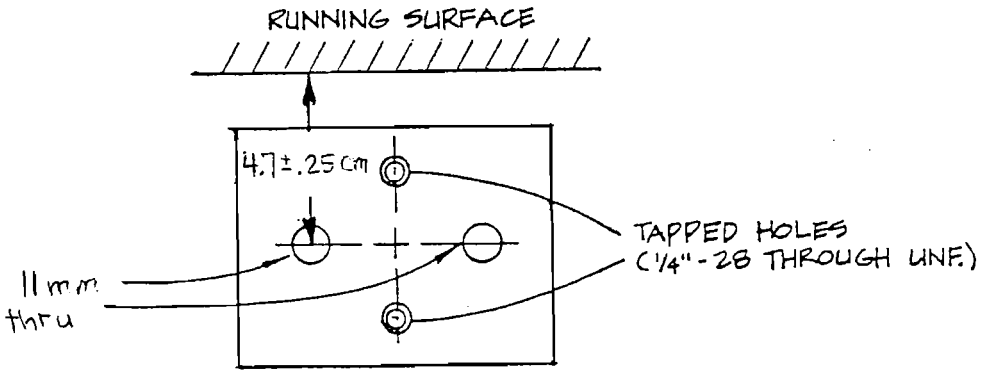
1. Drill and tap the correct Bolt Hole pattern on the Base Mounting area of the Bracket. The Bolt Hole pattern is for the attachment of the M-5 Mounting Base.



2. Assure correct vertical position.



3. Assure correct horizontal position.



4. Drill holes in mounting flange of Bracket and transfer these holes to the machine.

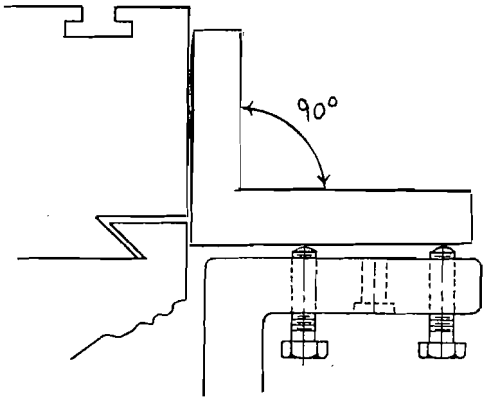
   Holes should be offset rather than vertical.

   Holes should be 2-3cm apart.

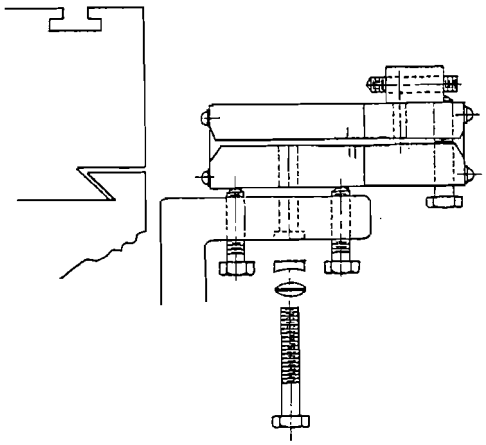
   Use M6 screws or larger.

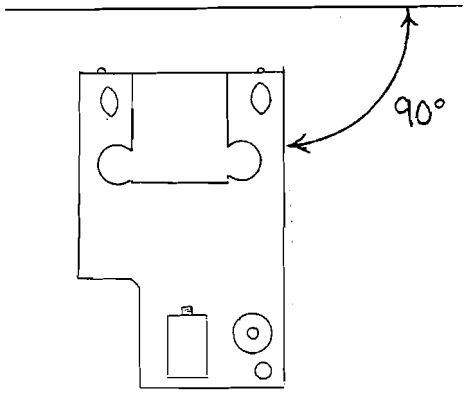
Step 4 Install the M-5 Mounting Base on the Bracket.

1. Screw in the Pusher Screws. Use a square to assure they are perpendicular to the running surface.

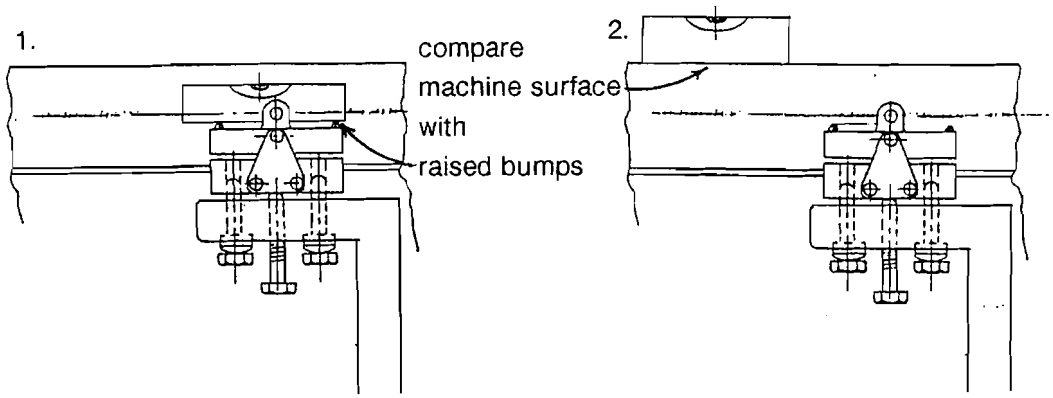


2. Place the M-5 Base on the pusher screws and screw in the puller screws.





3. Use a bubble level to align the raised bumps on the M-5 base with the Machine Tool surface.



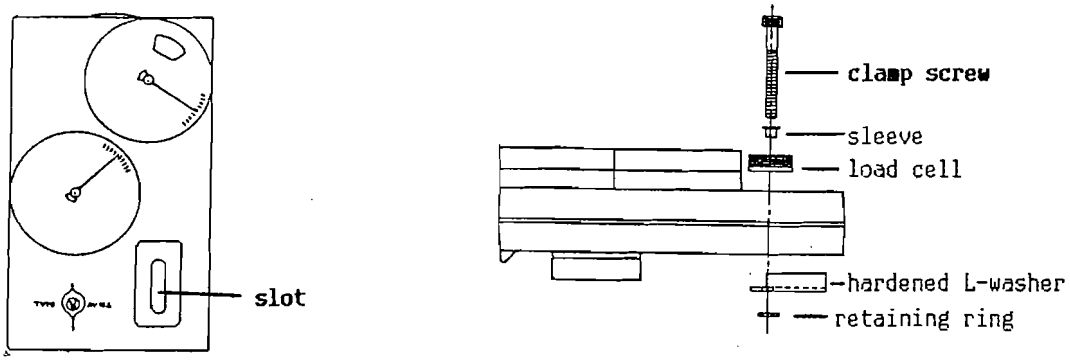
Step 4 Install the M-5 Mounting Base on the Bracket. (Continued)

Make the bubble level reading of the M-5 Base agree *exactly* with that of the machine table or way surface by tightening the Puller Screws.

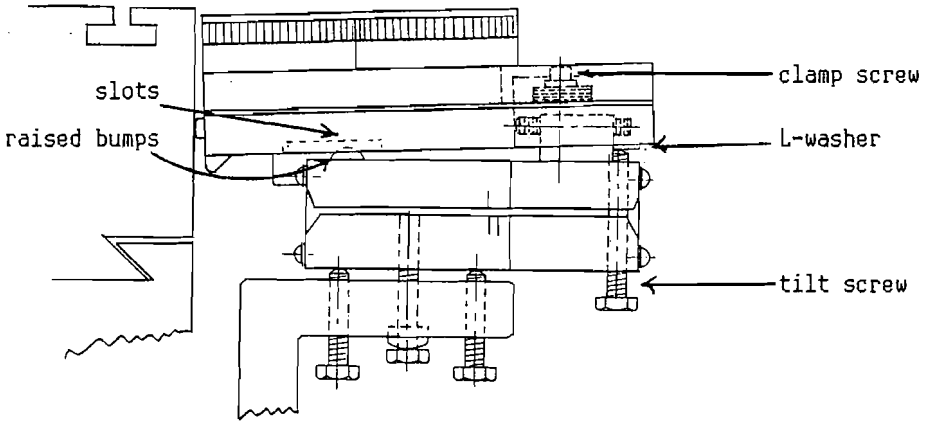
The M-5 Base must be square, level and installed tightly!

Step 5 Install the Trav-A-Dial onto the M-5 Base.

1. Place the clamp screw assembly through the slot on the back of the Trav-A-Dial.



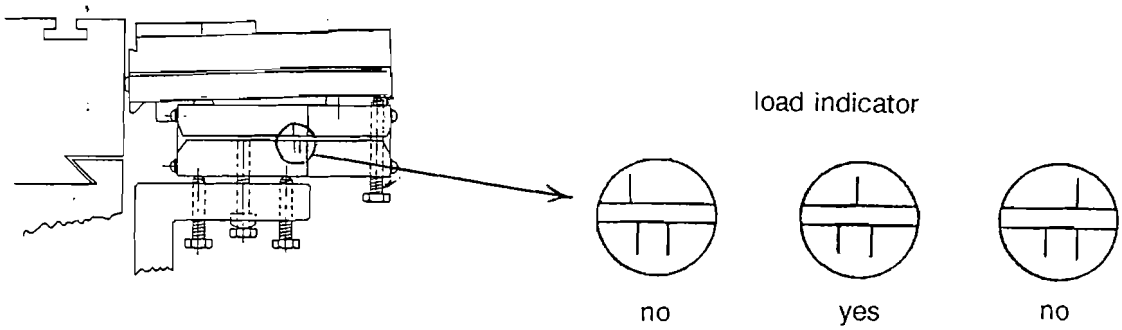
2. Place the Trav-A-Dial (with clamp screw assembly) onto the M-5 Base. Screw in clamp screw to be snug, but not tight. Push the Trav-A-Dial so that the Gage Wheel is in contact with the Running Surface.



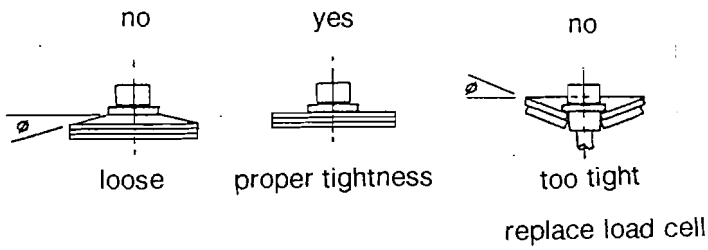
The Trav-A-Dial should fit with the raised bumps of the M-5 Base in the slots on the underside of the Trav-A-Dial, the Clamp Screw screwed into the hole of the M-5 Base, and the Tilt Screw of the M-5 Base in contact with the hardened L-Washer.

Step 5 Install the Trav-A-Dial onto the M-5 Base. (Continued)

3. Screw in the Loading Screw of the M-5 Base until the load indicator is in the "YES" condition (see below).



4. Tighten the clamp screw until the load cell washers become flat.



5. Soak the foam pad surrounding the Gage Wheel and the Running Surface with light way oil.

Step 6 Establish Gage Wheel Track.

Traverse the machine axis so that the Gage Wheel rolls over its running surface from 4-6 times.

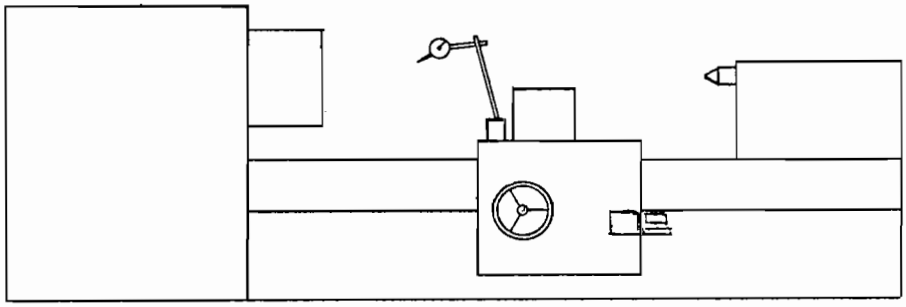
A hardened way surface may require additional passes to establish the track.

Fill the wiper pad which surrounds the Gage Wheel with light oil (like that used for the machine way surface).

Note: Whenever an adjustment to the Trav-A-Dial or M-5 Mounting Base is made, it is necessary to change the contact point of the Gage Wheel on the Running Surface and repeat this step to establish a new track.

Step 7 Test for Repeatability of Measurement.

1. Set up a dial indicator with a resolution of .002mm on a part of the machine. For example, the carriage of a lathe.



2. Establish a reference point by touching the dial indicator to a rigid part of the machine. For example, the lathe chuck.

3. Set the Trav-A-Dial to zero.

4. Move the machine axis at least 150mm away from the reference point.

5. Return to the reference point and observe the reading of the Trav-A-Dial. Once again, move away and return to the reference.

   If the Trav-A-Dial returns to zero both times, it is repeating properly. Go to Step 8-Calibration.

   If the Trav-A-Dial does not return to zero, it is not repeating. Continue with the following procedure. THE TRAV-A-DIAL MUST REPEAT PROPERLY.

6. Repeat the parts 4 and 5 above to determine the type of error the Trav-A-Dial exhibits. Write down the Trav-A-Dial reading each time the machine is returned to its reference point. Do not reset the Trav-A-Dial to zero between readings. See the following discussions of Accumulating and Random Error to interpret your results.

Step 7 Test for Repeatability of Measurement. (Continued)

There are two types of repeatibility error, Accumulating and Random:

Accumulating Error

Example of Accumulating Error:

# Returns	Machine Reference	Trav-A-Dial Reading
first	0	+ .01 mm
second	0	+ .02 mm
third	0	+ .04 mm
fourth	0	+ .07 mm
fifth	0	+ .11 mm

In the above example the Trav-A-Dial exhibits a regular and predictable pattern of accumulating error in a regular and predictable amount each time.

Accumulating error is caused by a failure to level the M-5 Base precisely with the machine travel.

Remove the Trav-A-Dial and level the M-5 Base again as shown in Step 4, Part 3.

When replacing the Trav-A-Dial after leveling, be sure to reestablish the Gage Wheel Track as in Step 6.

Step 7 Test for Repeatability of Measurement. (Continued)

Random Error

Example of Random Error:

# Returns	Machine Reference	Trav-A-Dial Reading
first	0	+ .02 mm
second	0	+ .11 mm
third	0	- .05 mm
fourth	0	+ .03 mm
fifth	0	- .01 mm

In the above example the Trav-A-Dial error is not of a regular, predictable pattern, it is Random.

Possible causes of random error:

- Dial Indicator set-up loose or too much flexture.
- Gage Wheel not in proper contact with Running Surface.
- Trav-A-Dial not mounted properly on M-5 Base.
- Clamp Screw Load Cell loose or broken.
- M-5 Base not tightened to Bracket.
- Bracket not mounted rigidly to machine.
- Bracket mounted to weak or loose part of machine.
- Bracket cracked or broken.
- Bracket material too thin or flexible.
- Bracket not supported properly.
- Run Bar loose.
- Machine parts loose.

To resolve Random Error, re-check the installation carefully starting from Step 1 especially ensure that everything is tight and fits well. Be sure to follow all installation steps carefully, including the proper loading of the Trav-A-Dial and establishment of Gage Wheel track.

Step 8 Calibration.

To be done only after Repeatability is verified (Step 7).

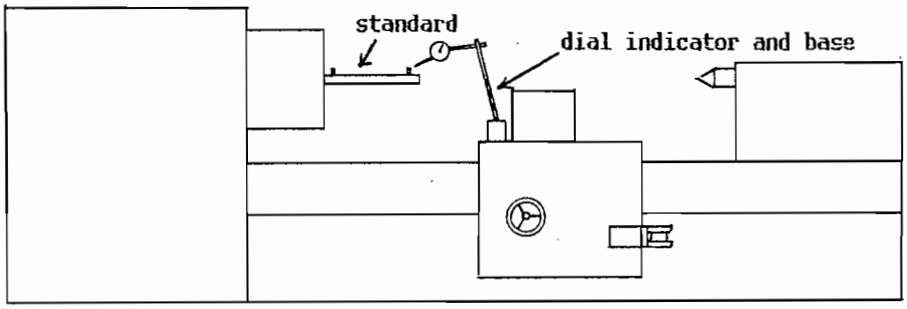
The Trav-A-Dial reading will be checked against an accurate standard and adjusted to match the standard length.

Any accurate measurement standard may be used. The standard should be in multiples of 150mm (e.g., 150mm, 300mm, 450mm, etc.)

Use a small (150mm minimum) standard for smaller machines, and a larger standard for machines that do work on larger parts.

To check the Trav-A-Dial measurement:

a. Set up measurement standard and dial test indicator.



b. Touch one end of standard.

c. Set Trav-A-Dial to zero.

d. Move to other end of standard.

e. Observe reading of Trav-A-Dial.

To adjust the Trav-A-Dial measurement:

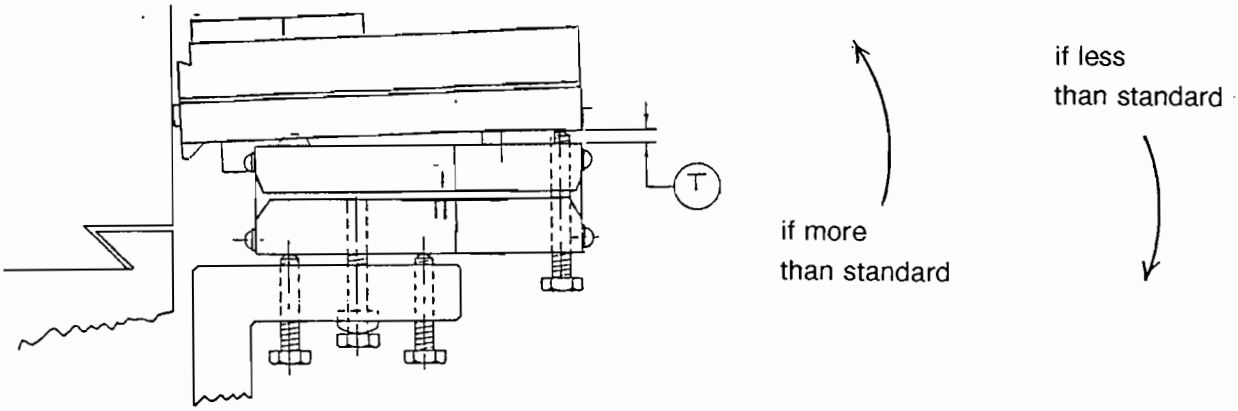
1. Loosen the loading screw.

2. Loosen the clamp screw.

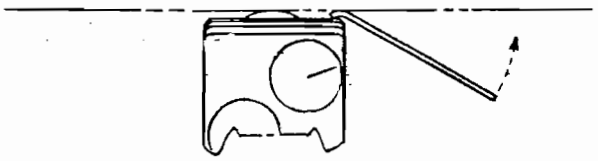
Step 8 Calibration. (Continued)

3. If the Trav-A-Dial reads *more* than the standard length, increase Tilt (T) below;

   If the Trav-A-Dial reads less than the standard length, decrease Tilt (T) below:



4. Pry the Trav-A-Dial away from the Running Surface and while the wheel is not touching, move it a small amount to change the Gage Wheel Track.



5. Retighten clamp screw to be snug, but not tight.

6. Reload the Trav-A-Dial by tightening the Load Screw. Then tighten clamp screw.

7. Traverse over the running surface 4 to 6 times to form a new track.

8. Check the measurement accuracy against the standard as in Steps a through e above. Repeat the adjustment procedure until accuracy is within .007mm - .01mm.

   Once the accuracy is within .05mm, it is not necessary to loosen the Clamp Screw and Load Screw, only the Tilt Screw. However, it is necessary to push the Gage Wheel off the running surface and form a new track after every adjustment.

B - PROCEDURE FOR MOUNTING A TRAK SENSOR

Step 1 Choose an Installation Area.

The installation area for the machine has the following:

- A good place to install a bracket.
- A good running surface for the Gage Wheel is present or may be installed.

Choose the installation area so that these conditions are met:

- The TRAK Sensor and its cable is out of the way of the workpiece and tools.
- The TRAK Sensor is kept away from excessive chips and coolant.
- The TRAK Sensor and its cable are not a safety hazard.
- The TRAK Sensor and its cable do not limit machine travel.

If unsure about the Installation Area, it is often helpful to assemble the TRAK Sensor, M-5 Base and Bracket, and present to the machine to verify that there is enough room and that there will be no interference with machine operation.

Step 2 Choose the Running Surface for the Gage Wheel.

The Running Surface allows the formation of the Gage Wheel "Micro-Rack-and-Pinion-System."

The best Running Surface is a part of the machine itself, for example, the table of a milling machine or the way of a lathe.

If part of the machine is not usable, a Run Bar must be installed (See Section III E).

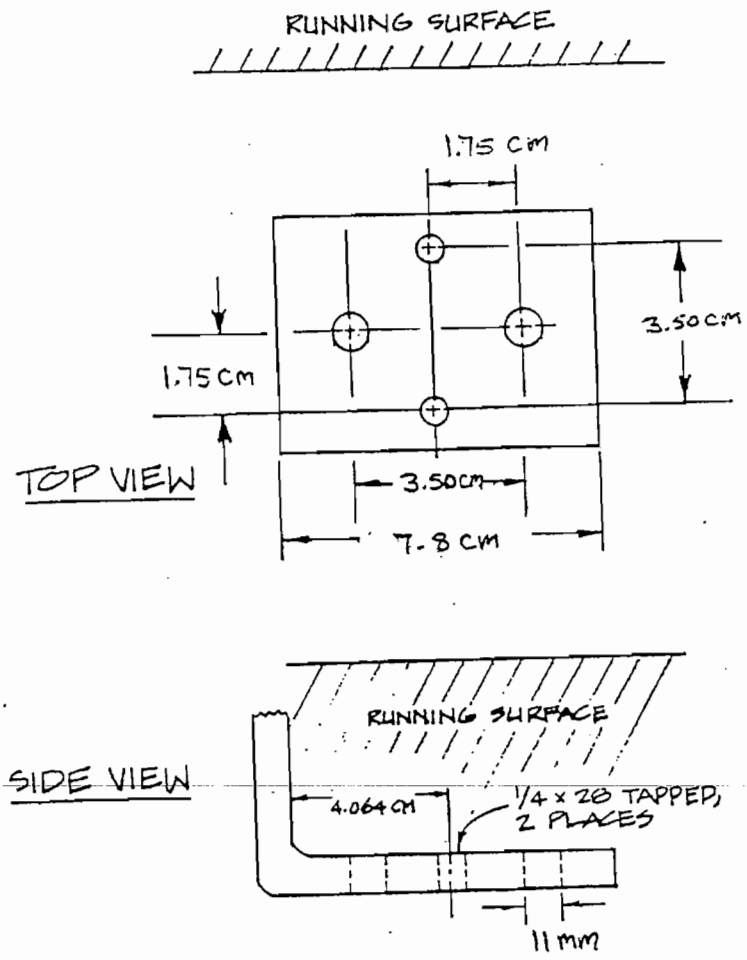
The Running Surface should have the following characteristics:

- Is parallel to the direction of travel (within 0.5mm)
- Has no twist
- Hardness below 30C Rockwell (45C maximum)
- Has no paint
- Is machined (not rough)
- Made of steel or cast iron, *not* aluminum

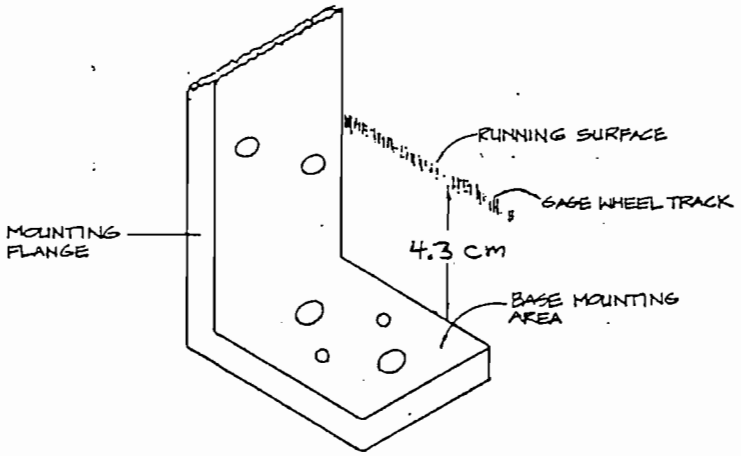
Step 3 Install the Bracket.

For details about Bracket Designs see Section III-D.

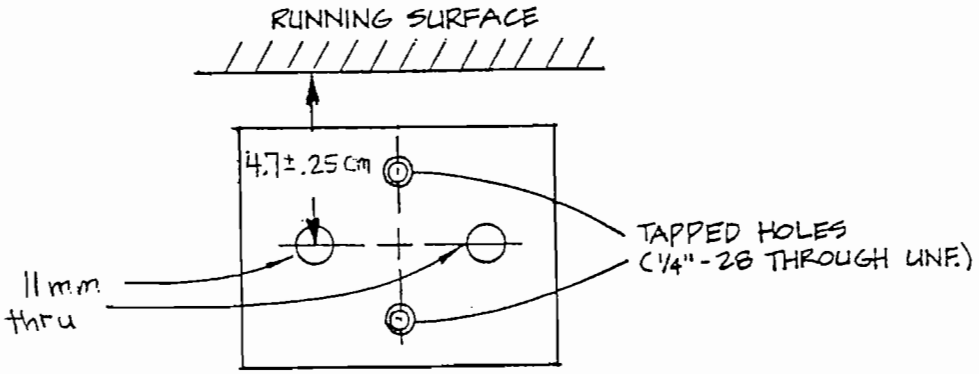
1. Drill and tap the correct Bolt Hole pattern on the Base Mounting area of the Bracket. The Bolt Hole pattern is for the attachment of the M-5 Mounting Base.



2. Assure correct vertical position.



3. Assure correct horizontal position.



4. Drill holes in mounting flange of Bracket and transfer these holes to the machine.

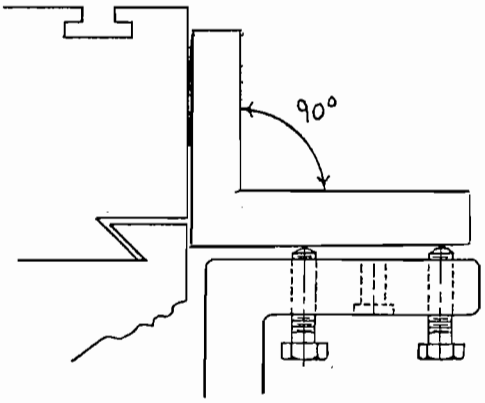
   Holes should be offset rather than vertical.

   Holes should be 2-3cm apart.

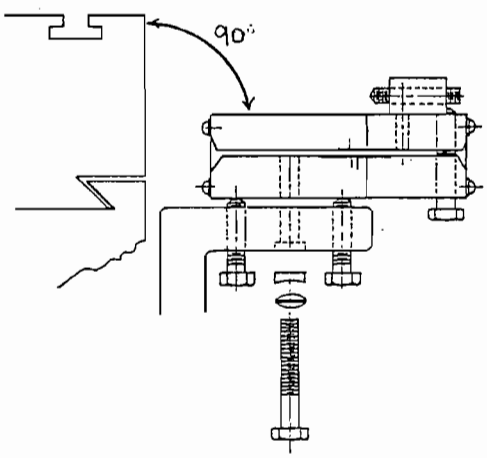
   Use M6 screws or larger.

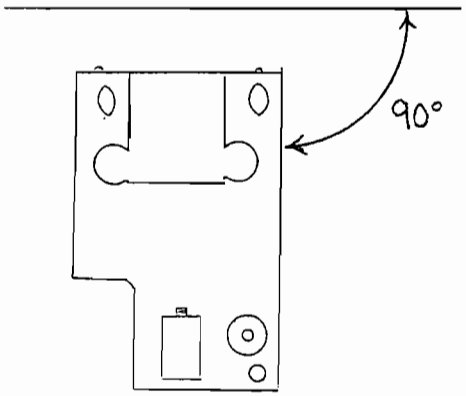
Step 4 Install the M-5 Mounting Base on the Bracket.

1. Screw in the Pusher Screws. Use a square to assure they are perpendicular to the running surface.

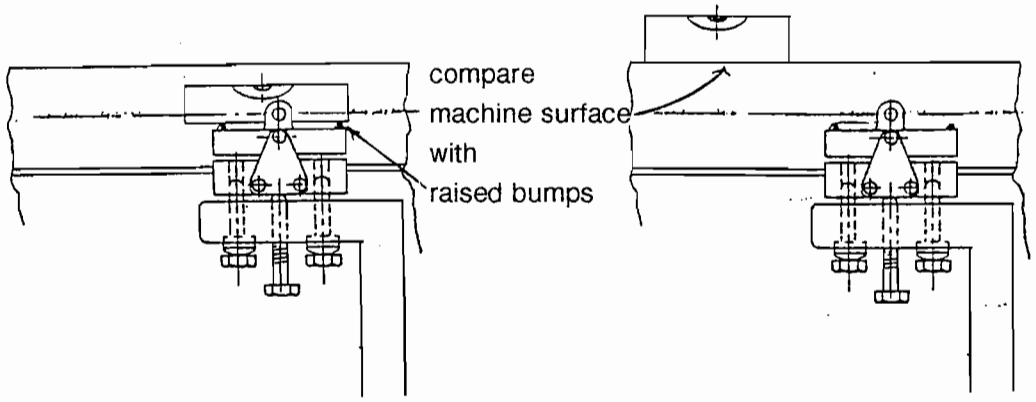


2. Place the M-5 Base on the pusher screws and screw in the puller screws.





3. Use a bubble level to align the raised bumps on the M-5 base with the Machine Tool surface.



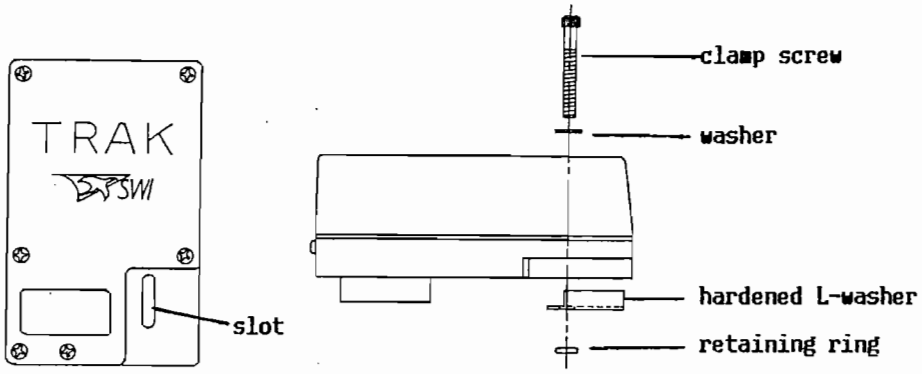
Step 4 Install the M-5 Mounting Base on the Bracket. (Continued)

Make the bubble level reading of the M-5 Base agree *exactly* with that of the machine table or way surface by tightening the Puller Screws.

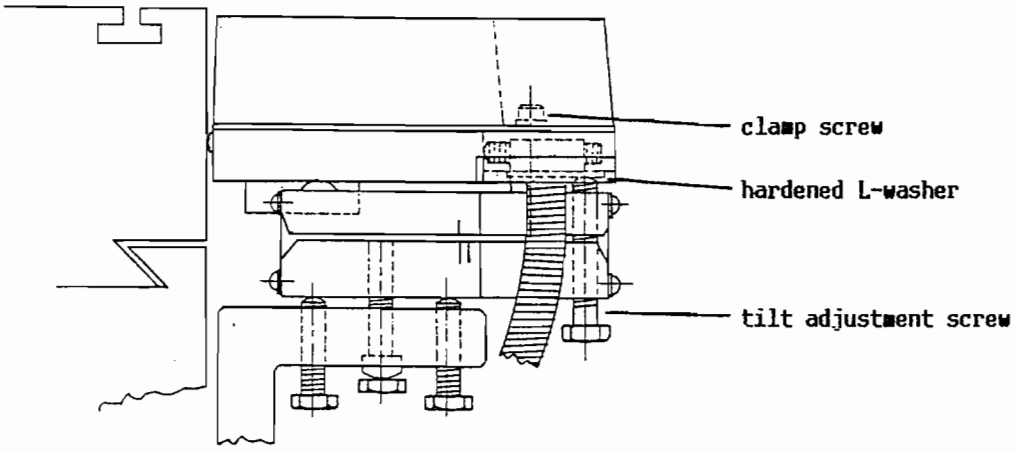
The M-5 Base must be square, level and installed tightly!

Step 5 Install the TRAK Sensor onto the M-5 Base.

1. Place the clamp through the slot on the back of the TRAK Sensor.



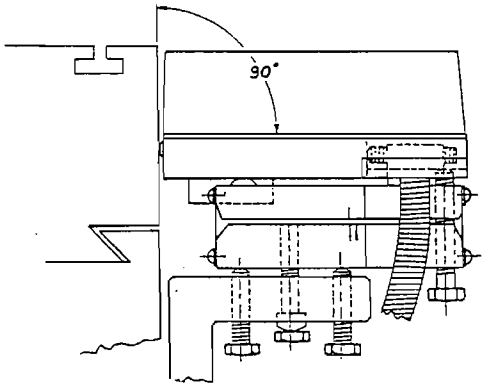
2. Place the TRAK Sensor on the M-5 Base. The TRAK Sensor has one slot on the underside and one flat that fit over the raised bumps of the M-5 Base. Screw in clamp screw to be snug, but not tight. Push the TRAK Sensor so that the Gage Wheel is in contact with the Running Surface.



The Clamp Screw is screwed into the M-5 Base, and the Hardened L-Washer is in contact with the Tilt Adjustment Screw.

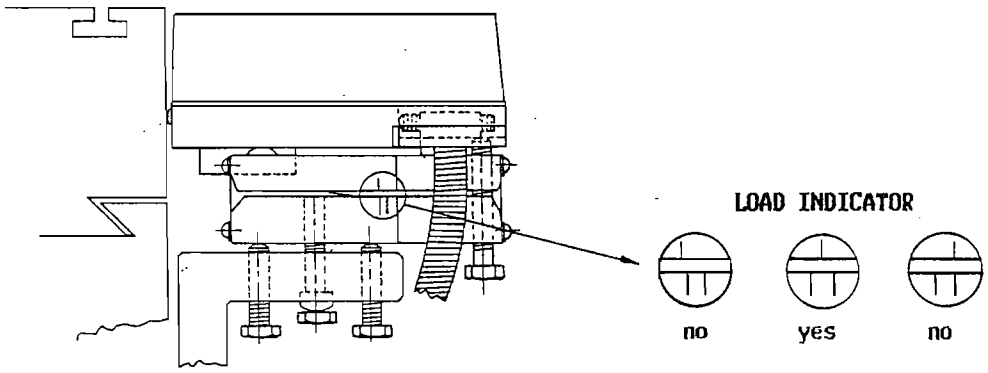
Step 5 Install the TRAK Sensor onto the M-5 Base. (Continued)

3. Assure that the TRAK Sensor is oriented properly to the Running Surface.



Use the Tilt Screw, if necessary, to orient properly. (Be sure to loosen the Clamp Screw first if raising the Tilt Screw.)

4. Screw in the loading screw of the M-5 Base until the load indicator is in the "yes" condition (see below).



5. Tighten the clamp screw but do not over-tighten.

6. Soak the foam pad surrounding the Gage Wheel and the Running Surface with light way oil.

7. Plug the Sensor Cable into the Digital Readout unit.

Step 6 Establish Gage Wheel Track.

Traverse the machine axis so that the Gage Wheel rolls over its running surface from 4-6 times.

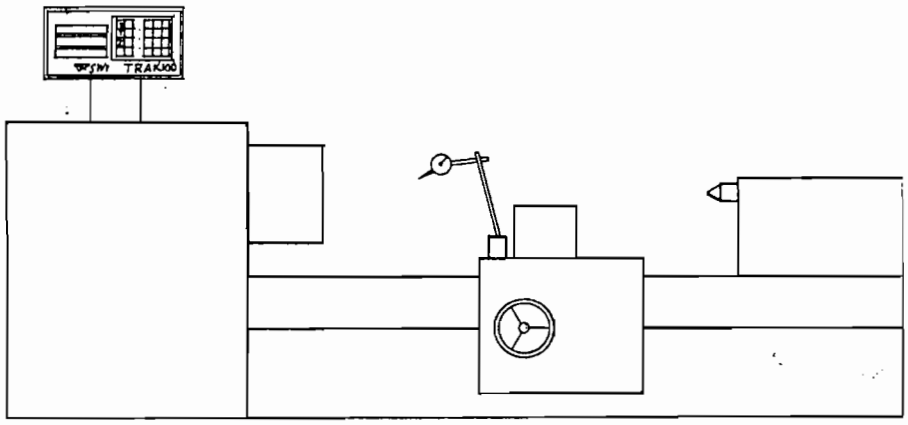
A hardened way surface may require additional passes to establish the track.

Fill the wiper pad which surrounds the Gage Wheel with light oil (like that used for the machine way surface).

NOTE: Whenever an adjustment to the TRAK Sensor or M-5 Mounting Base is made, it is necessary to change the contact point of the Gage Wheel on the Running Surface and repeat this step to establish a new track.

Step 7 Test for Repeatability of Measurement.

1. Set up a dial indicator with a resolution of .002mm on a part of the machine, for example, the carriage of a lathe.



2. Establish a reference point by touching the dial indicator to a part of the machine. For example, the lathe chuck.

3. Set the Digital Readout to zero by pressing the axis button and then "Preset" (see operations manual for the appropriate DRO model).

4. Move the machine axis at least 150mm away from the reference point.

5. Return to the reference point and observe the reading of the Digital Readout. Repeat this procedure again.

   If the Digital Readout returns to zero both times, it is repeating properly. Go to the Calibration section in the manual of the Digital Readout model you are calibrating.

   If the Digital Readout does not return to zero, the TRAK Sensor is not repeating. Continue with the following procedure. THE TRAK SENSOR MUST REPEAT PROPERLY TO BE OF VALUE.

Step 7 Test for Repeatability of Measurement. (Continued)

6. Repeat the parts 4 and 5 above to determine the type of error the TRAK Sensor exhibits. Write down the Digital Readout reading each time the machine is returned to its reference point. Do not reset the Digital Readout to zero.

   There are two types of repeatibility error.

   Example of Accumulating Error

# Returns	Machine Reference	Trav-A-Dial Reading
first	0	+ .01 mm
second	0	+ .02 mm
third	0	+ .04 mm
fourth	0	+ .07 mm
fifth	0	+ .11 mm

   In the above example the TRAK Sensor exhibits a pattern of accumulating error in a regular and predictable amount each time.

   Accumulating error is caused by a failure to level the M-5 Base precisely with the machine travel.

   Remove the TRAK Sensor and level the M-5 Base again as shown in Step 4, Part 3.

   When replacing the TRAK Sensor after leveling, be sure to reestablish the Gage Wheel Track as in Step 6.

   Example of Random Error

# Returns	Machine Reference	Trav-A-Dial Reading
first	0	+ .02 mm
second	0	+ .11 mm
third	0	- .05 mm
fourth	0	+ .03 mm
fifth	0	- .01 mm

   In the above example the TRAK Sensor error is not of a regular, predictable pattern, it is Random.

Step 7 Test for Repeatability of Measurement. (Continued)

Possible causes of random error:

- Dial Indicator set-up loose or too much flexture.
- Gage Wheel not in proper contact with Running Surface.
- Trav-A-Dial not mounted properly on M-5 Base.
- Clamp Screw Load Cell loose or broken.
- M-5 Base not tightened to Bracket.
- Bracket not mounted rigidly to machine.
- Bracket mounted to weak or loose part of machine.
- Bracket cracked or broken.
- Bracket material too thin or flexible.
- Bracket not supported properly.
- Run Bar loose.
- Machine parts loose.

To resolve Random Error, re-check the installation carefully starting from Step 1 especially ensure that everything is tight and fits well. Be sure to follow all installation steps carefully, including the proper loading of the Trav-A-Dial and establishment of Gage Wheel track.

Once the TRAK Sensor is repeating properly, refer to the Calibration Section in the operator's manual of the appropriate Digital Readout or CNC product.

C - MAINTENANCE OF GAGE WHEEL PRODUCTS*

1. Lubrication

When the machine tool on which the Trav-A-Dial or TRAK Sensor is mounted receives its regular lubrication, it is a good practice to apply a generous amount of way oil to the wiper pad.

This flushes out any tiny chips which may have collected in the wiper pad and enables it to perform its cleansing function better.

2. Changing of Wiper Pad

The wiper pad should be changed periodically. This will prolong the useful life the Gage Wheel product.

The frequency of change depends on the conditions of use. SWI recommends that the Wiper Pad be changed twice per year if the environment is dirty or if the machine is used heavily. For cleaner environments with less machine use, the wiper pad change can be less frequent.

To change the Wiper Pad:

a. First loosen the loading screw, then the clamp screw, and then remove the Trav-A-Dial or TRAK Sensor from the M-5 base.

b. Thoroughly remove the old wiper pad and all residue. Use acetone or kerosene to clean off oil or remaining glue.

c. Attach a new Wiper Pad using a liberal amount of petroleum based adhesive (glue). Allow the glue to dry for one minute.

d. Clean the bottom of the Trav-A-Dial or TRAK Sensor and replace it. (The Trav-A-Dial does not need to be re-calibrated if the calibration was good.)

e. Apply a liberal amount of way oil to the wiper pad.

f. Replace the clamp screw and reload the Trav-A-Dial or TRAK Sensor.

g. Traverse the machine full travel 4-6 times in order to establish a new Gage Wheel track.

*See "Maintenance Accessories" in Section V.

3. Changing of the Chip Scraper (TRAK Sensor only)

If chips are a concern due to the placement of the TRAK Sensor, the chip scraper should be changed every 1 to 2 years.

The TRAK Sensor may be used without a Chip Scraper, if desired.

To change the chip scraper:

a. First loosen the load screw, then the clamp screw, then remove the TRAK Sensor from the M-5 Base.

b. Change the old Chip Scraper for a new one.

c. Clean the M-5 Base, then clean the bottom of the TRAK Sensor and replace it.

d. Replace the Clamp Screw and reload the TRAK Sensor.

e. Traverse the machine full travel 4-6 times in order to establish a new Gage Wheel track.

4. Changing of Plastic Crystal (Trav-A-Dial only)

The plastic cyrstals of the Trav-A-Dial may be replaced when they become scarred and the reading is difficult to see.

To change the crystals:

a. Use a knife blade to pry old crystal off. Be careful not to bend the aluminum bezel.

b. Thoroughly scrape away all glue residue.

c. If coolant contamination is a concern, put a bead of cement around the bezel to seal out moisture. If not, apply only 2 or 3 drops.

d. Snap on new crystal.

5. Changing of Dial Hands (Trav-A-Dial only)

Dial hands may be replaced if necessary.

Make sure the new hands are seated properly.

6. Changing of Dial Face (Trav-A-Dial)

Each dial face may be replaced if necessary.

Use a small amount of petroleum based glue to secure the new dial face.

D - TRAK 100 DISPLAY INSTALLATION

The TRAK display unit is equipped with rubber feet and may be placed on any flat surface which is convenient for the operator. A number of special hanging or platform brackets and pendants may be purchased to optimize visibility and accessibility by the operator. Brackets may be attached from the threaded hole at the top or bottom of the display after unscrewing the platic plug.

Adequate grounding is necessary for the proper functioning of all digital readout systems. Attach one end of the braided strap (furnished with each system) under the wing nut on the display back panel and attach the other end to a good earth ground. The machine tool should also be electrically connected to a good earth ground. Examples of good grounds are cold water pipes and many electrical conduits.

E - OPERATION OF TRAK 100 DRO

1. Description

a. Keyboard

All TRAK 100 operator input is through a sealed keyboard on the front panel (Figure 1). The system will beep when proper contact has been made with each key.

X, Y, Z: Selects axis for subsequent commands.

***** : Initiates system configuration commands.

PRESET: Loads data.

INC/ABS (stands for incremental/absolute): Converts one or all axes from incremental to absolute or from absolute to incremental.

RSTR (stands for restore): Used to restore the system or clear entry.

M: Switches from "DRO" to "RUN" to "LEARN" modes.

TOOL SET: Loads tool offsets.

TOOL: Selects tool number.

ALERT (option): Used to set dimension for alert signal.

PRINT (option): Outputs display data through RS232 port.

+/- : Converts input data from + to - or - to +.

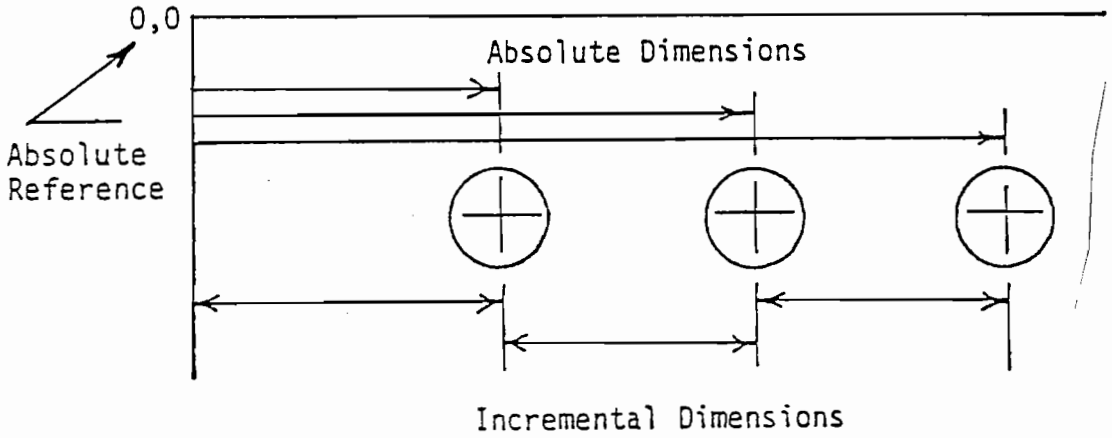
0-9, . : Data may be loaded as fixed or floating point.

b. Back Panel

The TRAK 100 back panel (Figure 2) contains the ON/OFF switch, power input connector, sensor connectors, print (test port) and alert connectors.

c. Incremental and Absolute Dimensions

Your TRAK 100 is equipped to allow you to operate in both incremental and absolute position coordinates. To help understand the difference between absolute and incremental position, consider the example in the figure below:



You have complete freedom to change the display readout back and forth between the incremental readout and the absolute readout. And you may locate the absolute reference anywhere on the print or part to be machined.

d. Power Interruption

The TRAK 100 automatically monitors the incoming power. If unacceptable power characteristics are sensed by the system, it automatically takes action to warn the operator and/or protect itself in the following ways:

- Low Voltage or Momentary Power Interruption: The TRAK 100 flashes all zeroes on all axes. Enter a RSTR and the flashing will stop.

  NOTE: If the flashing is repeated, a continuing incoming power problem may exist.

- Power Surge or Spike: The TRAK 100 is equipped with a high voltage guard mechanism which prevents excessive voltage from damaging the system. This mechanism shuts down the system and blanks all lights. If the momentary power problem has been rectified, switch the system off for a minimum of ten seconds and then back on to re-initialize the system.

NOTE: If the input power surge is large or more than momentary, the systems slo-blo fuse will blow.

To check the fuse, remove the four screws holding the back case to the front. The 3/4 amp glass fuse is on the back printed circuit board near the top. Inspect and replace as is necessary.

d. Maximum Display Readout Limits

Each TRAK 100 system is manufactured with limits on the maximum +/- dimension that can be displayed on an axis of readout. These limits are identifiable from the display model number and its associated specifications. For example, a TRAK 102-60 limits each axis to read +/- 60 inches.

Any operation resulting in an attempt to display a dimension exceeding these +/- limits will cause a logic fault and the display will flash. A RSTR command restores the system, but the position information which exceeded the limit is lost.

2. Configuring Your TRAK 100

The TRAK 100 is a general purpose digital readout which can be tailored to your specific application.

The * key along with a set of code numbers are used to select the appropriate options and features. All of your selections are stored by the TRAK 100 (even without power) until they are changed by you.

a. To Change from English to Metric or Metric to English

- Press * and hold three seconds
- Press 66, PRESET

NOTE: In English the display reads X.XXXX, and in metric X.XXX.

b. To Select Crossfeed on Any Axis

- Press * and hold three seconds
- Press X or Y or Z, 02, PRESET

c. To Cancel Crossfeed on Any Axis

- Press * and hold three seconds
- Press X or Y or Z, 01, PRESET

d. To Select Resolution for Each Axis

- Press * and hold three seconds
- Press X or Y or Z, 11 or 12 or 13 (see below), PRESET

CODE	RESOLUTION NON-CROSSFEED	RESOLUTION CROSSFEED	APPLICABLE SENSOR
11	.0002"/.005mm	.0005"/.01mm	Standard M250 Sensor
12	.0005"/.01mm	.0005"/.01mm	Standard M250 Sensor
13	.001"/.01mm	.001"/.01mm	Standard M250 Sensor

e. To Deactivate Any Axis

- Press * and hold three seconds
- Press X or Y or Z, 21, PRESET

f. To Reactivate Any Axis

- Press * and hold three seconds
- Press X or Y or Z, 22, PRESET

g. To Reverse Direction of Count on Any Axis

- Press * and hold three seconds
- Press X or Y or Z, 41, PRESET

h. To Activate the Make-Learn Feature

- Press * and hold three seconds
- Press 93, PRESET

i. To Deactivate the Make-Learn Feature

- Press * and Hold three seconds
- Press 94, PRESET

j. To Activate the Tool Offset Feature

- Press * and hold three seconds
- Press 91, PRESET

k. To Deactivate the Tool Offset Feature

- Press * and hold three seconds
- Press 92, PRESET

l. To Test the Keyboard

- Press * and hold three seconds
- Press 88, PRESET
- Each key will "beep" when pressed
- The TRAK 100 will automatically revert back to normal operation after 25 seconds or if it is turned off and back on

3. General Operation

The TRAK 100 has been designed with both the shop manager and operator in mind. Much effort was spent on making the TRAK 100 operations logical, simple, and error-proof. At the same time, the system was designed for flexibility of operations so that it can handle your jobs--whether simple or complex.

a. System On

To turn on the system, place the ON/OFF power switch on the back panel to the ON position (up). All display axes will start with a 0 reading and flash. To stop the flashing and proceed with normal operations, enter a RSTR (restore) command.

b. Absolute Position Data Indicator

When any axis readout is displaying an absolute dimension or position a small red dot will appear above the axis display +/- sign.

c. Reset Incremental

Make sure the axis is reading incremental data--no red dot (see Section 4.7). Press X or Y or Z, PRESET.

d. Preset Incremental

Make sure the axis is reading incremental data--no red dot (see Section 4.7). Press X or Y or Z, numeric data, PRESET.

e. Reset Absolute Reference

Make sure the axis is reading absolute data--red dot (see Section 4.7). Press X or Y or Z, PRESET. This also automatically resets incremental.

f. Preset Absolute Reference

Make sure the axis is reading absolute data--red dot (see Section 4.7). Press X or Y or Z, numeric data, PRESET. This also automatically presets incremental.

g. Recall Absolute or Incremental Position on One Axis

Press X or Y or Z, INC/ABS. Note presence of red dot above selected axis +/- to determine if the axis is reading incremental (no red dot), or absolute (red dot). Repeat to get selected axis back to original reading.

h. Recall Absolute or Incremental on All Axes

Press INC/ABS. Note presence of red dot above each axis +/- to determine if the axis is reading incremental (no red dot), or absolute (red dot). Press INC/ABS again to revert to the original reading. If one axis is reading incremental and another absolute, pressing INC/ABS will switch each axis to the other mode.

i. Clear Entry

Press RSTR.

j. Master Reset

To master reset the TRAK 100, press and hold the RSTR key for three seconds. This automatically sets the system in the DRO mode (see Section 5.1), cancels the alert positions (see Section 7.4 & 7.5) and recalls the Tool 1 reference (see Section 6).

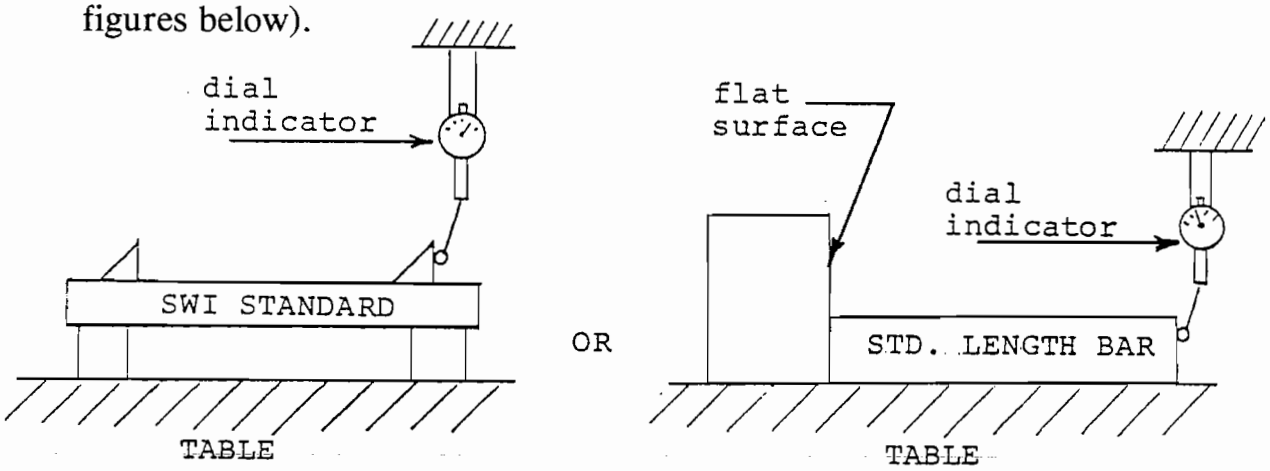
4. Calibration Procedure

The TRAK 100 (like all Southwestern Industries' DRO and CNC Systems) incorporates computerized machine tool error compensation. Most machine tools--and especially those with overhanging tables like knee mills--have inherent errors due to wear, bow, or pitch in their table, ways, and/or beds. These are known as ABBE error and can be as long as 0.25mm per 300mm of travel.

The TRAK 100 computes this error, determines a linear compensating factor, and automatically stores it into memory.

a. Be certain that the TRAK Sensor encoders and TRAK 100 display are properly installed (see Section IV, B).

b. Mount a standard of known length parallel to the movement along the axis to be measured. It is strongly recommended that the standard be a multiple of 150.00mm; that is 150.00mm, 300.00mm, 450.00mm, etc. Also mount a dial indicator so that it can be touched off each end of the standard (see figures below).



c. Switch to the measuring system of the standard--that is, inch or mm.

d. Press * and hold three seconds. Press 123, PRESET.

e. Move the table so that the dial indicator is zeroed at one end of the standard.

f. Press X or Y or Z (axis to be calibrated).

g. Move the table so that the dial indicator is zeroed at the other end of the standard.

h. Observe whether the readout is equal to or greater (but not more than 1% greater) than the standard length. If it is, continue as below. If not, check the installation of the sensor, be certain the system is properly configured (especially as in Section 2.6 and 2.d) and consider the note below.

NOTE: When calibrating a crossfeed application (direct diameter readout) the display will read twice the standard length (e.g., 300mm for a 150mm standard). This doubled number must be entered in Step (i) for correct calibration.

i. Press numeric data equal to the standard length, PRESET.

j. The axis display will read the standard length if the calibration factor was correctly computed and stored. The axis display will blank if not. In this case, press RSTR and go back over the entire procedure with special attention to (h) above.

k. Repeat the procedure for each axis.