
Section 09: Attached Optional Devices

M-Function Board Use and Setup

Miscellaneous Functions (M-Codes)

Miscellaneous functions, or M-codes, are used to control actions other than the normal machine movement. M-functions may control functions such as starting and stopping of motors, indexers, turning coolant on and off, changing tools, and clamping and unclamping parts. M functions are the letter M followed by a two-digit code. The following page has a list of the Fadal M-codes.

Fadal provides user available M-functions. Additional functions or functions requiring feedback require optional hardware.

Note: List of M function codes used by the Siemens Controlled Fadal VMC.

M0	NC STOP
M1	Optional Stop
M2 / M30	NC Program End
M3	CW Spindle On
M4	CCW Spindle On
M5	Spindle Off
M6	Tool Change
M7	Coolant 1
M8	Coolant 2
M11	Reset Tool Order
M19	Orient and Lock Spindle
M41	Low Gear
M42	High Gear
M83	Spindle Set Up (Gear Ratio Measurement)

Fadal M Functions

M0	Program Stop	M48.3	Dual Rotary Pot Active Pallet B
M1	Optional Stop	M49	Feed Rate and RPM Pot Inactive
M2	End of Program	M49.1	Servo Coolant Pot Inactive
M3	Spindle on Clockwise	M49.2	Dual Rotary Pot Inactive Pallet A
M3.1	Sub-Spindle On Ignore Magnet CW	M49.3	Dual Rotary Pot Inactive Pallet B
M3.2	Acknowledge Spindle Magnet	M60-69	User Attached Devices
M4	Spindle On Counter Clockwise		M60 A Axis Brake On
M4.1	Sub-Spindle On Ignore Magnet CCW		M61 A Axis Brake Off
M4.2	Acknowledge Spindle Magnet		M62 B Axis Brake On
M5	Spindle Off		M63 B Axis Brake Off
M6	Change Tool		M64 MP Probe Active
M7	Coolant 1 On		M65 TS-20 Probe Active
M7.1	Servo Coolant 1 On		M66 MP-12 Probe Active
M8	Coolant 2 On		M67 Laser Probe Active
M8.1	Servo Coolant 2 On	M80	Automatic Doors Open
M9	Coolant Off	M81	Automatic Doors Close
M10	Cancel Reciprocation	M90	Default Gain (from SV command)
M11	X-Axis Reciprocation	M90.1	Advanced Feed Forward Gain Enable
M12	Y-Axis Reciprocation		P=Gain (50-250)
M13	Z-Axis Reciprocation	M91	Normal gain
M14	B-Axis Reciprocation	M92	Intermediate Gain
M15	A-Axis Reciprocation	M94	Feed Forward
M16	C-Axis Reciprocation		P=Angle Tolerance
M17	End of Subroutine		Q= Line Length (Moves less)
M18	Cycle Cushman Indexer		Ex: M94 P91 Q.002
M19	Spindle Stop / Orient	M94.1	Feed Forward by Feed Rate Modification
M20	Cycle General Purpose Indexer		State Feed Rate Before M94.1 Line
	Also: Automatic Doors Close		P=Angle
	Also: Toggle On/Off Hydrosweep		Q=Percentage change each modification
M30	End of All Subroutines		R0+=Min. Feed Rate Modification
	Also: End of Program (Format 2)		R1+=Length to Ignore M94.1
M31	Exchange Pallets		R2+=Modify feed every, this angle, from P
M32	Store / Load Pallet		Ex: M94.1 P170 Q10. R0+50. R1+1. R2+15.
M32.1	Load and Verify Pallet A	M94.2	Advanced Feed Forward On
M33	Store / Load Pallet B		P=Ramp, Q=Detail Window
M33.1	Load and Verify Pallet B	M95	Feed Forward Cancel
M41	Low Range RPM	M95.1	Feed Forward by Modify Cancel
M42	High Range RPM	M95.2	Advanced Feed Forward Cancel
M45	Execute Fixed Cycle	M96	Roll CRC
M46	Positive Approach On	M97	Intersectional CRC
M47	Cancel Positive Approach	M98	Execute Sub Program
M48	Feed Rate and RPM Pot Active		P=Program #
M48.1	Servo Coolant Pot Active		L=# of repetitions, Line repeat / Sub repeat
M48.2	Dual Rotary Pot Active Pallet A	M99	End of Sub Program
			Also: Line Jump, P=Line #, Ex: M99 P#

WARNING:

Any wires leaving the control box must be in a grounded conduit. Please obey the electrical code. In Applications where there is high current, use M-functions to activate relay.

Fadal Normally Supplied M-Functions

Fadal supplies M-Functions M60 thru M69 with all machines. They are output on the 1100-1 board. The even numbered M-code activates the relay and the odd number deactivates the relay. Each set of M-codes has a relay and a fuse. On the terminal block (TB), each M-function set has two connections with a 120 VAC connection on one side and a return (RET) on the other side.

To show proper connection of the M-Function, use the M60 / M61, which uses connections TB2, pins 39 and 40. Next to pin 40 is a 120 VAC connection. Jumper this 120 VAC connection to pin 39 and connect the two wires, from the device, to the RET next to pin 39 and to pin 40 (see the example on the next page).

Up to 3 amps at 120VAC may be taken from the 120 VAC output next to the terminals.

This group of M-Functions uses solid-state relays; therefore, 120 VAC must be used across the output connections.

Fadal Optional M-Functions

Note: If the machine that the M-Function option is being installed in has a 1060-1A Motherboard, then a PCB-0175 circuit board, an M-Function interface, 1340-0, and a WIR-1679 Cable Assembly with a 40pin, 1060-1A to 1340 are required. A WIR-0178 Cable, a 5C indexer, and an MTR to Control may also be needed.

1050-3A M-Function PCBA (PCB-0008) - Two M Functions.

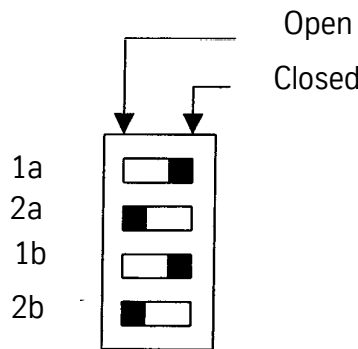
The 1050-3a, M-Function board, decodes two (2) M-Functions. The M-Functions are selected by installing jumpers at U6 on the circuit board. The following example illustrates how to select the M-functions using jumpers. The M20 and M80 M-functions are displayed.

U6 (Jumper)

M20	1	16	"A" M-Function
M30	2	15	"B" M-Function
M40	3	14	
M50	4	13	
M60	5	12	
M70	6	11	
M80	7	10	
M90	8	9	

U7 (Dip Switch)

Each M-Function can be set for the desired reset condition using the set of switches located at U7. Switches 1 a & 2a correspond to the "A" M-Function, switches 1 b & 2b correspond to the "B" M-Function.



Reset Options

The selected M-Function delays the part program until the condition for reset is satisfied (see chart below for the four (4) reset conditions).

Duration of relay Closure	CNC Proceeds	M-Function			
		«A» 1a	2a	«B» 1b	2b
(1) .1 sec. Pulse	Immediately after pulse	open	open	open	open
(2) .1 sec Pulse	At reset closure	closed	open	closed	open
(3) Held	At reset closure	open	closed	open	closed
(4) Held	After reset release	closed	closed	closed	closed

Note: Electro-Mechanical relays are required for any device not using DC.

M-Function Contacts

Each M-Function has one set of normally open contacts. The contacts are available to the user at TB 1, TB2 and TB3 on the backplane.

"A" M-Function - TB 1 pins 7 & 13

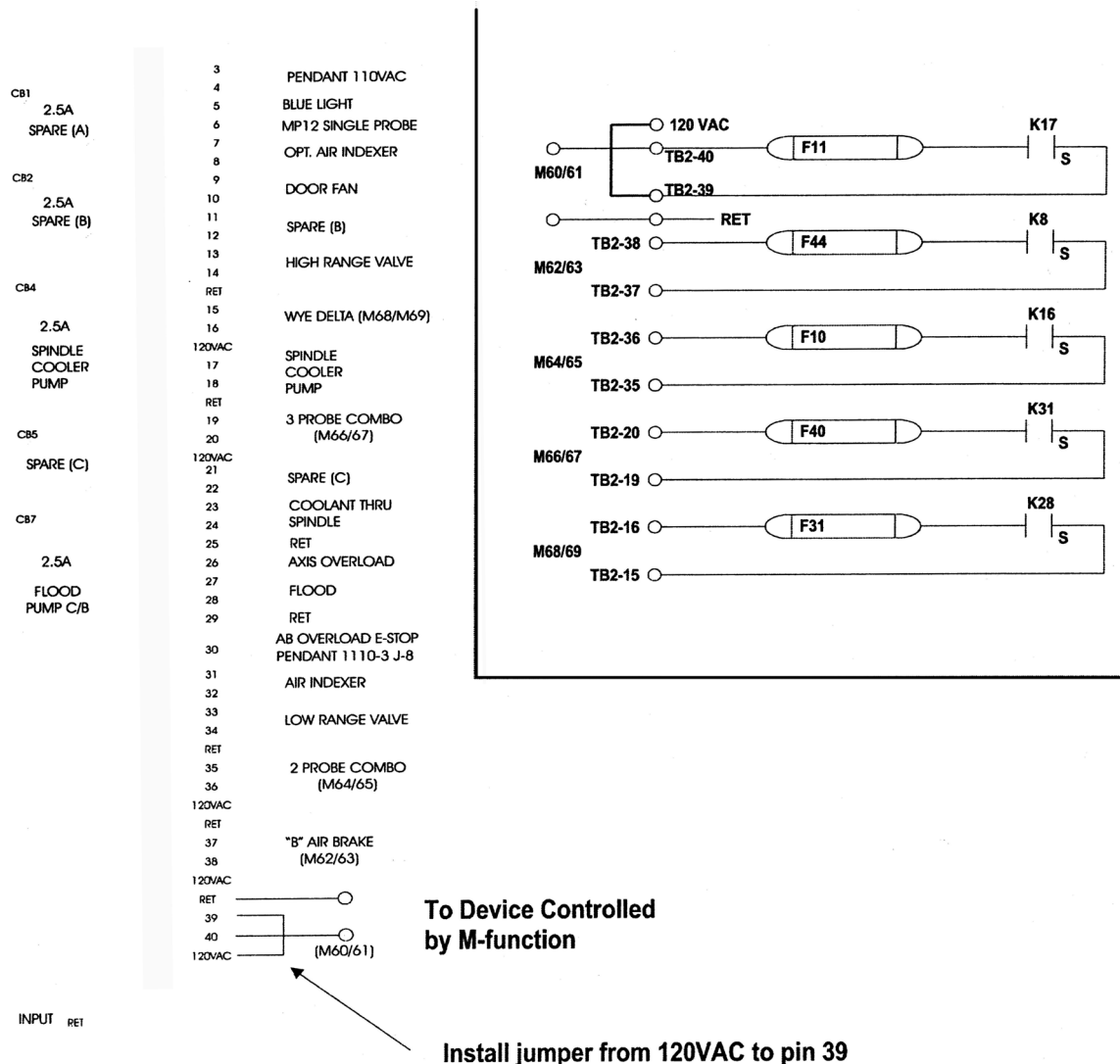
"B" M-Function- TB2 pins 11 & 10

A reset condition is accomplished by connecting between the terminals of TB3, pin 1 & 2. TB3 is located on the lower portion of the motherboard.

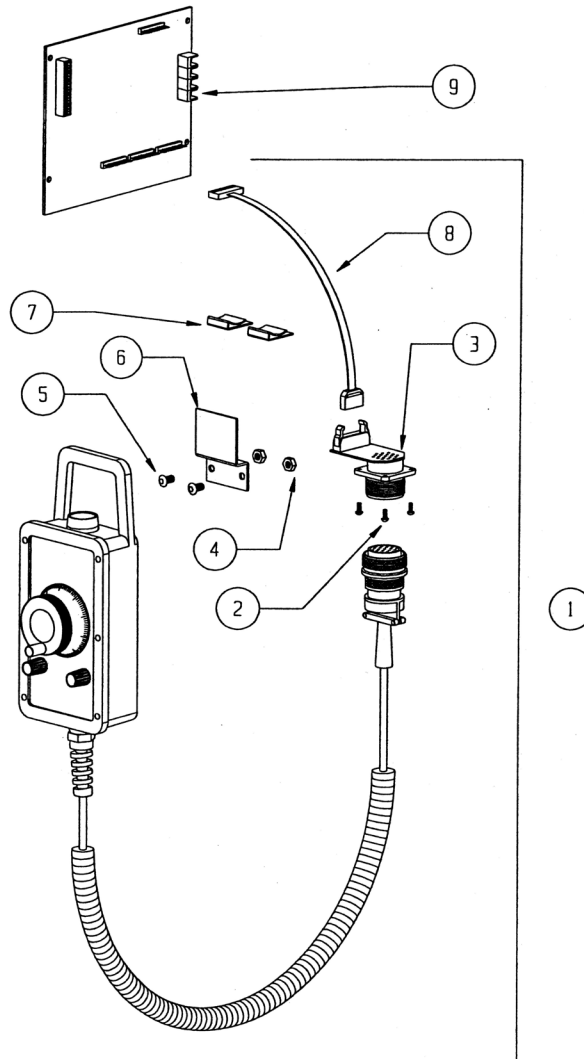
Note: WIR-0178 Cable, SC Indexer; MTR to CNTRL (indexer cable)

1050-0 M-Function PCBA (PCB-0007) - One to twenty M functions

M-Function Hook-up



Remote Manual Pulse Generator

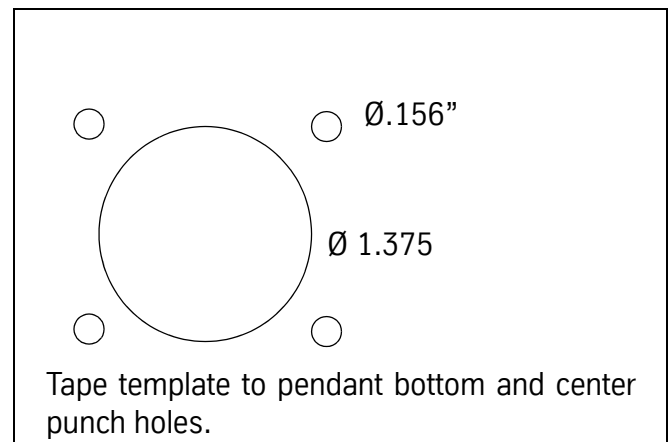


PART #	PART #	PART #	PART #
1 MPG-0005*	3 MPG-0002	5 HDW-0348	7 WIR-0446
2 HDW-0594	4 HDW-0366	6 STM-0138	8 WIR-0218
			9 PCB-0012
* SUB ASSEMBLIES MPG-0003 BOX AND CABLE ONLY,			
WIR -0538 REPLACEMENT CABLE			
ELE-0080 7 POSITION SELECTOR SWITCH FOR PENDANT (NOT SHOWN)			
SEE STD PENDANT DRAWING FOR LOCATION			

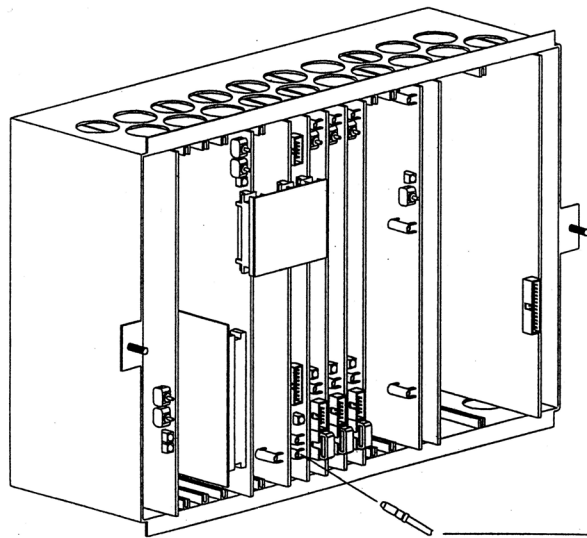
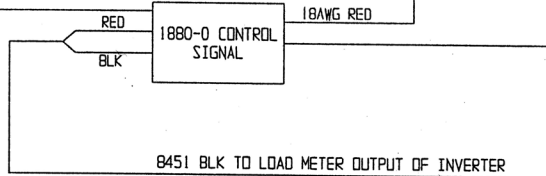
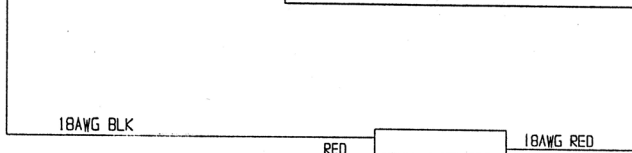
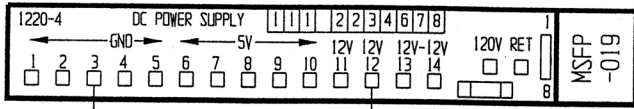
**Installation
Procedure**

- 1) If Remote MPG is to be installed on a NEW style pendant (CNC88HS), remove tacked-on cover for adapter with hammer and punch or chisel.
- 2) If Remote MPG is to be installed on earlier pendant that does not have pre-drilled holes, then mount the adapter jack about 3" from the back side and 3" from the left side (as viewed from the front). Some pendants may have a 1110-1 board mounted here, so locate 3" from the right side in that case.
- 3) Using the template, mark and center punch the 5 hole locations. Punch the center hole using a hole punch or a large step drill. Diameter is 1.375 inches. Then drill the four mounting holes at .156 inches in diameter.
- 4) With a gasket between the jack and the floor of the pendant, install using (4) 6-32 screws and keps nuts.
- 5) Remove the 201090 board and replace with the enclosed 201090-3. A board reconnecting all cables and wires into the same locations as was on the original board. Connect included cable with 12-pin connector at J7, and install the two separate wires at connector J5 on the new 201090-3A at pins 5 and 8 (either wire at S or 8).
- 6) Plug the 14 pin connector from cable #5241 to connector on 201770-0. Note pin 1 orientation on connector (red stripe on ribbon) and board. Reversed plug will not only cause Remote MPG not to operate, but will damage unit.
- 7) Remove 6-position axis selector switch on pendant and replace with #1453-2 7-position switch. Wiring is identical to old switch.

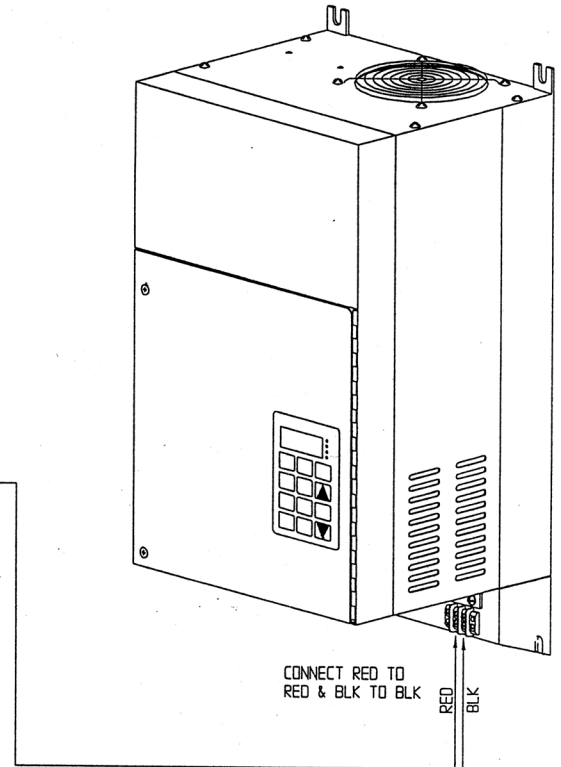
Red-1
Wht-2
Grn-4
Blk-C



Dynamic Tool Load Compensation

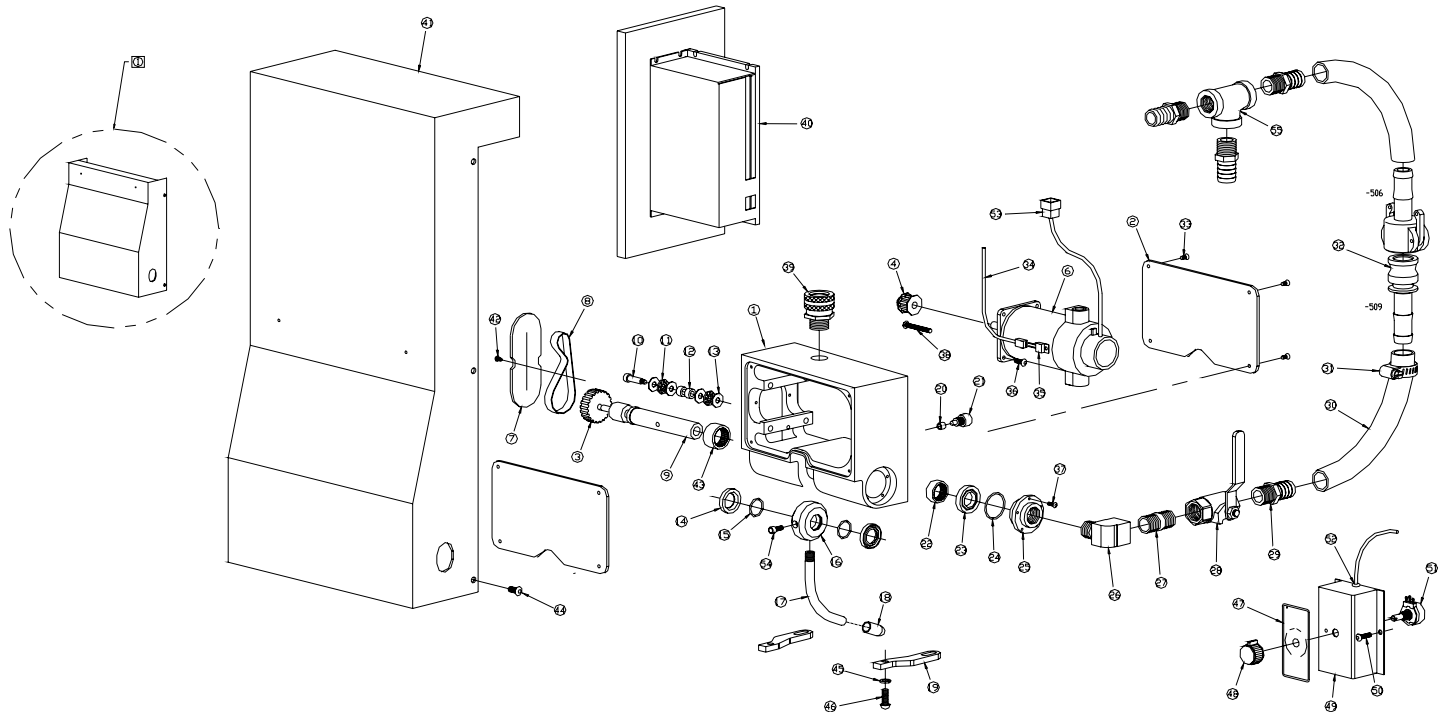


PLUG CONNECTOR INTO J5 (POTS) ON 1030-1 BOARD



N:\MAIN\PR2\QC\1880-0.PRT

Servo Coolant Assembly



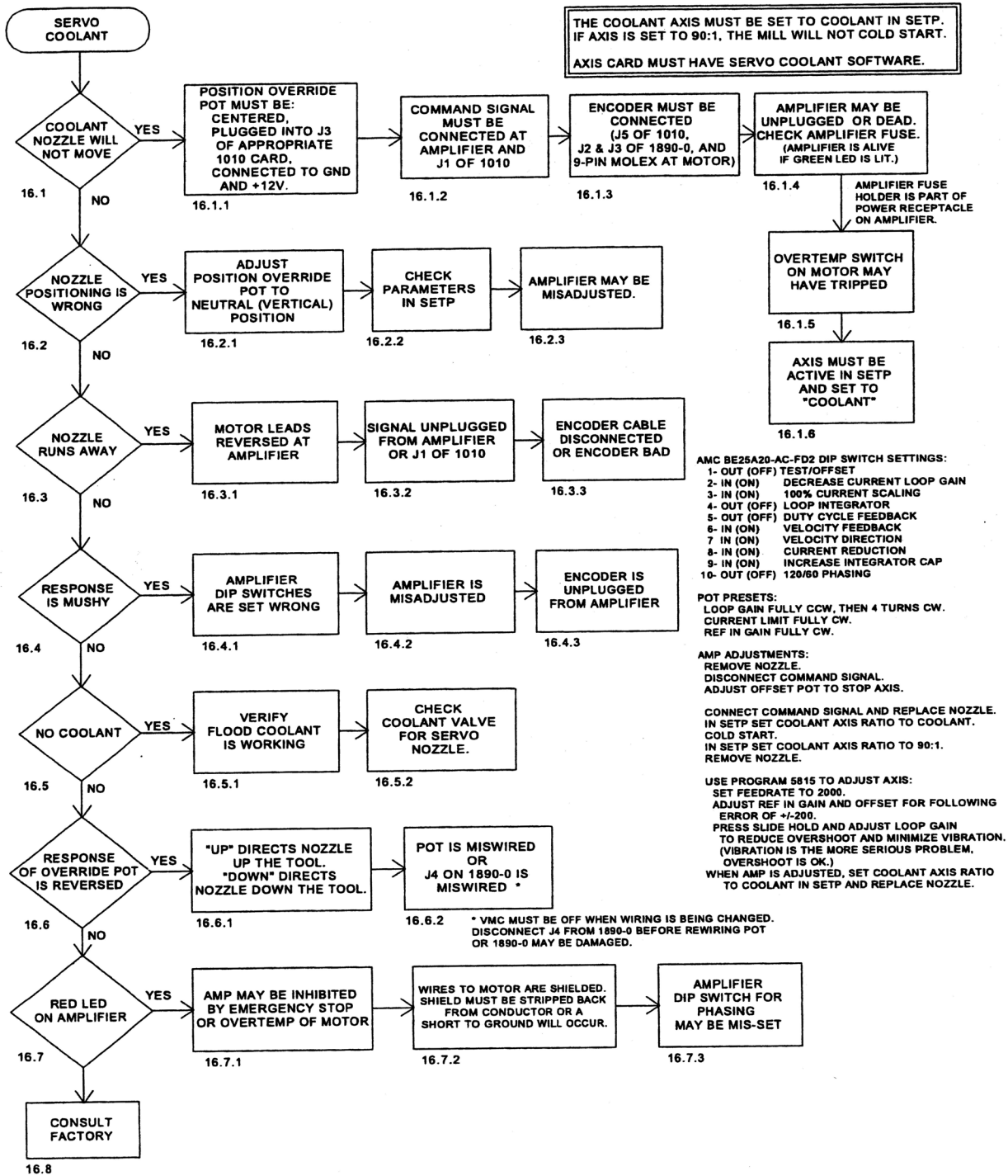
ITEM	QTY.	PART DESCRIPTION	PART #
1	1	SERVO COOLANT HOUSING	CNT-0188
2	2	COVER, SERVO COOLANT	CNT-0190
3	1	LARGE PULLEY (4607-103)	PUL-0049
4	1	SMALL PULLEY (4607-102)	PUL-0048
5		DELETE	
6	1	1/17 HP. BOBINE MOTOR/ ENCODER	MTR-0055
7	1	COVER, SERVO COOLANT, SIDE	CNT-0189
8	1	PULLEY BELT	BEL-0028
9	1	COOLANT SHAFT	CNT-0153
10	1	250 X 75 X 10-32 SHOULDER BOLT	HDW-0800
11	2	THRUST ROLLER BEARING NYA-411	BRG-0120
12	2	NEEDLE ROLLER BEARING B-44	BRG-0116
13	4	THRUST WASHER TRA-411	BRG-0119
14	2	CR SEAL 7414	HDW-0758
15	2	O'RING	HDW-0696
16	1	COOLANT WHEEL	CNT-0155
17	1	SPRAY TUBE	CNT-0152
18	1	PIPE NOZZLE	CNT-0161
19	2	MOUNTING TAB	CNT-0160
20	1	PIPE GUIDE SPACER	CNT-0157
21	1	PIPE GUIDE SCREW	CNT-0156
22	1	NEEDLE ROLLER BEARING B-126	BRG-0118
23	1	CR SEAL 7434	HDW-0757
24	1	O'RING	HDW-0697
25	1	PIPE ADAPTER	CNT-0154
26	1	1/2" x 1/2" 90° STREET ELBOW	PLM-0189
27	1	1/2" NPT SHORT NIPPLE	PLM-0092
28	1	COOLANT VALVE	VLV-0017

29	4	1/2 x 1/2 HOSE BARB	PLM-0104
30	1	1/2 PARKER HOSE	PLM-0014
31	6	HOSE CLAMP	HDW-0253
32	1	QUICK DISCONNECT	PLM-0020/PLM-0144
33	4	6-32 x 3/75 FLATHEAD	HDW-0325
34	1	SERVO COOLANT HARNESS ASSEMBLY	WIR-0533
35	1	TEMP SWITCH	ELE-0722
36	4	10-32 x .5 SDCAP.	HDW-0302
37	6	6-32 x 3/75 BUTTON HEAD	HDW-0594
38	4	SCREW, 10-32 X 1.75, ROUND HEAD	HDW-1114
39	1	1/2 APPLETON	WIR-0517
40	1	AMPLIFIER (BE25A20ACD-F01)	AMP-0013
41	1	SERVO COOLANT COVER	STM-0674
42	4	6-32 x 25 BUTTONHEAD	HDW-0593
43	1	BH-1312 ROLLER BEARING	BRG-0117
44	6	1/4-20 x .5 BUTTONHEAD	HDW-0346
45	2	1/4 SPLIT LOCKWASHER	HDW-0279
46	2	1/4-20 x .75 BUTTONHEAD	HDW-0589
47	1	SRV. CLNT. LABEL LBL-0044/LBL-0180/LBL-0246	
48	1	KNOB	HDW-0671
49	1	SERVO COOLANT BOX	STM-0759
50	2	10-32 x .5 BUTTONHEAD	HDW-0348
51	1	SPINDLE POTENTIOMETER	ELE-0066
52	1	1/4 RUBBER GROMMET	HDW-0687
53	1	CONNECTER	WIR-0048
54	1	10-32 x .5 SDCAP.	HDW-0302
55	1	1/2 NPT TEE	PLM-0089

ⓐ USE STM-1132 INSTEAD OF STM-0674 (ITEM 41)
FOR SLANT MACHINES WITH CHAIN HOIST OPTION

NOTES:

Servo Coolant Control

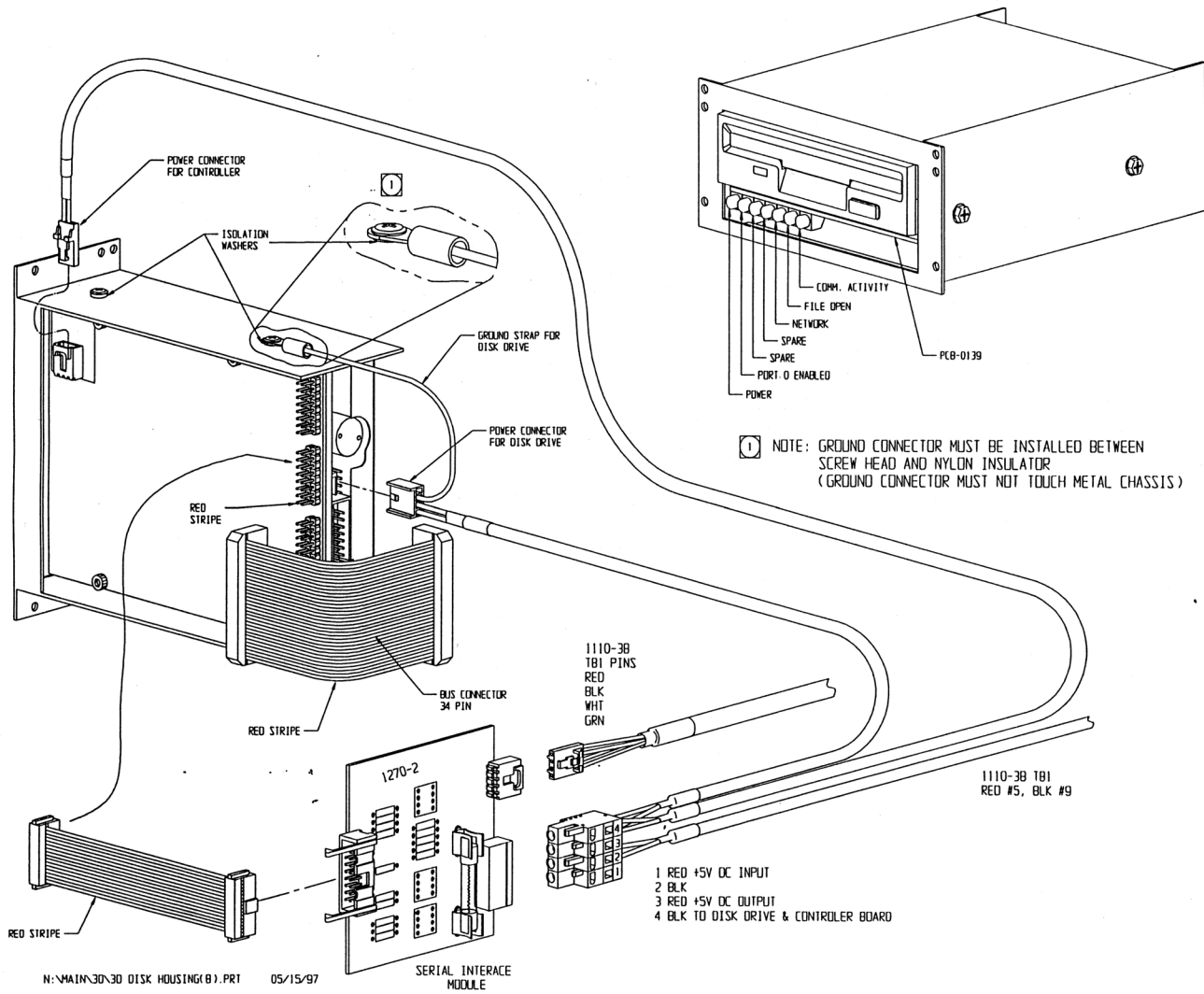


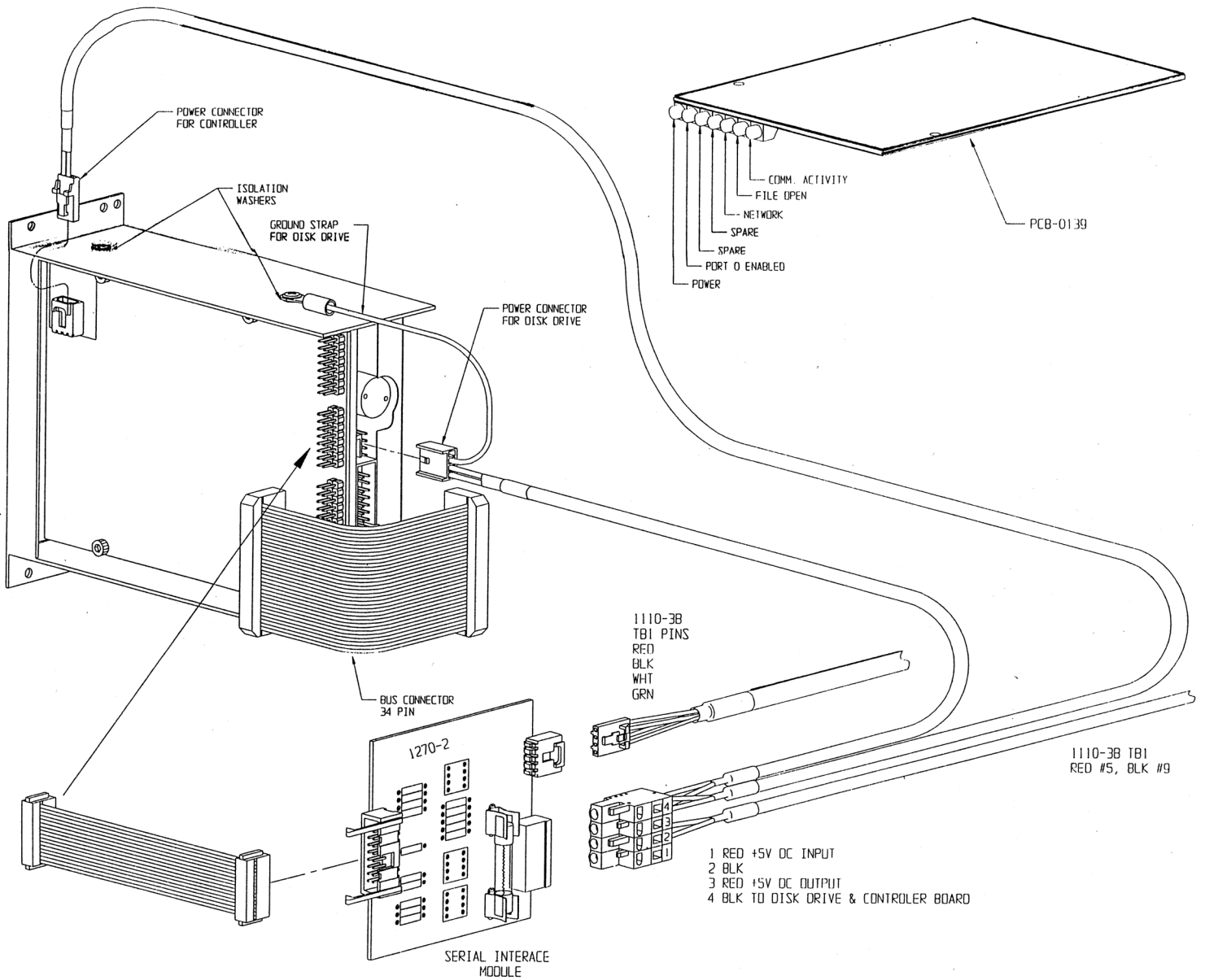
**Troubleshooting
Checklist**

- 1) Make sure all connectors are plugged in properly.
- 2) Check dip switch settings. Switch 2=3=6=7=ON; Switch 1=4=5=8=9=10=OFF.
- 3) Check AC line fuse. AC LINE FUSE=16A, 250 VAC Slow blow (dimensions 5x20 mm) Wickman Part Number 19195-16. Check shunt regulator fuse (amplifier case must be removed to do this). SHUNT FUSE= Bussman Part #MDLL3, 3A, 250 VAC Motor delay fuse (dimensions, d=6.3mm, l=32 mm).
- 4) With the power removed, use a DVM to check between motor phases (Motor A, B and C), between motor phases and PGND and between motor phases and +HV. The cover must be removed to access +HV and PGND points. If any shorts are detected, the amplifier should be replaced.
- 5) Check AC bus voltage. Nominal voltage should be approximately 115 VAC. If the shunt regulator is on too long or if the AC line voltage is too high (over 130 VAC), the shunt fuse could blow causing an amp over voltage condition. The shunt regulator trip voltage is 185 VDC (130 VAC). The amplifier should over voltage at 195 VDC (137 VAC). Amplifier specified input voltage is 30-125 VAC.

LED: RED LED indicates the following faults: output short circuit, over-voltage, over temperature, inhibit, and power-up reset.

CNC 88 HS Optional Diskette Drive





**CNC88HS Optional
Diskette Drive-
Miscellaneous**

Specifications 3.5" diskette medium. 1.44 Megabyte capacity; will read/write 720K diskettes. MS-DOS format.

Requirements Software version 96.1 A6-3 or later.

Access from Control The drive is accessed from the Functions menu on the CNC by selecting option 0-DISK. A submenu is displayed with the following options:

```
FUNCTIONS-----PRESS MANUAL TO ABORT--  
DISK FUNCTIONS;
```

```
1-DISK TO MEMORY  3-DIRECTORY    5-FORMAT    7-RUN PROGRAM  
2-MEMORY TO DISK  4-DELETE      6-VIEW
```

Disk to Memory- Loads a program from a diskette into CNC memory.

Memory to Disk- Saves a program from CNC memory onto a diskette.

Directory- Displays a list of the tiles and directories on a diskette.

Delete- Deletes a file from the diskette.

Format- Formats a diskette (all files on diskette are deleted).

View-Displays the contents of a tile from a diskette (one page at a time) on the CNC monitor.

Run Program- Runs the VMC from a file nn a diskette using DNC.

Options are:

- 1) Error checking
- 2) Dry run
- 3) Mid-program start by block #

Note: The % character is not needed for running DNC from a diskette, but can be included in the file on the diskette.

**Access from
Program Using
Macro Statement
#DISK**

Macro language statement #DISK invokes a program on disk from within a program in the CNC memory. After processing the file from disk, control is routed back to the line of the program in memory that follows the #DISK statement. Macro Statement Format #DISK,filename

**Macro Statement
Format**

DISK filename

Example:

```
N1 G90 GO S10000 M3 EI XO YO
```

```
N2 H 1 Z.1 M7
```

N3 #DISK CAVRUF- Calls the disk file named CAVRUF and runs it relative to Fixture 1.

N4 GO Z.1- Program execution continues with this line, positioning the head to Z.1 after CAVRUF finishes running the first time.

NS E2 XO YO- Positions to XO YO of Fixture 2

N6 #DISK CAVRUF- Calls the disk file named CAVRUF and runs it again, this time relative to Fixture 2.

**Restrictions on File
Content and Format**

The file needs to be in text file format, without any formatting characters or codes, such as those a Word Processor might use. In addition, the following guidelines apply:

- 1) The file needs to consist of standard CNC program words, similar to what would be typed or transmitted into the memory of the machine.
- 2) The file must not contain an O word.
- 3) The file should not contain an M30, M99, or an M2. The CNC will return to the program in memory automatically at the end of the file.
- 4) The lines can be numbered, but do not need to be.
- 5) The file itself cannot contain any #DISK statements.

Note: The % character is not needed for running a program from disk, although it can be included in the file.

Restrictions on User Defined Subroutines

The file executes in the CNC memory just as if it were a part of the program that executes the #DISK statement, with the following restrictions on user-defined subroutines:

- 1) The program on the disk cannot define a user-defined subroutine.
- 2) The disk file cannot call a user-defined subroutine.

Subprograms and Fixed Subroutines ARE Allowed

Subprograms and fixed subroutines can be called from the disk file. Use the standard subprogram call format: M98 P# (where # is the subprogram to call). After the subprogram has executed, the program returns to the line after the subprogram call. For example, L100 might be used in memory to define subroutine one, but this cannot be accomplished in the disk file.

Diskette Drive Error Codes

CODE	DESCRIPTION	CAUSE
1001	Reserved	
1002	FILE ALREADY EXISTS	File selected for reading or deletion not in directory
1003	FILE DOES NOT EXIST	File selected for reading or deletion not in directory
1004	ILLEGAL COMMAND	Command not recognized
1005	DISKETTE FULL	Diskette has no room for transmitted data, or directory has no room for another entry
1006-1008	Reserved	
1009	COMMUNICATIONS ERROR	Mini-file detected check character error or other software or hardware communications problem
1010-1099	Not Used	
1100	DISK READ ERROR	Mini-file unable to read directory without error. Usually caused by an unformatted diskette
1101	BLOCK CHECK ERROR	Four attempts failed to read diskette block without error
1103	SEEK ERROR	Mini-file could not track while reading, or before writing, data block
1104	DISKETTE TIME-OUT	Mini-file could not access diskette. Usually due to lack of diskette in drive
1105	DISK WRITE PROTECTED	Minifile tried to write on write-protected diskette