

You now have operated the toolchanger in both MANUAL and LOCAL. Let's use the AUTO mode now with a numerical control.

NC PROGRAMMING REQUIREMENTS FOR AUTO:

There are two programming requirements. The first is the sequence of M functions that must be issued to make a tool change and an optional RPM change. The sequence is as follows:

1. Spindle home
2. Spindle-off
3. Tool-change (requires at least three M-functions)
4. Spindle-on
5. Optional RPM-change (one for each RPM STEP)

The second requirement is that the tool changer and optional RPM changer must be returned to "home" position at the end of the program. This is due to the fact that they are sequential devices. This is accomplished by programming an RPM "home" M-function command while the spindle is running, and a turret "home" after stopping the spindle. This will return the spindle speed changer to the lower limit setting, and return the tool turret to the "number one" tool bucket position. Then an end of program may be initiated.

PROGRAMMING THE ATC:

Earlier we discussed the M-FUNCTION cable and the codes which were assigned to do specific functions. Lets review these codes:

M20 - Tool-out	M24 - RPM Up
M21 - Turret CW	M25 - RPM Down
M22 - Turret CCW	M26 - RPM Home
M23 - Tool-in	M27 - Turret Home

It is assumed the N/C system has been properly interfaced, but keep in mind other M-codes could have been used. The only restriction is that they close the right circuit to the ATC.

Most N/C systems use the following standard M-codes:

M0 - Program STOP	M4 - SPINDLE ON REVERSE
M2 - End of Program	M5 - SPINDLE OFF
M3 - SPINDLE ON FORWARD	M6 - TOOL CHANGE

The M6 command may be interfaced to shut off the spindle without having to program a M5 command. For this discussion we will only use M5.

Lets establish the following conditions:

- a. Spindle motor off
- b. Arm & claw at the spindle
- c. No tool holder in the spindle
- d. Tool bucket #1 is empty and tool holders are in tool buckets 2, 3, and 4
- e. The N/C system is turned on and ready to output M-Functions

PLEASE NOTE - it is necessary that tool bucket #1 is empty - If a tool holder is in the bucket and you attempt to move the arm to the carousel, the arm will bind against the tool holder. Also if a tool holder is in the spindle, a tool-out would remove the holder and try to place it in a full bucket.

1. Place the ATC mode switch to AUTO and turn the power switch on. The programmer must move the spindle quill to the "HOME" position so a tool change can be made.
2. Program M27 - The tool carousel will rotate to turret home which is tool bucket #1.
3. Program M20 - The arm & claw will move to the tool box, the door opens and the arm & claw will position to the toolholder.

At this point the tool holder for bucket #1 should be inserted manually.

4. Program M23 - The arm & claw will pick up the #1 tool holder and return to the spindle and the power draw bar will engage the tool holder into the spindle quill.
5. Program M3 - The spindle motor will run in the forward direction. The part program can be initiated.
6. Program M5 - The spindle motor will shut off.
7. Program M20 - The power draw bar will dis-engage the tool holder and the arm & claw assembly will return the holder to tool bucket #1.

Now let's select Tool holder #3.

8. Program M22 - The tool carousel will rotate CCW once so tool bucket #2 is in position.

Program M22 again - The carousel will move once more, placing tool bucket #3 in position for a tool-in cycle.

9. Program 23 - The arm & claw will now pick up tool holder #3 and put it into the spindle.
10. Program M4 - The spindle motor will reverse direction. (SPINDLE REVERSE may be an option) and the part program can be cut.
11. Program M5 - Shut off spindle.

At this point you might decide to return the #3 tool holder to tool bucket #3 and stop or maybe move the turret CW with a M21 command to prepare to pick up another tool.

However, when the program is completed, always program a M27 before the M0 or M2 to put the tool carousel back to "HOME" so you know where to start from the next time.

See the section on the OPTIONAL RPM CHANGER for its programming requirements.