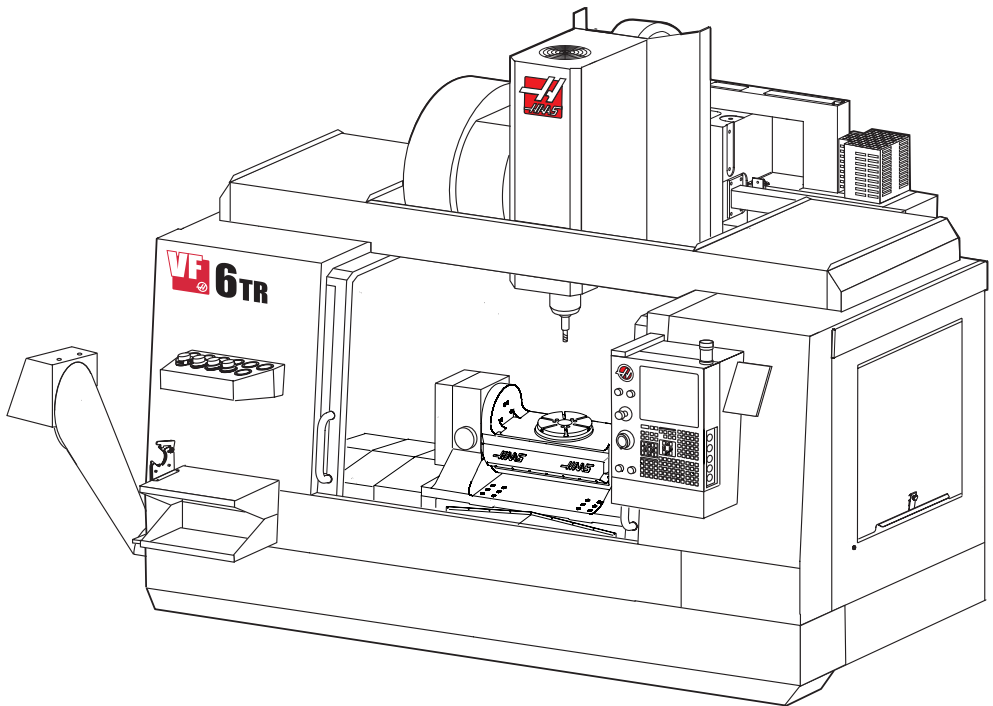# VF Trunnion Series

Five-Axis Machining Center

Operator's Addendum

OVERVIEW

This addendum is to be used in conjunction with the Mill Operator's Manual. It contains information on the Installation, Programming, Operation, and Maintenance of the Trunnion series of machines. Information provided (i.e. macro variables, parameters, etc.) is in addition to what is currently in the Mill Operator's Manual.

SHIPPING BRACKETS

The following illustrations show the positions of the shipping brackets. All of these brackets **MUST** be removed before any axis movement takes place. Not doing so will damage the machine and may void the warranty.
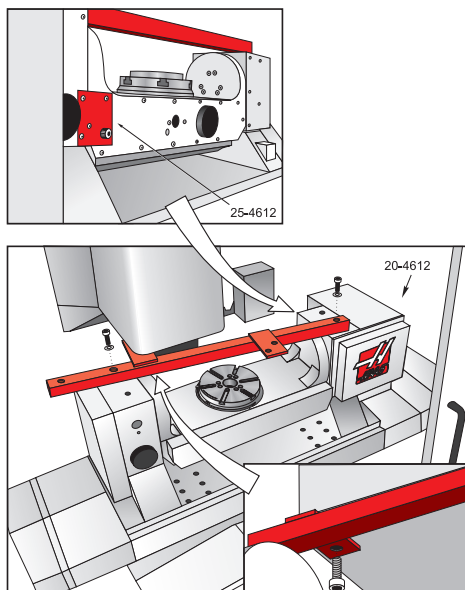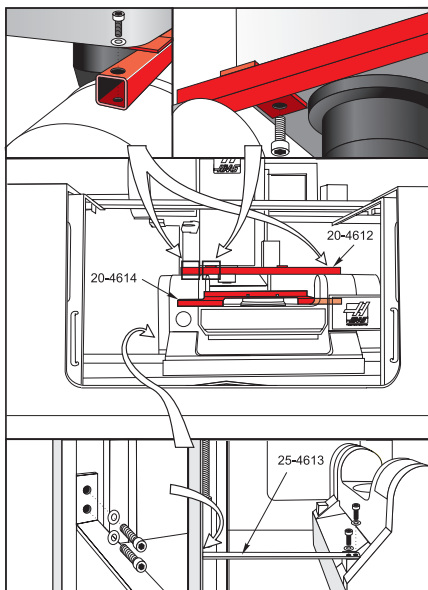

Figure 1 VF-5TR

Figure 2 VF-6TR

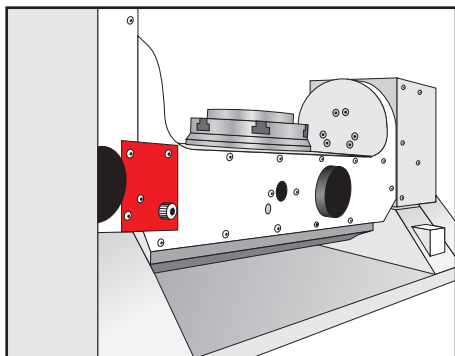Shipping bracket part numbers and descriptions

20-4612	Z-axis Shipping Bracket
20-4614	A-axis Shipping Bracket (VF-6TR)
25-4613	Shipping Bracket Y-axis 6TR (VF-6TR only)
25-4612	Shipping Bracket A-Axis 5TR (VF-5TR only)
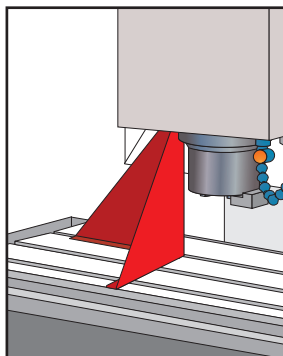
Figure 3 VF-2 TR Shipping Brackets
*Trunnion table bracket is located on the back*

LEVELING THE VMC

See the reference manual for more information on machine leveling.

Leveling of the machine is required to obtain the correct right angle geometry of all of the axes. Incorrect level will result in out-of-round circle milling and incorrect linear interpolation.

Leveling is done in two steps: **rough leveling** to ensure the machine is level for coolant and oil drainage, and **fine leveling** for axes' geometry. Finally, the spindle sweep is checked. Leveling is done without removing any covers.

> **NOTE:** All measurements are taken with the platter in the horizontal position.

> **NOTE:** Many factors can affect a machine's ability to re-main level — the rigidity of the floor, the stability of the support under the floor, trains or trucks passing nearby, seismic activity, and so on. Therefore, until your experience shows how often re-leveling is required, you should check the machine's level frequently after it is installed.
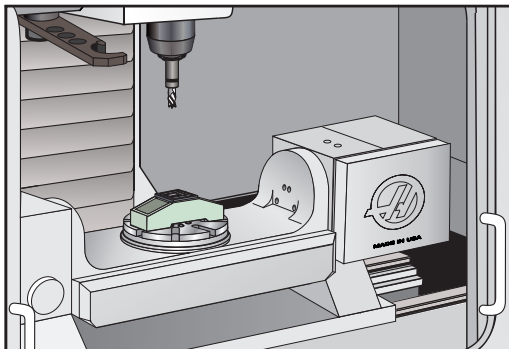
Use a precision bubble level with each division equal to **0.0005** inch per **10** inches, or **.05** mm per meter, or **10** seconds per division. Before starting, check the accuracy of your level. Set it on the table on the X-axis and record the reading. Then turn it **180°** and the reading should be the same. If it is not, the level is out of calibration and should be adjusted before you continue.

ROUGH LEVELING

1. Screw the four leveling screws at the corners through the base until the base is 2½" to 3" above the floor. That translates into a minimum of one inch of the leveling screw extending out of the bottom of the base of the machine, or one inch between the pads and the casting. Turn each screw until the tension is about the same as the tension on the other screws (it takes the same effort to turn each screw).
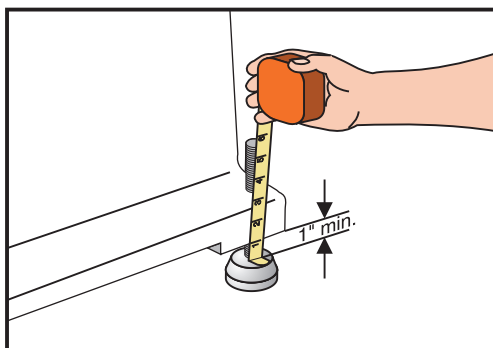
2. Install the two center leveling screws, ensuring that they do not touch the floor.

3. Use HANDLE JOG set for **0.01** on the X- and Y- axes for the leveling procedure. (See the "Introduction" section for details on selecting jog rate and axis.) This provides a good rate of travel as you manually move the table.

4. Using the jog handle, center the platter under the spindle. You do not need to move the table while rough-leveling the machine.

5. Place the bubble level on the center of the platter, parallel to the Y-axis (front to back). Tram in the A-axis using the handle jog function until the bubble level is reading zero.

6. Place the level parallel to the X-axis (side-to-side) on the table and observe the bubble. If the bubble is centered, the table is level on this axis. If the bubble is off to the left of the level, it means that the left side of the table is high. And, conversely, if the bubble is off to the right, it means that the right side of the table is high.

> **NOTE:** Each time you read the level, make sure that the bubble has steadied before you take the reading.

7. Turn the screws on the low side of the machine clockwise (screw them in) a little at a time and check the level until the bubble is centered.

> **NOTE:** In most cases it is better to raise a side or corner than it is to lower it — when you lower a machine there is a greater risk of running out of adjustment.

8. Repeat the previous steps with the level on the Y-axis (front-to-back).

9. Continue this process until the machine is level on both axes.

> **NOTE:** If the level is off on both axes, it indicates that one corner of the machine is high or low.

10. As the process continues, the leveling screws are turned in smaller increments — 1/4 turn, 1/8 turn, and smaller. Also, as the machine is leveled, make sure that the tension continues to be equal on the screw at all four corners.

11. Place a 0.0001 indicator in the spindle to measure A-axis tram. Position the indicator on the platter at the 12 O'clock position and zero the indicator, jog the Y-axis to the 6 O'clock position and record this reading. The deviation from these locations should be no greater than 0.0003. Re-tram the A-axis and re-level the Y-axis until the reading is less than .0003.

> **NOTE:** The following procedure for fine leveling the machine must be performed exactly as noted to ensure machine will meet all quality standards for machining operations. Failure to follow these guidelines will prevent the machine from being truly leveled and result in poor machining finishes.

FINE LEVELING

12. With the table centered, place the bubble level in the center of the platter parallel to the X-axis. Using the jog handle, move the Y-axis, stopping at the front, middle, and back of the travels. The objective is to adjust the level to make the Y-axis guides parallel. The bubble level must indicate the same reading at each position (front, middle, back). Note the movement of the bubble and if the table is at front or back of travel. If the bubble moves, for example, to the right and the platter is at the front of the travel, lower the right front corner adjustment screw slightly. Repeat the procedure until you get the bubble steady from front to back. This is the only leveling adjustment that can be done.

13. Re-check A-axis tram. Position the indicator on the platter at the 12 O'clock position and zero the indicator, jog the Y-axis to the 6 O'clock position and record this reading. The deviation from these locations should be no greater than 0.0003. Re-tram the A-axis and re-level the Y-axis until the reading is less than .0003.

The following procedure is simply a check of machine level. Repeat this operation if it does not meet specifications. Do not adjust the middle screws at this point.

Refer to the Machine Inspection Report that accompanies the machine. Check the leveling results with those of the report under the Table Travel Flatness verification. By duplicating these results exactly, the same alignment specifications will be obtained that were achieved at the factory.

14. Place a **0.0005** test indicator in the spindle and sweep a **10" diameter** circle on the table (See the Machine Inspection Report in the manual for the results of this test at the factory). Grease the dimple in each of the two remaining pads, locate them under the middle leveling screws, and use these screws to compensate for any error. If there is no error, tighten the screws evenly until they contact the pads.

PROGRAMMING THE FIVE-AXIS CONTROL

This section contains information specific to the five-axis control. The Mill Operator's Manual contains all other information necessary to program the HAAS control.

> **NOTE:** Most 5-axis programs are complex; CAD/CAM software should be used to create the programs.

THE COORDINATE SYSTEM

The layout of the **A** and **B** axes on the HAAS five-axis control are depicted. The **A** axis is rotary motion about the **X** axis, while the **B** axis is rotary motion about the **Z** axis.

The right hand rule can be used to determine axis rotation for the **A** and **B** axes. When placing the thumb of the right hand along the positive **X** axis, the fingers of the right hand will point in the direction of tool movement for a positive **A**-axis command. Likewise, when placing the thumb of the right hand along the positive **Z** axis, the fingers of the right hand will point in the direction of tool movement for a positive **B**-axis command.
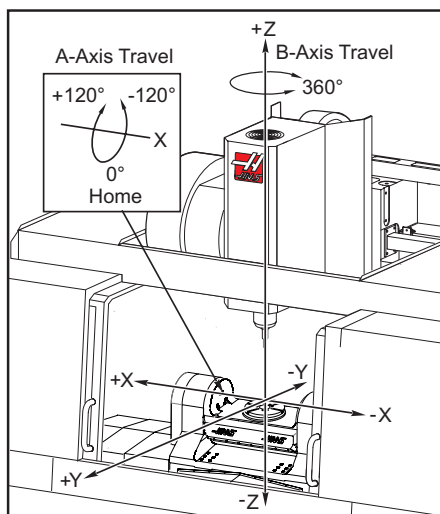
VF Trunnion axis motion.

ALPHABETICAL ADDRESS CODES

The **A** and **B** address codes are used to program the fourth and fifth axes, respectively.

A   Fourth axis rotary motion

The **A** address character is used to specify motion for the fourth (**A**) axis. It specifies an angle in degrees for this axis. It is always followed by a signed number and up to three fractional decimal positions. If no decimal point is entered, the last digit is assumed to be 1/1000 degrees. The smallest magnitude is 0.001 degrees, the most negative value is -120.000 degrees, and the largest number is +120.000 degrees.

B   Fifth axis rotary motion

The **B** address character is used to specify motion for the fifth (**B**) axis. It specifies an angle in degrees for this axis. It is always followed by a signed number and up to three fractional decimal positions. If no decimal point is entered, the last digit is assumed to be 1/1000 degrees. The smallest magnitude is 0.001 degrees, complete to 360.000 degrees of rotation.

G CODES & M CODES

All **G** codes that have an option for an **A** axis motion command can also simultaneously command fifth axis (**B**) motion. Since address **B** is modal, it can be entered on any line.

The **A** and **B** axes can be commanded in the following **G** codes:

G00	G03	G29	G73	G77	G83	G86	G89	G101
G01	G10	G31	G74	G81	G84	G87	G92	G102
G02	G28	G36	G76	G82	G85	G88	G100	G136

Fifth-axis programming is not affected by the selection of inch (G20) or metric (G21). The **A** and **B** axes are always programmed in degrees.

M Codes

The following **M** codes affect operation of the fourth and fifth-axis brakes. See the operator's manual for more information.

M10 / M11   Engage / Release 4th Axis Brake
M12 / M13   Engage / Release 5th Axis Brake

Operation

Handle Jog

All aspects of handle jogging for the fourth and fifth axes work as they do for the other axes. The exception is the method of selecting jogging between axis **A** and axis **B**.

The '+A' and '-A' keys, when pressed, will select the **A** axis for jogging. The display will show "JOGGING A AXIS HANDLE while you are jogging the **A** axis. The **B** axis can be selected for jogging by pressing the SHIFT key, and then pressing either the '+A' or '-A' key. When this is done the control will switch to jogging the **B** axis and the display will change to "JOGGING B AXIS HANDLE.

The axis assigned to the '+A' and '-A' keys will remain selected for jogging even if the operating mode is changed or if the machine is turned off. The selected axis for '+A' and '-A' can be toggled by pressing the SHIFT key prior to pressing the '+A' or '-A' keys.

Settings

The following settings affect the fourth and fifth axes. Read the operator's manual for more information.

48   MIRROR IMAGE A-AXIS
**80   MIRROR IMAGE B-AXIS**

Offsets

Work offsets can be specified for the fourth **(A)** and fifth **(B)** axes, and are shown on the offset display page.

The last column of the offsets display serves a dual purpose. Either **A** or **B** axis tool offsets are accessed in the last column. By using the left or right arrow keys, the screen cursor is moved into the axis field to set.

B ON A AXIS OFFSET

This procedure determines the distance between the plane of the B-axis platter and the A-axis centerline on tilting rotary products. Some CAM software applications require this offset. It is not used by the Haas control.
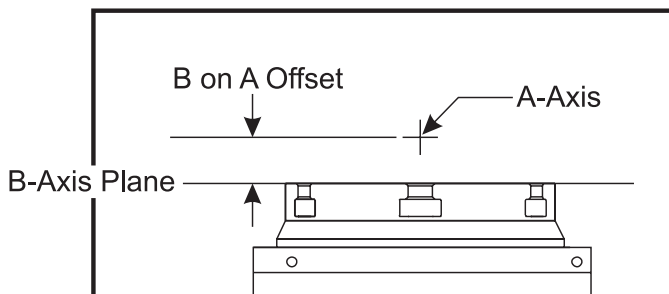
1. Rotate the A-axis until the B-axis is vertical. Mount a dial indicator on the machine spindle (or other surface independent of table motion) and indicate the platter face. Set the indicator to zero.

2. Set the Y-axis operator position to zero (select the position and press ORIGIN).

3. Rotate the A-axis 180°.

4. The platter face must now be indicated from the same direction as the first indication. Place a 1-2-3 block against the platter face and indicate the face of the block that rests against the platter face. Move the Y-axis to meet the block with the indicator tip. Reset the indicator to zero.

5. Read the new Y-axis position. Divide this value by 2 to determine the B on A axis offset.

3. Rotate A-axis 180°

A-Axis

1. Indicate Face

4-5. Indicate 1-2-3 block
and read new Y-Axis
position. Divide by 2.
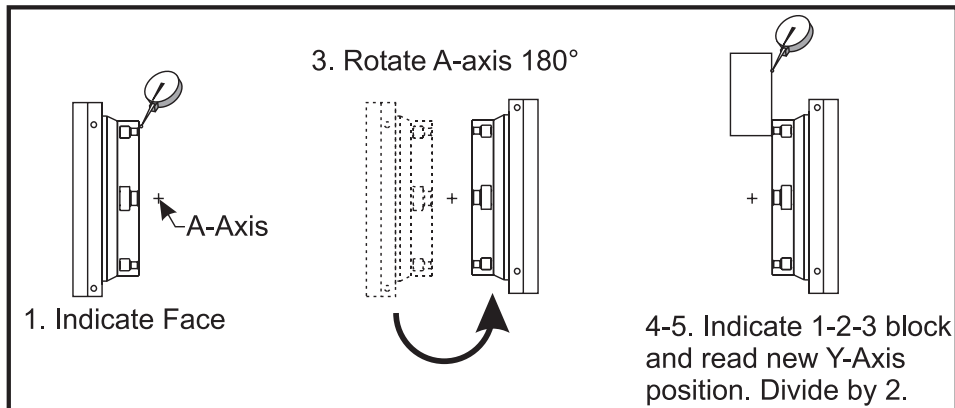
B on A Axis Illustrated Procedure

MAINTENANCE

The following is a list of required regular maintenance for the HAAS VF Trunnion Machining Center. These items must be performed in addition to the maintenance items listed in the Mill Operator's Manual.

Listed are the frequence of service, capacities, and type of fluids required. These specifications must be followed in order to keep your machine in good working order and to protect your warranty.

INTERVAL   MAINTENANCE PERFORMED

MONTHLY   Grease all pivot points on the tool changer assembly.

Check the oil in the trunnion table. The A-axis covers need to be removed to access the filler cap and the sight glass. the B-axis filler is on the outside of the casting. Add Mobil SHC-630 to the top of the casting.

Change A and B Axis oil every two years.