Section 04: Machine Maintenance

Scheduled Maintenance

Maintenance & Lubrication Schedule

Daily

1) Check air pressure: Right regulator 120 PSI. max. (Tool Out Only). Left Regulator 80-90 PSI.

2) Check way lube level. Use Castrol Magna BD68, Shell Tonna 68V or Mobil Vactra #2 ONLY. (Not applicable to TRM)

3) Check way lube system for adequate oil flow to all way surfaces.

4) With tool in spindle blow chips from around A.T.C. and slide. NEVER blow chips from around these areas during automatic tool change or without a tool in the spindle.

5) Remove heavy chip build up from guards and way covers.

6) Wash A.T.C. and machine work area.

7) Check coolant level. (Not applicable to TRM)

8) Clean coolant screen. (Not applicable to TRM)

9) Clean the area around the machine.

10) Immediately clean any spills in the area.

Weekly

1) Check spindle cooler pump and refrigeration unit for proper operation. (Not applicable to TRM)

2) Check fluid level of chiller tank and refill, if needed, with a 50/50 mix of Dowfrost clear and de-ionized water. If de-ionized water is not available, sodium-free distilled water can be substituted. *Do not accept any substitutes for DOWFROST CLEAR!* (Not applicable to TRM)

3) Clean A.T.C. slide. (Not applicable to TRM)

4) Check air regulator.

5) Drain and clean water separator.

6) Fill oiler if needed. (Not applicable to TRM)

7) Activate Thru-Tool coolant system for 2-3 minutes (if machine has this option). (Not applicable to TRM)

8) Lubricate Y axis telescoping ball screw cover with way lube. (Not applicable to TRM)

9) Grease axis way cover using molygraph.(Not applicable to TRM)

10) Grease retention rings using molygraph. (Not applicable to TRM)

11) Grease Geneva wheel and gear using Kopr-Kote. (Not applicable to TRM)

12) For high torque machines, check fluid level in the hydraulic actuator reservoir. Refill, if needed, with Mobil DTE Heavy Medium.

13) Inspect all cooling fans, clean screens if necessary.

Every 4 months
Service way lube filter. Machines with an external filter require less frequent replacement; however, do not exceed 4 months. When replacing the external filter, fill the new filter with way lube prior to installation.

EMC & TRM Lubrication of the ballscrews

Every 6 months
To keep the EMC & TRM running smoothly, it is crucial that the ballscrews are lubricated with MOBIL SHC #32 grease at least every 6 months depending on use. Fadal recommends that a Fadal certified service person lubricate the ballscrews.

1) Remove the way axis covers.

2) Locate the ZERK fittings on the ballscrew ballnut.

3) Insert the hose of the grease gun (TLC-0285) onto the ZERK fitting.

4) Pump MOBIL SHC #32 grease (CHM-0083) into each ballscrew ballnut. Pump until grease begins to come out of the ballscrew ballnut.

5) Remove the grease gun.

6) RE-install the axis covers.

TRM Lubrication of the Ways

Every 3 months
To keep the TRM running smoothly, it is crucial that the ways are lubricated with bearing grease at least every 3 months depending on use.

1) Locate the ZERK fittings on the ways on the linear way truck.

2) Insert the hose of the grease gun (TLC-0285) onto the ZERK fitting.

3) Pump MOBIL SHC #32 grease (CHM-0083) into each linear way truck. Pump until grease begins to come out of the linear way truck.

4) Remove the grease gun.

Lubrication of the Ways

Waylube System
USE WAYLUBE TYPE Castrol Magna BD68, Shell Tonna 68V or Mobil Vactra Oil #2.

The Positive Displacement Injection (PDI) lube system is a solenoid-controlled pneumatic system. When the solenoid is activated, the pump sends oil to the junction block assemblies, which may contain several different size valves, at a pressure ratio of 5:1. The pump is activated for 10 seconds, within a 4 minute cycle, during which oil is distributed to all of the valves on the junction block assemblies. When the solenoid is deactivated the oil flow stops and creates back pressure which escapes through a relief valve. When the pressure on the valve drops below 50 psi, a spring inside the valve is then able to inject oil into the lines.

The CNC has direct control of the automatic lube system. The cycle is activated by executing an axis motion in a CNC program, commanding an axis move in MDI mode or pressing the JOG key. Once activated it monitors the oil level to be sure the reservoir is above the minimum level. In addition, it shuts the oil system down if the machine sits idle longer than one cycle of the lube system.

Frequently clogging filters indicate that the wrong waylube is being used. *Use Castrol Magna BD68, Shell Tonna 68V or Mobil Vactra Oil #2 ONLY.*

Procedure for Flushing a Contaminated Waylube System
This procedure is necessary when the waylube that was being used in the machine was incorrect. Other waylubes may contain paraffin wax or silicone.

1) Replace the 10-port way lube junction block that is located at the left side of the saddle.

2) Replace the External filter on the BIJUR PDI way lube pump (Part # LUB-0049).

3) Remove the oil line that is between the way lube pump and the three port junction T that is located near the pump mount.

4) Verify that the flush pump air regulator is fully counterclockwise.

5) Attach an air line to the flush pump.

WARNING

Verify that the air regulator is closed.

6) Insert the 3/8" hose from the flush pump into a container of grade A kerosene.

7) Slowly open the air regulator clockwise to start the flush pump.

8) Increase the air pressure being careful that the output pressure does not exceed 180 PSI at the gauge.

9) The pump is 4:1 ratio, 45 PSI input air pressure is 180 PSI output.

10) Enter a program that will exercise all axes to their limits. Start the program running.

11) The flow of kerosene through the way lube system should be steady.

12) If the kerosene is dripping slowly down the column from underneath the Z axis head the manifold filters are probably clogged. Replace the 8 port junction block located on the Z axis head. Start over at step D.

13) Remove the 3/8" hose from the kerosene and place the hose in a can of clean fresh waylube.

14) Slowly open the regulator clockwise on the flush pump. Pump waylube through the lines until the system is well lubricated.

15) Stop the machine and return it to the COLD START position.

16) Turn the flush pump air regulator fully counterclockwise and remove the air line.

17) Remove the flush pump and reattach the oil line from the Bijur pump to the 3 port junction.

Cooling Fans

WARNING

Power off the machine at the main disconnect switch and lockout/tagout the main disconnect.

There are numerous cooling fans on the VMC that require periodic inspection. Located in the CNC box and the junction box.

WARNING

Wear safety glasses!

If the fan is turning slowly or not at all it may require cleaning or replacement. The fan on the bottom of the junction box has a screen that requires periodic inspection and removal for cleaning.

Spindle & Ballscrew Cooling System

The spindle and ballscrew cooling system is made up of a motor pump assembly, ambient-liquid temperature sensor assembly and a DP5P chiller. As long as there is power to the machine the chiller pump is circulating Dowfrost through the system. The ambient sensor is used to measure casting/air temperature and the liquid sensor to measure Dowfrost temperature in the return line. When there is a one degree temperature differential between the two sensors the chiller is then powered on.

Pump Filter

There is a small filter and pressure gauge located on the pump head assembly. Normal pressure is 3-5 pounds, cooled ball screws are 10 to 30 pounds. If the pressure gauge shows a pressure above normal the filter should be inspected and cleaned.

Figure 4-1 Pump Filter

Tank Reservoir

The tank reservoir is located next to the motor pump assembly in the chiller cabinet. The tank has a 2 1/2 gallon capacity. Visually check the fluid level with the machine powered on. If the fluid level is less than 1/2 of the tank, mix the

Dowfrost to a 50:50 solution, with deionized water, or sodium free distilled water and fill to no more than 3/4 full.

Figure 4-2 Tank Reservoir

Source for Dowfrost:
GOLDENWEST LUBRICANTS
1816 POTRERO AVE.
SOUTH EL MONTE, CA 91733
(626) 443 - 3441
(800) 540 - 5823

Do not accept any substitutes for DOWFROST!

Pressure
The cooling system should maintain a constant pressure of 3 to 5 psi on machines with 400 I.P.M. rapid or 10 to 30 psi with 700 I.P.M. rapid.
If the pressure rises, the following conditions may exist:
   • clogged pump filter;
   • pinched oil lines;
   • clogged cross tubes (only on 400 I.P.M. machines equipped with cooled ball screws).

If the machine is losing pressure and the Dowfrost level keeps dropping, the following conditions may exist:
   • the O-ring that seals the ball screw cross tubes is leaking;
   • there is a hole in one of the lines.

Fuses, Heaters, & Relays   SEE SECTION 18: Fuses, Heaters, Parameters

Fluids

Table 1: Fluids

RESERVOIR	FILL WITH
Waylube	CASTROL MAGNA BD68 SHELL TONNA 68V or MOBIL VACTRA #2
Spindle Cooling System	DOWFROST CLEAR (Mixed 50/50 with de-ionized water or sodium free distilled water)
Rotary Tables	MOBIL GEAR 626
Hydraulic Hi/Low	MOBIL DTE HEAVY MEDIUM
Hydraulic Brake	HYDRAULIC OIL 32

Auger   **Cleaning and Freeing Chips from the Auger Chip Removal System**
Prior to cleaning or removing jammed material from the Auger or its exit tube.

1) Shut down the VMC by disconnecting the main switch in the back. It is imperative to use OSHA approved Lock Out – Tag Out procedures to power down the VMC.

Figure 4-3 Lock Out-Tag Out

WARNING
Chips from the machining process are extremely sharp. Do not attempt to remove these materials with bare hands.

WARNING

⚠

Do not remove material while the machine is operating or in the Emergency Stop mode.

Chip Removal from the Machine Interior

Remove the side panels, open front doors, and remove the material from the Auger. Wear heavy leather gloves and use a tool, such as pliers, when removing material between the sheet metal and the auger.

Do not climb inside the machine to clean the auger. As shown below, all portions of the auger are easily accessible from the front and side panel doors.
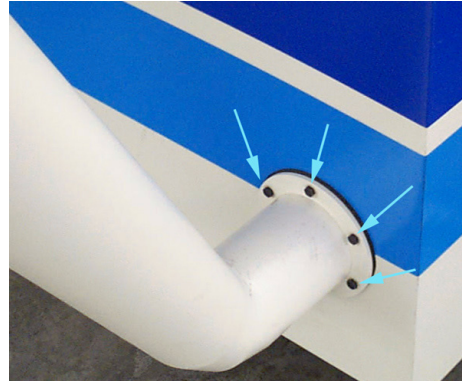

Figure 4-4 Auger Accessibility from Front and Side Panel Doors

Chip Removal from the Exit Tube

1) Removal of the tube may be necessary for material jammed in the exit tube.

2) Remove 6 hex bolts and washers from auger exit tube connection to the sheetmetal housing.

Figure 4-5 Remove Hex Bolts and Washers from Auger Exit Tube

3) Wear heavy leather gloves and use a tool such as pliers when removing jammed material from the auger exit tube. Remove using a heavy steel rod (for hard to reach area in the mid-section of the tube) or pliers.

4) Reattach the auger exit tube to the sheet metal housing.

Dual Arm Tool Changer
The causes of abnormal wear and fractures will be apparent when the tool changer is used without lubricant. It is very important to grease all moving parts of the tool changer at least once a week.

Lubricant
The lubricant should be changed annually, or when it has become visibly deteriorated. The recommended lubricant is SAE 90-140, approximately 1.3 gallons.

Grease
Grease should be spread once a week in the following locations:
1) The claws of the tool changing arm unit.

2) The tip of the release pin of the tool changing arm unit.

Cleaning
1) Remove the chip powder from around the proximity switch inducing box.

2) Remove the chip powder from around the inverted moving body of the tool pot.

3) The tool changing mechanism must be cleaned frequently to prevent excess build up of chip powder.

Inspection
Check the parts of the tool falling mechanism regularly and, check for grease on the sliding base of the tool falling mechanism and the sliding base of the pull rod. Check the parts of the tool pots and tool discs for tightness and overall condition.

Scheduled Maintenance for Dual Arm Tool Changer

The maintenance schedule is based on machine usage of eight hours a day, five days a week.

Daily Maintenance
Perform the following daily:

1) Cleaning

   a. Remove the chips and debris surrounding the proximity switch inducing block.
   b. Remove the chips and debris that have accumulated on the inverted moving body of the tool pot.
   c. Clear the tool changing mechanism of all debris before any operation.

2) Inspection:

   a. Check the parts of the tool falling mechanism for damage and wear. Add grease to the sliding base of the tool falling mechanism and the pull rod.
   b. Check the parts of the tool pots, tool discs, and snap rings for damage and tightness.

Weekly Maintenance
Perform the following weekly:

1) Greasing:

   a. Grease the claws of the tool changing arm unit.
   b. Grease the tip of the release pin of the tool changing unit.

Miscellaneous Maintenance
Perform the following as necessary:

Change the lubricant annually or as needed. The recommended lubricant is SAE 90-140. The Dual Arm Tool Changer uses approximately 5 liters (1.3 gallons).

Calibration of VMCs using the Renishaw laser

Scope

This qualification procedure applies to all Fadal VMCs calibrated using the Renishaw Laser and software.

Reference Documentation

Renishaw Laser Measurement System – Current Version – User Manual

Materials and Equipment

- PC Loaded with Renishaw Software and PC10 Plug-in card.
- Renishaw ML10 Laser
- Renishaw Interferometer
- Renishaw Reflector
- Temperature Sensor 'Magnetic'
- Temperature Sensor 'Mechanical'
- Laser Tripod

Safety and Environmental

Always use caution when working around machinery. Wear proper protective clothing and wear safety glasses at all times.

Although the laser used for this measurement is safe to use, it is never a good idea to look at a "Laser beam" with an unprotected eye. Take care to avoid an unmanaged or unshielded beam, which could strike a bystander.

Definitions

Laser Calibration process – The process of obtaining deviations from a standard and using these values to correct a standard via software.

Calibration Measurement – the final calibration measurement after the survey compensation data has been entered into the controller. This is verification that the survey compensation data has corrected the axis to the laser standard.

Survey – Laser measurement to obtain deviation data "to survey" which will be used to enter compensation values into the controller.

Responsibilities

Fadal Machining Centers and Quality have responsibility for the test procedure. Managers and Supervisors have responsibility for following this test procedure where its use is required.

Procedure

This procedure will measure unidirectional axis travel in reference to a calibrated laser. Deviations are generated which are loaded into the VMC controller software. The software will correct for the mechanical deviations improving the accuracy of axis travel. This procedure is designed as a production qualification and machine calibration procedure. It covers only one type of laser measurement. Refer to the current Renishaw manual for other

laser methods if required. It may be used for re-calibration of a machine after service or re-build. It may also be used for re-calibration of a machine after service or re-build

The procedure is written for a technician that has had training both with the Renishaw manual and on the job… Therefore, only trained technicians should be performing this calibration procedure.

For further detail on Laser set-up, refer to the set-up section of the current Renishaw manual.

CAUTION: Laser could cause severe eye damage, do not point laser outside or mirror range nor look directly into.

Standard Fadal   Axis to be Calibrated and Configuration
Cnc88hs

There are three axis (X, Y and Z) which may be calibrated using this procedure and two configurations one using the motor encoder the other using the optional scale box. The table below directs which axis and configuration to use during production testing:

	No Scale Option	X/Y Scale Option	Z Scale Option
Survey at Encoder	X Y Z*	X Y	X Y Z
Survey with Scale		X Y	X Y Z
Calibrate with Encoder	X Y	X Y	X Y Z
Calibrate with Scale		X Y	X Y Z

 * ONLY if Z-Calibrate Option is ordered.

The reason both Encoder and Scale calibration measurements are completed, when the scale option is purchased, is to provide a backup calibration to the customer in the event the scales need to be disabled.

Documentation   Place copies of **all** axis surveys and calibrations in the Fadal Machine Assembly Checkout Record.
Place copies of the final axis surveys in customer documentation pocket of the VMC.

Calibration Requirements and Limits

VMCs over compensated via software...this is not considered calibrated. The limits for proper calibration are (100%pas).

Maximum Target to Target Compensation < 0.0003"

Maximum Range of Compensation (Max delta from lowest value to highest) < See Table Below.

VMC Model	X	Y
TRM	15	30
EMC	15	30
15, 15XT	15	10
2216, 2016L, 3016L	15	10
4020, 4020S	20	10
4020A	30	10
5020A	40	10
6030	50	20
8030	110	20
3020	20	10
4525	50	20
6535	110	20

X and Y values above are Compensation Values they represent 0.0001" units.

Laser Setup

To perform a VMC calibration the VMC must be in good working order and have the table free of fixtures and parts.

- With the machine powered up and in HOME position clear out old survey data.
- Set up and level out the tripod so that the leveling bubble is in the middle of the target circle on the tripod legs at their base, set laser on the tripod.
- The front two feet on the bottom of the laser fit into the two holes on the top of the tripod.
- Aim the laser towards the middle T-slot of the machine.
- Plug the laser cable into the small port on the back of the laser unit.
- Plug the power cord into the back of the laser unit and plug in the computer power source.
- Power on the computer and the laser.

CAUTION:

Laser could cause severe eye damage, do not point laser outside of mirror range, nor look directly into beam.

Note: The laser will require 15 minutes to warm up.

- Plug the RS232 cable into the RS232 serial port on the back of the side wiring cabinet of the VMC.

- Plug the laser cable into the small port on the back of the laser unit.
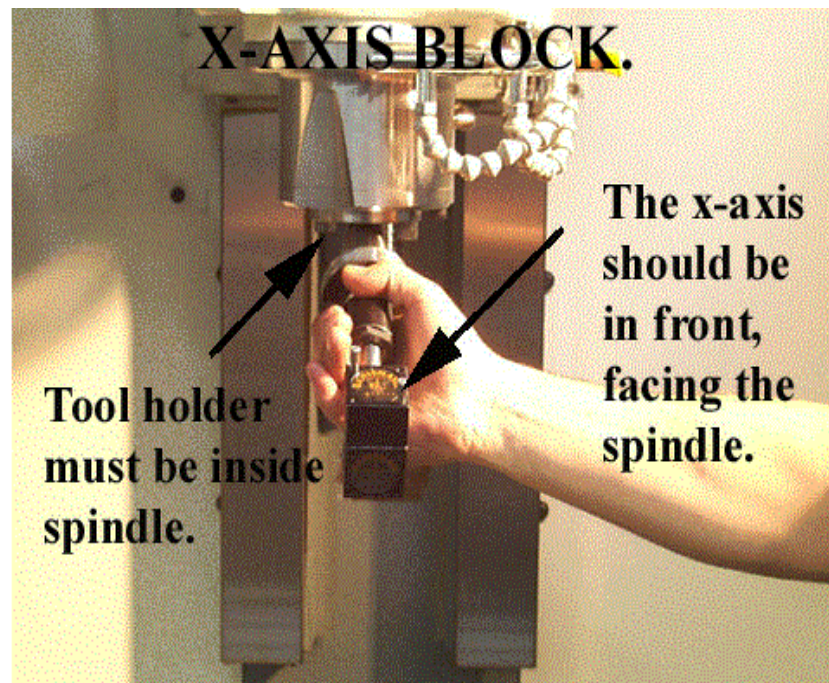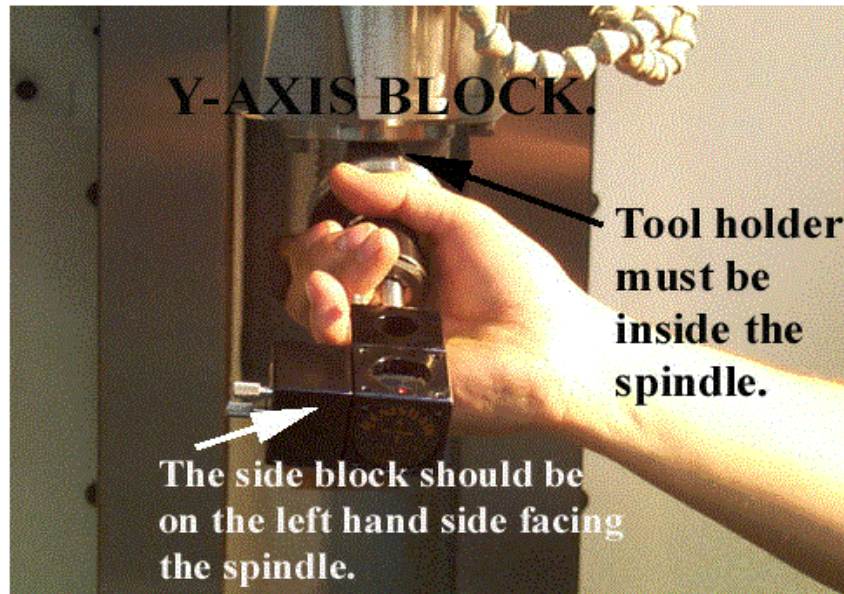
• Install beam splitter into spindle. There are two arrows on the beam splitter for calibrating the X–axis, the arrows should be pointing down the X-axis and away from the column. The mirror "must be attached" to the front of the beam splitter. For calibrating the Y-axis, the arrows go in the same direction as the X-axis, but attach the mirror to the left of the beam splitter.

• Install mirror unit in the middle T-slot on the table.

• Jog Z-axis head down so the bottom of the beam splitter and the mirror on the table are horizontally even.

• Tighten down the mirror on the table.

• Install the first temperature sensor on the inside of the door away from any draft, the second sensor, which is a magnetic temperature sensor is to be placed in the middle T- Slot, middle of the table.

Aligning the laser

• When lining up the laser beam the beam must go into the beam splitter from the laser at 3:00 and come out of the splitter at 9:00 for X-axis.

• With the X-axis at its negative end, line up the beams superimposed on each other. Do this by jogging the head and adjusting the mirrors from side to side. Be sure that the mirror and the beam splitter are completely parallel with each other.

• Once the beams superimpose, jog the X-axis to its positive limit.

• Line up the beams on the target of the laser superimposed. (This may take a while with a lot of adjusting.)

• Use the three adjusters to correct the lasers position, always level first, then rotate (unit turning CW or CCW), and last translate (laser up and down). This is the proper way for fast and accurate alignment of the laser.

• Once the beams superimpose, then turn the dial on the front of the laser one turn in the clockwise direction. This should leave the target position to open, to let the laser receive the beam.

• After laser set up check the computer screen to see if the signal meter is completely green, if so then you are ready to go. (If the signal meter is not green, then adjust using steps above).

Download Survey   For Fadal Control use the following survey downloading procedure:

§   Run Survey Download off computer desktop [REN2FAD.EXE]

§   On Fadal Control and at Enter Next Command, type CD,6

§   Follow program instructions and enter appropriate data.

Note: Program will move into axis calibration.

Axis Calibration   Data Capture
Target Sequence – Linear
Number of runs – 1 for survey 2 for calibration
Select Direction – Unidirectional

Amend Title Information – (Do as Prompted)
VMC Type
Serial Number
Location – (Same as "Auto Target Generate" Target)
Title – Encoder or Scale, and Survey or Calibration

Escape

ALT P = Changes the Datum
F2 = Datum's the Laser
Alt – = Changes the sign from negative to positive and vice versa.

Run program on CPU   Select axis (x, y, or z)
Select length of axis
Agree or disagree

Push F2 to datum the computer
Start Data Capture
Push Auto and run the rest of the program on the VMC
When prompted, hit **enter** and slidehold the program – **SETCS** and send axis to home position

Save data – Save and Name Computer files as follows:
[Axis] [E,S or C] [The last 6 serial number digits]
E = Encoder Survey, S = Scale Survey, C = Calibration Axis = X, Y
or Z

For a SN: 01200010111, an example is: XE010111 or YS010111

Analyze

Surveys – (Error Comp Table)
Absolute Value
Produce Error Comp Table
Graph – (Renishaw Analysis)

Copies of survey and calibration placed in machine (electrical cabinet pocket) and document book or jacket.

Exit Application

Sample output from a laser measurement system.

RENISHAW CALIBRATION INTERFEROMETER SYSTEM
ERROR COMPENSATION TABLE

MACHINE VMC 3020	SERIAL No: XXXX
DATE: XXXXX	By:
Axis: Y AXIS	Location: –9
Title: Type	Combined table with backlash
value	
Compensation type	Absolute
Compensation resolution	0.0001 in
Reference position	–9.0000 in
Compensation start	–9.0000 in
Compensation end	10.0000 in
Compensation spacing	1.0000 in
Backlash value	0.0000 in

No.	Axis position (in)	Compensation values Combined (0.0001 in)
1	–9.00000	0
2	–8.00000	–1
3	–7.00000	–2
4	–6.00000	–2
5	–5.00000	–3
6	–4.00000	–3
7	–3.00000	–4
8	–2.00000	–4
9	–1.00000	–4
10	0.00000	–4
11	1.00000	–4
12	2.00000	–4
13	3.00000	–4
14	4.00000	–5
15	5.00000	–4
16	6.00000	–5
17	7.00000	–5
18	8.00000	–6
19	9.00000	–6
20	10.00000	–7

This partial view of COMP_VALUES_y shows the survey values from the above file. Notice that there are three pointers in the brackets. Out of those three, the middle number has the same meaning as the position No. in the file above.

N50 $AA_ENC_COMP [_ENC_NR, 1, AX2] = - 0.0000 corresponds to No. 1 and N75 $AA_ENC_COMP [_ENC_NR, 6, AX2] = - 0.0003 corresponds to No. 6 in the table.

N75 $AA_ENC_COMP[_ENC_NR, 6, AX2] = - 0.0003
N35 $MA_ENC_COMP_ENABLE[_ENC_NR, AX2] =0
N40 NEWCONF
stopre
;-----BEGINNING—OF—SURVEY----------

N45 $AA_ENC_COMP[_ENC_NR,0,AX2]=-0.0000
N50 $AA_ENC_COMP[_ENC_NR,1,AX2]=-0.0000
N55 $AA_ENC_COMP[_ENC_NR,2,AX2]=-0.0001
N60 $AA_ENC_COMP[_ENC_NR,3,AX2]=-0.0002
N65 $AA_ENC_COMP[_ENC_NR,4,AX2]=-0.0002
N70 $AA_ENC_COMP[_ENC_NR,5,AX2]=-0.0003
N75 $AA_ENC_COMP[_ENC_NR,6,AX2]=-0.0003
N80 $AA_ENC_COMP[_ENC_NR,7,AX2]=-0.0004
N85 $AA_ENC_COMP[_ENC_NR,8,AX2]=-0.0004
N90 $AA_ENC_COMP[_ENC_NR,9,AX2]=-0.0004
N95 $AA_ENC_COMP[_ENC_NR,10,AX2]=-0.0004
N100 $AA_ENC_COMP[_ENC_NR,11,AX2]=-0.0004
N105 $AA_ENC_COMP[_ENC_NR,12,AX2]=-0.0004
N110 $AA_ENC_COMP[_ENC_NR,13,AX2]=-0.0004
N115 $AA_ENC_COMP[_ENC_NR,14,AX2]=-0.0005
N120 $AA_ENC_COMP[_ENC_NR,15,AX2]=-0.0004
N125 $AA_ENC_COMP[_ENC_NR,16,AX2]=-0.0005
N130 $AA_ENC_COMP[_ENC_NR,17,AX2]=-0.0005
N135 $AA_ENC_COMP[_ENC_NR,18,AX2]=-0.0006
N140 $AA_ENC_COMP[_ENC_NR,19,AX2]=-0.0006
N145 $AA_ENC_COMP[_ENC_NR,20,AX2]=-0.0007

;-------END--OF--SURVEY----------------

N150 $AA_ENC_COMP_STEP[_ENC_NR,AX2]=1

Laser Shut Down
- When finished with entire calibration procedure for all axes Press F5 and exit application, then exit to DOS.
- Turn off laser and move dial one notch until target shows.
- Unplug laser cable and RS232 cable.
- Power down and Unplug computer.
- Store all equipment and clean up workstation.

Pallet Changer/ Hydro Sweep™

Each Part Cycle

1) Make certain that HydroSweep unit is cycled before every Pallet Exchange. Use an M20 in the program to make it automatic. Frequent washing out of chips prevents them from building up into difficult-to-remove piles.

2) Blow away any chips that may lodge underneath Pallet in Hydraulic Arm groove.

Daily Maintenance

1) Put both Pallets away onto stand. Put tool in spindle. Wash down interior with coolant hose nozzle, using care to keep splash away from Automatic Tool Changer, Head assembly, or any wiring connections.

2) Wash out HydroSweep drum, clearing any chips from inside. Inspect behind HydroSweep Ram for any stray chips blocking return slot.

3) Clean chips from trough behind Table and Saddle, and on Sliding Doors.

4) Guard, and inspect between front Y-axis way cover and front of machine for chip buildup.

5) Remove screen/tank cover over fluid tank, and clean screen protecting pumps.

6) Using tool, check for any chip buildup in tank ahead of screen.

7) Check tank reservoir fluid level, and refill as necessary.

8) Check Waylube level, refill with Castrol Magna BD68, Shell Tonna V68, or Mobil Vactra #2.

9) Check for air pressure. Single regulators should be set for 80PSI. Dual regulators should be set at 80PSI on the left gauge, and 90-100PSI maximum on the right gauge.

10) Move X-axis to either side, and flip over outer X-axis way cover. Inspect for chip buildup, and clean. Check for waylube presence on both X-axis ways. Inspect Z-axis and Y-axis as well.

11) Check pressures/vacuum on Coolant-Thru pump filter and replace filter, if necessary.

Weekly Maintenance

1) Check Hydraulic Fluid level for Pallet Clamp on top of machine. Use Mobil DTE Heavy Medium.

2) Remove Hydraulic Arm pump cover, and inspect Hydraulic Arm system, refilling fluid if necessary.

3) Check Hydraulic Arm chain tension by push/pull on arm.

4) Remove Head Cover, and inspect fluid lines for Hi/Lo Idler assembly, refilling, if necessary.

5) Remove all tools from tool changer, and clean out any chip buildup. When returning tools to ATC, inspect retention ring tension on tool holders for excessive looseness, replacing rings, if necessary.

6) Disconnect front Y-axis way cover from saddle, and check for chip buildup.

7) Inspect under Y-axis motor for chips, and clear out drain ports under Y-axis ways nearest the column.

Monthly Maintenance

1) Carefully remove pallets, and grease rail bearings, using care not to damage lip seals.

2) Remove spindle motor top filter cover, and inspect filter. Replace, if necessary.

3) Inspect Pallet Roller latch system for both Pallets on stand.

4) Inspect all HydroSweep nozzles for chip clogging.

5) Check Pallet Lift Door for smooth operation.

6) Inspect Chiller cabinet for low fluid in container, should be 1/2 to 3/4 full.

7) Inspect Chiller recirculation pump filter, and clean as needed.

8) Blow air into top of Chiller louvers to clear out dirt collecting on condenser.

9) At bottom of rear cabinet, remove fan filter screen and clean.

10) Inspect front door rollers, tightening as necessary.

11) Check door interlock system for proper operation.

12) Remove head cover and inspect belts, and check for any Coolant-thru system leaks.

13) Inspect all cables, hoses, and tubing for looseness, or damage.

HydroSweep™ Only

Each Part Cycle

1) Make certain that HydroSweep unit is cycled before every part change, or run at least 20 minutes per hour run time. Use an M20 in the program to make it automatic. Frequent washing out of chips prevents them from building up into difficult-to-remove piles, and clears drum from chip buildup.

2) Clean away any chips that may lodge in rear trough at bottom of Y-axis sliding tray.

Daily Maintenance

1) Wash down interior with coolant hose nozzle, using care to keep splash away from Automatic Tool Changer, Head assembly, or any wiring connections.

2) Wash out HydroSweep drum, clearing any chips from inside. Inspect behind HydroSweep Ram for any stray chips blocking return slot.

3) Clean chips from trough behind Table and Saddle, and on Sliding Guard, and behind Sliding Guard near Y-axis ballscrew, and inspect between front Y-axis way cover and front of machine for chip buildup.

4) Remove screen/tank cover over fluid tank, and clean screen protecting pumps.

5) Using shovel, check for any chip buildup in tank ahead of screen.

6) Check tank reservoir fluid level, and refill as necessary, using only coolant with anti-foam inhibitors.

7) Check Waylube level, refill with Castrol Magna BD68, Shell Tonna V68, or Mobil Vactra #2.

8) Check for air pressure. Single regulators should be set for 80PSI. Dual regulators should be set at 80PSI on the left gauge, and 90-100PSI maximum on the right gauge.

9) Move X-axis to either side, and flip over outer X-axis way cover. Inspect for chip buildup, and clean. Check for waylube presence on both X-axis ways. Inspect Z-axis and Y-axis as well.

10) Check pressures/vacuum on Coolant-Thru pump filter and replace filter, if necessary.

Weekly Maintenance

1) Remove Head Cover, and inspect fluid lines for Hi/Lo Idler assembly, refilling, if necessary.

2) Remove all tools from tool changer, and clean out any chip buildup found. When returning tools to ATC, inspect retention ring tension on tool holders for excessive looseness, replacing rings, if necessary.

3) Disconnect front Y-axis way cover from saddle, and check for chip buildup.

4) Inspect under Y-axis motor for chips, and clear out drain ports under Y-axis ways nearest the column.

Monthly Maintenance

1) Remove spindle motor top filter cover, and inspect filter. Replace, if necessary.

2) Inspect all HydroSweep nozzles for chip clogging.

3) Inspect Chiller cabinet for low fluid in container, should be 1/2 to 3/4 full.

4) Inspect Chiller recirculation pump filter, and clean as needed.

5) Blow air into top of Chiller louvers to clear out dirt collecting on condenser.

6) At bottom of rear cabinet, remove fan filter screen and clean.

7) Inspect front door rollers, tightening as necessary.

8) Check door interlock system for proper operation.

9) Remove head cover and inspect belts, and check for any Coolant-thru system leaks.

10) Inspect all cables, hoses, and tubing for looseness, or damage.

The above maintenance procedures may be performed by customer's maintenance crew.

6-Month Planned Maintenance

This should be performed by the Fadal Planned Maintenance Crew semi-annually.

Tests for CE Safeguards on Fadal Machines

These tests should be done when machine is first installed and after servicing when any components are replaced.

1) Power on machine but do not cold start.

Start spindle. (Press Shift-Spindle on)
- Spindle will not start OR
- Press Emergency Stop; spindle must stop.
- Immediately release Emergency Stop; spindle does not start.

2) Cold start machine.

Start spindle. (Press Shift-Spindle on)
- Press Emergency Stop; spindle must stop.
- Immediately release Emergency Stop; spindle shall not start, VMC remains in emergency stop.
- Repeat test in Auto, MDI, and Jog modes.

3) Start spindle. (Press Shift-Spindle on)

- Open front door; spindle must stop.
- Try to restart spindle; spindle does not start with doors open.
- Check LED on 2000-1 board; it should be on.
- Check contactor for spindle; contacts should be out. (There may be a 5 to 10 second delay between the opening of the door and the release of the contactor. This allows a controlled stop).

4) Close doors.

- Repeat test with left side panel.
- Repeat test with right side panel.

5) Do a TC,1 with doors open.

- Z-axis does not rise if doors are open.
- close doors and execute TC,1.

6) With doors open press manual (ending TC,1).

- Z-axis does not move unless doors are closed.

Daily & Weekly Safety Tests for CE Safety Circuits
To ensure proper functioning of safety circuits, the following tests should be performed on a regular basis.

Daily
The Door Interlock Monitor will be on the 1310-0C board if the machine has an auger, or on the 2000-1A board.

If the machine does not have an auger and is not CE, there will be no Door Interlock Monitor.

Door Interlock Monitor Daily Test for 2000-1A or 1310-0C
1) Close all doors. Make sure VMC is not in emergency stop.

2) Start spindle at slow speed.

3) Open front door.

   Spindle should stop immediately (fully stopped from any speed in less than 5 seconds). Five to ten seconds after the door is opened you should hear the spindle contactor open. (The five to ten second delay allows the spindle to come to a controlled stop.)

4) Close front door. Spindle contactor will immediately reenergize.

Daily
Front Door Lock Daily Test for 2030-0A
1) Close all doors. Make sure machine is not in emergency stop.

2) Open front door. You may be able to hear the spindle contactor open, if not a second person will be needed to watch the contactor.

3) Close front door. You may be able to hear the contactor close, if not see 2 above.

4) Start spindle. Attempt to open front door. Front door should be locked.

5) Stop spindle. There should be a delay of 1 to 5 seconds after the spindle comes to a complete stop before the door unlocks. (This delay can be adjusted from 1 to 5 seconds with R22.)

6) In either automatic or manual mode command a tool change. Attempt to open the door. Front door should be locked while turret is moving toward spindle or while dual arm tool changer arm is in motion.

Dual Arm Tool Changer (1330) Daily Test
No daily test.

Pallet Changer (1100-3A) Daily Test
No daily test.

Weekly
The Door Interlock Monitor will be on the 1310-0C board if the machine has an auger, or on the 2000-1A board.

If the machine does not have an auger and is not CE, there will be no Door Interlock Monitor.

Door Interlock Monitor (2000-1A) Weekly Test
1) Close all doors. Make sure VMC is not in emergency stop.

2) Open cabinet containing Door Interlock Board (2000-1A) and examine LEDs and relays on the 2000-1A board.

   • Red door LEDs should be off.
   • Green door LEDs should be on.
   • Estop relay (K3) should be on (LED lit).
   • Output relay for spindle contactor (K2) should be on (LED lit).

3) Press Emergency Stop switch.

   • Estop relay should go off immediately.
   • Output relay should go off after 5 to 10 seconds.

4) Release Emergency Stop switch and clear emergency stop condition by pressing Jog.

5) Open front door.

   • Front door red LED should be on.
   • Green door LEDs should be off.
   • Spindle contactor should release after 5 to 10 seconds.

6) Close front door and open left side door.

   • Left door red LED should be on.
   • Green door LEDs should be off.
   • Spindle contactor should release after 5 to 10 seconds.

7) Close left side door and open right side door.

   • Right door red LED should be on.
   • Green door LEDs should be off.
   • Spindle contactor should release after 5 to 10 seconds.

Weekly
Door Interlock Monitor Weekly Test for 2000-1 B or -1 C

1) Close all doors. Make sure VMC is not in emergency stop.

2) Open cabinet containing Door Interlock Board (2000-1 B or -1 C) and examine LEDs and relays on the 2000-1 B or -1 C board.

   • Red door LEDs should be off.
   • Yellow door LEDs should be off. Green "Doors Closed" LED should be on.
   • Red Slidehold LEDs should be off.
   • Estop relay (K3) should be on (LED lit).
   • Green "Spindle Enable" LED should be on.
   • "Spindle" relay for spindle contactor (K2) should be on (LED lit).

3) Press Emergency Stop switch.

   • Estop relay should go off immediately.
   • Spindle Enable LED and Spindle relay should go off after 5 to 10 seconds.
   • Spindle contactor should then release.

4) Release Emergency Stop switch and clear emergency stop condition by pressing Jog.

5) Open front door.

   • Front door red LEDs should be on.
   • Green "Doors Closed" LED should be off.
   • The yellow LED for the front door should flash at the instant the door is opened.
   • Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds.

6) Close front door and open left side door.

   • Left door red LEDs should be on.
   • Green "Doors Closed" LED should be off.
   • Yellow door LED should flash at the instant the one door is closed and when the other door is opened.
   • Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds.

7) Close left side door and open right side door.

   • Right door red LEDs should be on.

- Green "Doors Closed" LED should be off.
- Yellow door LED should flash at the instants the one door is closed and when the other door is opened.
- Spindle Enable LED and Spindle relay should go off and Spindle contactor should release after 5 to 10 seconds.

Door Interlock Monitor on Auger Board (1310-0C) Weekly Test

1) Close all doors. Make sure VMC is not in emergency stop.

2) Open cabinet containing Auger Board (1310-0A) and examine LEDs and relays on the 1310-0A board.

   - Red door LEDs should be off.
   - Green door LEDs should be on.
   - Estop relay (K7) should be on (LED lit).
   - Spindle relay for spindle contactor (K5) should be on (LED lit).
   - Heart LED should be blinking.

3) Press Emergency Stop switch.

   - Estop relay should go off immediately.
   - Heart LED should be off.
   - Spindle relay should go off after 5 to 10 seconds.

4) Release Emergency Stop switch and clear emergency stop condition by pressing Jog.

5) Open front door.

   - Front door red LED should be on.
   - Green door LEDs should be off.
   - Heart LED should be off.
   - Spindle contactor should release after 5 to 10 seconds.

6) Close front door and open left side door.

   - Left door red LED should be on.
   - Green door LEDs should be off.
   - Spindle contactor should release after 5 to 10 seconds.

7) Close left side door and open right side door.

   - Right door red LED should be on.
   - Green door LEDs should be off.
   - Heart LED should be off.
   - Spindle contactor should release after 5 to 10 seconds.

Weekly:
Front Door Lock Weekly Test for 2030-OA
1) Close all doors.

2) Open cabinet containing Front Door Lock Board (2030-OA) and examine LEDs and relays on the 2030-OA board.

   - Power LED should be on.
   - Green "Unlock Door" LED should be on.
   - Green "Doors Closed" LED should be on.
   - LED on K6 and K7 should be on.
   - No other LEDs should be on.

3) Open front door.

   - Green "Doors Closed" LED should be off.
   - LED on K7 should be off.
   - Other LEDs should be unchanged.

4) Close front door and start spindle.

   - Attempt to open front door.
   - Front door should be locked.
   - "Spindle Rotating", "Spindle ON", "VMC Motion", and "Unlock Delay" LEDs should be on.
   - "Unlock Door" LED should be off.
   - LED on K6 should be off.

5) Stop SPINDLE.

   - There should be a delay of 1 to 5 seconds after the spindle comes to a complete stop before the door unlocks.

6) If there is a pallet changer start a pallet change.

   - Attempt to open front door. Front door should be locked.
   - "Pallet Motion", "VMC Motion", and "Unlock Delay" LEDs should be on.
   - "Unlock LED should be off.
   - LED on K6 should be off.

Dual Arm Tool Changer (1330) Weekly Test
1) Make sure the VMC is not in emergency stop, that the spindle is off, and that no tool change is in progress.

2) Open cabinet containing the Dual Arm Tool Changer Control Board 1330-0 and examine the LEDs and relays.

- The LED (D16) for the contactor SSR should be off.
- The E-stop relay (K5) should be energized (LED on, contact indicator showing).
- The E-stop Signal relay (K6) should be energized (LED on, contact indicator showing).
- The Drawbar and Arm Interlock relay (K7) should be energized (LED on, contact indicator showing).
- The Arm Power relay (K8) should be energized (LED on, contact indicator showing).

3) Start spindle and examine LEDs and relays on 1330-0.

- The Drawbar and Arm Interlock relay (K7) should not be energized (LED off, contact indicator not showing).
- The Arm Power relay (K8) should not be energized (LED off, contact indicator not showing).

4) Stop spindle. Press Emergency Stop. Examine LEDs on 1330-0.

- The E-stop relay (K5) should not be energized (LED off, contact indicator not showing).
- The Drawbar and Arm Interlock relay (K7) should not be energized (LED off, contact indicator not showing).
- The Arm Power relay (K8) should not be energized (LED off, contact indicator not showing).

Pallet Changer (1100-3A) Weekly Test
1) Make sure there are no obstructions to the light curtain.

- The green LED on the Light Curtain receiver should be on.
- The red LED on the Light Curtain receiver should be off.

2) Break the light curtain path with your hand.

- The green LED on the Light Curtain receiver should be off.
- The red LED on the Light Curtain receiver should be on.
- Red LEDs on the receiver will also show the beams that are being obstructed.

3) Make sure there are no obstructions to the light curtain. Open the cabinet containing Pallet Change Power Distribution board (1100-3A) and examine the LEDs on the 1100-3A.

- The green LEDs (D8 and D9) on the 1100-3A board should be on.
- The red LED (D7) on the 1100-3A board should be off.

4) Obstruct the light curtain (a towel over one of the mirrors will do this) and observe the LEDs on the 1100-3A.

   -   The green LEDs (D8 and D9) on the 1100-3A board will be off.
   -   The red LED (D7) on the 1100-3A board will be on.

5) Start a pallet change and while the pallet is in motion obstruct the light curtain. The pallet change should stop immediately and a message should appear on the monitor requiring Start to be pressed to continue.

Zero-Out Memory Procedure

Note: Everything in memory will be erased! Store desired programs & data to disk

1) Send machine to COLD START:

• Type SETCS < ENTER >.
• Type HO <ENTER>.
• Press START.

2) Display and record the BACKLASH settings on the second page of this instruction sheet (Settings) in the spaces provided:

• Type BL <ENTER>. Record the displayed values.

3) Display and record the PARAMETER settings on the second page of this instruction sheet (Settings) in the spaces provided:

NOTE: Some parameters appear ONLY in Format 1 or in Format 2, but NOT IN BOTH FORMATS.

• Type SETP <ENTER>. Record the displayed values.
• Type P <ENTER> to display the second page of settings. Record the displayed values.
• Type P <ENTER> to display the third, page of settings. Record the displayed values.

4) After all BACKLASH and PARAMETER settings have been recorded, zero memory:

• Press <MANUAL> to get to ENTER NEXT COMMAND.
• Type DI < ENTER >.

• Type GOA3000 <ENTER> to display the Diagnostics Menu.
• Press spacebar to get to Page 2 of the Diagnostic Menu, and select option 5 - ZERO MEMORY.
• Answer "Y" (type Y) to both questions the control asks. Memory is reset.

NOTE: If you are replacing a module(s), now is the time to power down the machine,
replace the module(s), and power up ---- then proceed directly to STEP 5 below.

• Select option 2 - START CNC. This will take the control back to ENTER NEXT COMMAND.

5) Restore PARAMETER values as needed:

NOTE: The control will ask for BACKLASH values, but the PARAMETER values must be checked first.

• Type SETP <ENTER> to check and, if needed, re-enter PARAMETER settings - page 1.
• Type P <ENTER> to check and, if needed, re-enter PARAMETER settings - page 2.
• Type P <ENTER> to check and, if needed, re-enter PARAMETER settings - page 3.

6) Restore BACKLASH values:

• Power off the machine, wait 15 seconds, power on the machine, COLD START.
• Enter the BACKLASH values previously recorded as follows:

for X axis	BL,1,value 1, value2, value3 < ENTER >
for Y axis	BL,2,valuel,value2,value3 <ENTER>
for Z axis	BL,3,value < ENTER >
for A axis	BL,4,value <ENTER>
for B axis	BL,S,value <ENTER>

7) Load the programs and offsets back into the machine. This procedure is now complete.

Zero-Out Memory Settings

Last Home Position X_____ Y_____ Z_____

Backlash Settings

X-axis Backlash _____ ,_____,_____
Y-axis Backlash _____ ,_____,_____
Z-axis Backlash_____
A-axis Backlash_____
B-axis Backlash_____

Parameter Settings

Format:_____Baud Rate:_____Spindle After M6:_____
Axes:_____Travel:_____Pendant:_____
Default:_____A-AxisRatio:_____M60/A-Axis Brake:_____
Default:_____B-AxisRatio:_____M60B-AxisBrake:_____
Default:Tool Changer Cap:IMM Fixed Cycle:
RPM Factor:Spindle Type:Orientation Factor:

Parameter settings - Page 2

Default:_____M3:_____M7:_____3 Phase>5%Low:_____
Pu Format:_____N-words Ordered:_____Tool Table:_____
Crc Mode:_____Binary Buffers:_____High Torque:_____
Spindle Off:_____Turret Factor:_____CMD Menu:_____
Pallet:_____Gain:_____Ramp:_____
Aspect:_____Tilers:_____Overload:_____

Parameter Settings - Page 3

Screw:_____Imp:_____Xyz Ramp:_____
Z Tap Gain:_____Vector:_____Axis Display:_____
Auto Brake:_____A-pallet:_____ B-pallet:_____
5-Axis Head:_____G0 Detail:_____Feedback:_____