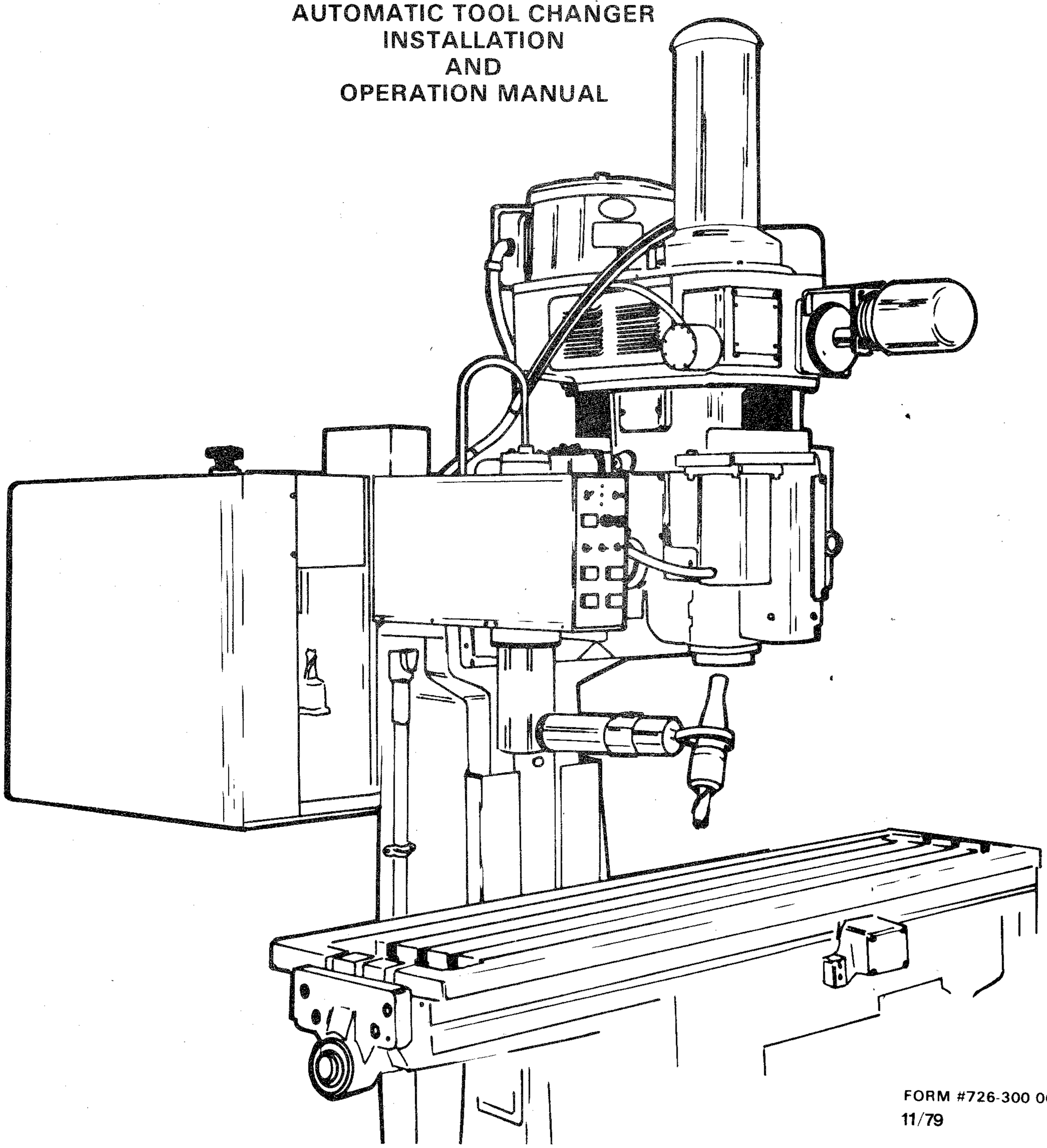
quickdraw™ atc

MODEL 6300 & 6301
AUTOMATIC TOOL CHANGER
INSTALLATION
AND
OPERATION MANUAL



FORM #726-300 00
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INTRODUCTION

The SUMMIT/Dana Industrial QUICKDRAW tm ATC Automatic Tool Changer provides an efficient means for accomplishing tool changes in automated machining operations. The unit consists of an automatic powered draw bar, a pneumatically operated arm & claw and a 24 station enclosed tool carousel for tools up to 3 1/2" in diameter and is easily adapted to most milling machines.

Operator set-up time is minimized by the Quickdraw's simple design. The tools are placed in the carousel tool buckets located inside the tool box. The door of the tool box remains closed during machining operations, and it opens automatically during a tool change. All that is required for an automatic tool change is input to remove the tool from the spindle, to index the carousel for the desired tool, and to install the new tool into the spindle. Tools can be selected from a position on the carousel which can be advanced in either direction to provide shortest access time to the next tool. The entire tool change cycle between adjacent tool holders requires only ten seconds.

Toolchangers may be ordered for mounting on either the right or left side of the milling machine. If desired, an extended arm version is available for those machines which require a longer spindle quill to main assembly distance. Consult the SUMMIT/Dana Industrial sales department.

Important instructions for properly interfacing and operating the Quickdraw Automatic Tool Changer are contained in this manual. WARNING: IT IS EXTREMELY IMPORTANT THAT THESE INSTALLATION AND OPERATION INSTRUCTIONS BE REVIEWED BEFORE ANY ATTEMPT IS MADE TO INSTALL OR OPERATE THE TOOL CHANGER , as incorrect installation or operation could result in serious or permanent damage to the tool changer or milling machine, and may possibly result in danger to the operator. Under no circumstances should the interface for previous tool changer models be used with this unit!

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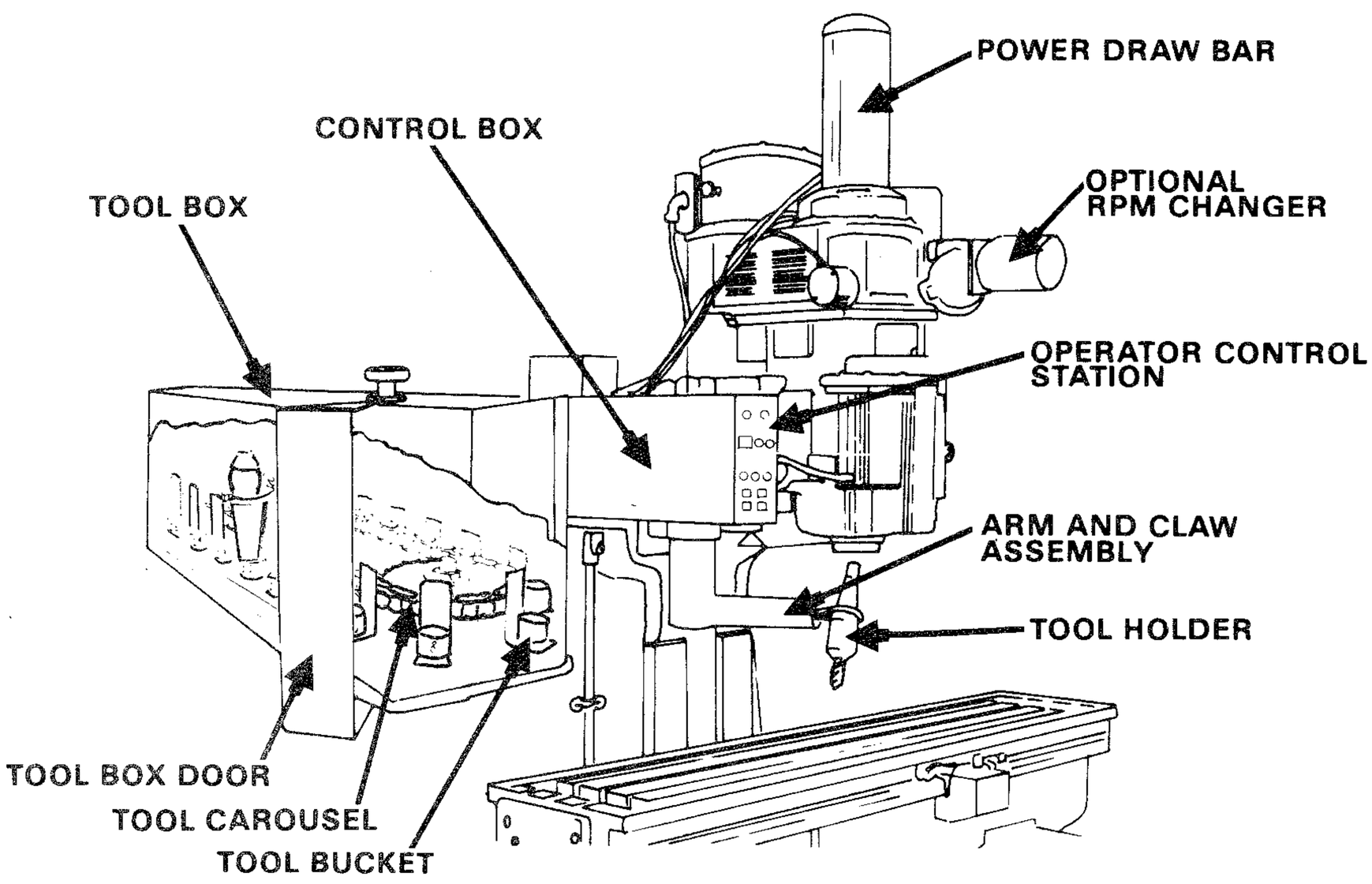
SECTION I

COMPONENTS OF THE ATC

The following is a brief description of the components of the Summit/Dana Industrial QUICKDRAW™ ATC Automatic Toolchanger and the optional Quickdraw RPM changer. The standard right hand model is mounted on the left side of a mill. An optional left hand model is available for mounting on the right side of a milling machine. Our discussion of the tool changer will be centered around the standard right hand model.



STANDARD RIGHT HAND MODEL

POWER DRAWBAR

The power drawbar is a unit consisting of a power head and spindle drawbar adapter assembly. The power head is an electrically actuated impact type wrench that provides the torque for turning the threaded spindle drawbar which secures the tool holder in the spindle taper. The force retaining the tool holder in the spindle is high enough to assure the retension of the tool holder during maximum machining loads.

The power drawbar adapter assembly replaces a standard spindle drawbar, but is very similar in that it performs the very same function of retaining the toolholder in the spindle taper. It differs in that is has a threaded knockout which threads onto the reworked spindle of the milling machine. It consists of a drawbar, knockout, and washers. The drawbar has splines at the top end, a flange near the top, and threads at the bottom. The splined end of the drawbar protrudes out of the milling spindle head 1¼ inches to interface with the power head. The flange, knockout, and washers provide the surfaces necessary for a tension force on the drawbar which retains the tool holder in the spindle taper, and a compression force to remove the tool holder from the spindle taper.

TOOL BOX

The tool box encloses a 24 station tool carousel. The tool box has a door which remains closed during normal machining operations. The door opens automatically during a tool change. Tool changes between adjacent tools require approximately 10 seconds. Tools up to 3½" in diameter may be used, but the total diameter of any two adjacent tools is limited to 5¼". The limit on tool length is approximately 12¼".

TOOL CAROUSEL

The tool carousel assembly contains 24 equally spaced tool buckets mounted to a roller chain. The roller chain is mounted between an idler sprocket located at the rear of the tool box and a drive sprocket located at the front of the tool box. The drive sprocket is driven by a motor controlled geneva mechanism. The tool carousel can be advanced in either direction providing shortest access time to the next tool.

ARM AND CLAW ASSEMBLY

The arm and claw assembly is used to transfer a tool holder from a tool bucket in the carousel and to place it into the spindle and visa-versa.

TOOL HOLDER

The tools are held in #30 MMT Erickson tool holders or #40 Erickson holders. Tool holders that are manufactured by firms other than Erickson may be used if the flanges conform to the requirements of the Erickson quick change device.

TOOL BOX DOOR

The tool box door operates in conjunction with the arm and claw assembly. As the arm approaches the tool box, the door opens. Conversely, the door closes as the arm returns to the spindle.

CONTROL BOX

The control box is attached to the front of the tool changer main housing assembly. The front panel of the control box is the operators control station. The box contains the incoming AC power isolation transformer, a 12V DC power supply and a terminal strip which interconnects the machine interlocks and AC power.

OPERATOR CONTROL STATION

The Quickdraw ATC can be operated in three modes of operation; auto, local or manual. The operator control station contains the necessary switches and pushbuttons for selecting the mode of operation and for performimg the manual control of tool changer functions.

OPTIONAL RPM CHANGER

The QUICKDRAW^{TM} RPM changer is an option for the ATC. The unit is used to control the spindle speed of a milling machine with a variable speed head; both manually and automatically.
(See Section X)

SECTION II

INSTALLATION INSTRUCTIONS

A. PRELIMINARY WORK

The ATC is designed to remove a tool holder from the spindle of a vertical milling machine. The spindle of the machine must not be rotating at the time of the tool withdrawal. There must be enough clearance between the spindle and the axes work surface so that the arm and claw assembly can rotate and swing the tool holder in an arc fashion and place the tool holder into the tool carousel.

It is therefore necessary for the CUSTOMER TO SUPPLY external interface components for the following:

1. A means of shutting off the spindle motor and a means of stopping the rotation of the spindle itself. Typically a spindle brake actuated by a device such as a solenoid or air cylinder or a spindle motor with an in-built electric brake is supplied.

2. An external switch or contact closure must be supplied to indicate that the spindle motor is "ON" and "OFF". When the spindle motor is "OFF" then a tool change can occur. When the spindle motor is "ON" then the optional RPM changer will function.

3. An external switch or contact closure must be supplied to indicate that the tool holder is in proper position relative to the arm and claw assembly for removal of the tool. This signal is usually called "spindle home" or "quill up".

The ATC is supplied with cables that will accept the signal inputs for "SPINDLE ON and OFF" and "SPINDLE HOME" or "QUILL UP". It is up to the customer to properly interface these signals to insure safe operation of the ATC. The section on Electrical Installation shows how these signals relate to the ATC.

SPINDLE CHECK- The spindle of the milling machine is to be checked and reworked if necessary to accept the ATC power drawbar assembly supplied by SUMMIT/Dana Industrial. The standard drawbar of the milling machine is not used.

B. MECHANICAL INSTALLATION

There are three units of the ATC to install on the machine.

1. The power draw bar
2. The tool changer main assembly
3. The RPM changer (optional)

The installation requires the drilling of five to ten holes in the mill for the main assembly, power draw bar and RPM changer. Existing holes are used when possible. All mounting hardware and brackets are available with the tool changer; contact the SUMMIT/Dana Industrial Sales Office for details.

POWER DRAW BAR

The installation of this unit involves the following steps:

1. The spindle must have a left hand thread on the upper end in order to accept the power draw bar assembly. The spindle thread must match the left hand thread on the inside of the knockout (cylinder on drawbar) of the power drawbar supplied.

   Figure (2.1) shows a typical rework of the spindle and should be used for reference only. It is not applicable to machines used outside of the United States. An appropriate metric thread is usually used on foreign machines. Contact SUMMIT/Dana Industrial for details.

   If there is no thread or it does not match, remove the spindle and turn a left hand thread on the upper end per the drawing specifications supplied with the power draw bar.

   NOTE: Shizuoka ANS and STN spindles are threaded at the factory and do not require removal or threading.

   Re-install the spindle in the milling head.

2. Apply a heavy coat of high temperature grease (such as automotive disk brake grease) to the upper end of the draw bar. Make sure that both thrust washers are on the draw bar (one above the shoulder and one below). Insert the drawbar into the spindle and thread the L.H. threaded retainer or knockout onto the spindle. The retainer should be tightened to approximately 75 lb.-ft. of torque to assure that it is fully engaged with the spindle. A high torque is not required because the normal action of the draw bar will not loosen the retainer.

3. Whenever possible, use existing holes in the housing above the spindle for mounting the power draw bar head assembly. Otherwise, holes must be drilled and tapped. A drill fixture is available from the SUMMIT/DANA Industrial Corporation for that purpose.

With the drawbar assembly in place, use the base of the assembly as a pattern for your hole locations. Drill and tap if necessary and screw the power unit down with 3 or 4 allen head cap screws depending on which mounting pattern is used. Before placing the cover over the power unit, make sure that the electrical lines will have enough slack under the cover to allow flexing as the power unit moves down and up.

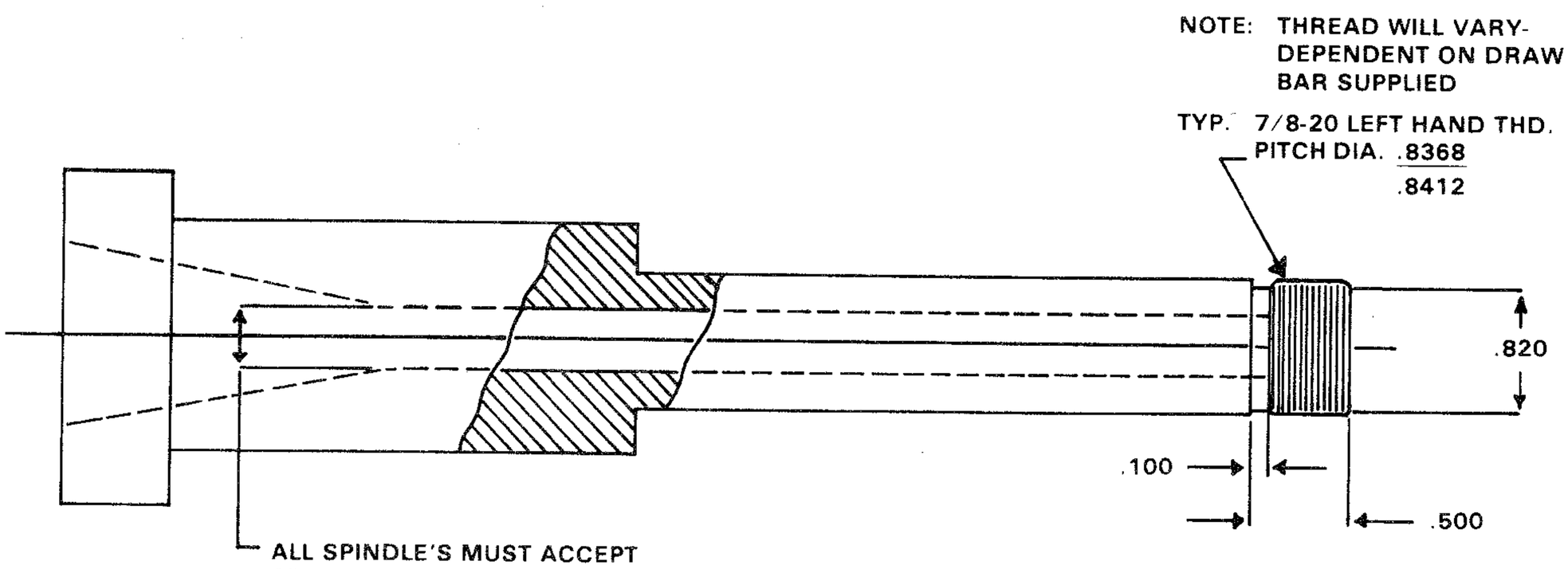
4. Insert a tool holder by hand into the spindle and screw the tool holder in until it is seated in the spindle taper.

Position the spindle quill so it is at the maximum up position or against the mechanical positive stop. Now move the spindle quill down or away from the positive stop approximately .200 inch. This position will be the home position of the Z axis for a tool change. The quill should be clamped or secured so it will not move during the mechanical installation. The home position of .200 is only a recommendation by SUMMIT/Dana Industrial for allowance of overtravel, etc. Each installation may vary dependent upon machine, etc.

5. With the tool holder installed and the Z axis at the home position, the main assembly is ready for installation.

FIGURE 2.1

TYPICAL SPINDLE REWORK



NOTE: 1. THREAD TO BE CONCENTRIC
AND SQUARE TO CENTERLINE

2. SCALE-NONE

MAIN ASSEMBLY

The main assembly is mounted to the milling machine by a mounting adapter plate. This plate must be located on the ram of the milling machine relative to the tool holder in the spindle quill.

An ATC Installation drill jig (#216-848 01) is available for this purpose. The drill jig attaches to the tool holder in the spindle and the mounting plate attaches to the drill jig. The assembly is then positioned to the ram so the proper holes can be drilled.

A newer version of the Installation drill jig (#216-848 02) is now available and is shown in figures 2.2 thru 2.5.

Refer to figures (2.2 through 2.13) at the end of this section as you do the installation.

Before following the installation procedure detailed below, be sure to sweep in the head so it is perpendicular to the table.

1. The 216-848 01 locating jig (see figure 2.8) consists of three parts: #30 or #40 tool holder holding arm (the jig comes with both), mounting adapter holding leg, and mounting with adapter holding clamp. The tool holder arm is bolted to the mounting adapter holding legs. The holding arm is an aluminum plate with two 3/8-16 holes on one end which are used to secure the aluminum plate to the mounting adapter holding leg. On the underside of the holding leg, near the other end, there are two 1/4-20 holes on the edge of a larger diameter hole.

   The mounting adapter holding leg has three positioning pins located in the upper position of the mounting adapter holding leg. These pins position the mounting adapter plate in the correct position relative to the tool holder which is bolted to the tool holder holding arm by two washers and 1/4-20 Allen cap screws. The mounting adapter plate is held on the mounting adapter holding leg by a small clamp with a 1/2" Allen-head cap screw through the clamp to the holding leg.

2. Select the proper tool holder holding arm #30 or #40, and assemble to the mounting adapter holding leg. Remove the two 1/4-20 screws, washers and retaining ring from the holding arm. Now take the assembly and slip the tool holder up inside, followed by the retaining ring; secure them in place using the washers and 1/4-20 cap screws.

3. Remove the mounting adapter plate (see figure 2.6) secured to the main assembly. Put the mounting adapter plate on its holding leg by positioning it by the three positioning pins.

The mounting brackets face the same direction as the tool holder holding arm. Secure the mounting adapter plate in place by tightening the small holding clamp as shown in figure 2.7.

4. With the locating jig and mounting adapter plate attached to the tool holder in the spindle, swing it over to the mill ram. (See figure 2.9)

5. The mounting adapter plate consists of seven main parts: one aluminum plate, three aluminum mounting brackets and three threaded bushings. The outside diameter of the bushing is threaded with a 5/8 - 11 UNC-2B thread. The bushing is drilled through with a 3/8" hole resembling a drill bushing. The bushings are screwed into the mounting brackets which are bolted to the aluminum plate in a triangular manner, two on the bottom and one at the top.

6. Position the mounting adapter plate by adjusting the threaded bushings in the brackets until contact is made with the surface of the milling machine (see Figure 2.9). There should be a minimum of .15 inches of bushing thread exposed beyond the end of each bracket.

7. With the mount plate thus positioned, the threaded bushings are used as drill bushings to start drilling the mounting holes in the mill. There are holes through the mount plate which give access to the bushings for this operation (see Figure 2.10). A long 3/8" drill may be necessary. A metric equivalent could be substituted if metric cap screws are to be used.

CAUTION: Do not drill too deep with the 3/8" drill because it is only for marking.

8. With the holes properly marked, remove the 3/8" drill and replace it with a 5/16" drill. Drill to approximately 1" deep, using the bushing as an angle guide.

9. Swing the assembly back, remove the drilling jig from the tool holder and take it off the mill. Then, remove the mounting adapter plate from the drill jig.

10. Tap the three holes (see figure 2.11) for 3/8-16 UNC-2B or metric equivalent and bolt the mounting adapter plate to the mill using 3/8-16 cap screws or metric equivalent (See figure 2.12).

11. Figure 2.13 shows the mounting adapter plate installed on the mill. The next step is to mount the ATC to the mounting adapter plate.

12. CAUTION: Be sure the arm is in the turret position to prevent it from hitting against anything. Use a suitable lifting device to raise the ATC up against the mounting adapter plate and using the three ½ - 20 x 2" hex head cap screws and six ½" flat washers provided, bolt the main assembly to the mounting plate. Just make sure they are snug at this point as the ATC final alignment will be made after electrical installation is complete.

For rough alignment, keep the base (bottom plate of turret) of the tool changer parallel with the top of the mill table; both side to side and front to back.

COMPRESSED AIR

A compressed air supply of 85-160 PSI must be provided. The air supply is connected to the filter/regulator/oiler which is supplied with the tool changer. Set the regulator to 80 PSI.

A master air solenoid is supplied with the tool changer. When the ATC is turned on, the solenoid energizes to provide air to the system.

SECTION III

ELECTRICAL INSTALLATION

The ATC interface incorporates cable assemblies to simplify installation and includes safety interlocks for operation.

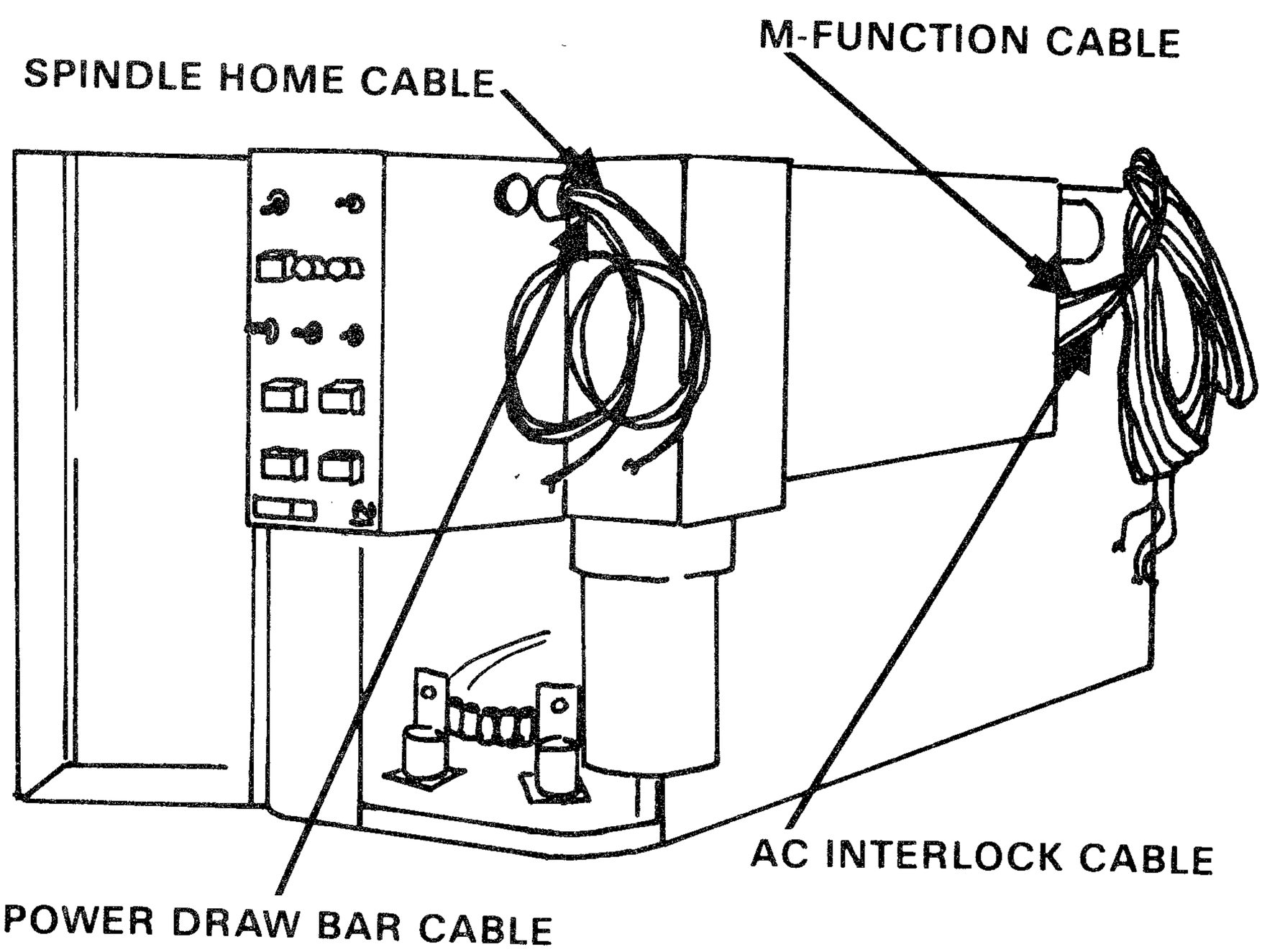
Three cables are supplied for customer use. See Figure (3.1).

a. An A.C. - Interlock cable with 9 conductors.
b. A Spindle Home or Quill Up Interlock cable with 2 conductors.
c. A M-function cable with 15 conductors.

The unit will not operate in any modes (local-LOC, manual-MAN, or automatic-AUTO) until the AC-interlock cable and the Spindle Home interlock cable are properly connected. Attempts to jumper or otherwise bypass the interlock circuitry can result in permanent damage to the ATC or milling machine.

A discussion of each cable assembly and how it relates to the functions of the tool changer is presented.

FIGURE 3.1



1. A.C. INTERLOCK CABLE

This cable supplies two inputs that the tool changer needs in order to function - Incoming A.C. power and the status of the spindle motor (ON or OFF). See Figure (3.2).

In addition, auxiliary contacts from the ATC stop switch are brought out for customer use.

A. INCOMING A.C. POWER INPUT - The A.C. interlock cable contains three wires which the customer uses for the A.C. power input. The wires are designated as AC HI, AC LO and Chassis Ground. The 3 wires are always used for any one of four possible voltage inputs.

The tool changer is equipped with an isolation transformer that will accept any ONE of four voltage inputs:

104 VAC, 115 VAC
208 VAC, 230 VAC
} 60 or 50 HZ

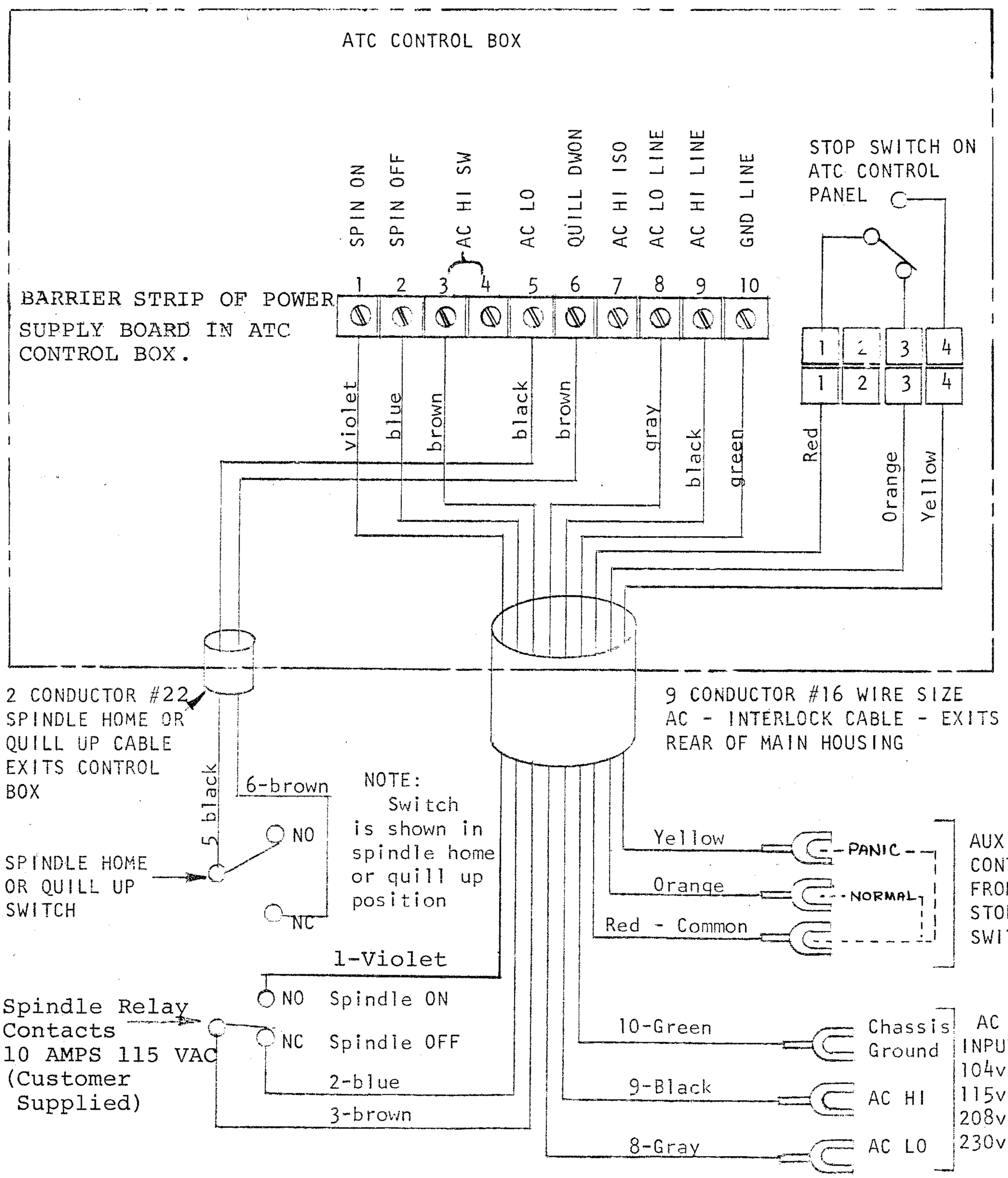
The ATC is factory connected for an incoming line voltage of 115 VAC.

B. RE-CONNECTION FOR OTHER VOLTAGES - For any of the three incoming voltages other than 115 VAC, the customer must re-connect wires on a terminal strip located inside the control station. (See Figure 3.3).

NOTE: REMOVE ALL INCOMING POWER TO THE ATC.

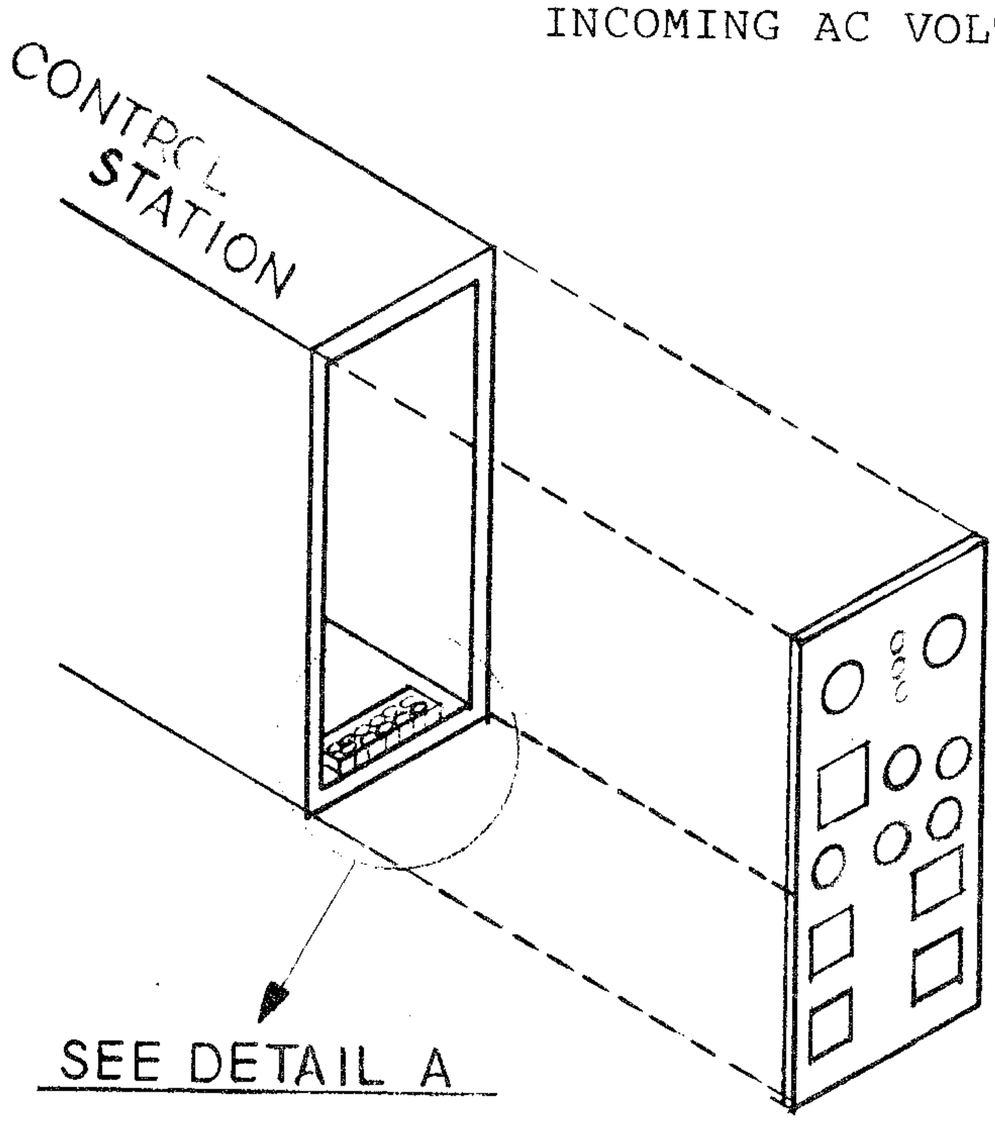
Remove the Operator Control Station panel from the front of the control station to gain access to the terminal strip. The front panel is secured by (4) phillips head screws. The terminal strip is mounted to the bottom of the control box. Using Figure (3.3) re-connect the wires for the desired voltage.

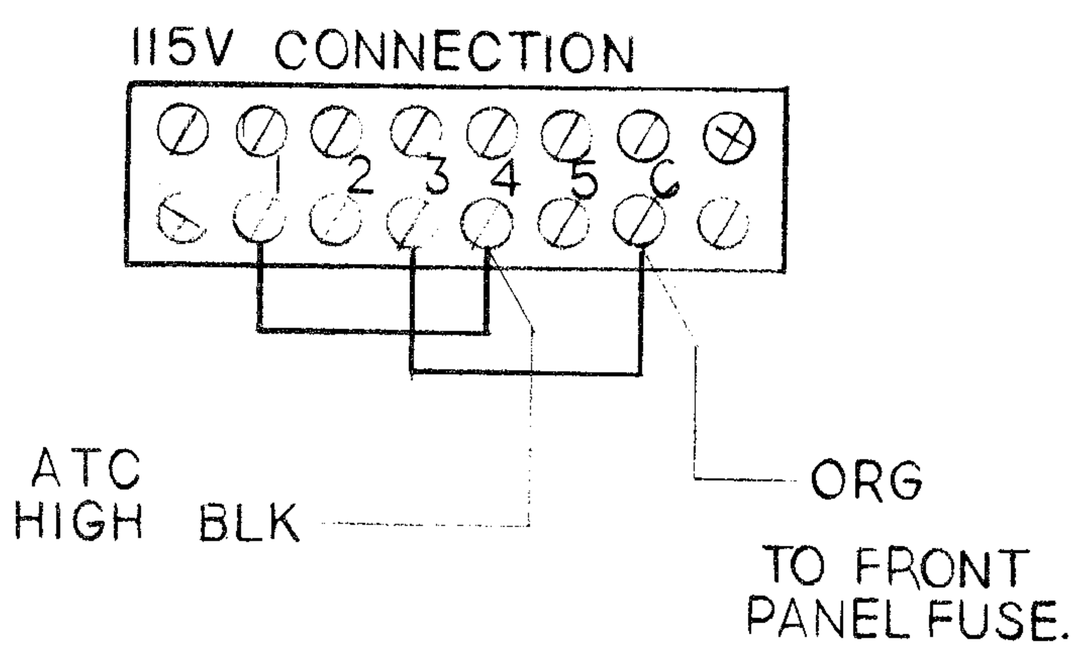
A.C. INTERLOCK CABLE
FIGURE 3.2



NOTE: Factory Connected for 115VAC. Change control box terminal strip wiring if used on 104, 208, or 230 VAC.

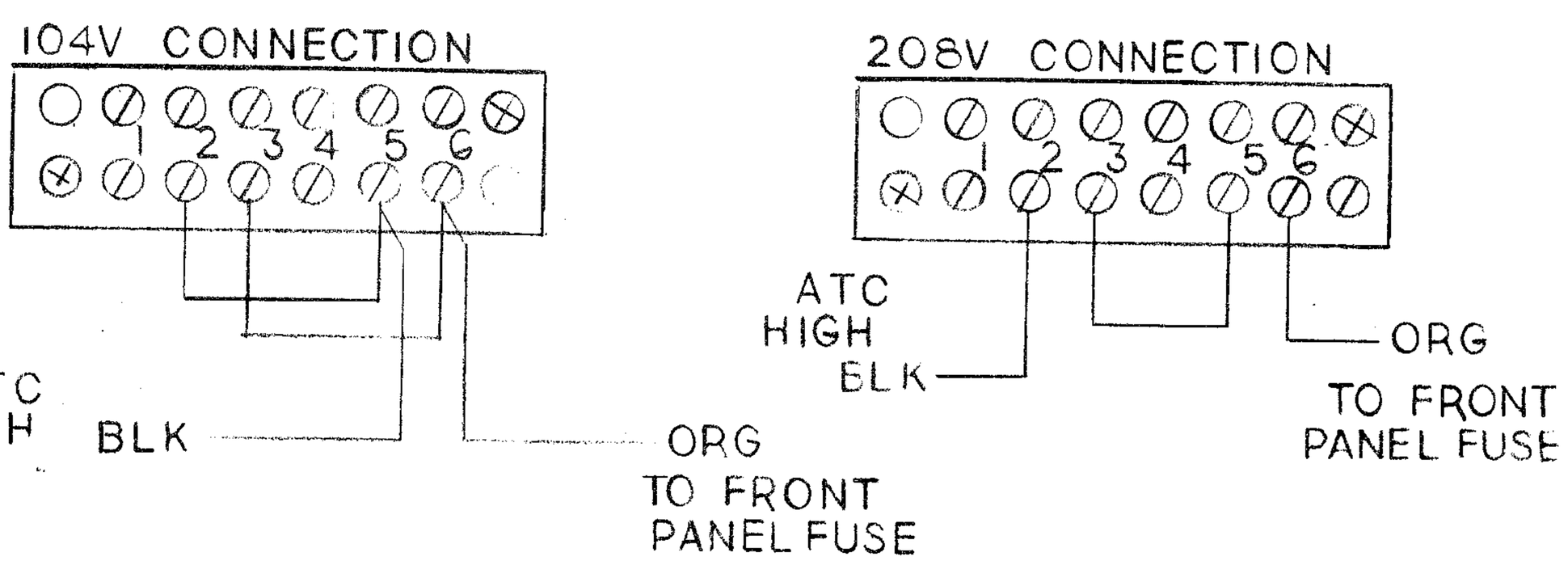
INCOMING AC VOLTAGE CONNECTION TERMINAL STRIP
FIGURE 3.3

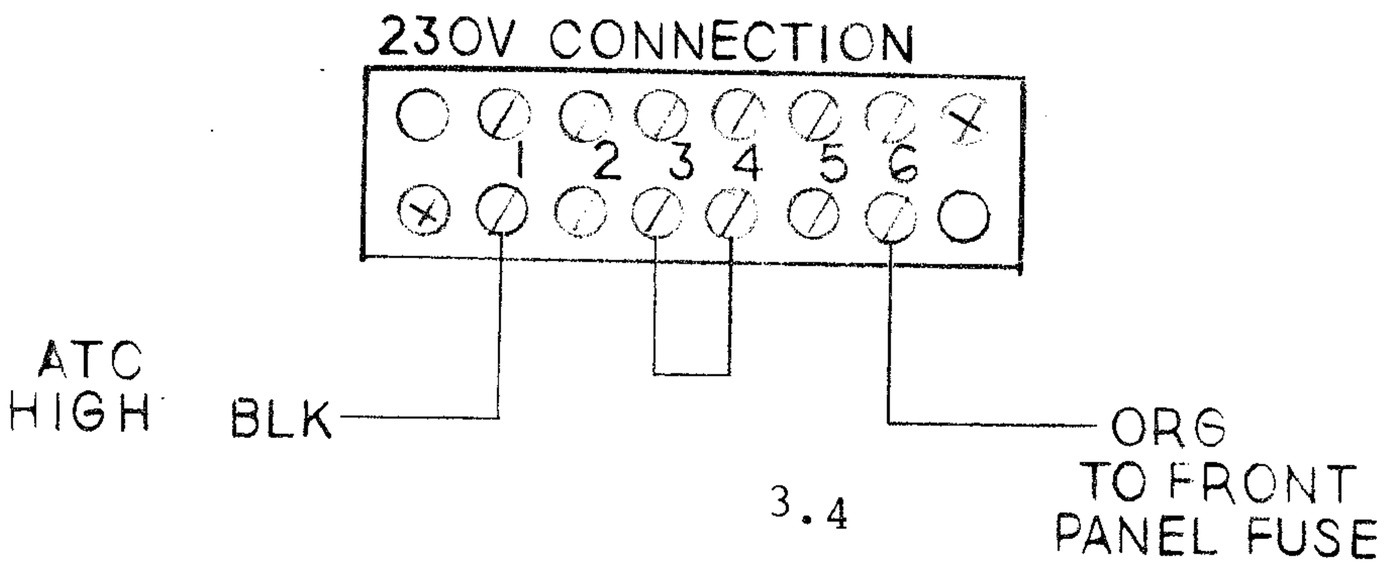




DETAIL A

FOR OTHER VOLTAGES CONNECT AS SHOWN BELOW





C. SPINDLE ON AND OFF INPUT - The A.C. Interlock cable also contains three wires which the customer uses to tell the tool changer the status of the machine spindle motor. The spindle motor must be "OFF" in order to do a tool change. When the optional RPM CHANGER is supplied, the spindle motor must be "ON" in order to change the spindle speed.

The "spindle relay" contacts shown in Figure (3.2) must be furnished by the customer and wired as shown or the ATC will NOT function.

The contacts should be either a "form C" relay contact or a 1NO-1NC auxiliary contact of the spindle motor contactor or starter. The contacts must be rated at 10 amps at 115 VAC.

D. ATC STOP SWITCH AUXILIARY CONTACTS - A spare set of "form C" (1NO-NC) contacts on the ATC STOP switch have been brought out through the Interlock cable for the user's convenience. (See Figure 3.2) The wire colors are red-common, orange-NORMAL, yellow-PANIC. These contacts are rated 5 amps at 115 VAC. They may be used to reset or otherwise inhibit the N/C control or they may be used to drop all AC power to the machine tool and activate the N/C panic stop circuitry. In the latter case the ATC STOP switch may then act as a system Panic Stop.

2. SPINDLE HOME INTERLOCK CABLE

This cable is used to determine where the tool change will occur in relation to the location of the spindle. See Figure (3.2).

The spindle-home or quill-up interlock will prevent any claw closure, arm movement, carousel indexing or tool change sequence if the spindle is in any position other than home (fully retracted or up). This is the 2 conductor #22 AWG wire (black & brown) cable. This should be connected to a limit switch that is actuated when the spindle or quill is in the "home" or "up" position. The 2 wires should be connected to the common and NC contacts and when the switch is actuated at the "HOME" position, it must OPEN the circuit. The ATC won't operate if there is a circuit or path between the black and brown wires.

3. M-FUNCTION CABLE

This cable is used to supply input signals from an external device to the ATC. When the tool changer is placed in the AUTO mode of operation these miscellaneous function signals command the tool changer to automatically perform a complete tool change, etc.

In addition, the cable contains the input wires for another interlock for the ATC which is referred to as a "SLIDE HOLD INTERLOCK".

For details on the proper interfacing of this cable, See section on M-functions and slide hold interface.

4. M-FUNCTION INTERFACING

When you operate the ATC in MANUAL or LOCAL mode, the operator controls the tool changer by pressing switches or buttons on the operator's control station front panel.

In the AUTO mode, the ATC operator control station is disabled. Therefore, an external controller (or N/C System) must be used to tell the tool changer to perform the same function as the operator would.

Keep in mind that the tool changer must select a tool from the tool carousel, place it into the spindle and then when requested remove the tool and place it back into the same tool bucket all automatically.

The ATC contains internal logic circuitry which must have certain external signal inputs applied by an external device to cause the tool changer to perform the following functions:

a. Tool-in
b. Tool-out
c. Turret CW
d. Turret CCW
e. Turret Home
f. RPM Up
g. RPM Down
h. RPM Home

The tool changer is supplied with a 24-ft. cable which is factory connected at one end to the ATC internal logic circuitry to perform the above functions. The cable is brought out the rear of the ATC assembly for connection to the external device by the customer. This cable is called a miscellaneous or M-function cable. See Figure (3.1).

4.1 WIRING THE M-FUNCTION CABLE

The M-function cable contains 15 #22 AWG color coded conductors and is used to provide input signals to the ATC as well as to transmit signals from the ATC to the external device. Each conductor is assigned for a specific function.

In addition to the eight input functions (tool-in, etc.), the cable is also used to transfer from the ATC logic to the external device the following signals:

a. Reset signals that the input function is complete.
b. +12 volt DC to the switching device within the external controller
c. A SLIDE HOLD INTERLOCK signal that air pressure is applied to keep the claw open.

Figure (3.4) shows the M-function cable and how it is connected to the ATC.

Using Figure (3.4) lets simulate a tool-out function in the AUTO mode. The external controller must contain a switching device which will close when a command is given to the controller to perform tool-out. The switching device will then connect or tie the green wire with the violet wire. Voltage will be applied from the violet wire through the green wire of the M-function cable to the logic circuits of the tool changer. The switching device must remain closed so voltage will continue to be applied through this wire until the tool-out function is complete. When tool-out is complete, the tool changer returns a reset signal to the external controller by closing the white/black and gray wires for a duration of approximately 100 milli-seconds. When the external controller receives the reset signal, the controller must immediately "Open" the switching device that connected the green to the violet wire to accomplish the tool-out function.

4.2 M-FUNCTION COMMANDS

In the above discussion of the M-function cable, we simulated a tool-out function. It is necessary that the external control be told specifically that it should only close the tool-out circuit.

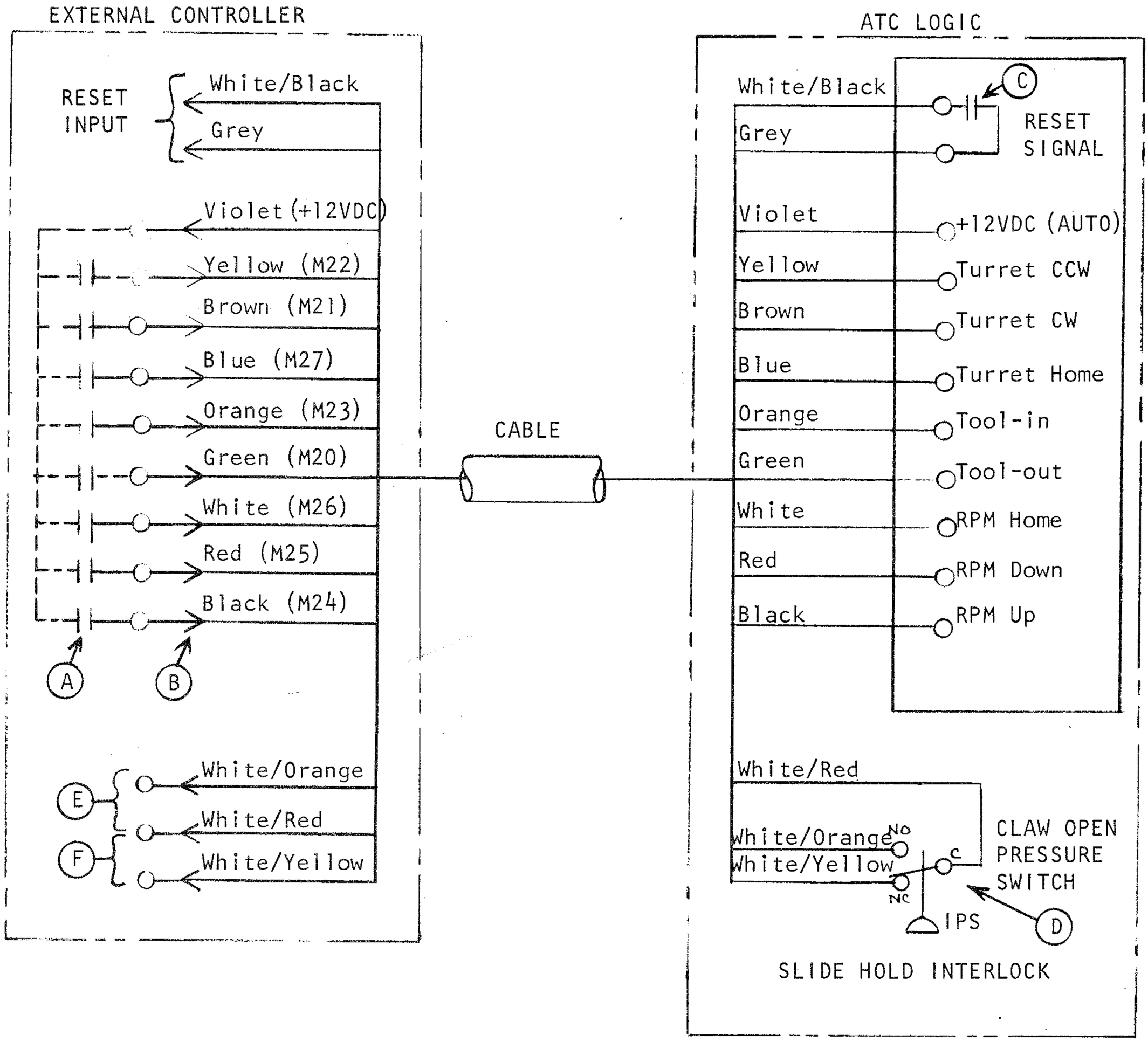
Therefore, we need to assign specific miscellaneous function commands to the individual circuits used by the ATC.

Summit/Dana has selected the M-20 series of commands in order to provide a standard for a discussion of tool changer functions.

The function and the associated wire color code are as follows:

M20 - Tool-out	Green	M24 - RPM Up	Black
M21 - Turret CW	Brown	M25 - RPM Down	Red
M22 - Turret CCW	Yellow	M26 - RPM Home	White
M23 - Tool-in	Orange	M27 - Turret Home	Blue

M-FUNCTION CABLE
FIGURE 3.4



NOTES:

A. CUSTOMER SWITCHING DEVICE (contact closure)
B. M-FUNCTION COMMAND OUTPUT TO ATC
C. INTERNAL RESET SIGNAL FROM ATC - 100 msec contact closure
D. ATC INTERNAL PRESSURE SWITCH FOR SLIDE HOLD - an output to controller
E. A N.O. CONTACT - closes when air pressure is applied to open claw
F. A N.C. CONTACT - opens when air pressure is applied to open claw

When an external controller is instructed to perform a specific M-function command, say M-20 for tool-out, then the internal circuitry of the controller must close a switching device (usually a relay contact) that closes the circuit between the green wire and the violet wire. Use Figure (3.4) as a reference.

This means that the M-function command must close a relay for a particular tool change function and keep that relay closed until the tool change function is complete. The ATC will then send a reset signal back to the controller to clear or reset the M-function command so the controller can go on to the next command.

4.3 M-FUNCTION INTERFACE WITH THE BANDIT ® CNC

The BANDIT ® CNC System internal firmware has the capability of outputting miscellaneous function signals from M00 to M99, but these are only logic signals.

In order to decode the internal logic signals into specific M-function signals, an optional printed circuit board called the M-FUNCTION BOARD is available.

The M-function board provides the customer with the ability to select which M-function signals he would want. But keep in mind that these outputs are still only signals. To isolate the CNC system circuitry from any outside noise, etc., it is necessary that the M-function board signals operate a reed relay for each specific M-function desired.

The reed relay contact may then be used in the customer's circuitry to actuate the closure of the tool-out or the turret CW wires in the M-function cable. It may be desirable to actuate a higher power handling relay in order to do something else.

A 10-Reed Relay Board is available as an option which will provide 10 reed relay contact closures, one for each M-function that you decode. Each contact is normally open and is rated for 200 milliamps at 24 volts D.C. MAX.

By ordering a BANDIT ® CNC system with the above optional boards, you would be able to interface the ATC for complete automatic operation.

Consult the installation and operation manual on the BANDIT ® CNC system for exactly how to interface the M-function and reed relay boards.

A simple and typical M-function interface drawing #ATC-2 is given as an example in the appendix of this manual.

5. SLIDE HOLD INTERLOCK

This interlock is provided for customer use to prevent damage to the arm and claw assembly when the tool changer power is off and the spindle quill axis drive is actuated by an external device.

If incoming AC power is turned off at the tool changer operator station and the arm and claw assembly is at the spindle quill position, it is possible to grasp the claw assembly and close the claw manually .

When the external controller is told to move the spindle quill axis, damage to the arm and claw assembly will result.

To prevent this situation from occuring, the ATC is supplied with an open claw pressure switch. The function of this switch is to provide a set of signals (normally open and normally closed contacts) that indicate when air pressure is provided to open the claw.

Three conductors are wired to the pressure switch, See Figure (3.4) and are brought out through the M-function cable for customer use. The wires are:

Common - White/Red
Normally Open - White/Orange
Normally Closed - White/Yellow

When power is applied to the ATC, the master air solenoid is energized, and supplies air pressure to the claw air solenoids. If the open claw solenoid is energized to open the claw then the N.O. contact of the pressure switch will be closed.

When the close claw solenoid is energized, no air pressure is available and the N.O. contact will open. The N.C. contact then closes to indicate that the claw is closed.

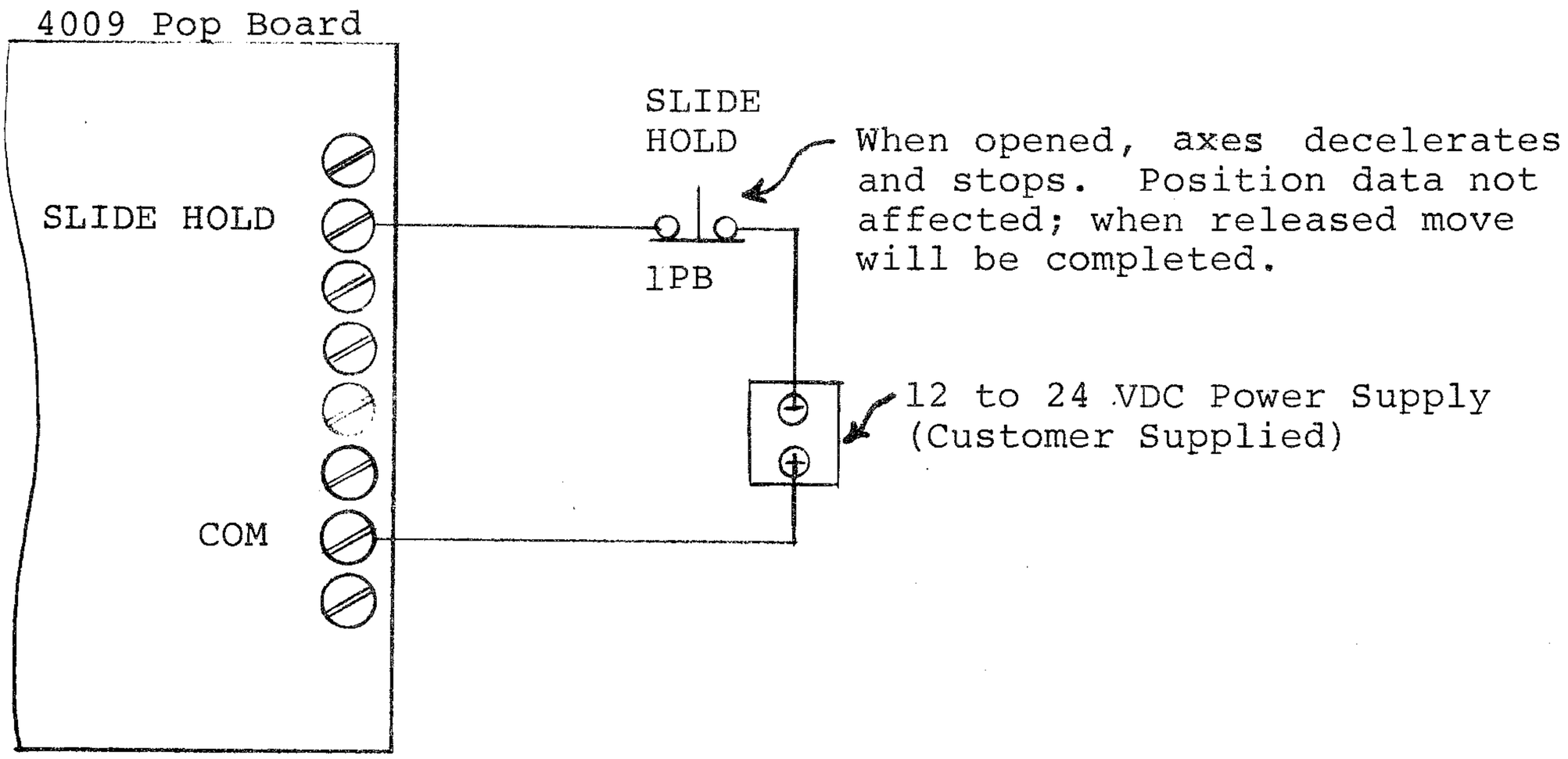
5.1. SLIDE HOLD INTERFACE WITH THE "BANDIT" CNC SYSTEM

The 4009 Power on Preset Interlock board, located in card file slot J4, has an input terminal on the board called SLIDE HOLD. When this terminal is "OPEN" or has no return path to the COM terminal of this board, all axes movement of the CNC system will be inhibited.

An external +12 VDC to +24 VDC power supply is normally provided by the customer in order to maintain optical isolation from out-side noise to the 4009 board.

Figure (3.5) shows a typical connection of a customer supplied external switch used for "SLIDE HOLD".

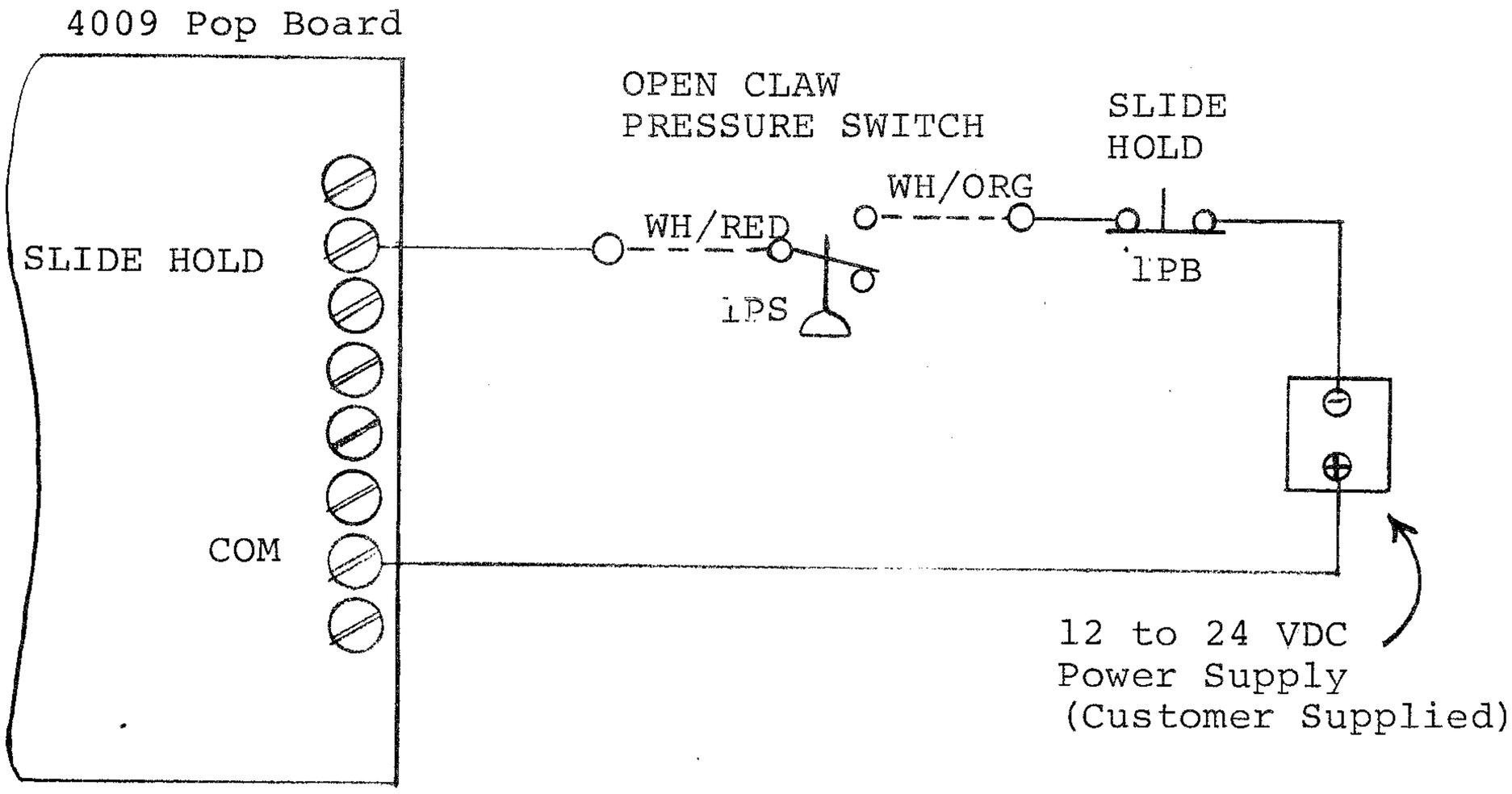
FIGURE 3.5



The following example will show how to add the ATC slide hold interlock to also inhibit the axes drives.

Refer to Figure (3.6). This shows the slide hold interlock and the color code of the wires located in the M-function cable. The white/red wire is common and the white/orange is the N.O. contact of the pressure switch.

FIGURE 3.6



Now using Figure (3.6), to install the open claw pressure switch slide hold interlock, you would simply rewire the circuitry so the normally open contact of the pressure switch "OPENS" the circuit to the POP board SLIDE HOLD terminal when there is no air pressure.

6. ATC INTERNAL INTERLOCKS

Claw interlock - The claw interlock prevents a carousel index unless the claw is open. This interlock is inside the ATC and requires no interfacing.

Turret home - In the auto mode, the limit switch senses the "Home" position of tool bucket #1 and stops the carousel. This interlock is inside the ATC and requires no interfacing.

SECTION IV

OPERATOR CONTROL STATION

The operator control station is used to select the three modes of operation of the tool changer; MANUAL, LOCAL, or AUTO.

Fold out drawing #ATC-1 of the operator's control station located in the appendix of this manual and lets discuss each switch or pushbutton function.

1. ON/OFF SWITCH - Supplies the incoming AC power necessary to run the ATC. In the "ON" positon, a red LED indicator will be illuminated to indicate the mode (manual, local or auto) that the tool changer is in.

2. MODE SELECT SWITCH - (MANUAL, LOCAL or AUTO)

   MANUAL - In this mode all the operator control switches and pushbuttons are activated to allow individual selection of tool change functions. The power drawbar is enabled to allow you to manually install or remove the tool with the tool-in or tool-out buttons. The arm, claw and turret (tool carousel) can be operated individually from the control panel by the respective toggle switches. When the spindle is running, the optional RPM Changer will change the spindle RPM by simply pushing a button.

   LOCAL - This mode is used primarily for setup and trouble shooting. LOCAL provides a sequence of events when either the tool-in or tool-out pushbuttons are momentarily depressed. The spindle motor must be "OFF".

   The sequence of the tool change in LOCAL is such that when the tool-out pushbutton is momentarily pressed, the claw closes, the power drawbar starts, disengages the tool and the arm places the tool into the tool bucket all in one operation.

   Conversely, when the tool-in pushbutton is momentarily pressed, the claw closes, the arm removes the tool from the tool carousel, places the tool into the spindle and the power drawbar draws the tool into the spindle all in one operation.

In LOCAL, the operator switches for claw and arm are disabled. The turret switch will control the direction of the tool carousel and the optional RPM pushbuttons will function when the spindle is running.

It is not possible to operate the power drawbar by itself in the LOCAL mode.

AUTO - In AUTO mode the Quickdraw accepts the M-function input signals from a numerical control for the tool-in sequence, tool-out sequence, turret clockwise, turret counterclockwise, RPM up, RPM down, RPM home and turret home. All operator control switches are disabled in the AUTO mode except the ON/OFF power switch, stop button and mode select switch.

AUTO is the normal mode of operation for the ATC.

2. STOP - The Quickdraw STOP pushbutton provides a means to interrupt all tool changer action for the safety of the operator or automatic tool changer or machine. The STOP condition can be activated by pressing the "STOP" button at the Quickdraw control or by activating a properly interfaced remote stop switch. The "STOP" button on the Quickdraw control panel is an illuminated pushbutton and the light will illuminate when the stop condition is activated. The light will remain "on" until the operator resets the panic condition by pressing the "STOP" button again. When stop is activated the following events occur:

a. The claw will relax but it will not open immediately. The newer model Quickdraw relaxes the claw to allow the operator to easily remove the tool from the claw. The tool will not drop unless it is heavy enough to force the jaws of the claw open and to do so takes a few seconds.

b. If the arm is in motion it will stop.

c. If the carousel is in motion it will stop

d. If the power drawbar is running it will stop and disengage.

e. If the optional RPM motor is running it will stop.

f. All front panel controls and M-functions will be disabled until panic stop is reset.

Recovery from the stop condition is accomplished by pressing the stop button at the control panel a second time.

CAUTION - When stop is reset, the Quickdraw immediately continues with the operation it was doing when stop was activated. It is extremely important that the situation that caused the operator to hit the stop in the first place be corrected before resetting the stop pushbutton.

4. CLAW SWITCH - A spring loaded, two position switch that normally remains in the "CLAW OPEN" position. In MANUAL mode the operator can close the claw by pressing the switch to the "CLAW CLOSED" position. When the switch is released by the operator it will return to the "CLAW OPEN" position and the claw will open. The claw switch is disabled in all but MANUAL mode.

5. ARM SWITCH - A spring loaded, three position switch that is normally in the neutral or center position. In MANUAL Mode the switch is pushed to the left to move the arm to the operator's left and to the right to move the arm to the right. The arm switch is disabled in all but MANUAL mode.

6. TURRET SWITCH - A spring loaded, three position switch that is normally in the neutral or center position. In MANUAL or LOCAL mode the switch is pressed to the left to index the turret clockwise and to the right to index the turret counterclockwise. The turret will complete an index after the switch is released if it has started to index before the switch is released. The turret will stop when it reaches the next tool change position; i.e. it will stop when it is in a position to accept a tool.

7. TOOL-IN BUTTON - A momentary pushbutton that is used in MANUAL mode to control the power drawbar for manual tool insertion, and in LOCAL mode to initiate a tool-in sequence. When in MANUAL mode, the power drawbar will continue to run as long as the "TOOL-IN" button is depressed. When the button is released the power unit will stop and disengage. In LOCAL mode the "TOOL-IN" button need only be pressed momentarily to initiate a tool-in sequence.

8. TOOL-OUT BUTTON - A momentary pushbutton that is used in MANUAL mode to control the power drawbar for manual tool releases, and in LOCAL mode to initiate a tool-out sequence. When in MANUAL mode, the power drawbar will continue to run as long as the "TOOL-OUT" button is depressed. When the button is released, the power unit will stop and disengage. In LOCAL mode the "TOOL-OUT" button need only be pressed momentarily to initiate a tool-out sequence.

9. OPTIONAL RPM CHANGER PUSHBUTTONS

RPM DOWN - A momentary pushbutton that will decrease the spindle RPM continuously when it is depressed in the LOCAL or MANUAL mode. The RPM changer motor will continue to turn the RPM Selector dial until the button is released or until the lower limit switch is reached. The spindle-off interlock will prevent the RPM changer motor from running if the spindle is not turned on.

RPM UP - A momentary pushbutton that will increase the spindle RPM continuously when it is depressed in the LOCAL or MANUAL mode. The RPM changer motor will continue to turn the RPM Selector dial until the button is released or until the upper limit switch is reached. The spindle-off interlock will prevent the RPM changer motor from running if the spindle is not turned on.

SECTION V

ATC FINAL ALIGNMENT

After installing the ATC main assembly and power drawbar and doing the electrical interface, it is necessary to align the main assembly so the claws on the end of the arm align with the flange of the tool holder in the spindle.

The tool holder can be adjusted in three planes; horizontal, vertical and in or out, all relative to the mill spindle and table. By loosening the (3) bolts of the mounting adapter plate, the ATC can be positioned up or down or moved front and back. The toolchanger arm position can be moved towards the spindle or away by adjusting the mounting leg jackscrews in or out.

During alignment, the turret base plate must be kept parallel with the top of the mill table. One way to accomplish this would be to support the main assembly on top of a piece of large I-Beam which is clamped to both the turret base plate and the top of the mill table.

The complete unit could then be moved up or down, in or out and left or right by manually moving the mill axes.

Alignment:

1. Position the spindle quill at the home position and clamp or secure the quill from moving.

2. Apply incoming power to the ATC, place the mode switch to MANUAL and turn the ATC "ON".

3. Place an empty tool holder in the spindle and insert the tool holder with the tool-in button.

4. With the tool changer supported on the mill table as described above, loosen the three adapter bolts just enough to move the main assembly. Place the arm in the spindle location with the arm toggle switch.

5. Use the claw toggle switch to close the claws around the tool holder flange. They must close without deflecting the arm up, down or sideways. Position the main assembly as necessary. The mount bolts should be tightened but should still allow some adjustment. When adjusting the arm, under or away from the spindle using the jack screws, be careful to adjust both the end and middle jack screws so you do not warp the adapter plate.

Proper claw alignment will be indicated when you close the claw around the tool holder, hear a single click, and see no movement of the arm.

6. Change the mode switch to LOCAL - Press the tool-out button and when the tool holder is clear of the spindle, press the tool-in button and re-insert the toolholder.

   As you do this, observe if the tool changer arm is being pulled from side to side as it engages the tool holder in the drawbar. The tool holder should descend out of the spindle smoothly and return without deflecting in any direction by more than .030 - .050 inches.

   Re-adjust the main assembly if necessary.

7. Tighten all mount bolts and remove the I-Beam support. Check alignment again by engaging and disengaging the tool holder in the Local mode. Adjust if necessary.

After the ATC has been aligned and operated, certain adjustments may have to be made. They are:

a. ARM SWING SPEED (oil needle valve)
b. DRAWBAR DELAY TIME (pot)
c. DRAWBAR TOOL-IN SPEED (pot)
d. DRAWBAR RUN TIME (pot)
e. TOOL-OUT ARM SPEED (air needle valve)

Refer to the sections on operation, power drawbar adjustments, mechanical adjustments and maintenance.

SECTION VI

OPERATION OF THE ATC

The toolchanger will operate in three modes: MANUAL, LOCAL or AUTO. It is assumed that the mechanical and electrical installation requirements have been satisfied and now lets use each of these modes to operate the toolchanger.

TOOL CHANGE CYCLE: The cycle is divided into three change functions as follows:

1. Tool-Out function. The tool is removed from the spindle and placed in the tool bucket that currently occupies the home position of the tool box. The tool box door is opened during this function.

2. Index function. The tool carousel may be indexed to the next tool position. The turret may be indexed either clockwise or counterclockwise. A turret "home" function will cause the turret to return to the "#1" tool position.

3. Tool-in function. A tool is picked up from the position of the tool carousel and placed in the spindle. The tool box door closes during this step.

MANUAL & LOCAL: Without any tool holders in the tool buckets to start with, lets insert the first tool holder. The arm & claw should be at the spindle with the spindle motor off.

1. Place the mode switch to MANUAL and turn power switch on. The claw should open to allow you to place a tool holder into the spindle. Position the spindle quill at "HOME".

2. Place the tool holder into the spindle and press the tool-in button and the tool will be drawn into the spindle by the power drawbar. Release the tool-in button when the tool is secured.

3. Change the mode switch to LOCAL - We will now want to place the toolholder into an empty tool bucket. Momentarily press the "tool-out" button. The claw will close and the power drawbar will start, dis-engage the tool holder from the spindle and shut off.

The arm will begin to swing the toolholder towards the tool box. The tool box door will begin to open and will open fully by the time the arm reaches the tool bucket. The arm will then place the tool into the bucket and the claw will open.

4. Observe the tool bucket number. Each bucket is numbered from 1 to 24. Lets switch back to Manual and by hand, remove the tool holder from the bucket. Now using the turret switch rotate the tool carousel until tool bucket #1 appears. Replace the tool holder in bucket #1.

5. Change the mode to LOCAL and when you press the "tool-in" button momentarily, the claw will grasp the tool holder and the arm will pick it out of the bucket. While the arm returns the tool holder to the spindle, the tool box door closes. The power drawbar will engage, automatically start, and draw the tool into the spindle and shut off. The claw will open.

At this point you have only one toolholder, but now lets add two or three more to the carousel. To do this, you must OVER-RIDE the tool box door. Use CAUTION with this procedure.

6. Place the ATC in MANUAL - Before the toolbox door can be opened by hand, the drive clutch hand nut must be loosened. With the drive clutch hand nut loose, open the door. You may now operate the turret and place the additional tool holders into say buckets 2, 3, and 4.

7. Close the tool box door and TIGHTEN the door drive clutch. If this is overlooked, and you operate the unit in Local or Auto, the arm will strike the door surface during the next tool change. This will cause no severe damage to the unit.

   If a crash occurs, the recovery procedure is:

   A. Grasp the toolholder with your left hand and hit the STOP button. The claw will relax and release the toolholder. Be careful not to drop the toolholder.
   B. Place into MANUAL Mode and actuate the arm switch. Then re-press the STOP button.
   C. Use the "ARM" switch to return the arm to the spindle position.
   D. Tighten the door drive clutch hand nut.
   E. Use the "ARM" switch to move the arm back to the tool bucket and then place the tool holder into the bucket.
   F. Place the mode switch into the mode you want.

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.

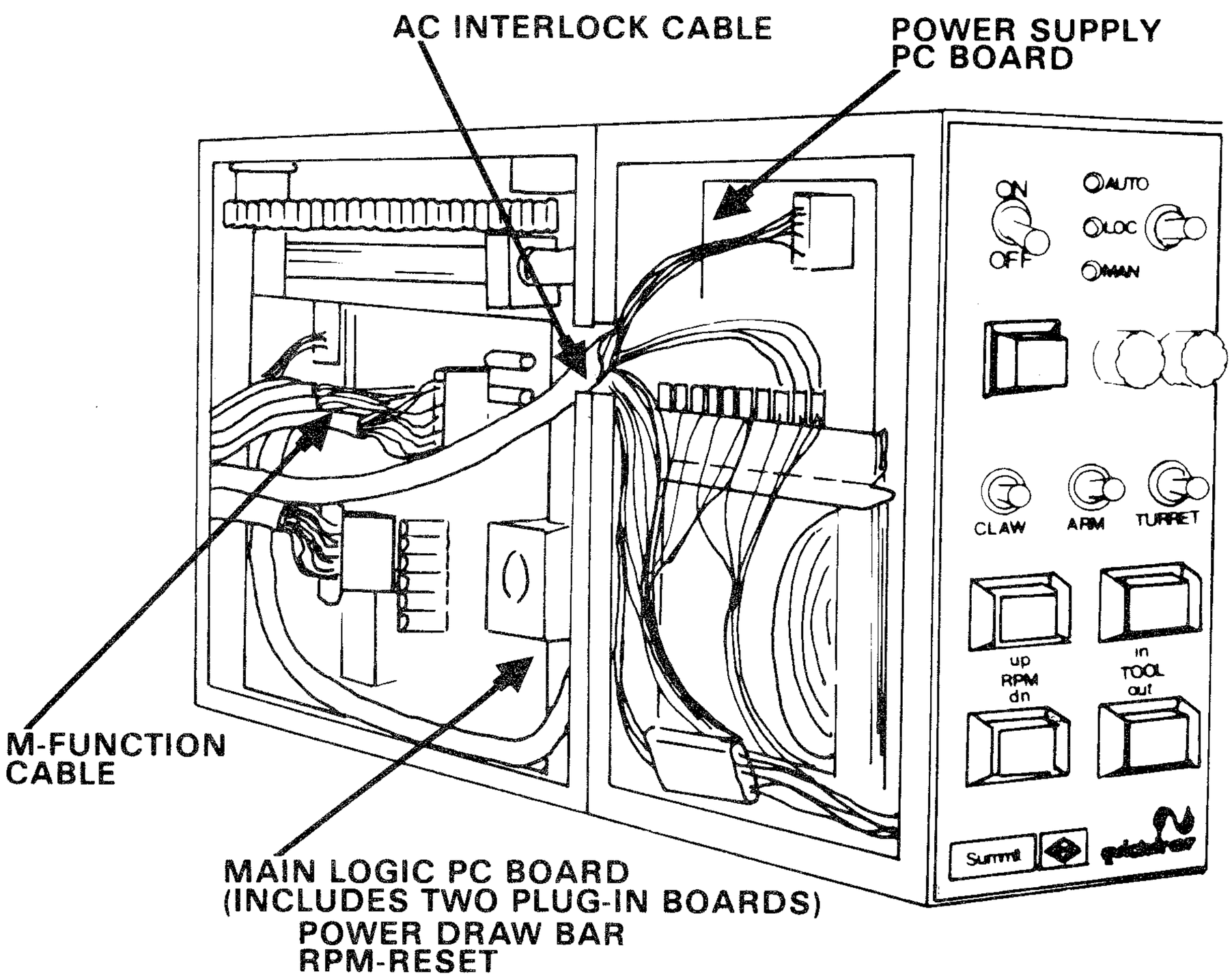
See the section on the OPTIONAL RPM CHANGER for its programming requirements.

SECTION VII
ELECTRICAL MAINTENANCE

The tool changer incorporates electronic, pneumatic and electro-mechanical components for its operation.

On the side of the Control Box housing, you will find a removable access plate. The Control box is divided into two sections. See Figure (7.1).

FIGURE 7.1



The front section of the Control Box contains the incoming power terminal strip, the isolation transformer and a Power Supply board #213-810 (31 or 33).

Located in the back section of the Control box are three electronic circuit boards. These boards are the Main Logic board #213-810 01, the Power Draw Bar board #213-810 22 and the RPM & RESET board #213-810 11.

The Main Logic board is mounted to the back panel of the control box on four threaded stand-offs. The Power Draw Bar and RPM-RESET boards are plugged into the Main Logic board.

Figure (7.1) also shows the location of the A.C. Interlock and M-Function cable.

The Power Draw bar board may have to be adjusted for optimum performance of the Power Draw Bar. The draw bar motor run time is a pot adjustment on the main logic board. Refer to the section on Power Draw bar adjustments.

Make sure that all incoming power to the ATC has been REMOVED before attempting to gain access to the inside of the CONTROL BOX.

There are no other adjustments for the Main Logic or RPM-Reset boards. If difficulties arise, SUMMIT/Dana Industrial recommends that only qualified service personnel be allowed to service the ATC.

Electrical schematics are supplied in the appendix for reference.

Electronic circuit boards in this tool changer MUST NOT BE EXCHANGED with earlier models of ATC's.

SECTION VIII

POWER DRAW BAR ADJUSTMENTS

The Power Draw Bar has three adjustments: tool-in motor speed, motor start delay and motor run time. These rates are adjusted at the factory for optimum operation and should not require further adjustment in the field. However, should you feel the need to make adjustments, the following procedure should be followed. Remember to use extreme caution at all times as 120 VAC is applied to all of the ATC boards. Adjustments should be made using only a nonconductive type adjusting tool (plastic or similar material).

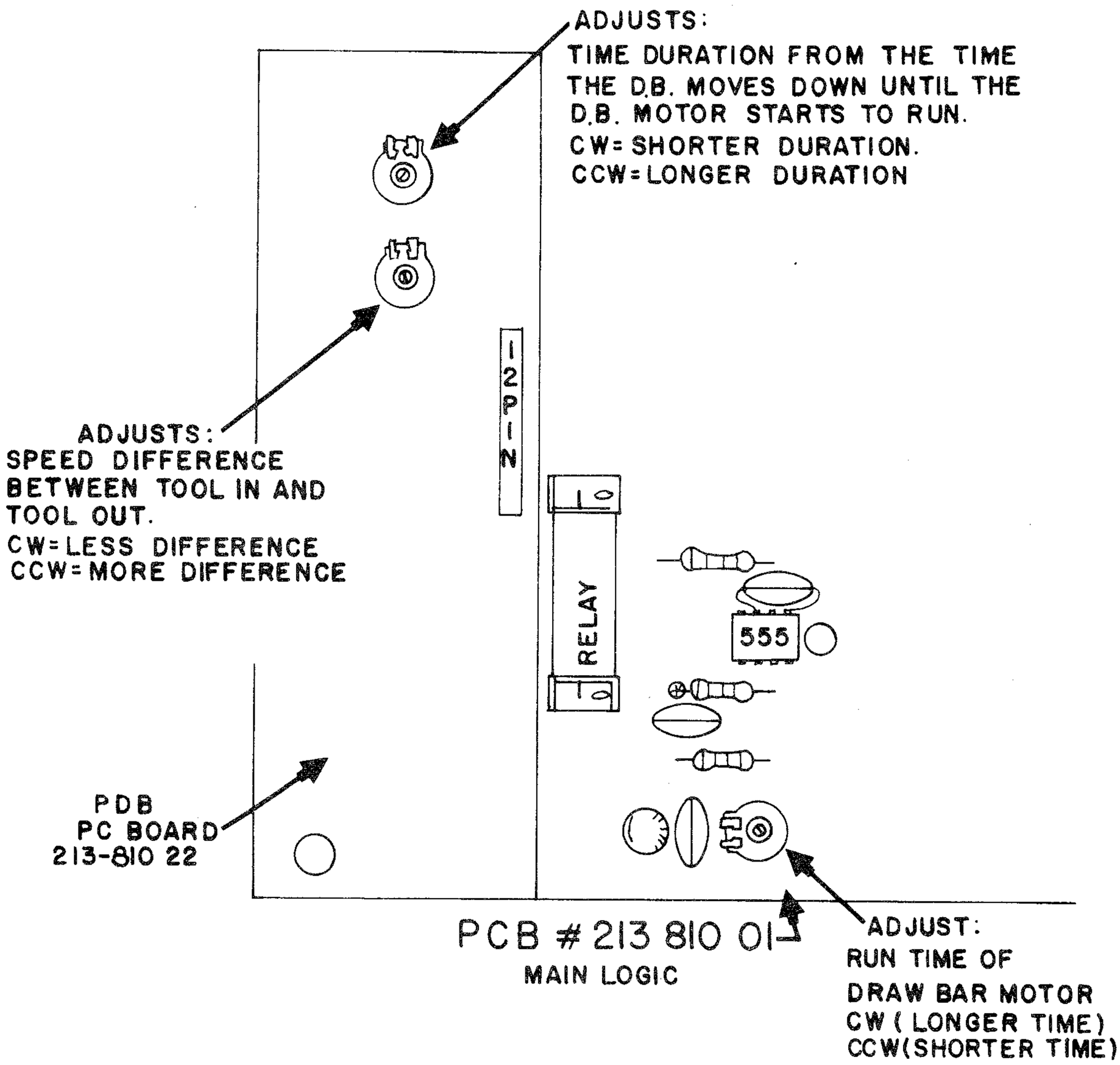
1. Tool-In Motor Speed

   Tool-out motor speed is fixed at motor maximum. Tool-in motor speed is variable from approximately 1/4 maximum to maximum motor speed. The tool-out high speed is slightly faster than tool-in high speed to insure that the tool will be both efficiently secured and released during automatic operation. The small plastic pot located near the center of the Power Draw Bar board is used to accomplish this adjustment (see figure 8.1). With ATC in manual mode, press tool-in, tool-out and adjust tool-in motor speed slightly lower than that of tool-out, using the speed pot. Caution: you must make sure that Power Draw Bar has returned to the up position and the motor has stopped completely before reversing direction, i.e. from tool-in to tool-out, in order to prevent burn out of SRC and fuses.

2. Motor Start Delay

   The motor start delay allows the Power Draw Bar to engage the Draw Bar shaft before the motor is turned on. This adjustment provides for smooth shaft engagement and long draw bar spline life. The delay pot, found above the In speed pot on the Power Draw Bar board (see Figure 8.1), should be adjusted so the motor starts running just when the power unit reaches full shaft engagement.

FIGURE 8.1



3. Motor Run Time

The duration of the Power Draw Bar run can be adjusted in those cases where more tool retention torque is desired. The Power Draw Bar run time is adjusted with the pot found on the lower left hand corner of the main logic board (see figure 8.1). The pot should normally be adjusted for approximately 1½-2 seconds. This is generally sufficient to assure proper tool retention. To check adjustment, place tool changer in local mode. Adjust run time to desired length during tool-in cycle.

SECTION IX

MECHANICAL ADJUSTMENTS & MAINTENANCE

Hydraulic

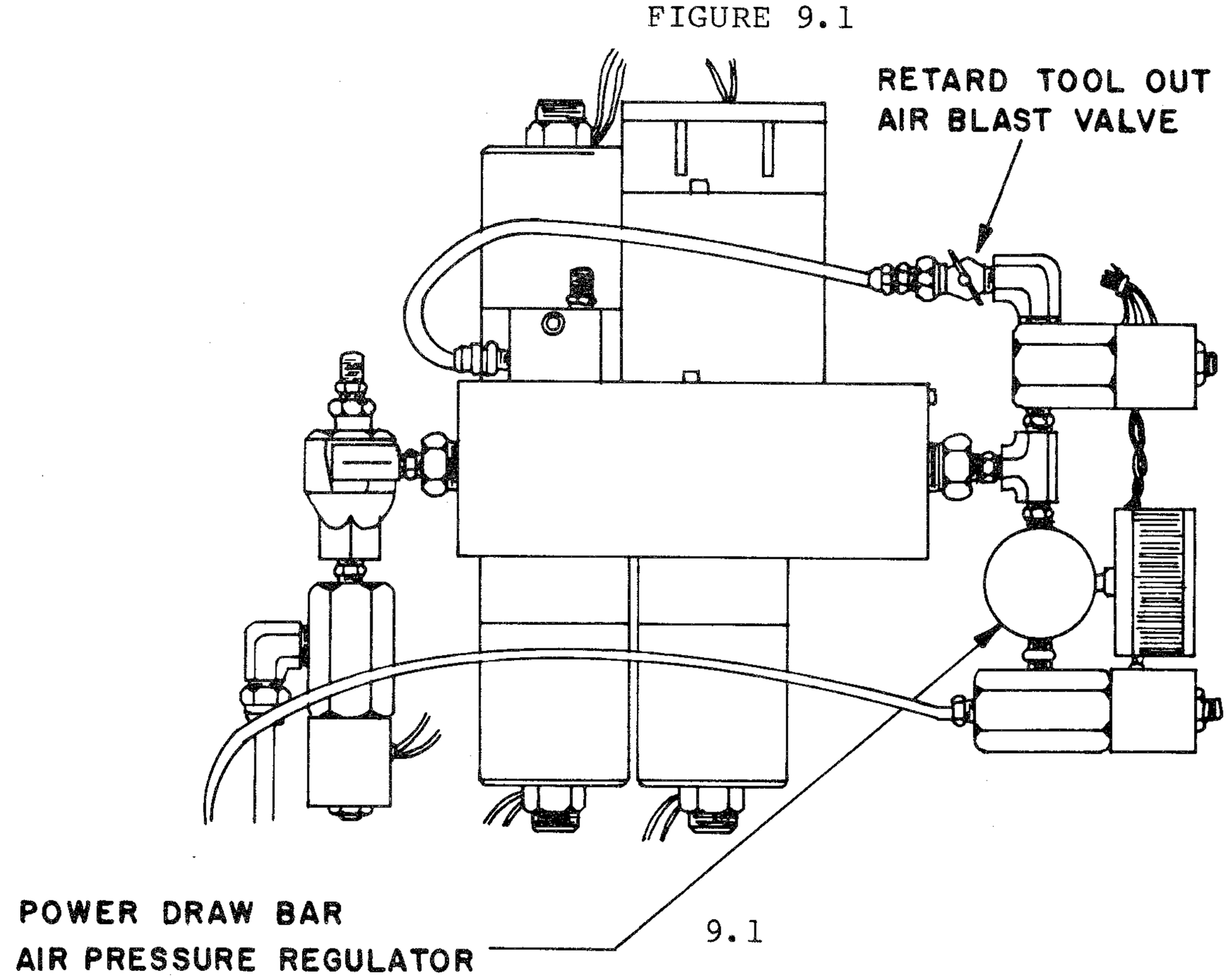
Maintain the level of oil in the oil cup on the top of the main housing at 1/3 to 2/3 full. Use any light, non-foaming hydraulic oil. The arm swing speed may be regulated by adjusting the needle valve inside the main housing. It is located on the brass cylinder about three inches to the rear of the circuit boards. Turning the valve clockwise slows down the swing speed while turning the valve counterclockwise increases the speed. The arm can run as fast as desired as long as it doesn't bang or make loud noises during the cycle.

Pneumatic

The air regulator on the rear of the tool cabinet should be set to 80 psi. The lubricator connected to the regulator should be kept full of air tool oil and adjusted so that it uses one drop of oil for about 10 tool change cycles.

The power draw bar air regulator located on the air valve assembly (see Figure 9.1) inside the rear tool cabinet cover should be set at about 50 psi.

FIGURE 9.1



The retard tool out air blast valve located on the air valve assembly (Figure 9.1) should be about 1/4 to 3/4 turn open (1/4-3/4 turn from fully clockwise). This valve controls air which cushions the arm during the tool out cycle. It prevents the arm from jerking when the draw bar thread releases the tool holder.

If adjusted properly the tool-out cycle is smooth and without any jerking motion at the instant that the tool holder is released from the drawbar. Any such jerking of the arm can cause premature failure of the drawbar threads.

Turret Tool Buckets

Any of the 24 tool buckets can be adjusted independently of the others. They can be raised, lowered, or tilted sideways by loosening the two screws which attach the angle bracket to the turret chain. The buckets can be tilted in and out by merely bending the bracket that they are attached to. All buckets can be shifted CW or CWW by loosening the two machine screws which secure the turret drive sprocket to the drive hub. This adjusment allows 60 degrees of rotation adjustment.

Arm Height at Turret

The height of the arm at the turret can be adjusted by moving the cylinder travel stop screw which limits the stroke of the air cylinder. Loosen the hex lock nut and turn the head of the 1/4-20 allen head set screw clockwise to raise the arm and counterclockwise to lower the arm. This adjustment will seriously affect the timing switch cam timing which must then be adjusted.

Timing Switch Cam

The timing switch cam is located under the rectangular cover secured to the top of the main housing with two machine screws. Run the ATC to move the arm to the turret position - leave power on. Remove the cover and loosen the set screws at top and bottom of the timing cam. Rotate the cam until the center switch's roller falls into the notch in the timing cam. Center the roller in the timing cam notch and tighten both set screws in the timing cam.

Run the arm to the spindle position. The lower switch's roller should fall into the notch cut in the lower cam. If it doesn't, re-check the cam timing. If the problem still exists, enlarge the notch with a file or machine tool.

Timing Switches

The adjustment of the three switches that run against the timing

cam is critical for dependable ATC operation. The switches must be adjusted so that over travel (roller movement after the switch trips) is approximately equal for both directions of cam rotation. The switch can be adjusted towards or away from the cam by moving the 4-40 allen head cap screw in or out and relocking the lock nut. When properly adjusted the roller should start down the ramp into the notch, switch about halfway down the ramp, run along the bottom without switching, climb up the ramp about halfway, switch, climb up to the top of the cam, and not switch until it goes down the ramp again.

SECTION X

OPTIONAL QUICKDRAW ™ RPM CHANGER

The QUICKDRAW™ RPM Changer is an option for the ATC. The unit is used to control the spindle speed of a milling machine with a variable speed head; both manually and automatically.

Spindle RPM may be changed in steps over the full range of the variable speed selector dial. The RPM changer has four functions: RPM-UP, RPM-DOWN, RPM-RESET and RPM-HOME. Home means to stop on the lowest limit of the speed selector.

NOTE: The ATC power switch must be on and the spindle drive motor must be running in order for the RPM changer to operate.

The unit is supplied with the following:

a) A gear motor with related mounting hardware.

b) A cable assembly consisting of two limit switch assemblies; one limit switch assembly for the detection of the RPM low and high limits and the other for the RPM Reset signal.

c) A variable speed indicator dial assembly which replaces the standard dial assembly of the milling head. It is used for detection of the RPM increments.

When the RPM changer is ordered with the ATC, the operator control station will include the RPM-UP and DOWN Pushbuttons Refer to drawing (ATC-1) of the operator control station in the appendix.

RPM changers are available for different types of milling machines. Consult Summit/Dana Industrial Sales Department for details.

INSTALLATION

1. PRELIMINARY WORK

The spindle motor ON and OFF external interlock as discussed in Section III of the ATC must be installed in order for the RPM changer to function.

Complete the installation of the ATC and check that the ATC functions properly.

Before beginning this installation, REMOVE ALL INCOMING POWER TO THE ATC.

FIGURE (10.1) shows a typical RPM mounting layout. Use only for reference as each RPM changer assembly will have its own mounting drawing.

2. MECHANICAL INSTALLATION

The installation of this unit involves the following steps:

1. The manual crank on the variable speed selector is removed along with the indicator dial.

2. The new indicator dial is fitted in place of the old one and the motor coupler is placed on the shaft.

3. The gear motor mount bracket is mounted on the head per the mounting layout.

4. The gear motor is mounted to the bracket and the motor shaft is attached to the coupling.

5. The RPM Reset Limit switch unit is mounted so the switch roller is tangential to the indicator dial at the diameter that is relieved to expose the cap screws or small notches.

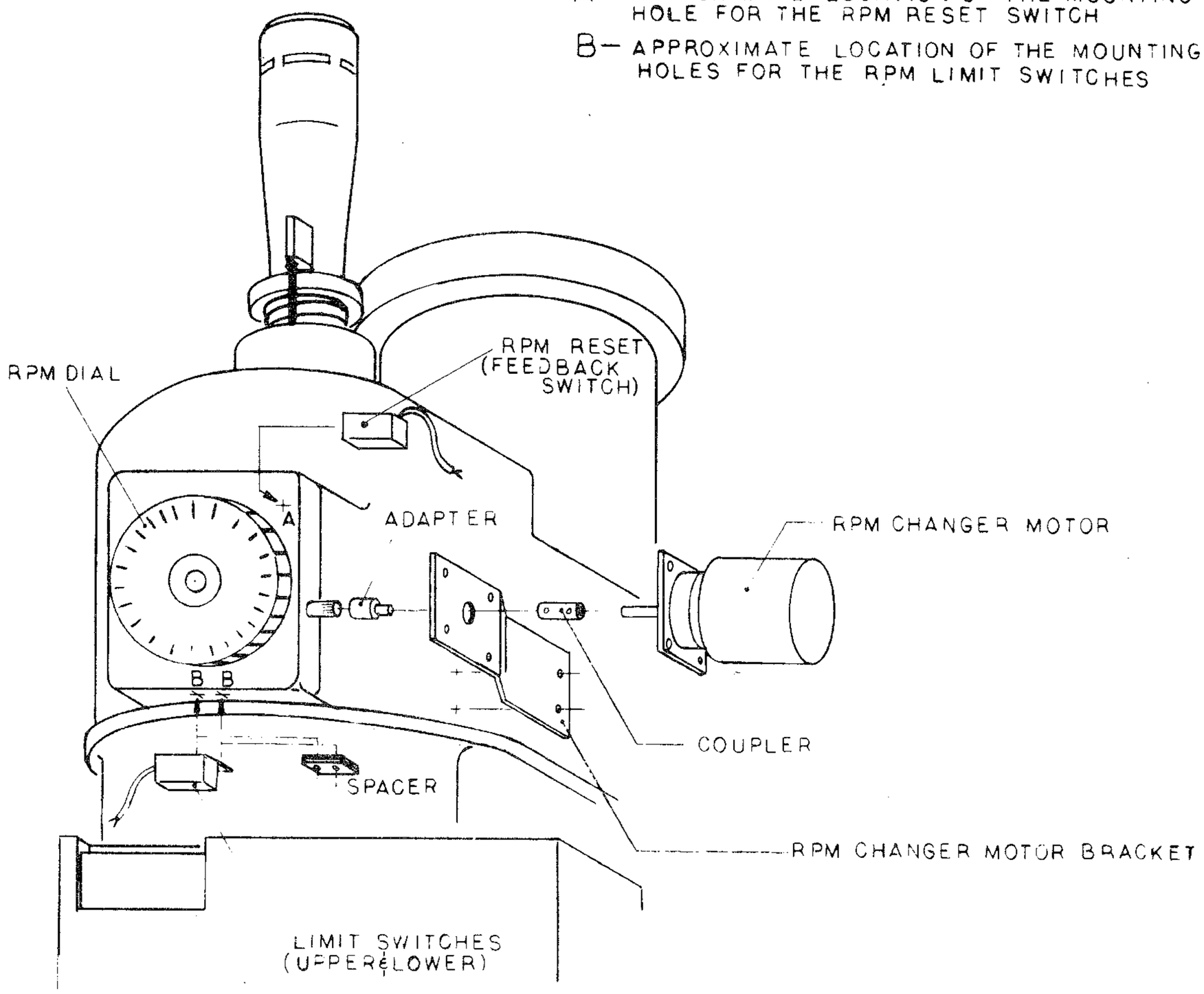
6. The RPM upper and lower limit switch assembly is mounted such that the switch rollers are tangent to the indicator dial at the flanges of the dial, on either side of the relieved portion. Adjust the switches such that they are both actuated.

3. ELECTRICAL INSTALLATION

The interconnect cable for the RPM changer is brought out through the side of the control box station. The cable is approximately 6 feet long and has two molex connectors. One connector supplies

TYPICAL RPM MOUNTING LAYOUT

FIGURE 10.1



REFERENCE: BRIDGEPORT SERIES 1

the power to the gear motor and the other connector receives the signal inputs from the limit switch assemblies for RPM upper limit and lower limit and RPM reset.

1. Plug the gear motor connector into its mating connector and the limit switch assembly into its matching connector.

2. Place the ATC mode switch to MANUAL.

3. Apply incoming AC power to the ATC and place the power ON/OFF switch to (ON).

4. Start the spindle drive motor.

5. Momentarily press the RPM up pushbutton to see if the RPM of the spindle motor increases. If the speed increases, proceed to Step 7. However, if speed decreases the motor is wired backwards. Proceed to Step 6.

6. Reversing motor direction - Tool changers equipped with the RPM changer option should be shipped with an RPM motor that rotates in the proper direction for the mill to which it will be fitted. To reverse the motor direction, proceed as follows:

   a) Turn the ATC Power switch "OFF" and remove all incoming AC power to the tool changer.

   b) Disconnect the molex connector of the motor.

   c) Interchange Pins 2 and 3 of the 5 pin molex connector.

   d) Re-connect the motor molex connector, apply incoming power to the ATC and place the ATC Power switch "ON".

REFERENCE:

Motor connector for clockwise rotation during RPM up viewed from the shaft end.

Pin 1 - White
Pin 2 - Green
Pin 3 - Black

Motor connector for counterclockwise rotation.

Pin 1 - White
Pin 2 - Black
Pin 3 - Green

A pin extractor, part number 660-090 25, can be ordered from Summit/Dana to facilitate the removal of pins from the connector.

7. Momentarily press the RPM down pushbutton to see if the RPM of the spindle motor decreases.

The RPM changer will now control the RPM up or down. The next step is to set the upper and lower limits of RPM and finalize the installation.

4. SETTING THE RPM LIMITS

The RPM changer will not run in the "RPM UP" direction if the upper limit switch is actuated nor will it run in the "RPM DOWN" direction if the lower limit switch is actuated. The switches are supplied already wired and part of the mounting procedures described earlier.

To determine which limit switch is the down limit, loosen the bracket which holds the limit switches to the dial so that both switches are not actuated.

Actuate the two switches by hand and press and hold the RPM DOWN pushbutton. As you start down in RPM open the outer switch. The limit switch should stop the RPM down actuation. If it does not, then the inner switch should be tried.

Mark the switches so you know which is the up and down limit switch and re-install the switches on the machine so both are actuated.

1. Press the RPM down button to rotate the variable speed drive to its lowest RPM limit.

2. Mark the point at which the limit switch roller "lower" limit contacts the flange of the dial.

3. Press the RPM up button to rotate the variable speed drive to its highest RPM limit and mark the point at which the "upper" limit switch contacts the flange of the RPM dial in a manner similar to step 2.

4. Press the RPM down button to return the variable speed drive to a midrange RPM.

5. Shut the spindle drive motor off and remove the RPM dial from the mill and file or machine a small amount of material from the flange of the dial at the points marked in steps 2 and 3.

   The amount of material removed should be sufficient to allow the upper and lower limit switch rollers to (fall into) the upper or lower limit notches respectively and open the appropriate switch about .20 inches before the RPM limit of the indicator dial travel is reached.

5. M-FUNCTION INTERFACING

The RPM CHANGER is designed to interface to an external controller in the same fashion as previously discussed for the tool changer M-Function interface.

Please refer to the ATC section that begins with the M-Function cable and review the interface requirements. Keep in mind that SUMMIT/Dana Industrial has selected the M24, 25, and 26 commands to perform RPM UP, DOWN and HOME.

The ATC must be in the AUTO mode to execute the M-Function commands. MANUAL and LOCAL will not accept the commands.

6. PROGRAMMING THE RPM CHANGER IN AUTO

The RPM changer responds to three M-Function commands, but only when the spindle motor is running. The assigned are:

M24 - RPM UP
M25 - RPM DOWN
M26 - RPM HOME

1. Turn the ATC power on and select the AUTO mode. Program M3 - The spindle motor will run in the forward direction.

2. Program M26 - The spindle speed will decrease until you activate the RPM HOME limit switch and then hold at that RPM.

3. Program M24 - Spindle speed will increase until you actuates the RPM RESET limit switch.

4. Program M24 again - Spindle speed increases again until you actuate the RPM RESET limit switch. You may continue to program a M24 for each increasing RPM Step.

5. Program M25 - The spindle speed will decrease until you actuate the RPM RESET limit switch. This works the same way as programming the M24 but only decreasing the speed in RPM steps.

6. Program M26 - This will decrease the spindle speed down to the RPM home position.

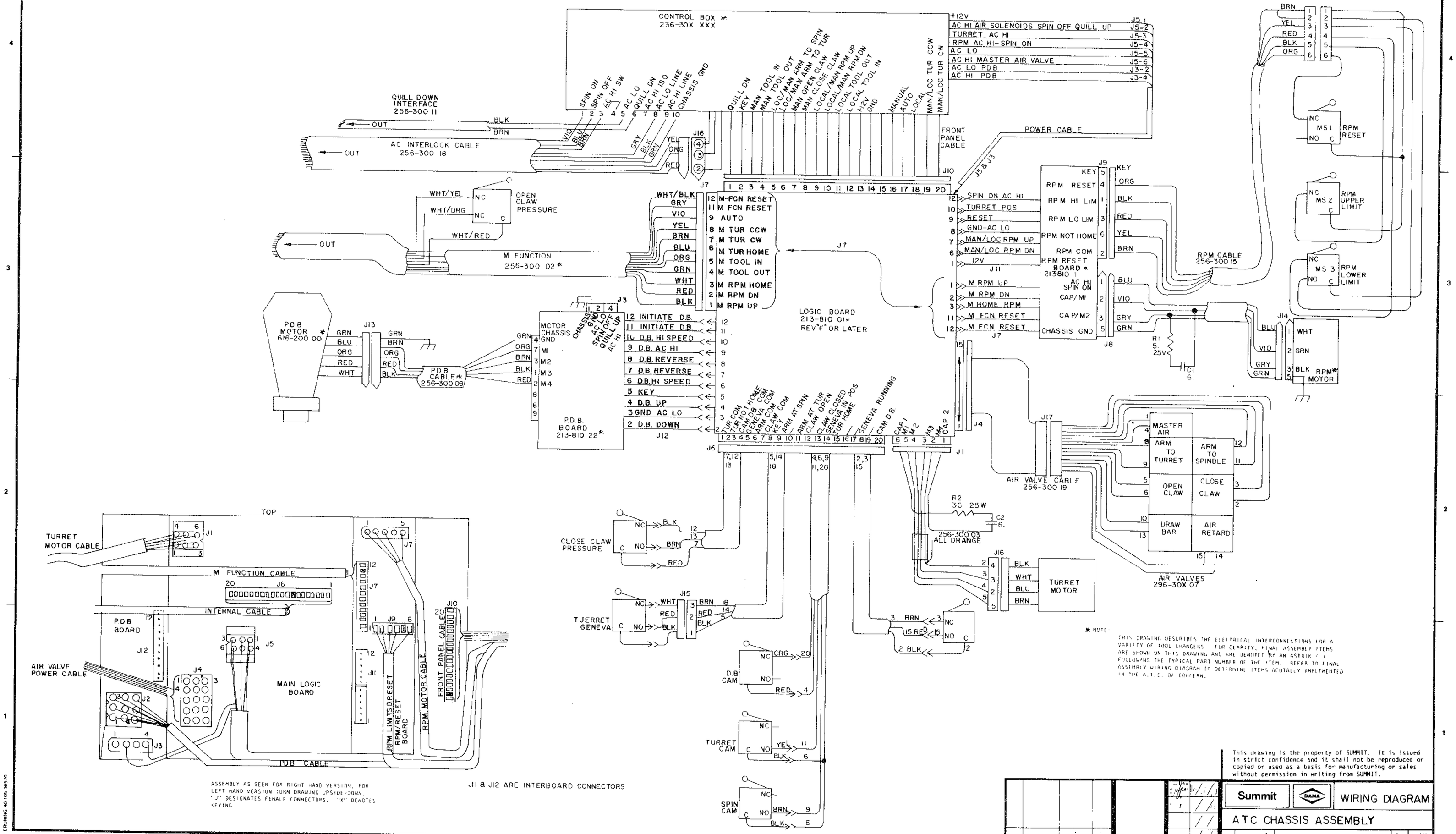
7. Program M5 - The spindle will shut off.

It is advisable to program the RPM changer to home before the end of program M2 command is initiated so you always know where to start from in the next program.

APPENDIX

1. Operator Control Station-DRG #ATC-1
2. Typical M-function Interface-DRG #ATC-2
3. Specifications-DRG #ATC-3
4. Schematics

Pneumatic - Hydraulic System	19	216 30X XX
Mechanical		
Final Assembly	62	216-30X XX
Chassis Assembly	62	226-30X XX
Control Box Assembly	62	236-30X XX
Mechanical Assembly	62	246-30X XX
Complete Arm Assembly	62	266-30X XX
Outer Arm Assembly	62	296-300 XX
Geneva Drive Assembly	62	296-300 08
PDB Air Cylinder Assembly	62	296-310 01
Electrical		
Chassis Wiring Assembly Diagram	13	226-30X XX
Control Box Wiring RH W/RPM & PDB	13	236-300 1X
Complete ATC Schematic	12	216-30X XX
Main Logic Schematic	12	213-810 01
RPM & Reset Schematic	12	213-810 11
Power Drawbar Schematic	12	213-810 22
Power Supply Schematic R.H.	12	213-810 31
Power Supply Schematic L.H.	12	213-810 33


CONTROL BOX *
236-30X XXX
SPIN ON
SPIN OFF
AC HI SW
AC LO
QUILL DN
AC HI ISO
AC LO LINE
AC HI LINE
CHASSIS GND
QUILL DN
KEY
MAN TOOL IN
MAN TOOL OUT
LOC/MAN ARM TO SPIN
MAN ARM TO TUR
MAN OPEN CLAW
LOCAL/MAN RPM UP
LOCAL/MAN RPM DN
LOCAL TOOL OUT
LOCAL TOOL IN
+12V
GND
MANUAL
AUTO
LOCAL
MAN/LOC TUR CCW
MAN/LOC TUR CW
+12V
AC HI AIR SOLENOIDS SPIN OFF QUILL UP J5-1
TURRET AC HI J5-2
RPM AC HI-SPIN ON J5-3
AC LO J5-4
AC HI MASTER AIR VALVE J5-5
AC LO PDB J5-6
AC HI PDB J3-2
J3-4
QUILL DOWN INTERFACE 256-300 11
OUT
BLK
BRN
AC INTERLOCK CABLE 256-300 18
OUT
VIO
BLU
BRN
GRY
BLK
GRN
YEL
ORG
RED
J16
FRONT PANEL CABLE
J10
POWER CABLE
J5 & J3
OPEN CLAW PRESSURE
WHT/YEL
WHT/ORG
WHT/RED
NC
NC
C
OUT
M FUNCTION 256-300 02*
WHT/BLK
GRY
VIO
YEL
BRN
BLU
ORG
GRN
WHT
RED
BLK
J7
12 M-FCN RESET
11 M FCN RESET
9 AUTO
8 M TUR CCW
7 M TUR CW
6 M TUR HOME
5 M TOOL IN
4 M TOOL OUT
3 M RPM HOME
2 M RPM DN
1 M RPM UP
J7
LOGIC BOARD 213-810 01* REV "F" OR LATER
J9
KEY 5
RPM RESET 4
RPM HI LIM 1
RPM LO LIM 3
RPM NOT HOME 6
RPM COM 2
RPM RESET BOARD * 213810 11
J8
J11
SPIN ON AC HI 12
TURRET POS 10
RESET 9
GND-AC LO 8
MAN/LOC RPM UP 7
MAN/LOC RPM DN 6
12V 1
M RPM UP 1
M RPM DN 2
M HOME RPM 3
M FCN RESET 11
M FCN RESET 12
J7
AC HI SPIN ON CAP/M1
CAP/M2
CHASSIS GND
KEY ORG
RPM RESET BLK
RPM HI LIM RED
RPM LO LIM YEL
RPM NOT HOME BRN
RPM COM
BLU
VIO
GRY
GRN
RPM CABLE 256-300 15
R1 5. 25W
C1 6.
BRN
YEL
RED
BLK
ORG
MS 1
RPM RESET
MS 2
RPM UPPER LIMIT
MS 3
RPM LOWER LIMIT
J14
WHT
GRN
BLK RPM* MOTOR
PDB MOTOR * 616-200 00
GRN
BLU
ORG
RED
WHT
J13
GRN
BRN
ORG
RED
BLK
PDB CABLE* 256-300 09
J3
MOTOR CHASSIS GND 4
MI 7
M2 3
M3 1
M4 2
8
6
9
CHASSIS GND
AC HI
SPIN OFF
QUILL UP
AC HI
P.D.B. BOARD 213-810 22*
J12
12 INITIATE D.B.
11 INITIATE D.B.
10 D.B. HI SPEED
9 D.B. AC HI
8 D.B. REVERSE
7 D.B. REVERSE
6 D.B. HI SPEED
5 KEY
4 D.B. UP
3 GND AC LO
2 D.B. DOWN
TUR COM
TUR NOT HOME
CAM D.B. COM
GENEVA COM
ARM COM
CLAW COM
KEY COM
ARM AT SPIN
ARM AT TUR
CLAW OPEN
CLAW CLOSED
GENEVA IN POS
TUR HOME
GENEVA RUNNING
CAM D.B.
J6
CAP 1
M1
M2
M3
M4
CAP 2
J1
J4
J17
MASTER AIR
ARM TO TURRET
ARM TO SPINDLE
OPEN CLAW
CLOSE CLAW
DRAW BAR
AIR RETARD
AIR VALVE CABLE 256-300 19
AIR VALVES 296-30X 07
R2 30 25W
C2 6.
256-300 03 ALL ORANGE
J16
BLK
WHT
BLU
BRN
TURRET MOTOR
CLOSE CLAW PRESSURE
NC
NO
C
BLK
BRN
RED
TUERRET GENEVA
J15
WHT
RED
BLK
BRN
RED
BLK
D.B CAM
TURRET CAM
SPIN CAM
ORG
RED
YEL
BLK
BRN
BLK
TOP
TURRET MOTOR CABLE
J1
M FUNCTION CABLE
J6
INTERNAL CABLE
PDB BOARD
J12
J5
J4
AIR VALVE POWER CABLE
J2
J3
MAIN LOGIC BOARD
J7
J11
RPM LIMITS & RESET RPM/RESET BOARD
RPM MOTOR CABLE
FRONT PANEL CABLE
J10
PDB CABLE
J9
ASSEMBLY AS SEEN FOR RIGHT HAND VERSION. FOR LEFT HAND VERSION TURN DRAWING UPSIDE-DOWN. "J" DESIGNATES FEMALE CONNECTORS. "X" DENOTES KEYING.
J11 & J12 ARE INTERBOARD CONNECTORS
* NOTE:
THIS DRAWING DESCRIBES THE ELECTRICAL INTERCONNECTIONS FOR A VARIETY OF TOOL CHANGERS. FOR CLARITY, FINAL ASSEMBLY ITEMS ARE SHOWN ON THIS DRAWING AND ARE DENOTED BY AN ASTRIK (*) FOLLOWING THE TYPICAL PART NUMBER OF THE ITEM. REFER TO FINAL ASSEMBLY WIRING DIAGRAM TO DETERMINE ITEMS ACUTALLY IMPLEMENTED IN THE A.T.C. OF CONCERN.
This drawing is the property of SUMMIT. It is issued in strict confidence and it shall not be reproduced or copied or used as a basis for manufacturing or sales without permission in writing from SUMMIT.
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DANA
WIRING DIAGRAM
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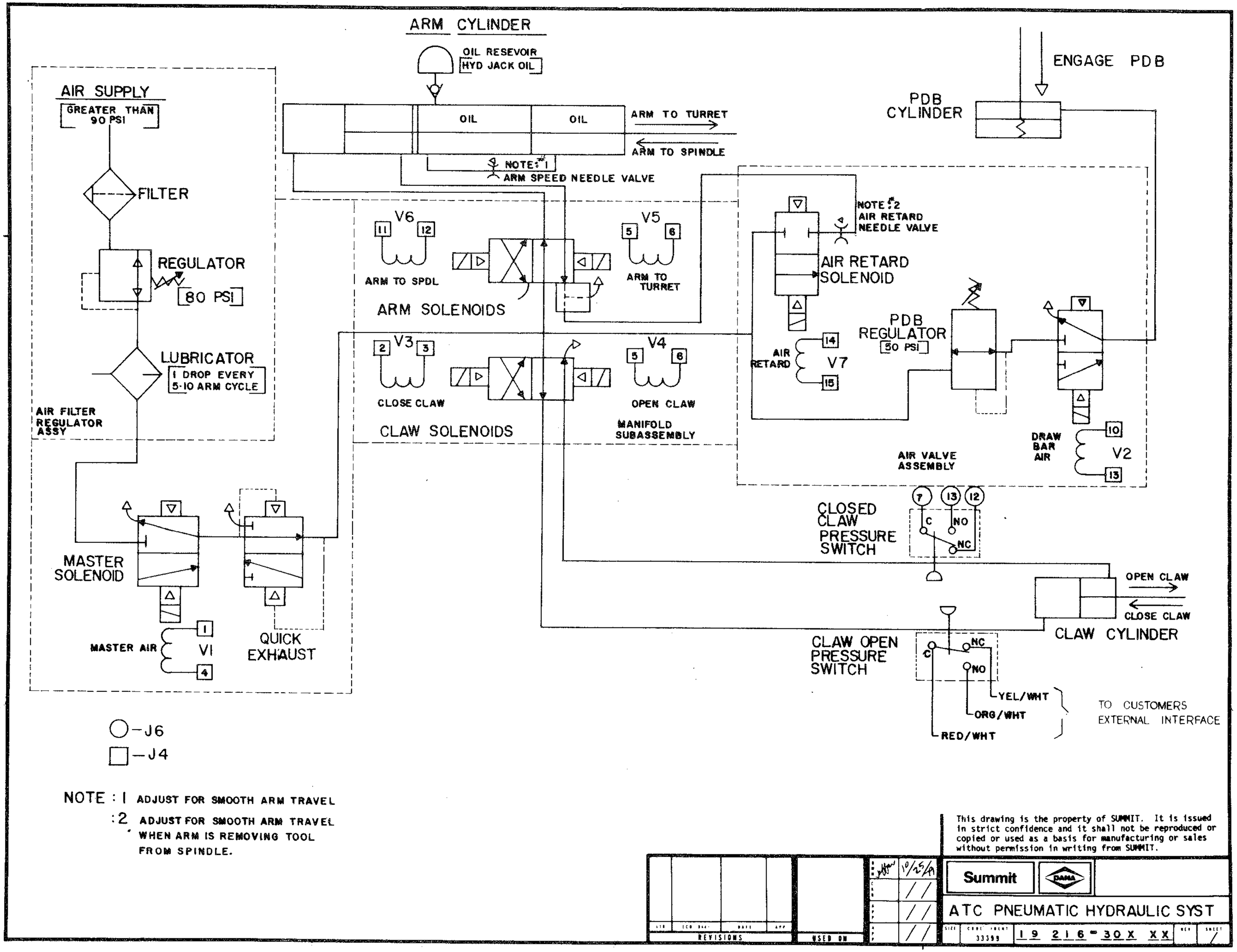

NOTE : 1 ADJUST FOR SMOOTH ARM TRAVEL

: 2 ADJUST FOR SMOOTH ARM TRAVEL WHEN ARM IS REMOVING TOOL FROM SPINDLE.

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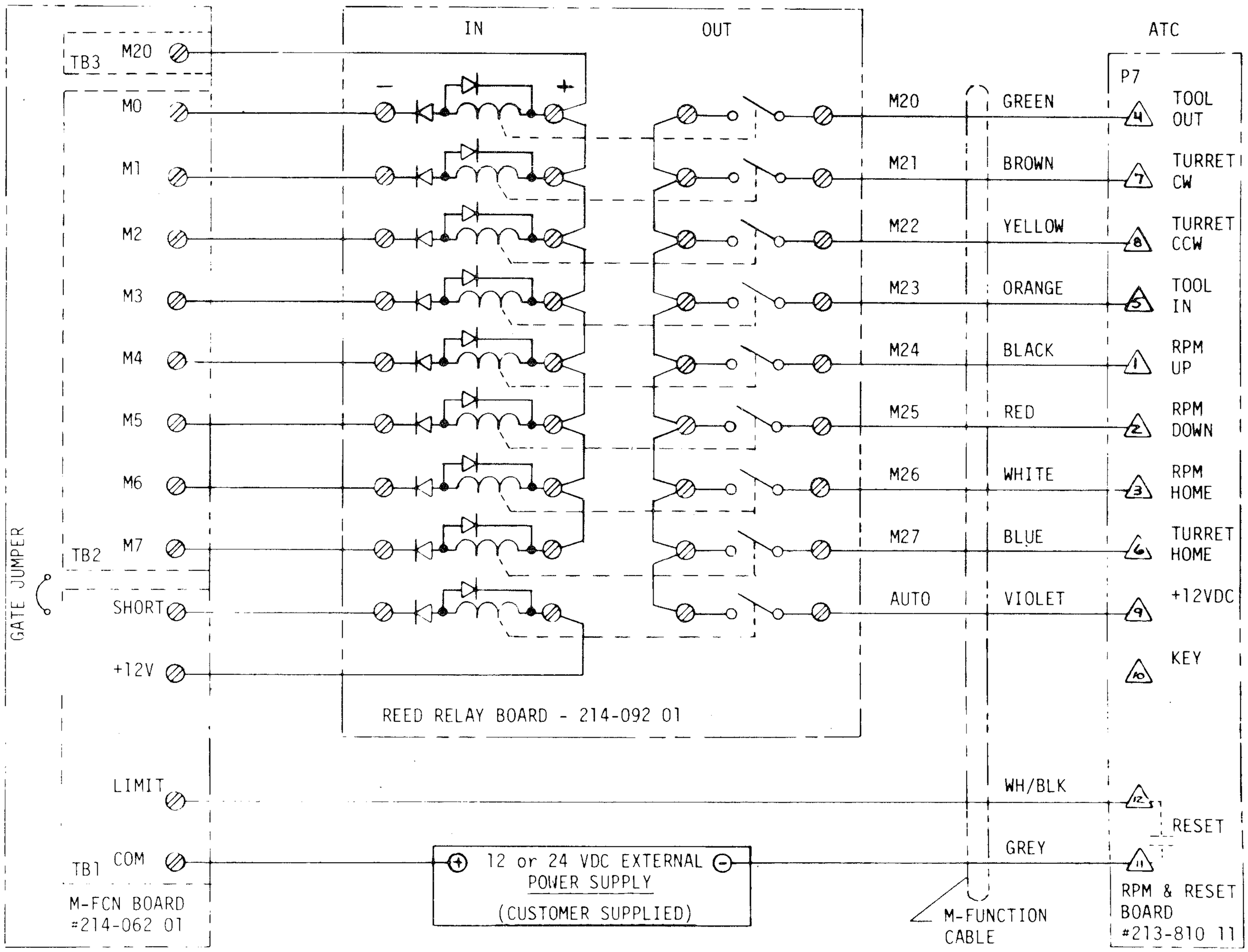
Summit | DANA

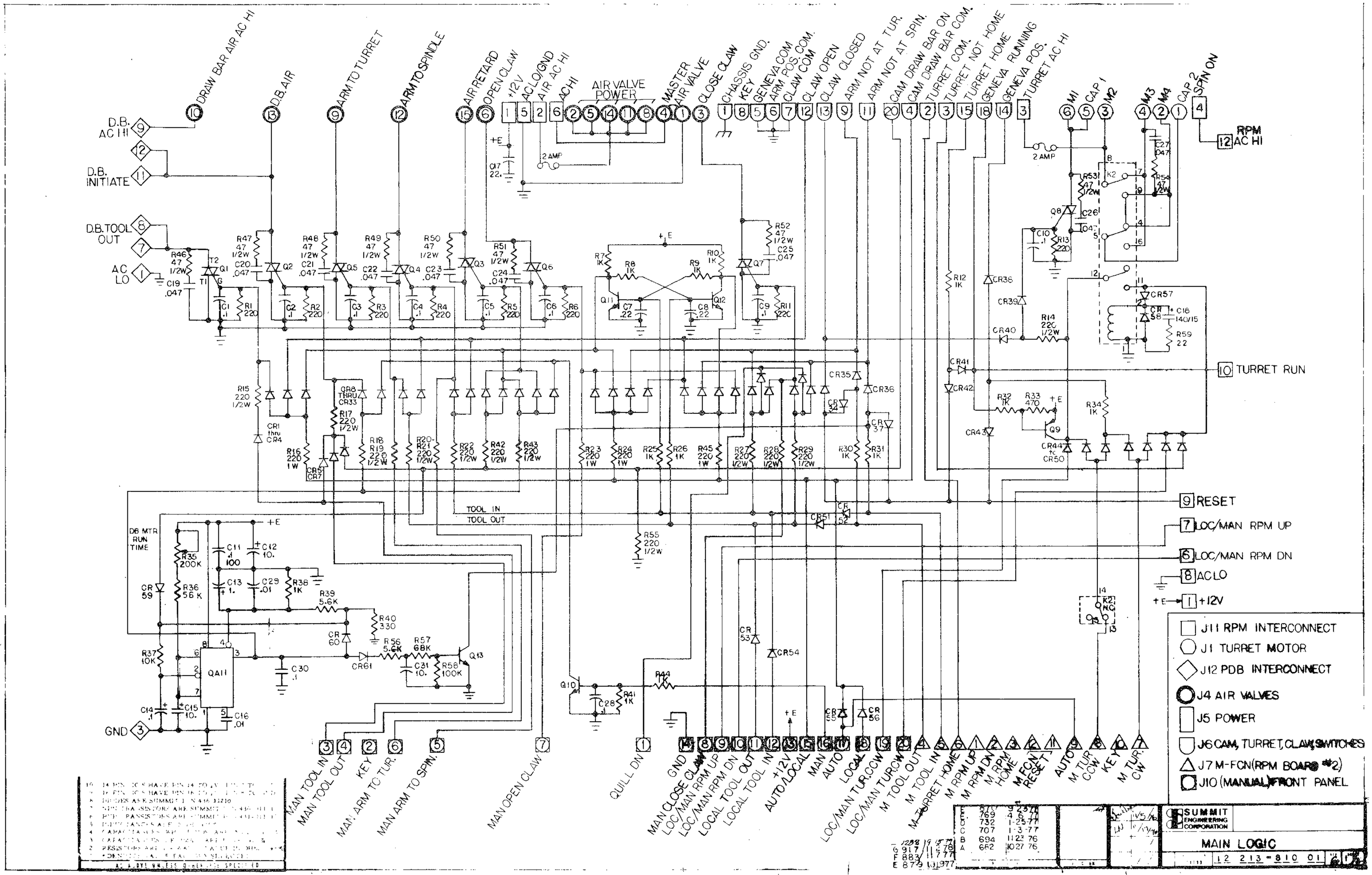
ATC PNEUMATIC HYDRAULIC SYST

SIZE | CAGE CODE 33399 | 19 216-30X XX | REV | SHEET 1



TYPICAL M-FUNCTION INTERFACE

drawing ATC-2


DRAW BAR AIR AC HI
D.B. AIR
ARM TO TURRET
ARM TO SPINDLE
AIR RETARD
OPEN CLAW
+12V
AC LO/GND
AIR AC HI
AC HI
AIR VALVE POWER
MASTER AIR VALVE
CLOSE CLAW
CHASSIS GND.
KEY
GENEVA COM
ARM POS. COM.
CLAW COM
CLAW OPEN
CLAW CLOSED
ARM NOT AT TUR.
ARM NOT AT SPIN.
CAM DRAW BAR ON
CAM DRAW BAR COM.
TURRET COM.
TURRET NOT HOME
TURRET HOME
GENEVA RUNNING
GENEVA POS.
TURRET AC HI
M1
CAP 1
M2
M3
M4
CAP 2
SPIN ON
RPM AC HI
D.B. AC HI
D.B. INITIATE
D.B. TOOL OUT
AC LO
2 AMP
TOOL IN
TOOL OUT
DB MTR RUN TIME
GND
MAN TOOL IN
MAN TOOL OUT
KEY
MAN ARM TO TUR.
MAN ARM TO SPIN.
MAN OPEN CLAW
QUILL DN
MAN CLOSE CLAW
LOC/MAN RPM UP
LOC/MAN RPM DN
LOCAL TOOL OUT
LOCAL TOOL IN
+12V
AUTO/LOCAL
MAN
AUTO
LOCAL
LOC/MAN TUR.CCW
LOC/MAN TUR.CW
M TOOL OUT
M TOOL IN
M TURRET HOME
M RPM UP
M RPM DN
M RPM HOME
M FCN RESET
AUTO
M TUR. CCW
KEY
M TUR. CW
TURRET RUN
RESET
LOC/MAN RPM UP
LOC/MAN RPM DN
AC LO
+12V
J11 RPM INTERCONNECT
J1 TURRET MOTOR
J12 PDB INTERCONNECT
J4 AIR VALVES
J5 POWER
J6 CAM, TURRET, CLAW, SWITCHES
J7 M-FCN (RPM BOARD #2)
J10 (MANUAL) FRONT PANEL
SUMMIT ENGINEERING CORPORATION
MAIN LOGIC
12 213 - 810 01