

Introduction

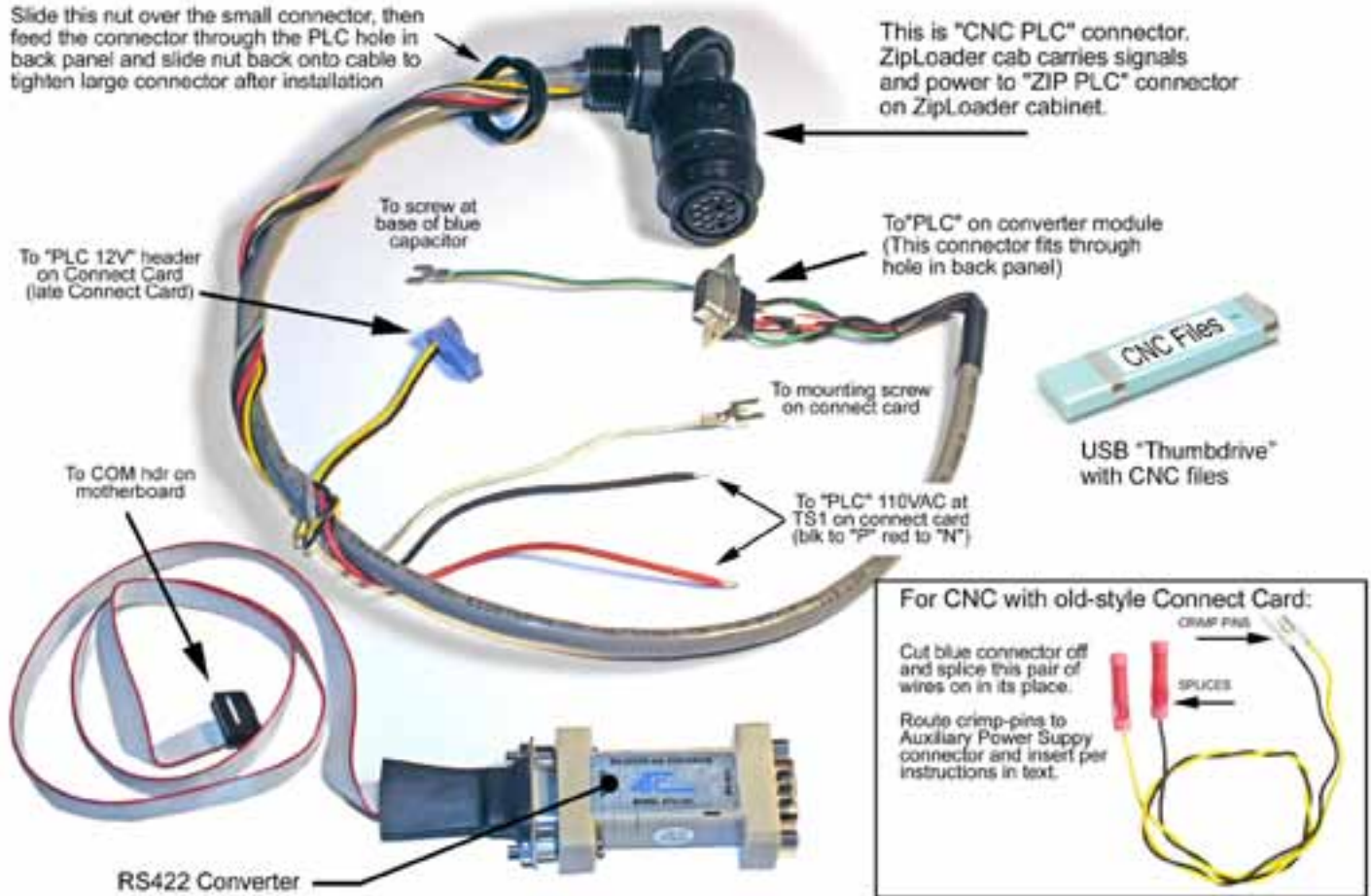
This document describes how to install Expanded I/O PLC in an OmniTurn GT-75 with G4 CNC.

The installation involves hardware and software changes to the CNC and hardware changes to the spindle drive cabinet.

Overview

- CNC: Install right-angle 14-pin bulkhead on rear panel to connector to carry communications and power to the PLC. Install RS422 Converter to communicate with the PLC. (See pages 2 - 8).
- GT75: Route cable from PLC connector on CNC to newly installed 14-pin bulkhead connector in Spindle Drive Box. (See page 9)
- Spindle Drive: Install 14-pin bulkhead connector in Spindle Drive Box for communications and power to the PLC, See pages 10-12)
- Computer: Copy new files to the hard drive so OmniTurn can control the loader (Page 13). Pages 14-19 are technical data and electrical schematics for reference.

CNC Control Modification Parts



Loopback plugs for troubleshooting communication errors

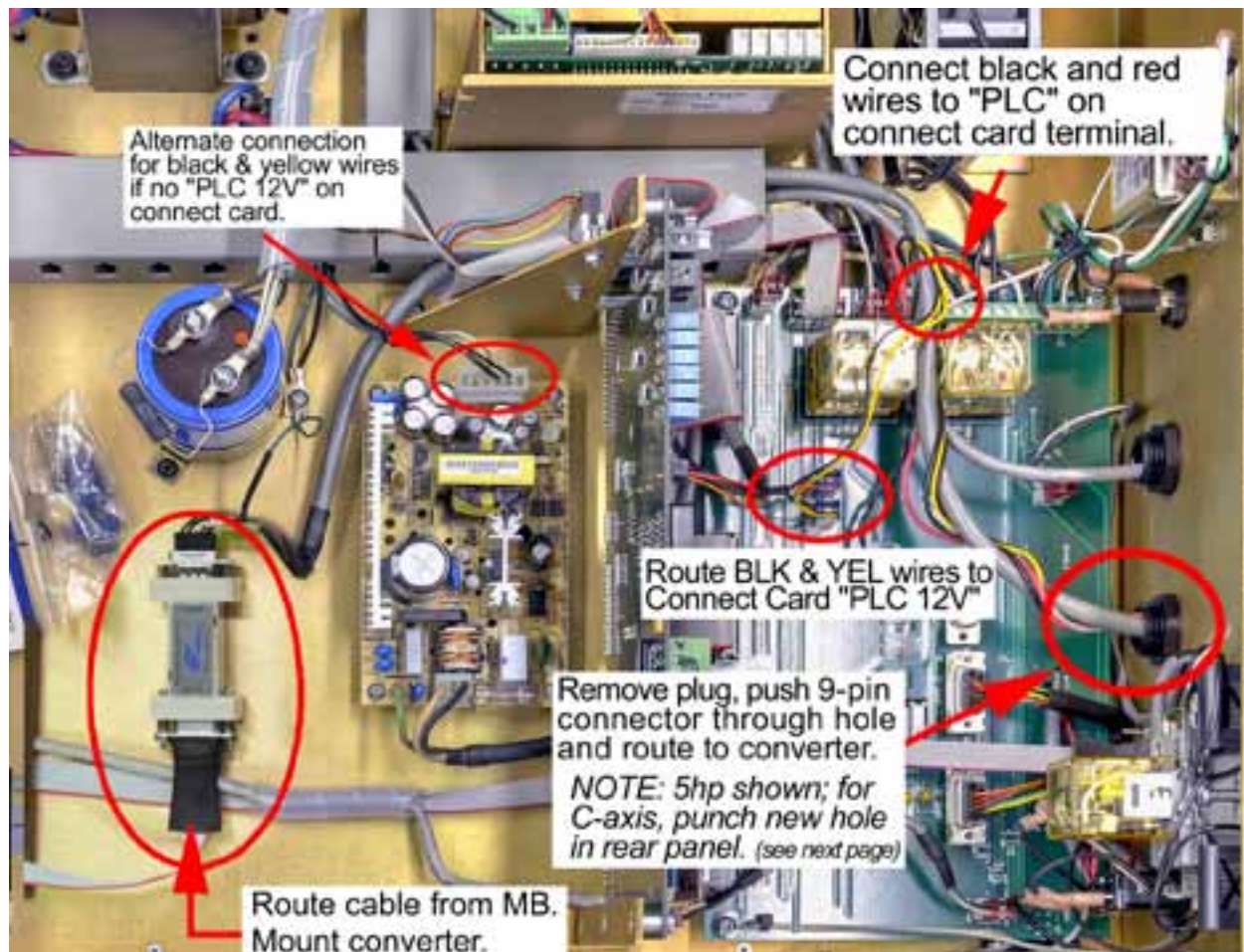


CNC Control Modification Summary

The general steps to install PLC option in the CNC Control are listed below.

More detailed instructions start on next page. See previous page for illustrated parts list.

1. Install special bulkhead connector in rear panel (must punch hole for C-Axis CNC); route cables to connect card (110vac), Auxiliary Power Supply (+12vdc) and RS422 Converter.
2. Connect black & red wire to "PLC" stations on Connect Card terminal strip.
3. Connect blue plug on black & yellow wires to "PLC 12V" on connect card (new-style) OR insert black & yellow wires into existing Auxiliary Power Supply output connector.
4. Route 10-pin ribbon cable from serial port on computer; connect cable to RS422 Converter and stick it to chassis.



Install PLC Connector

CNC controls equipped for standard 5hp spindle drive have plugged hole next to Operator's Station connector on back panel (see photo at right). C-Axis CNC control uses this hole, so additional hole must be punched at far right of rear panel to accommodate PLC.

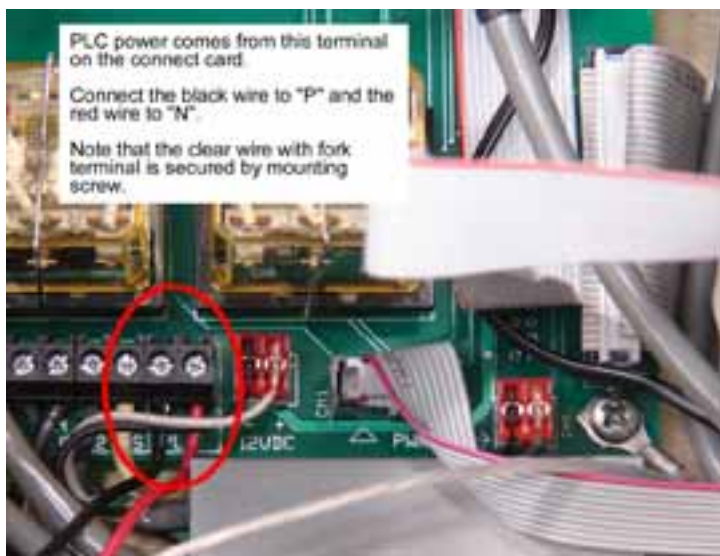
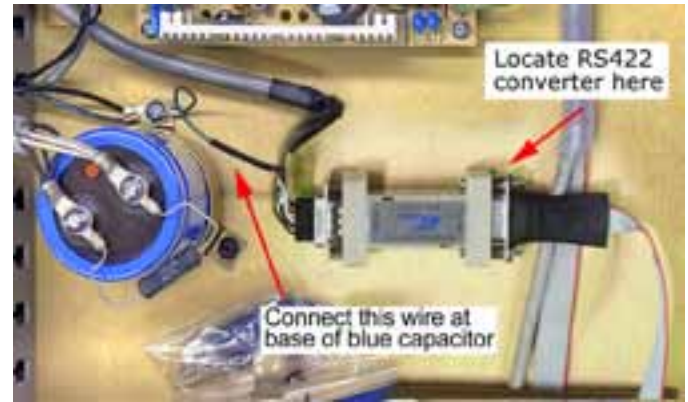
1. Remove plug (5hp) or punch 1/2" knock-out (7/8" dia) hole (C-Axis) in rear panel.
2. Push all cables through the nut that secures the connector to the panel. The 25-pin connector does fit, but the nut must be squeezed hard to 'oval' it for clearance.
3. Route the cables to their final locations per overall picture on previous page.



Mount RS422 Converter

Double-sided tape is used to affix RS422 converter to the control chassis. Locate the converter as shown at right, peel off the backing and stick it to the chassis.

Route black wire with terminal to one of the screws that mount the blue servo power supply capacitor. This is the shield wire for the communications cable.



Connect 110vac Wires

1. The "PLC" terminals are at end of Connect Card terminal board as shown at left.
2. Loosen the locking screws, insert the wires and re-tighten.
3. The black wire should go to "P" and the red wire to "N".

These wires supply power to the PLC.

Route Black & Yellow wire to “PLC 12V” header

“New-style” Connect Card

Plug blue connector into “PLC 12V” header on Connect Card as shown at right. 

If your G4 CNC has the old-style Connect Card, there is no “PLC 12V” header available, so you must cut off the blue connector, and use the butt-splices on black & yellow pair of wires provided with crimp-pins to plug into auxiliary power supply as shown below.



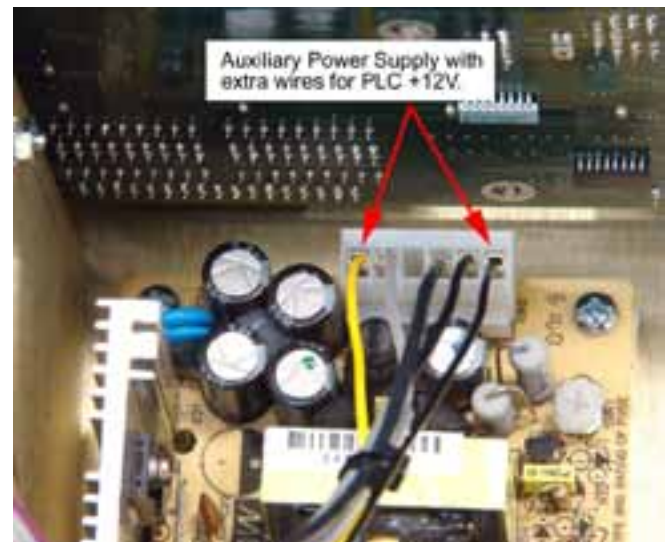
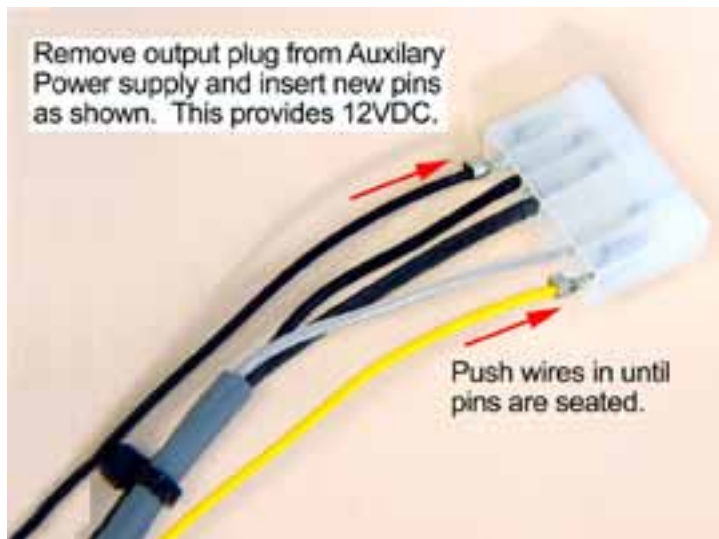
For “old-style” Connect Card without “PLC 12V” header

If your Connect Card doesn't have the “PLC 12V” header, you must use the auxiliary power supply extension wires (supplied). Cut blue connector off the black and yellow wires and strip the wires about 1/4". Use the supplied butt-splices to connect these wires to the black and yellow pair which have the silver crimp-pins, matching the colors. Add the wires to the Auxiliary Power Supply Connector as shown below.

To modify auxiliary power supply connector:

Remove output connector from Auxiliary Power Supply and insert black and yellow wires into connector as shown below. Pins will ‘click’ when properly seated; verify seating by pulling on the wires.

If necessary to remove pin, use small screwdriver to lift flap on connector; pull wire out.



IMPORTANT! Verify which MotherBoard before routing ribbon cable

Three different motherboards have been used through the years; review this page and next two pages to determine which motherboard you have.

**Epia ML MotherBoard
(Earliest G4 CNC's; floppy drive)**



Connecting to Epia ML MotherBoard

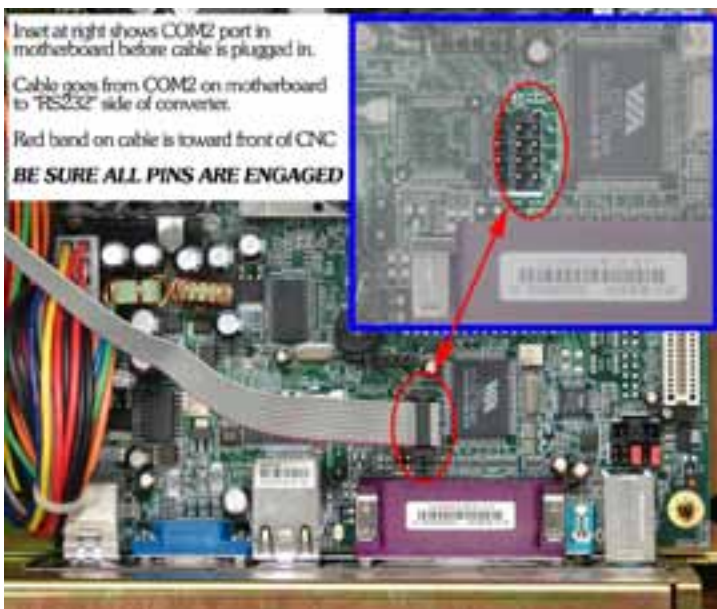


Back Panel of Epia ML Mother Board



Route Ribbon Cable to COM2

The 10-pin ribbon cable from RS422 converter connects to COM2 port on computer motherboard: remove front panel, disconnect cables, and slide computer chassis out to access the COM2 port. **Be sure that all pins are engaged**; it's easy to miss a row a row or column. route cable through space between front-panel and chassis (see below).

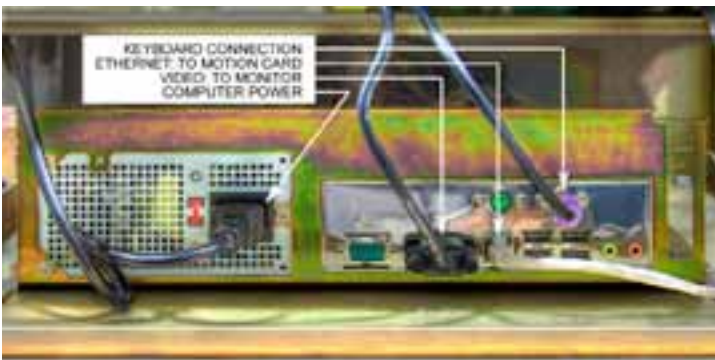


IMPORTANT! Verify which MotherBoard before routing ribbon cable

Epia M830 MotherBoard
(Mid 2011 - late 2016; no floppy)



Connecting to Epia M830 MotherBoard



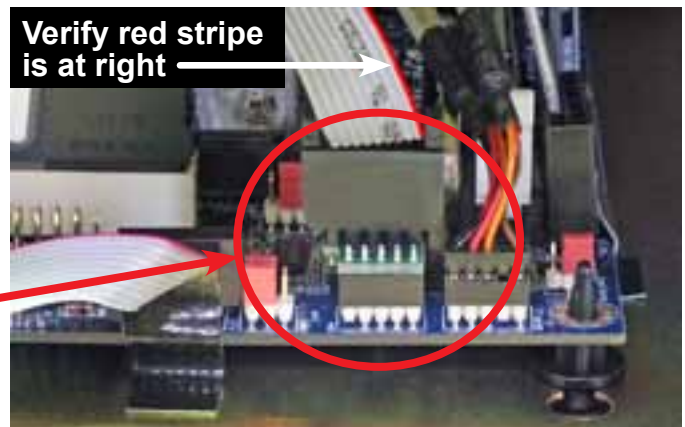
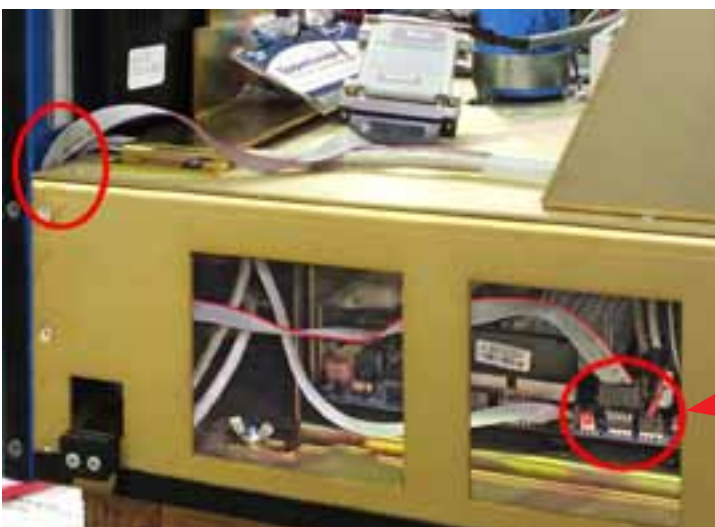
Back Panel of Epia ML Mother Board



Route Ribbon Cable to COM4

The 10-pin ribbon cable from RS422 converter connects to COM4 port on motherboard using adapter*: route cable through space between front-panel and chassis (below left) and connect to motherboard as shown below. **Be sure that all pins are engaged;** it's easy to miss a row a row or column.

*Some kits may include fine-pitch cable to fit COM4 port without adapter



IMPORTANT! Verify which MotherBoard before routing ribbon cable

VB7009 MotherBoard
(Current G4 CNC's)



Connecting to VB7009 MotherBoard



Back Panel of EPIA ML Mother Board



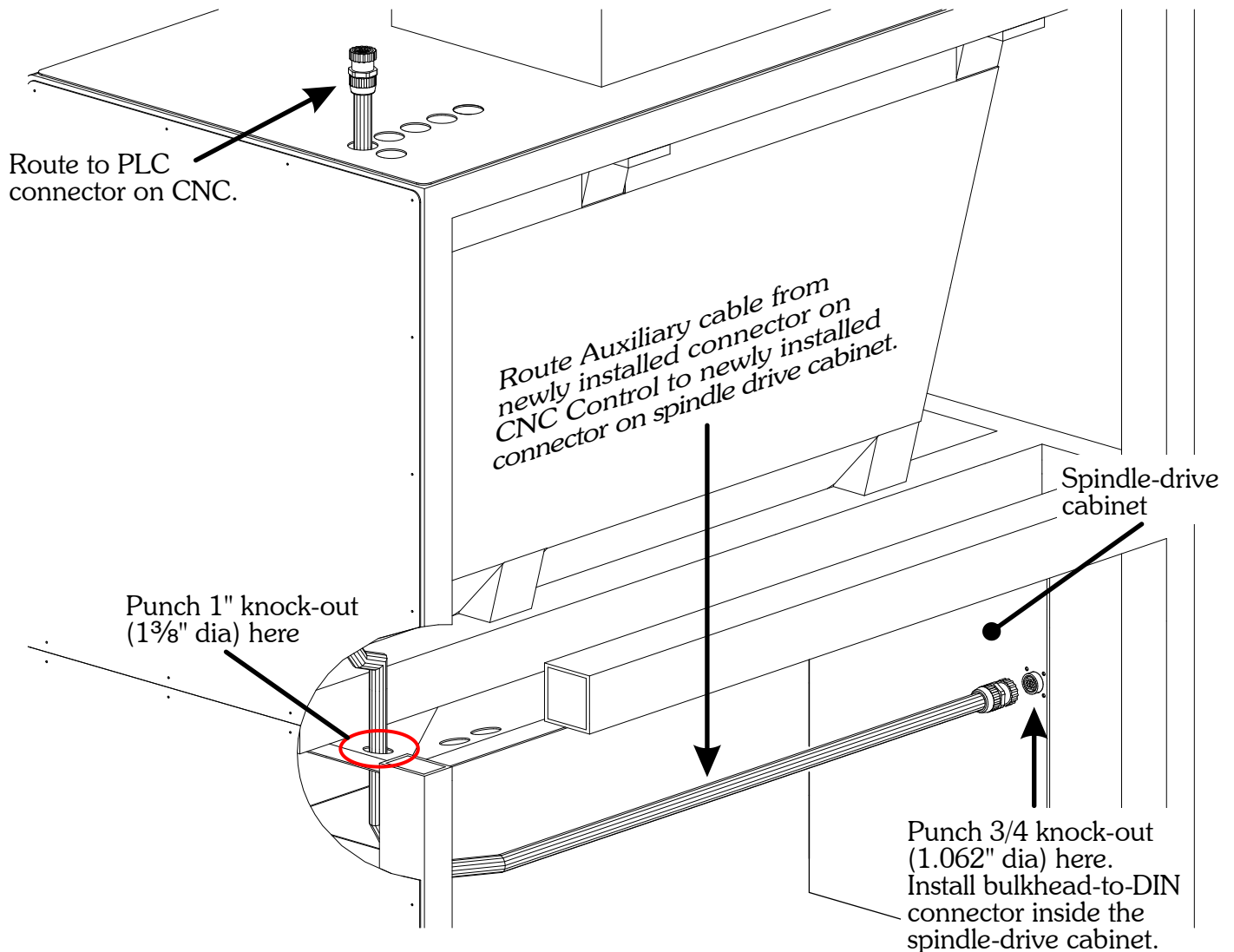
Route Ribbon Cable to COM3

The 10-pin ribbon cable from RS422 converter connects to COM3 port on motherboard: route cable through space between front-panel and chassis (below left) and connect to motherboard as shown below. **Be sure that all pins are engaged;** it's easy to miss a row a row or column.



GT75 Modifications:

1. Remove top and bottom rear panels from GT75.
2. Punch 1" knock-out (1d" dia) in far left corner of white pan where other cables from control pass through.
3. Punch 3/4 knock-out (1.062" dia) at right side of spindle drive cabinet, about 7/8" from edge and 6" from top.
4. Use bulkhead connector on cable as template to mark mounting holes. Drill four 3/16 holes.
5. Install cable with bulkhead connector to mini-DIN using four 8-32 screws (supplied).
6. Route Auxiliary cable from newly installed connector on CNC Control to newly installed connector on spindle drive cabinet. Use nylon cable clamps (supplied) to secure cable to frame.
7. Replace top and bottom rear panels on GT75.



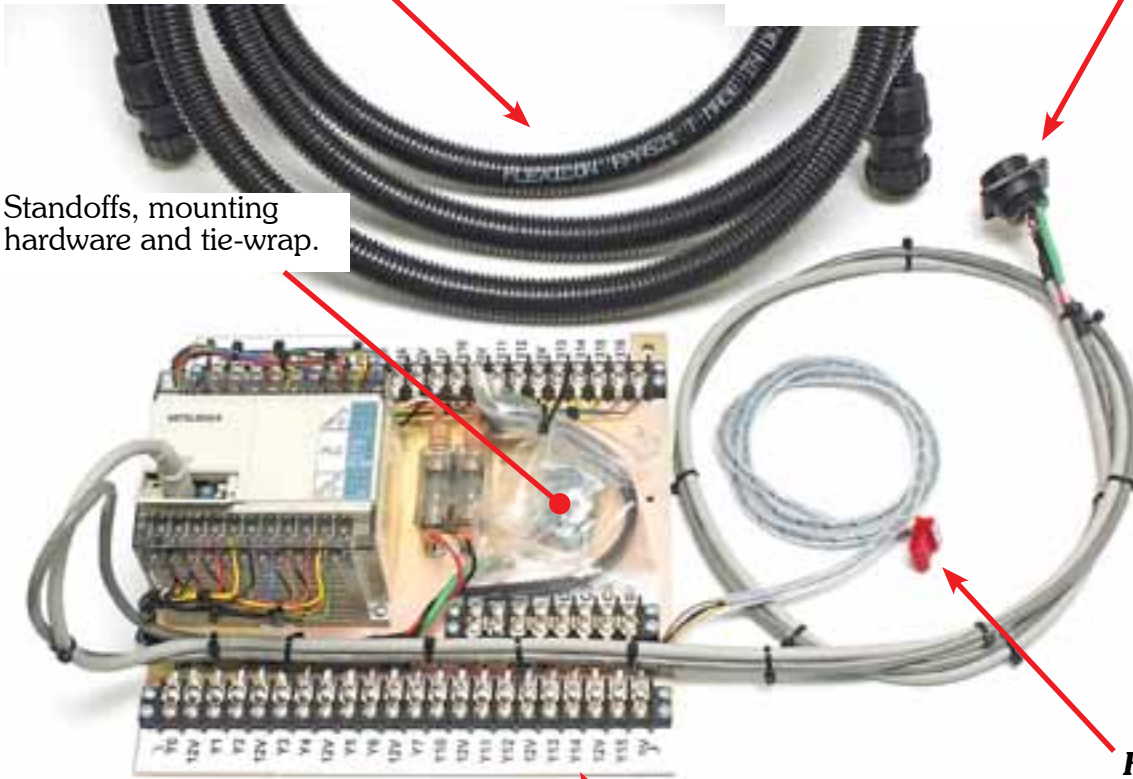
PLC Chassis and CNC to PLC Cable

Install Connector:

Make a 1-1/16" diameter hole (use 3/4 conduit knockout punch).
Use connector as template for four mounting screw holes. Install connector with screws provided. Don't over tighten.

CNC to PLC Cable

Standoffs, mounting hardware and tie-wrap.



HDR109: Connect to PWB. If TB1 version see page 12.

PLC Panel: Mounts on standoffs (provided) on spindle cabinet door. Refer to picture on page 1 for cable routing.

Installing the PLC Chassis

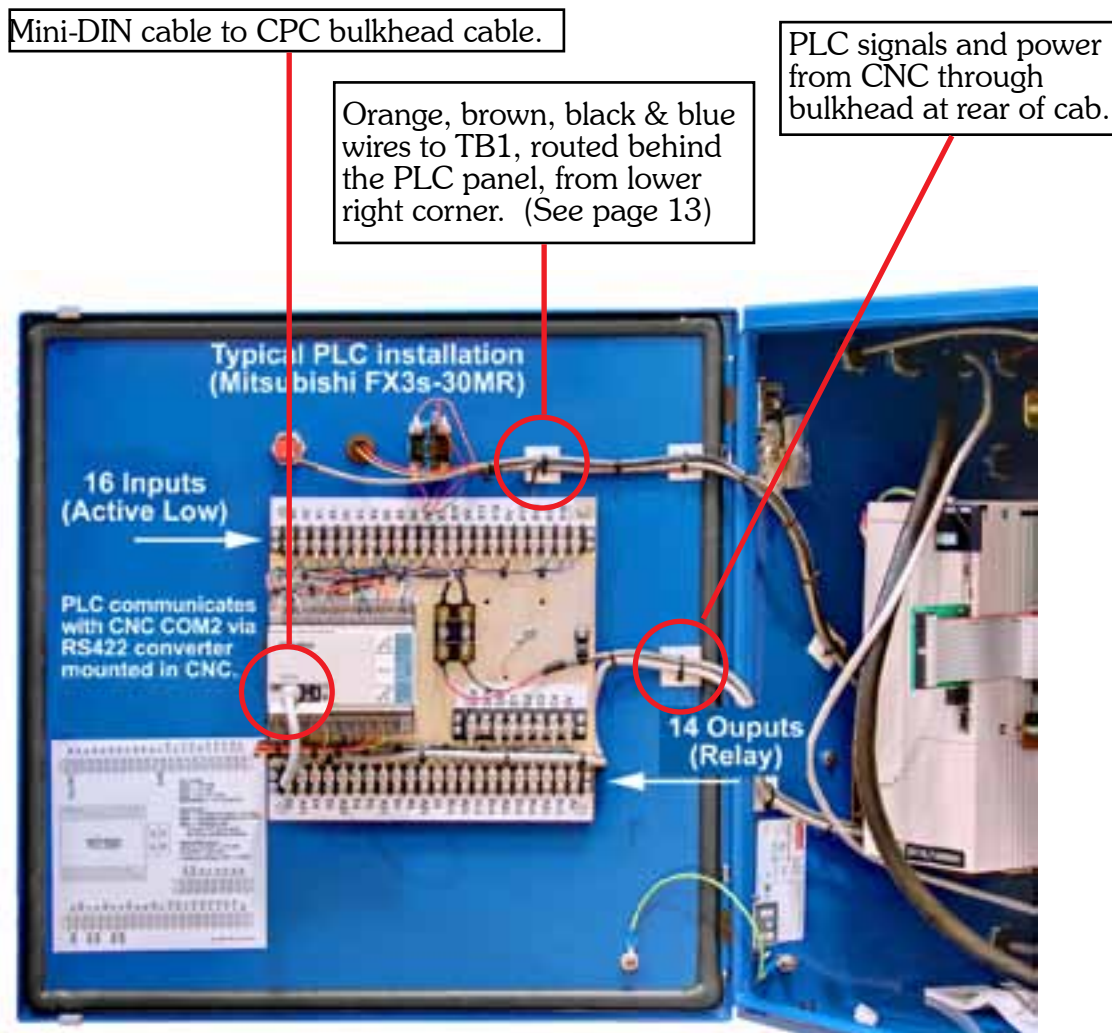
1. Drill holes in door of spindle drive cabinet to accommodate PLC chassis. Use panel as template. Use standoffs and hardware to mount chassis as shown in picture below.
2. Route mini-DIN cable to connector on PLC behind little door. Insure that RUN/STOP switch on PLC is set to RUN.
3. Route additional wires as follows:

See photos on next page to identify spindle cabinet as PWB or TB1

PWB: Plug red connector into HDR109

TB1: connect wires as follows (see illustration on page 13):

- a. Orange 22ga wire to FLT relay pin 10 on drive panel.
- b. Brown 22ga wire to FLT relay pin 6 on drive panel.
- c. Black 22ga wire to TB1-8 on drive panel.
- d. Blue 22ga wire TB1-9 on drive panel.



Spindle Drive Box Identification

The G4 CNC might have been installed on an earlier version GT-75. To quickly identify your version, open the spindle drive cabinet and compare it to the two pictures below. The picture on the right is the earlier “TB1” (Terminal Board) version; the picture on the left is the latest “PWB” (Printed Wiring Board) version.

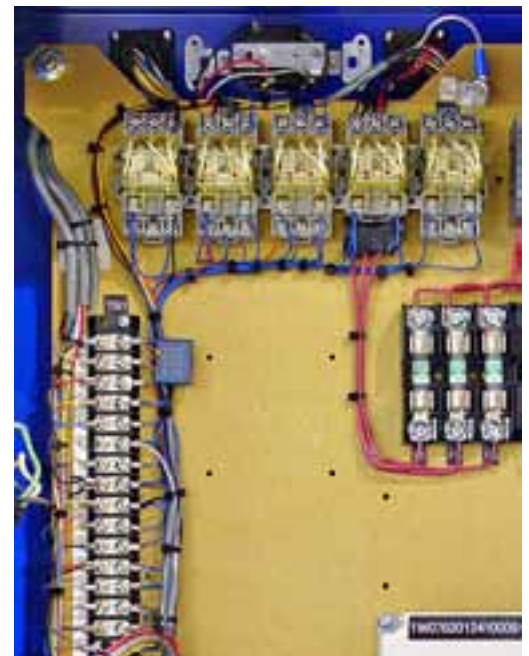
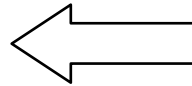
***If you have the PWB version, plug red connector into HDR-109.
See photo on next page.***

If you have the TB1 version, cut off red connector to free the orange, brown, black and blue wires. Strip wires, crimp fork terminals (supplied) onto wires.

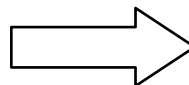
Connect these wires to TB1 according to instructions on next page



PWB Version



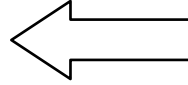
TB1 Version



Spindle Drive Box Wiring

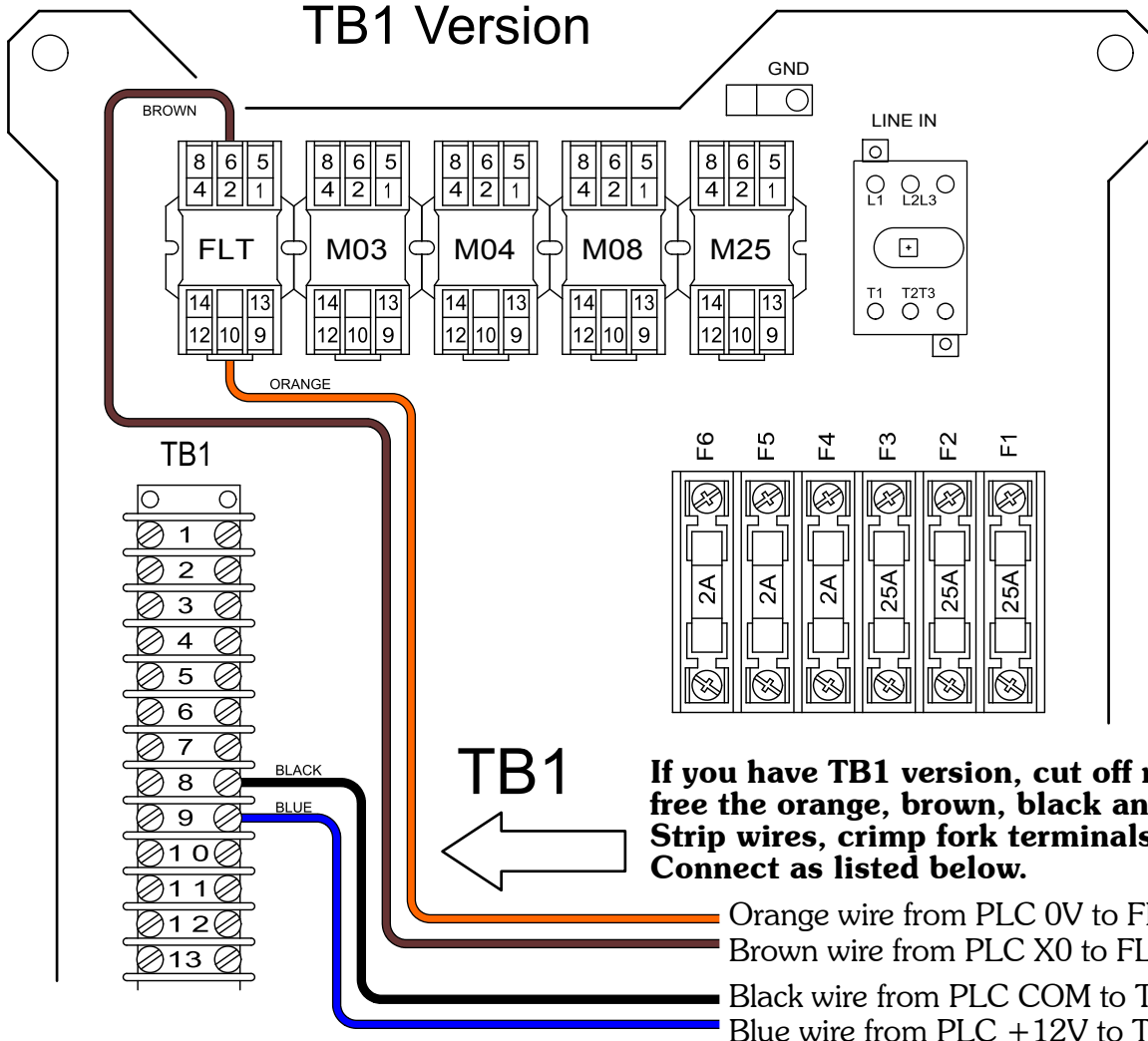


PWB Version

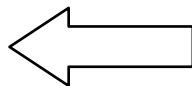


If you have the PWB version, plug red connector into HDR-109.

TB1 Version



TB1



If you have TB1 version, cut off red connector to free the orange, brown, black and blue wires. Strip wires, crimp fork terminals onto wires. Connect as listed below.

To copy files to the computer:

1. Temporarily replace backup thumb drive with “CNC Files” thumb drive
 2. Turn on CNC Control as usual.
 3. At CNC ‘splash’ screen, press and hold the Ctrl key, then press C key (Ctrl-C).
This will drop to DOS with K:\CNCFILES> prompt.
 4. Type C: then press Enter; you should see C:\RUNFILES> prompt.
 5. Type d:plcg4 then press Enter; you should see
This program will copy M-function files to CNC
Press any key to continue
 6. Press any key; files will be copied to the hard drive.
 7. Process should take a few seconds; you should see
ALL DONE...
 8. Set CNC off, then on to reboot.
-

Test

The PLC-specific M-functions are already installed in your CNC.

To test the installation, go to MDI mode and exercise the M-functions below and observe the lamps on the PLC per the door label:

Y4 always ON except during E-stop

M32=Y0 ON

M33=Y1 ON

M38=Y0 and Y1 OFF

M60=Y3 ON

M61=Y3 OFF

M62: First, use jumper to short X7 to 0V, then issue M62, then issue M62.

M62: (with jumper)=Y2 ON for 1/2 second, then OFF (1/2 second pulse)
CNC will display waitoff7 in command line: remove jumper to continue

M-Functions and “USR file code

M-Functions

M32 - Air tool #1 (PLC output Y0 on)
M33 - Air tool #2 (PLC output Y1 on)
M38 - Airtools off (PLC output Y0 & Y1 off)
M60 - Enable bar pusher (PLC output Y3 on)
M61 - Disable bar pusher (PLC output Y3 off)
M62 - Change bar (Pulse PLC output Y2, wait for end of bar signal (X7) to clear)

“USR” files code

M32.USR code:
setb0
End
M33.USR code:
setb1
end
M38.USR code:
clrb0
clrb1
end
M60.USR code:
setb3
end
M61.USR code:
clrb3
end
M62.USR code:
setb2
delay.5
clrb2
waitoff7
end

PLC I/O Assignment for Barfeeder

INPUTS:

X0 - NOT E-Stop

Description:

This input is ON when neither lathe nor bar feeder is in emergency stop.

X7 - End of Bar

Description:

This input must turn ON (shorted to 0V) when the end of the bar is reached and remain ON until the bar change cycle is complete.

OUTPUTS:

Y0 - Air tool (M-32 turns on, M38 turns off)

Y1 - Air tools (M-33 turns on, M38 turns off)

Y2 - Initiate bar load (M62: Y2 pulses on for 1/2 second, then CNC waits for End of Bar to clear)

Y3 - Enable bar pusher (M60 turns on, M61 turns off)

Y4 - NOT E-stop (Signals barfeeder that lathe is not in E-stop. Follows X0 exactly.)

Editing & Writing .usr files to access the additional I/O

To edit or create a usr file on the OmniTurn:

1. Turn on the OmniTurn.
2. At **Please backup program files (Y/N)** prompt, press and hold Ctrl key, then press C key (Ctrl-C)
3. At **K:\CNC>** prompt, type **C :** then press enter
4. At **C:\RUNFILES>** prompt type **edit m?? .usr** (where m?? is the number of the M-function: for example, **m62 .usr** where 62 replaces the question marks) then press enter to start OmniTurn editor.
5. Edit the program as usual, save and exit, then restart the OmniTurn.

There are only ten commands in the 'usr language':

setbn	Turns an <i>output</i> ON: setb10 turns on output Y10.
setmn	Turns a <i>mark</i> ON: setm7 turns on M7 in PLC.
clrbn	Turns an <i>output</i> OFF: clrb10 turns off output Y10.
clrmn	Turns a <i>mark</i> OFF: clrm7 turns off M7 in PLC
waiton	Stops the usr program until an <i>input</i> turns ON :waiton14 waits for X14 to go on.
waitmonn	Stops the usr program until a <i>mark</i> in the PLC is set: waitmon8 waits for M8.
waitoffn	Stops the usr program until an <i>input</i> turns OFF: waitof14 waits for X14 to go off.
waitmoffn	Stops the usr program until a <i>mark</i> is cleared: waitmoff8 waits for M8 to clear.
delayn	This command stops the usr program for a number of seconds, from .1 sec to 10: delay.3 waits for 3/10 of a second. Used mostly for pulsing an output.
end	This command must be the last command in every usr program.

Conditional Sub-Routine M-Function

M97InCnPn

In is the PLC Input which is monitored. Generally EOB, X7

Cn is the Condition of the input to cause the jump: 1 (on) or 0 (off)

Pn is the number of the sub-routine to execute

Notes: The PLC Inputs are X0 through X7: grounding an input turns it on.
The input must be active before the M97 block is called

code for program

.
. .
. .

M97I5C1P2 (Execute Subroutine #2 if Input 5 is on)

.
. .
. .

M30(Or M02: end of program)

}1

code for subroutine #1

.
. .
. .

M99(End of sub routine)

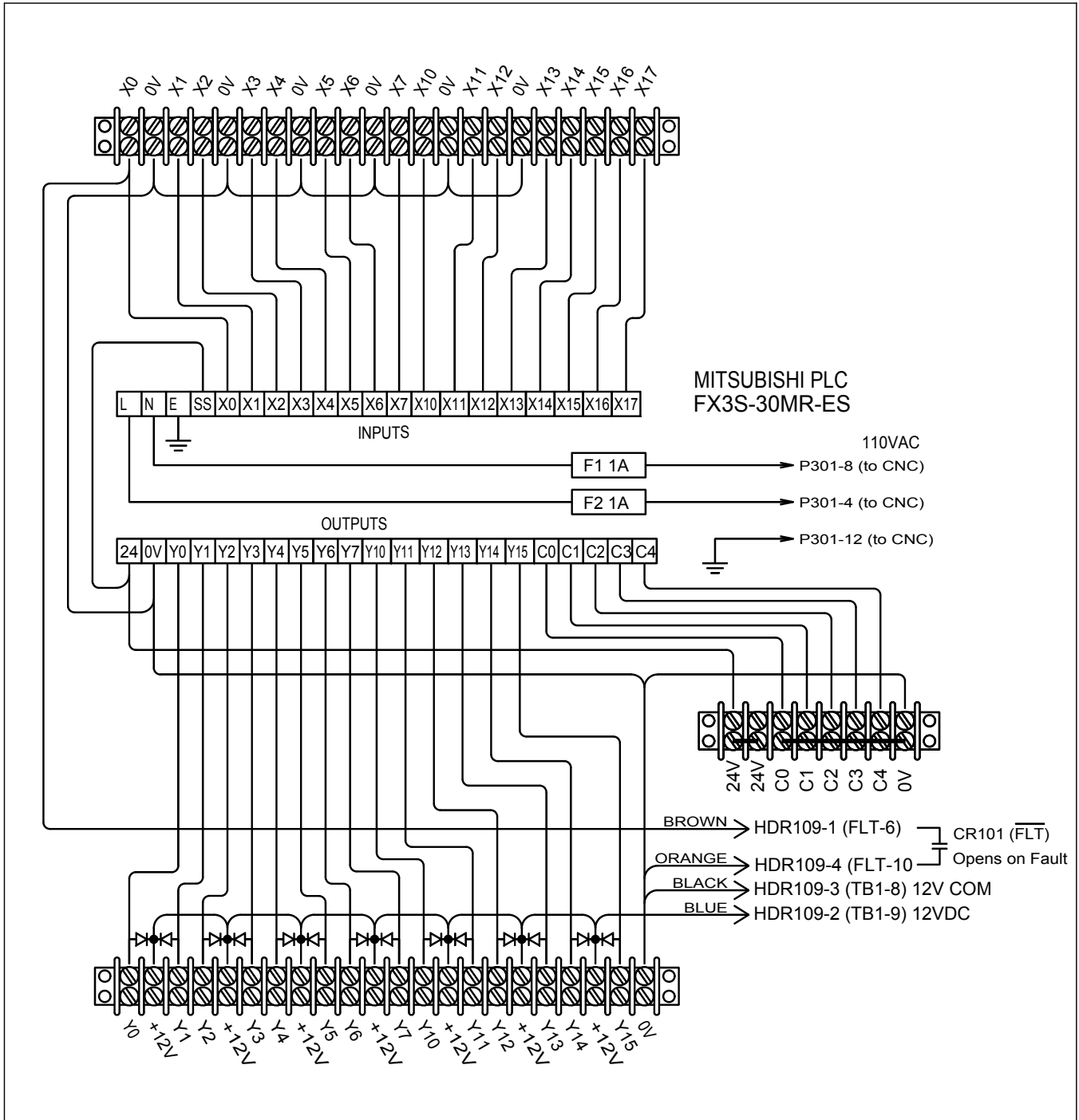
}2

code for subroutine #2

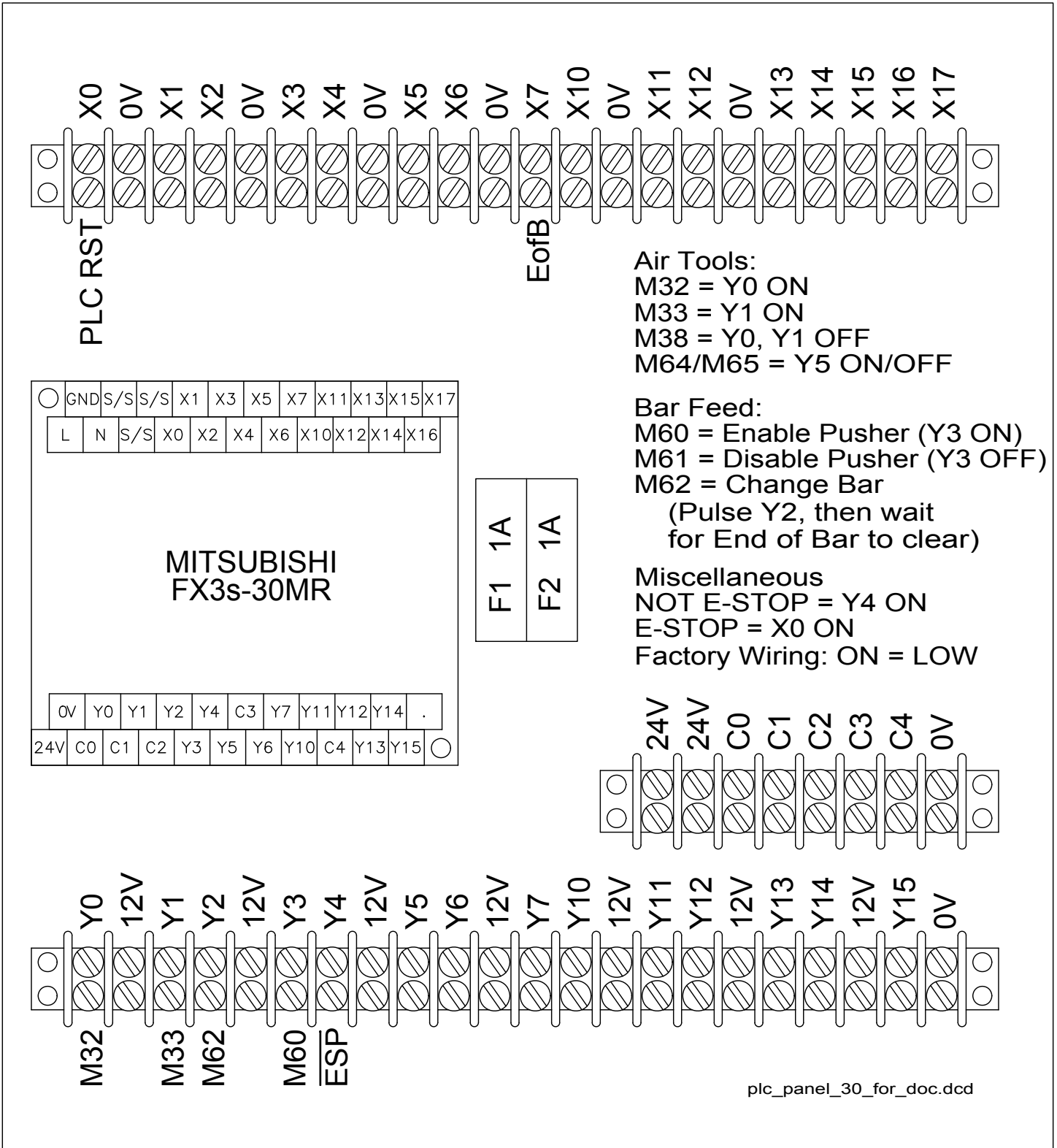
.
. .
. .

M99(End of sub routine)

Expanded I/O (PLC) Wiring



Expanded I/O (PLC) Panel



CNC to PLC Cable

