

Automatic Tool Changer (ATC) for the proLIGHT 1000

A Supplement to the proLIGHT 1000 User's Guide

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Warning

Improper setup or use of the Automatic Tool Changer can result in tool crashes which may cause damage to the Machining Center.

Installation

Software

Follow the software installation directions in your proLIGHT 1000 User's Guide.

Hardware

Follow the general hardware installation procedures in your proLIGHT 1000 User's Guide. Then perform the additional procedures outlined below.

Connect the ATC to an Air Supply

The Automatic Tool Changer requires a regulated shop air supply of 90 psi. Connect the air supply to the Filter Pressure Regulator Unit at the back of the Machining Center. Adjust the ATC air regulator to 80-85lbs. If the pressure drops below 75lbs., the ATC will not work. The Control Program will generate a message indicating the air pressure is low.

Connect the ATC to the Computer

Connect the supplied interface cable from the connector marked "Parallel" on the Machining Center to the parallel port of your computer. This cable must be connected directly to the parallel port; there must not be any software interface plugs between the cable and the parallel port connector.

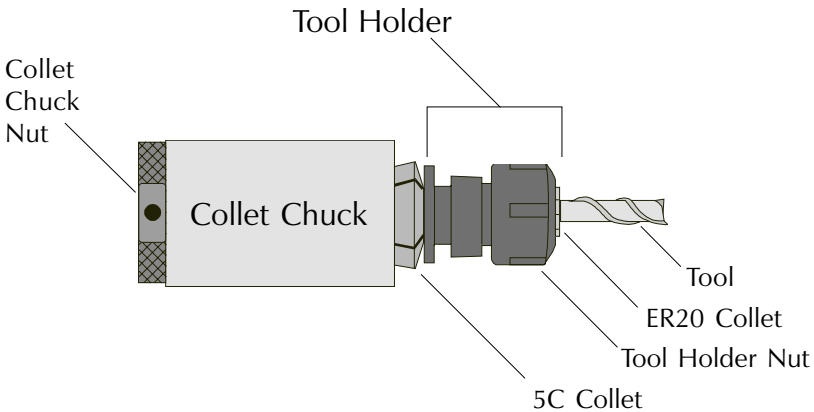
Warning

Do not connect the ATC to the Light Machines Interface Card! You must make certain to connect the ATC to the computer parallel port only!

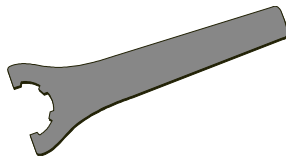
Install the Tools

Tools used with the ATC are inserted into the four tool holders supplied with the ATC. To insert the tools into the holders, you must use the Manual Collet Chuck (supplied).

1. Mount the Manual Collet Chuck into a vise.
2. Insert an ER20 collet into the tool holder.
 - a. Remove the nut from the tool holder.
 - b. Insert the ER20 collet. It should snap in.
 - c. Replace the nut on the tool holder, but do not tighten it.



Use the wrench supplied in the ATC Accessory Kit to tighten the Tool Holder Nut.



3. Insert the tool holder into the chuck.
4. Insert a tool into the tool holder.
5. Tighten the collet chuck nut to secure the tool holder.
6. Tighten the tool holder nut using the supplied wrench to secure the tool.

CAUTION: Do not overtighten the nut. Maximum torque should be no more than 35 ft-lbs.

7. Loosen the collet chuck nut and remove the tool holder from the chuck.
8. Hang the tool holder on a tool station of the ATC. Press the tool holder, with the tool end hanging down, into the tool station until you feel a slight snap as the holder passes the detent on the station.

Important!

The tools are assigned numbers one through four starting at the front. The tool you mount closest to the front of the Machining Center is regarded as tool #1. The tool you mount furthest from the front of the Machining Center is regarded as tool #4.

General Information

When the Machine is Not in Use

It is recommended that you leave the spindle empty when the Machining Center is not in use. Before exiting the Control Program, use the **Remove Tool** button on the Manual Control Panel to place the current tool back on the ATC. When started, if the system *sees* that the draw bar is clamped or that a tool station is up, the system will ask for the tool number before you are allowed to proceed.

Homing the Machining Center

You must home the Machining Center (establish the machine zero position) before you can use the ATC. The Control Program prevents the ATC from operating until the machine is homed. You can see whether or not the machine has been homed by looking at the home status on the Manual Control Panel. If the word “No” appears in red letters, you must home the machine.

The Machining Center must also be homed any time the message “Machine must be recalibrated” appears. This message generally appears after an emergency stop occurs during a rapid traverse motion. After homing the machine in this instance, you must also reestablish the tool position in relation to the workpiece point of origin.

Note: You can automatically home the Machining Center when starting the Control Program by using the DOS command line switch /HM. (e.g. PLM1000 /HM)

Tool Offsets

Using tool offsets with the ATC is different than the procedure typically used with the proLIGHT 1000 (covered in the User’s Guide). Use only the procedures in this supplement for defining tool offsets.

Programming the ATC

You must use the M6T## format for programming tool changes on the PLM1000 with ATC. For example:

G53Z0; MOVE TOOL TO Z ZERO POSITION

M6T02; CHANGE TO TOOL #2

Z0; MOVE TOOL TIP TO Z0

The Pneumatic Draw Bar

The pneumatic draw bar will revert to a “normally closed” state if air pressure is lost. If you lose shop air while a tool holder is inserted in the draw bar, you will not be able to remove the tool holder. If you lose shop air with no tool inserted, you will not be able to insert a tool until air is restored. Refer to the section on *Recovering from Interrupted Tool Changes* in this supplement for more information.

System Sensors

The ATC has four sensors:

Low Air Pressure Sensor

This sensor is mounted in the ATC Controller Box, and monitors the pressure of the shop air supply to the ATC. If air pressure drops below 75 psi at a point in the tool change operation where air is used, the ATC aborts and you are notified and must restart the NC program.

Spindle Rotation Sensor

This sensor is mounted in the ATC Controller Box, and monitors power to the Spindle Motor. This is a safety device designed to prevent the draw bar from unclamping as long as the spindle is rotating.

Draw Bar Position Sensor

This sensor is mounted in the Draw Bar Assembly on the Spindle Head, and monitors the presence or absence of a tool holder in the spindle. The sensor will only turn on when the spindle is empty *and* the draw-bar is clamped. If you insert a tool holder using the Insert button on the Manual Control Panel, the system will first put away the current

tool holder. You will be prompted to inform the system which tool holder is currently loaded.

If you have started the system with a tool holder already inserted in the spindle, or if you have manually changed the tool holders, the Control Program will not know which tool holder you have inserted. To remedy this condition, select the **Insert Tool** or **Remove Tool** button on the Manual Control Panel. A dialog box appears requesting the number of the tool holder currently in the spindle.

Tool In Position Sensor

This sensor is mounted in the bottom of the spindle head, and monitors the height of the tool holders. A small post is mounted on each tool station on the ATC. When the tool station inserts a tool holder into the spindle, the small post is seen by the sensor. If the sensor does not see the post, the tool holder is too far away from the spindle.

To correct this situation, you must reinitialize the ATC. Make sure that the top of the tool holders are centered and just touching the plug during initialization.

System Initialization

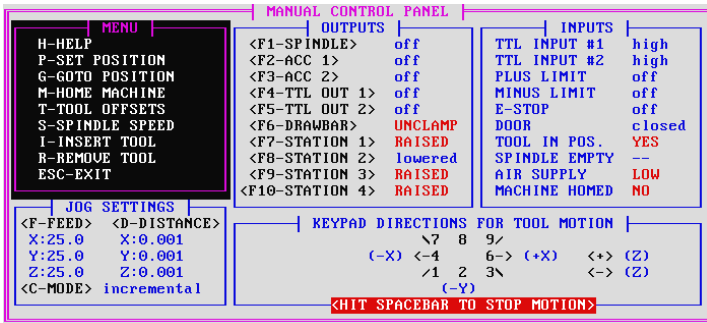
Before using the ATC you must initialize it; set the X, Y and Z positions for each of the four tool holders. It is important that this initialization is performed properly in order to avoid tool crashes.

The machine initialization should be performed one time only. If the ATC is ever removed from the Machining Center and reinstalled, the initialization must be performed again.

Note: When exiting the Control Program, make sure to save the program parameters so you won't have to reinitialize the machine the next time you use it.

To initialize the tool holders, a tool gauge plug (supplied) is inserted into the spindle, then each tool is jogged to the plug and the position is set.

1. Start the system.
 - a. Make sure the tool holders are mounted in the forks on the ATC.
 - b. Turn on the computer.
 - c. Turn on the Machining Center.
 - d. At the C:\PLM1000> prompt type "PLM1000" to start the Control Program. The Control Program starts and the main screen appears.
 - e. Select **Manual Control** from the Main Menu. The Manual Control Panel appears.



To select commands from the Menu Area, press the corresponding key (e.g. H for Help) or click on the command with the mouse.

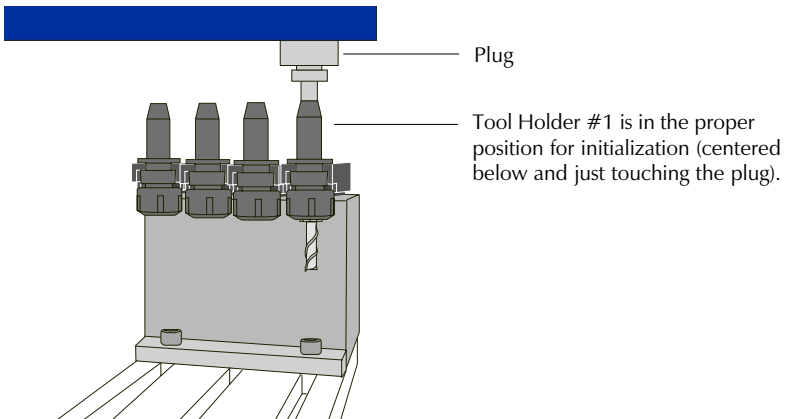
To select commands from the Outputs Area, press the corresponding F-key (e.g. F6 to clamp or unclamp the draw bar) or click on the command with the mouse.

The Inputs Area is provided for status only.

2. Before you can proceed, you must *home* the Machining Center. If you do not Home the Machining Center, you will not be allowed to complete Initialization.

Select **H-Home Machine** from the Menu Area of the Manual Control Panel. The Machining Center will be automatically homed; after which, you may proceed with the ATC Initialization.

3. Insert the tool gauge plug.
 - a. Select the **Draw Bar** button on the Outputs Area of the Manual Control Panel to *unclamp* the draw bar.
 - b. Insert the tool gauge plug, smallest end down, into the draw bar. Make sure the plug is inserted all the way into the spindle.
 - c. Select the **Draw Bar** button on the Outputs Area of the Manual Control Panel to *clamp* the draw bar.
4. Initialize the tools.
 - a. Use the Manual Control jog keys to jog the top of tool holder #1 up to the bottom of the tool gauge plug. Using small increments, jog the tool holder until it is centered below the tool gauge plug. The top of the tool holder should be *just touching* the tool gauge plug. If it is not touching, you may get a “TOOL IN POS sensor not activated” message when automatic tool changes are commanded or programmed.



- b. Press Alt+O (the letter “O” for Offsets). A dialog box appears asking if the tool holder is in position.
 - c. Select **Yes**. The Select Station dialog box appears. This dialog box has several buttons, one for each tool holder.
 - d. Select the button that represents the tool holder you are initializing; in this case, tool holder #1. You will hear an audible beep indicating the position has been stored.
 - e. Jog the tool away from the plug and repeat steps 4a through 4d for each tool holder.
5. Remove the tool gauge plug.
- a. Jog the last tool away from the spindle.
 - b. Select the **Draw Bar** button on the Outputs Area of the Manual Control Panel to *unclamp* the draw bar.
 - c. Remove the tool gauge plug from the draw bar.
 - d. Select the **Draw Bar** button on the Outputs Area of the Manual Control Panel to *clamp* the draw bar.

Recovering from Interrupted Tool Changes

If an emergency stop is executed while the ATC is in the middle of a tool change, and the tool holder is not secure in the spindle, the tool holder must be released and the ATC must be jogged away from the spindle head. If the tool holder is secure in the spindle, or in its station, this procedure is not necessary.

Move the ATC away from the spindle.

1. Use the **Unclamp** button on the Manual Control Panel to release the tool holder. If there is a tool holder in the spindle, be prepared so the tool doesn't fall onto the cross slide.
2. Lower the tool station.
3. Make sure there is no tool in the spindle. Place the tool manually into the tool station.
4. Slowly jog the tool station away from the spindle head.
5. Use the **Clamp** button on the Manual Control Panel to clamp the draw bar.

If the Emergency Stop button on the Machining Center is pressed during a rapid traverse motion, the machine must be homed and the workpiece coordinates must be reset once the ATC is away from the spindle head.

1. Home the Machining Center.
2. Locate the point of origin on the workpiece. It is important that this is performed properly in order to avoid tool crashes.
 - a. Make sure the workpiece is still secured to the cross slide.
 - b. Install the tool gauge plug as you did when performing the initialization.
 - c. Use the Manual Control keys to jog the tool gauge plug to the top of the workpiece.
 - d. Select **Set Position** from the Menu Area of the Manual Control Panel. Set the Z axis position to zero.
 - e. Follow the instructions in your User's Guide to set the X and Y axis positions.

Establishing Tool Offsets

The tool offset value for a particular tool is normally a positive value equal to the difference in length between the tool and the tool gauge plug, measured from the point where each protrudes from the spindle. To establish multiple tool offsets, follow the procedure below.

Note: You can set offsets for up to eight tools. Set the offsets for the first four tools, remove those tools from the tool stations, then mount any additional tools and set the offsets for those tools. Make sure to place a pause in the NC program before calling tools 5 through 8. While the program is paused, change the tools. Tools 5 through 8 fit into stations 1 through 4, respectively.

1. Start the system.
 - a. Make sure that all the tools are properly mounted on the ATC.
 - b. Start the computer and Machining Center.
 - d. Start the Control Program and select Manual Control from the Main Menu.
 - c. Follow the directions in your User's Guide to *home* the Machining Center.
2. Install the tool gauge plug.
 - a. Select the **Drawbar** button on the Manual Control Panel to open the draw bar.
 - b. Place a tool height offset sensor, or other reference surface, on the machine cross slide.
 - c. Place the tool gauge plug in the spindle.
 - d. Select the **Drawbar** button on the Manual Control Panel to clamp the draw bar.
3. Establish the Z zero point.
 - a. Jog the plug down until it just touches the tip of the tool height offset sensor. The LED on the sensor should light.
 - b. Press Alt-Z or select **Set Position** from the Setup Menu and set the Z axis position to zero. Select **OK**.
4. Remove the tool gauge plug.
 - a. Jog the plug up, away from the tool height offset sensor.
 - b. Select the **Drawbar** button on the Manual Control Panel to unclamp the draw bar.

- c. Remove the plug from the spindle.
 - d. Select the **Drawbar** button on the Manual Control Panel to clamp the draw bar.
5. Set the offset for Tool #1.
 - a. Select the **Insert Tool** button on the Menu Area of the Manual Control Panel.
 - b. When the dialog box appears, select Tool #1. The ATC automatically loads tool holder #1 into the spindle.
 - c. Jog Tool #1 down until the tip just touches the tip of the tool height offset sensor. The LED on the sensor should light.
 - d. Select the **Tool Offsets** command from the Menu Area. The Tool Definitions dialog box appears.
 - e. Select **Tool #1**; select the **Set Current Position** button; then select **OK**.
6. Repeat steps 5a through 5e for each of the remaining tools.
7. After initializing the ATC you must locate the point of origin on the workpiece. It is important that this is performed properly in order to avoid tool crashes.

Error Messages

The proLIGHT 1000 with ATC has several error messages in common with the regular proLIGHT 1000, however, there are additional error messages for the ATC only.

Common proLIGHT 1000 Error Messages

Refer to your User's Guide for an explanation and remedy for the following errors.

Normal Program Stop (M02/M30)

Emergency Stop (Machine Halt)

Emergency Stop (Keyboard)

Error-> Interface Card Failure

3D Arcs Can't Have Colinear Start and End Pts.

Radius Canned Cycle Bad Points

Radius Canned Cycle Crosses Quadrant

Radius Canned Cycle >90 Degrees

Homing Position Doesn't Match Commanded Position

ATC Error Messages

Tool Changer Error->Air Supply Not Up to Pressure

This message appears when the air pressure drops below 75psi at a point in the tool change where air is used. If this error occurs the ATC aborts and you must restart the NC program.

Tool Changer Error->Tool Station Not Raised or in Position

This message appears if the Tool in Position Sensor does not see the post for that particular tool station. If you get this error message, the most likely problem is that the tool station needs to be reinitialized.

This error will also occur if the tool station has been bent.

If the post is not within .050" of the sensor, you must reinitialize that tool station. First, unclamp the spindle and lower the tool station using the commands on the Manual Control Panel. Follow the instructions in this supplement for initializing the tool station.

If the error still exists after you reinitialize the station, you need to adjust the post itself. Make sure you do not raise the post so high that it rubs against the bottom of the spindle head as it picks up a new tool.

Tool Changer Error->Tool Holder Not in Spindle

This error occurs when the ATC is directed to insert a tool from an empty tool station.

Tool Changer Error->Machine Must Be Homed First

This is a common message that appears to prompt you to home the Machining Center. The tool changer will not work until the machine is homed.

Tool Changer Error->Don't Know Which Tool is in Spindle

This error will occur if you leave a tool in the spindle when you exit the Control Program, or when you manually change a tool.

Tool Changer Error->Drawbar Unclamped or Tool Station Up

Check the status of the drawbar and tool station on the Manual Control Panel. Use the commands on the Manual Control Panel to clamp the drawbar or lower the tool station as required. You can not exit the software without unclamping the draw bar and lowering all the tool stations. The system will give you four chances to do it yourself, then it will lower the tool stations and clamp the draw bar itself, then exit.

Tool Changer Error->Spindle Still Rotating

This error should not appear unless you have incorrectly connected the spindle on the proLIGHT 1000 so it rotates constantly. The machine will not allow a tool change to take place while the spindle is rotating.

Initiating Tool Change Too Close to Changer->Move Away First

This error appears when a tool change is attempted while the tool changer is within one inch of the spindle head on the X axis. Move the tool changer away from the spindle head and try again.



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