# M15 4th AXIS UPGRADE

M15 removed from mill.

New parts to be added.
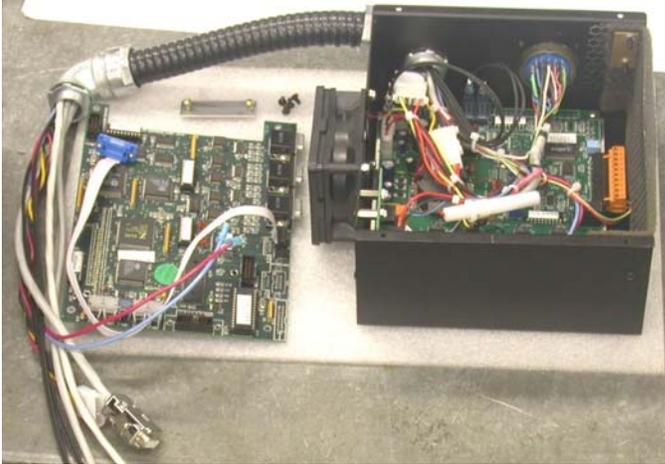
The tools that will be needed.

Also a drill and a #23 or 5/32 or .154 in. drill bit.

1. Remove the keyboard tray.
2. With the keyboard tray upside down mark the location of the mounting holes for the 4th axis module.
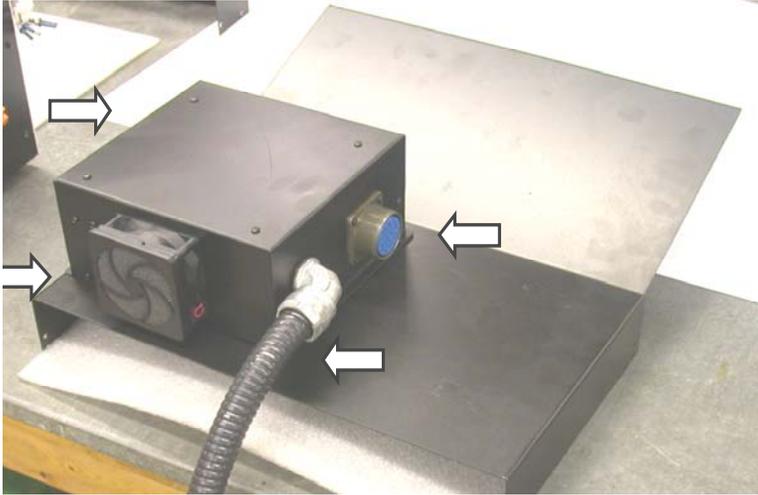
3. Drill 4 holes using a #25 or 5/32 or .154 in. drill bit. Mount the 4th axis module by using the 4 6-32 by 3/8in. screws and Nylock nuts provided. Set this assembly to the side.
4. Next remove the (19) 6-32 Phillips head screws from the top cover. Do **NOT** remove the 5 screws from the center of the cover. They hold the drive to the cover.


5. With the top tilted up, disconnect all of the wires and cabling from the drive. The motor power input and output wires use screw terminals. All of the others are push on connectors. When disconnecting the fiber optic cables grip them at the connector itself. Do not pull on the cables. Set the top cover and drive to the side.

6. With the top cover and drive removed remove the switch block from the back of the E-stop switch. Disconnect the cable for the MPG connector.

7. Remove the white wire with a black stripe that is connected between the E-stop switch block and the connector that plugs into H12 on the servo drive.
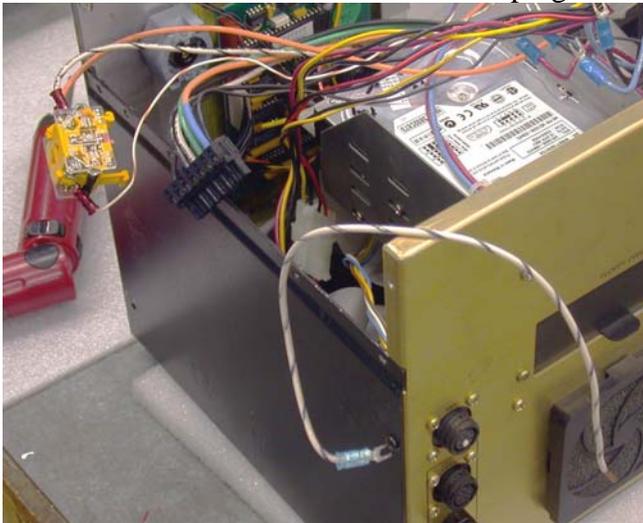
8. Remove the 4-40 screws from the keyboard and mouse connector. Remove the 4-40 standoffs from the CPU7 DB9 connectors. Remove the 6-32 screws holding the back panel on. There are 3 on the bottom, 2 remaining on the sides and 1 in the middle of the back panel.
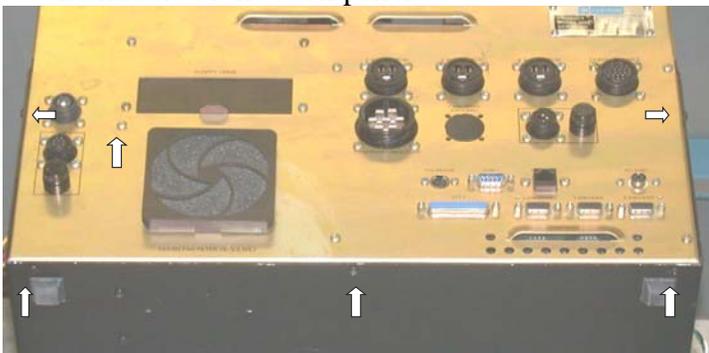
9. Carefully lay the back panel flat. Some of the wires and cables may have to be moved / rerouted to allow the panel to lay completely down flat.
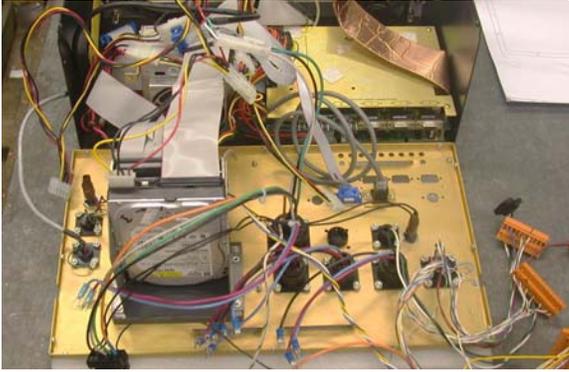

10. With the back panel down, remove the DB25 connector for the printer port LPT1 and the plug from the hole for the optional Z axis brake. Install the provided cover plate for the DB25 connector hole. (The cover plate uses 6-32 screws, they will self thread through the original DB25 connector mounting holes.)


11. Using a step drill or a ¾ in. conduit punch open up the hole for the optional Z axis brake large enough to accept a ¾ in. conduit connector. If using a step drill be extremely careful that metal chips do not get into the motherboard or other electronic components.
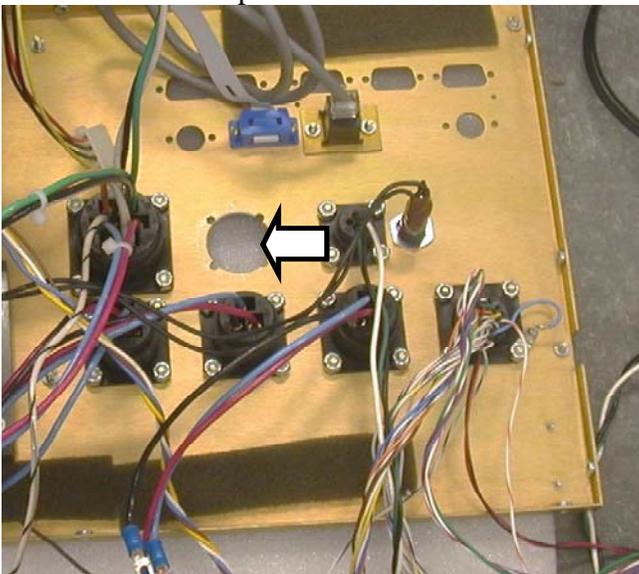
12. Remove the cover plate from the CPU7 card. After marking the Jog panel cable connector to make sure it will be reconnected correctly, disconnect the jog panel cable. After making sure that the TXS, CKS and RXS fiber optic cables are clearly marked, remove the fiber optic cables. The DATA and SYNC fibers will not be reused and should be separated from the other 3 fibers. Remove the CPU7 card.
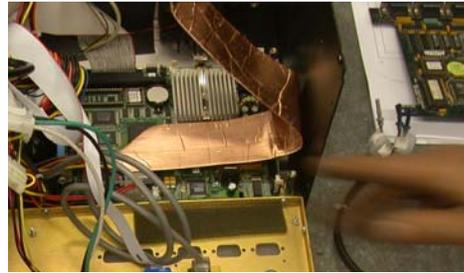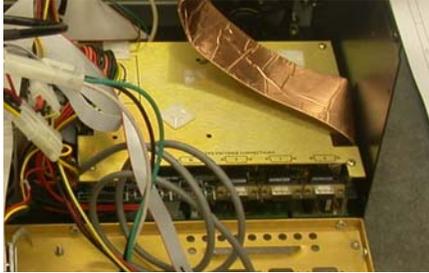
13. Set the M15 on top of the keyboard tray and 4th axis module using something (a block of wood)to allow it to set level. Remove the DB9 connector cover and install the conduit and cables into the back panel. Reinstall the DB9 connector cover.
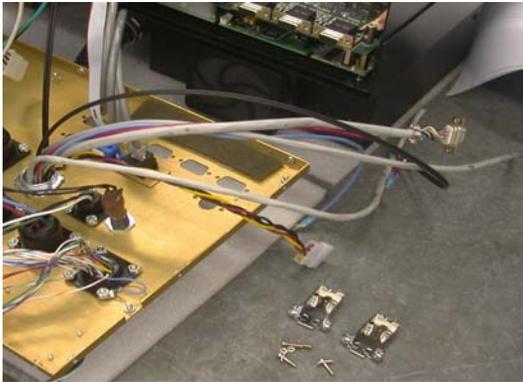
14. Being very careful that the pins line up install the new CPU7 card that has the 4th axis connections. Then reconnect the jog panel cable making sure that it is positioned correctly. Connect the original TXS, CKS and RXS fiber optic cables to the CPU7. Connect the new fiber optic cables with the **GRAY** ends from the conduit to the CPU7. Number 4 to the DATA connector and number 5 to the SYNC connector. Reinstall the cover plate.
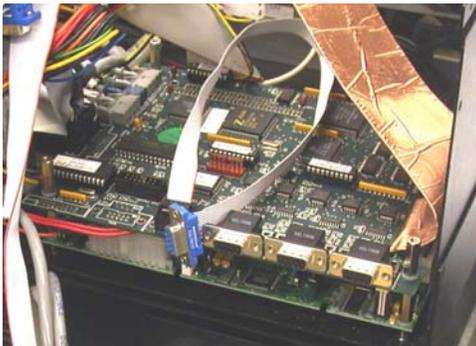
15. Being careful that no wires or cables are in the way, move the back panel into position and install the top 2 side screws and the 1 in the back panel. Reinstall the keyboard and mouse connectors. (The mouse connector is under the conduit.) Reinstall the 4-40 standoffs for the CPU7 DB9 connectors. After installing the 3 bottom screws, the keyboard tray can be attached
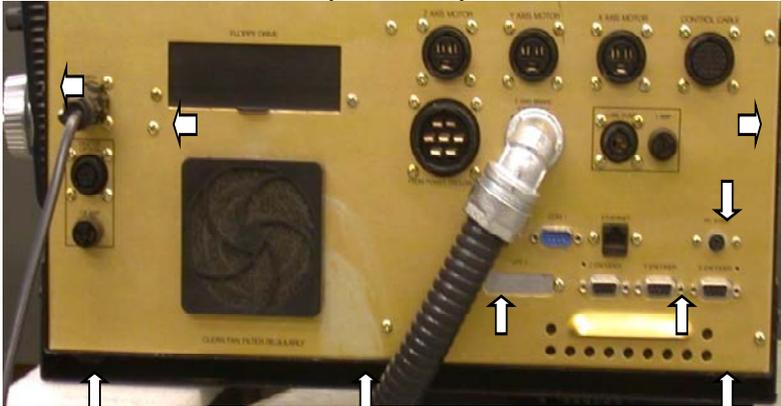
16. Connect the wires from the conduit to the correct locations. (See schematic drawing) Connect the 4th axis encoder cable to the 4th axis ribbon cable DB9 connector. The cables and wires should also be bundled and routed so that nothing is pinched or stretched. (Use the drive for reference when routing cables.)
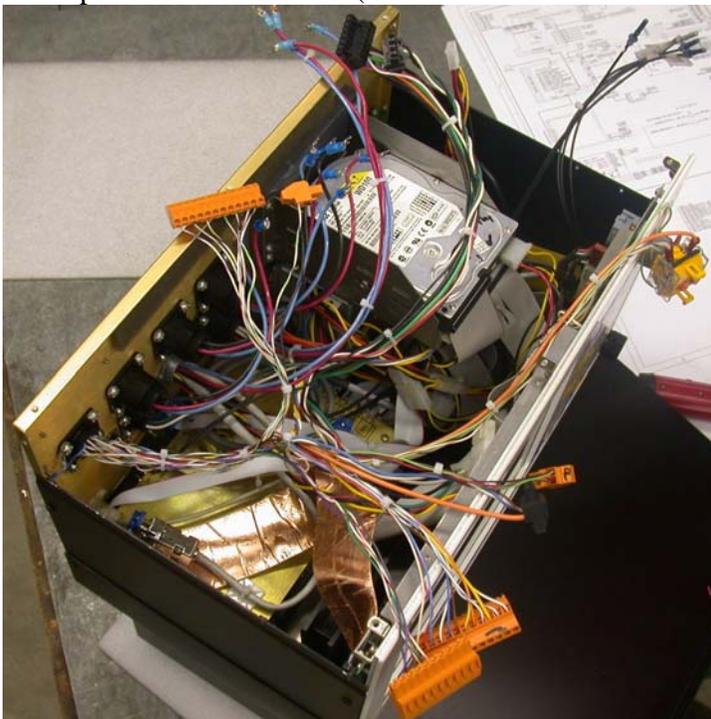
17. Reconnect the MPG connector cable and the E-stop switch block. Make sure that any other wires or cables that may have been pulled loose are connected. Then install the drive and top cover. (Connect the motor power input and output wires first.) Several of the connectors are the same size. Make sure that they are connected to the correct location on the SERVO3IO board. (If unsure of the connector location refer to the schematic and match up the wire colors to identify

the connector. Connect the original TXS, CKS and RXS fiber optic cables to the SERVO3IO. Connect the new fiber optic cables with the **BLUE** ends from the conduit to the SERVO3IO. Number 4 to the DATA connector and number 5 to the SYNC connector.

18. Double check all of the connections. Check that when the cover is closed that no wires or cables will be pinched. Be extra careful that when the cover is closed the fiber optic cables will not be pinched.
19. Close the cover and remount the M15 on the mill.
20. After applying power use TB 11 to set up the rotary table.

TB011- Parameter Setting for Rotary Tables

See also the following TECH NEWS Documents:

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TB022   Modifying CNC7.hom file for homing program.

Steps

*Set the Machine Configuration as below for the **4th axis only.**
*DO NOT CHANGE THE VALUES FOR 1, 2, 3 AXIS!

Go to the proper screens as follows: F1<Setup>, F3<Config>, Password= 137 <Enter>; then F3<Params> or F2<Machine> as instructed below. Always be sure to use F10 <Save> before exiting.

1. In the F2<Machine> configuration, set the #4 Axis label to B and edit this same line as indicated below to replicate the proper configuration for the proper rotary table.

Parameters are as follows:

Rotary Table	Mtr/Tbl Ratio	Slow Jog	Fast Jog	Max Rate	Rev/ degree	Encode counts	Limit + -	Home + -	Dir
Troyke	180:1	360	720	1,200	0.5	8,000	0 0	14 14	N
Yuasa SUDX 220 w/5.27	90:1	2,000	3,937	3,937	0.25	8,000	0 0	14 14	N
Yuasa SUDX 220 w/6.00	90:1	2,000	12,000	12,000	0.25	8,000	0 0	14 14	N
Yuasa SUDX 140 w/5.27	70:1	2,000	3,937	3,937	0.2	8,000	0 0	14 14	N
Yuasa SUDX 140 w/6.00	70:1	2,000	12,000	12,000	0.2	8,000	0 0	14 14	N
Golden Sun CNC-201R	90:1	2,000	9,000	9,000	.25	8,000	0 0	14 14	N
Golden Sun CNC-151R	90:1	2,000	9,000	9,000	.25	8,000	0 0	14 14	N

2.To figure your Revs/degree you need to divide the Motor Revs./ Table Revs. ratio by 360. See table above.
3. In the **F3<Params>** screen, change parameter 94 to 1.0 (this will flag that axis as rotary). The conversational software will then display degrees, minutes, and seconds for that axis in linear moves. Also change parameter 98 to 45.0 (the autotune move distance).

*To find feedrate for a rotary axis in degrees/min, you must do the following:
(Surface Velocity/Part Diameter) * (114.591559) = Deg/Min

The degree per minute is the input required for the feedrate.

4. From the main screen of CNC7, press F6<Edit> and open the file
   c:\cnc7\cnc7.hom.
   Add these lines at the end of the file for homing the rotary axis.
   If you have a home/limit switch add these lines - M92/B   M26/B
   If you don't have a home/limit switch just add this line - M26/B

   Special Note For Golden Sun with DC brush motor:

   The Kd parameter will need to be adjusted for the 17 lb/in motor that is installed in the table.
   Follow the instructions below.

   Go to the proper screens as follows: F1<Setup>, F3<Config>, Password= 137 <Enter>; then F4<PID>, F1<PID> Use the right arrow key to move over to the Kd column then the down arrow key to get to the correct row and axis, in this case B. Change the value in this field to 5.000. Always be sure to use F10 <Save> before exiting.

Testing
- Check the clamp. With proper air supply, press <F3> for MDI then M10<enter>(clamp on). Verify that the table is clamped, or locked, into position so that it cannot rotate. Issue an M11<enter>(clamp off) to unclamp the table.

- Jog the 4th axis in both directions to verify proper motor wiring. (Note: If the motor power leads are reversed, an axis will move the same direction a small amount no matter which direction it is told to go. If this is the case call Tech Support)

- Verify proper homing. During homing sequence, the table will turn at the slow jog rate to the switch and then come off the switch at 24 deg/min a short amount before setting home. (Note: If the input is not connected, the table will turn at 24deg/min indefinitely.)

- Go into MDI. If the rotary table is labeled B, enter the following commands: B0<cycle start> B360 <cycle start>. Verify that the table completes one revolution.
- If the table is the 4th axis, set parameter 98 to 45. This will cause autotune to move 45 degrees on the rotary table. See chapter 10 in the manual. Run Autotune.

The final M-15 with 4th Axis Upgrade