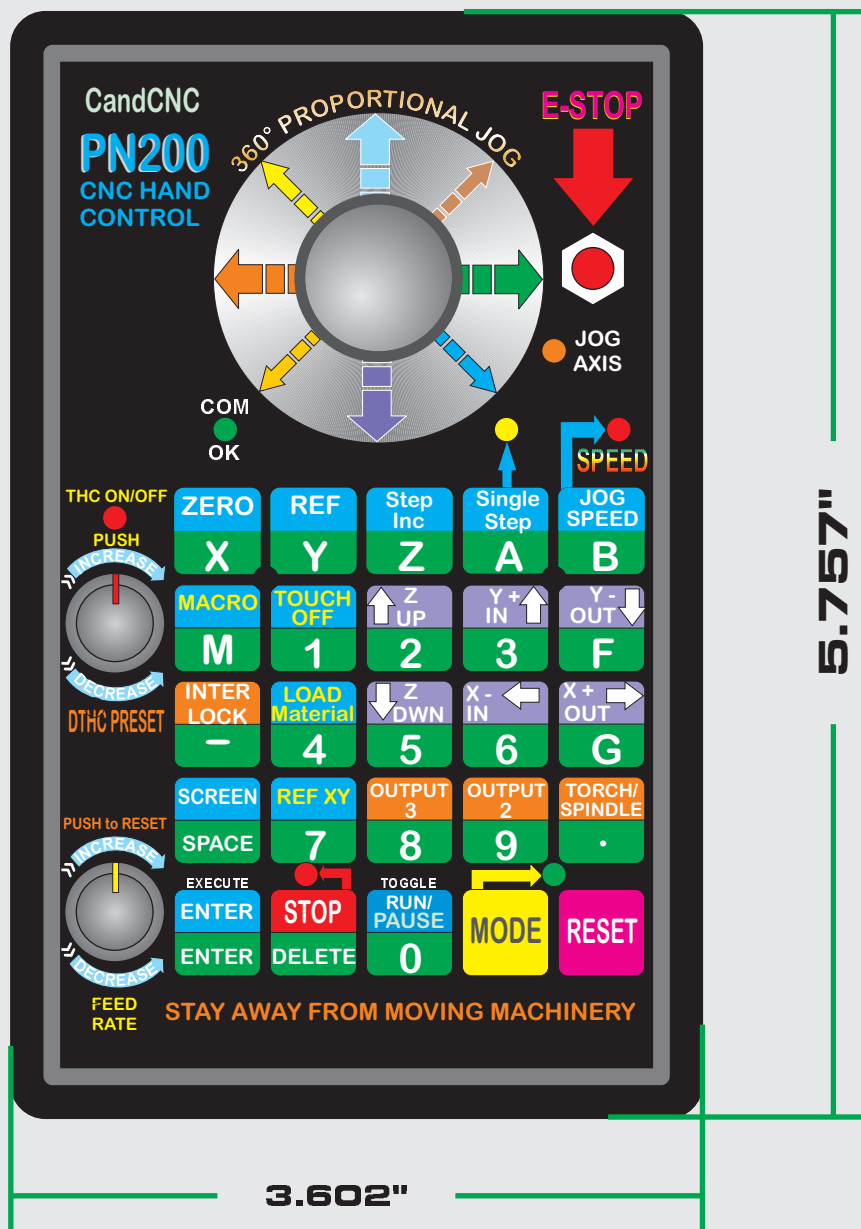# PN200 Hand Control for MACH3 based systems

PN200

TOTAL CONTROL from the PALM OF ONE HAND!

DISCLAIMER: THIS MANUAL IS NOT COMPLETE AND HAS NOT BEEN PROOFED:
A LATER REVISION WILL BE RELEASED WITH ADDED INFORMATION AND CORRECTIONS
....Please check the CandCNC website (Manuals Page) for updates
to this manual. We will also post any new Macros and new software.

360° Proportional Jog Stick. Allows motion in two axis. Direction is based on jogstick direction. Speed is from 10% to 100% of selected JOG SPEED based on deflection.
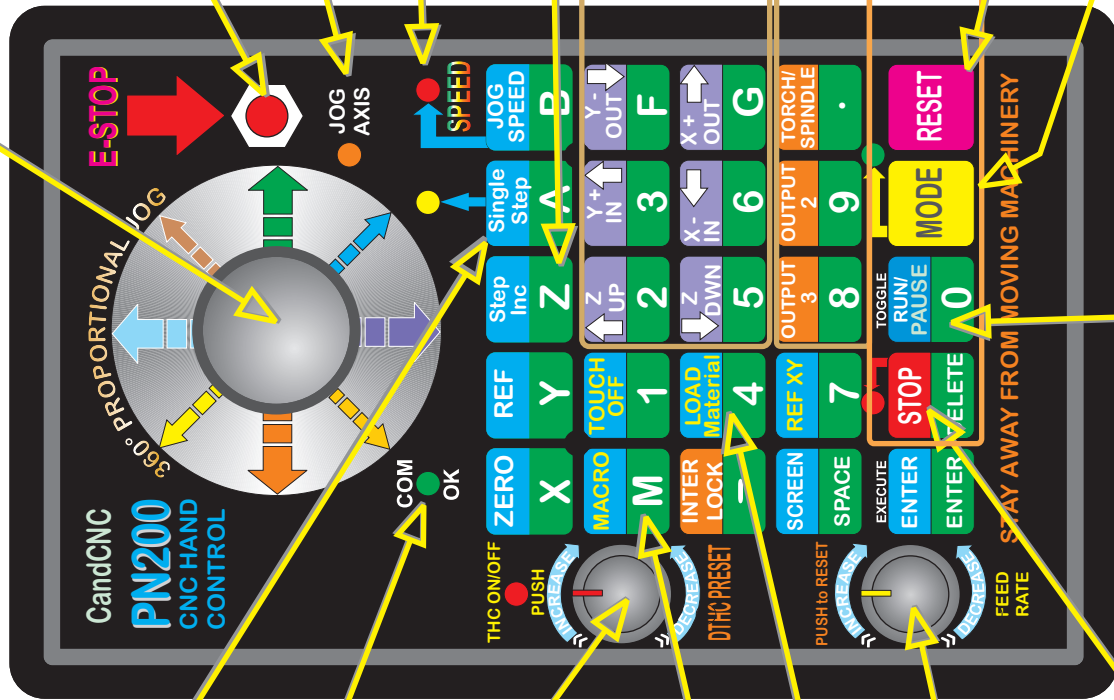
POSITIVE EMERGENCY STOP. Hardwired to system E-stop. Pendant must be plugged in for release

JOG AXIS LED shows axis pair selected for Jogstick (XY or ZA)

JOG SPEED LED indicator. Color and state shows current Jog rate: Flashing Green = 10%
Solid Green = 25% Flashing Red = 50% Solid Red = 100%

STEP INC Button. Sets set increment in .1 .01 and .001 increments JOG AXIS LED flashes Fast, Med, Slow

Keypad Jog Group. Fixed rate jog in single direction set by JOG SPEED. When in Single Step one step per push. Holding button down starts 5 steps per sec.

OUTPUT Control Group. Turns on Output1; Output2 and Ouput3. Requires INTERLOCK be depressed to turn any output ON

PROGRAM RUN GROUP. Provides control of program run. STOP (stops program) Run/Pause (toggle) RESET (shutdown).

RESET KEY: Brings MACH IN and OUT of RESET

MODE KEY. Switches keyboard function from SETUP to PROGRAM mode. LED changes color and state:
SOLID GREEN = Setup Mode
FLASHING GREEN =PROG
OFF = Run Mode
FLASHING RED = Reset

Number Keypad. 0 - 9, SPACE, • , ⁻, XYZABFGM for MDI G-code entry. ENTER executes a typed in G-Code line (MDI)

STOP LED:
SOLID RED = G-Code Stop (Code Loaded)
Flashing RED = Pause.

FEED RATE OVERRIDE ROTARY ENCODER Increases/Decreases Feedrate with rotation. Push on top to switch To reset Feedrate Override to 0 (normal commanded Feedrate. CLICK DETENT

Single Button Macros: Load Material (Move) TOUCH OFF (Torch)

MACRO CALL BUTTON: Allows calling stored macros using number keypad. ENTER executes the Macro (5 sec timeout)

DTHC ROTARY ENCODER (Plasma Cutting) Increases/Decreases PRESET VOLTS one volt per detent. Push on top to switch for Enable/Disable THC functions. Push & Hold for using with OXY-FUEL. LED on SOLID for THC active. OFF for THC OFF. FLASHING for Z manual (no THC) CLICK DETENT

COM LED. Shows RS485 communication with host. ON = Active

Single Step Option. Puts Jog mode in single step on all axis. Flashes LED

360 Degs of Jog Control
90 Stored Macros
80 + Functions
29 buttons
6 indicators (3 dual color)
3 Direct Run Macros
3 Modes
2 Rotary Encoders
1 Analog Jogstick
All in one hand

E-STOP
JOG AXIS
SPEED
JOG SPEED
Single Step
Step Inc
REF
ZERO
Y - OUT
Y + IN
Z UP
TOUCH OFF
MACRO
X + OUT
X - IN
Z DWN
LOAD Material
INTER LOCK
TORCH/ SPINDLE
OUTPUT 2
OUTPUT 3
REF XY
SCREEN
RUN/ PAUSE
TOGGLE
STOP
MODE
RESET
EXECUTE
ENTER
DELETE
SPACE

CandCNC
PN200 CNC HAND CONTROL
360° PROPORTIONAL JOG
COM OK
THC ON/OFF
PUSH
DTHC PRESET
PUSH to RESET
FEED RATE
STAY AWAY FROM MOVING MACHINERY

PN200 FEATURES LIST

Control virtually every aspect of your MACH based CNC machine from the palm of your hand!

Lightweight . Easy to hold, easy to carry, easy to store. Hangs with Velcro

Rugged, All Solid State. High Impact Plastic case. Sealed keyboard.

Matching Screen Files with Giant DRO's and LED's. Visible from 20 ft; Stand back and CONTROL!

Single, small, flexible, UTP CAT5 network cable. Can be used up to 100ft from PC

USB Connection at PC (requires optional USB to RS485 Adapter). Plug-n-Play installer.

Uses RS485 Communication. High Speed, industrial low-noise. Status LED com line is active

360° Proportional Jog stick. Jog axis Pairs XY or by clicking top switch, ZA

Jog Axis Designators and directions defined in USER SETUP (plug-in). Jog axis can be changed

Keypad Jog (Axis definitions in USER SETUP).

Single Handed Operation.

Rotary Encoders (spinners) for setting **Feedrate** and changing **DTHC** or **Spindle Speed** Settings

4 Selectable Jog Speeds/Ranges. Applies to both Jogstick and Keypad

Single Step Select (via keypad or jogstick)

Step Increment Select (for precise setup or touch off. Move in .1 , .01 or .001 increments Hold jog key down for step repeat.

3 preset Macros (single button macros)

Up to 99 Stored Macros. Recall and execute from keypad.

Easy to See Multicolor Status LED's

Program Mode allows entry and execution of single line common G-Code (MDI)

Large Emergency Stop Button is hardwired and NC. Safety shutdown if PN200 is unplugged.

There are several steps to installing and setting up your PN200 for proper opertaion. In the following pages we will guide you through the following steps

Inventory and check of components.
Running the Auto Install file from the CD
Attaching the USB-485 Module to your MACH3 Control PC
Checking the communications between the PN200 and the PC
Changing the screen set in MACH
Checking the PN200 for proper operation
Discovery of PN200 features
Using and Running Macros from the PN200
Hooking Up the E-STOP Button

PN200 + USB-485 Combo System

The PN200 uses Industrial RS485 Serial Communications that are extremely reliable and noise immune. Differential signaling and proper impendence matching, allows long runs of unshielded twisted pair (UTP) cable to be used for communication, and allows for small flexible cables. Since PC's do not ship with an RS485 communications port, and expansion cards for that purpose are expensive and hard to find, CandCNC developed our own USB to RS485 communications module. The USB-485 allows any PC with a Standard USB type 2 port to be used. **NOTE: Your MACH3 Control PC may need other types of communication ports to function with the Motor and advanced features. This USB solution is for use with the PN200 only and provides no other interface (at this time) for other system devices.** The USB-485 is placed close to the PC (5 ft interface cable included). It is recommended the USB-485 to PC cable NOT be longer than 6ft and NOT be extended beyond that. USB is not noise immune and not as robust a protocol as RS485 for reliable communications.   The PN200 was developed to be a hand Control that the operator can count on to respond and do the functions selected. Safety and reliability in a control are important. For controls that must operate in the harsh conditions of a shop and not subject the operator or the machine to possible out-of-control situations, the wireless approach was not considered.

PN200 Combo Kit as shown ships with:

    1ea PN200 Hand Remote Control
    1ea USB-485 USB to RS485 Communications Module
    1ea USB A to USB B 5ft Cable (PC to USB-485 module connection)
    1ea CAT5 UTP cable (25ft) PN200 to USB-485 connection)*
    1ea 9 to 12VDC wallplug power adapter (120VAC operation only)
    1ea Installation and Support CD
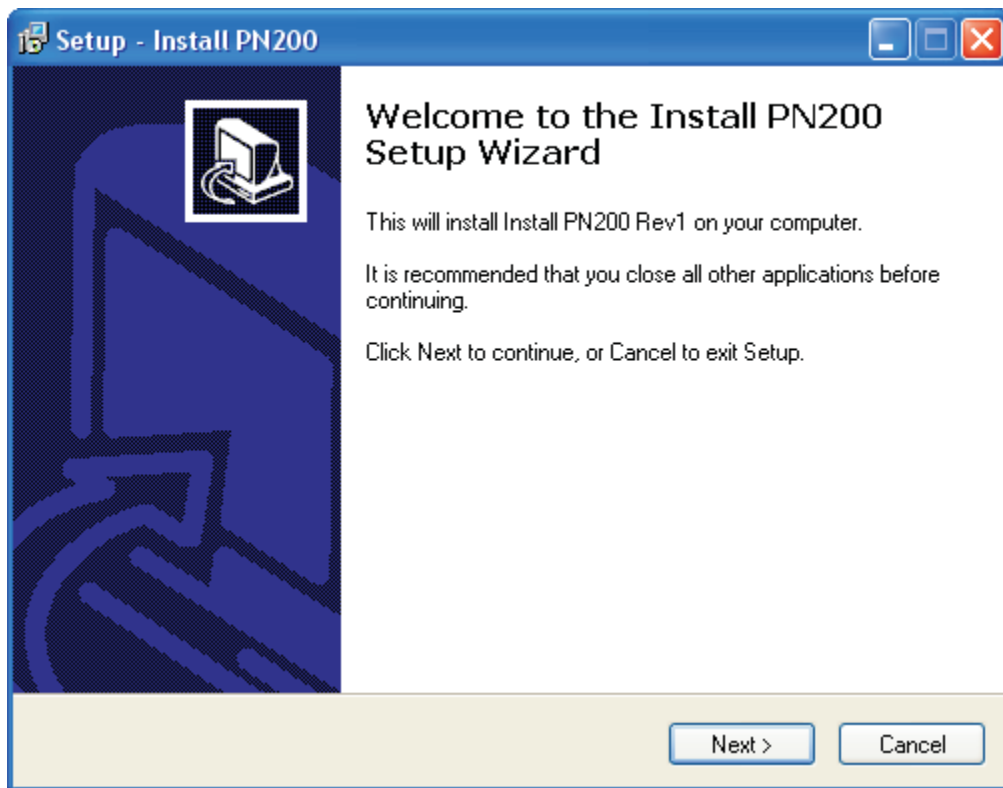
Running the Auto Install from the CD:

1. Place the CD in the CD slot of the PC you wish to use as the MACH3 Control PC.
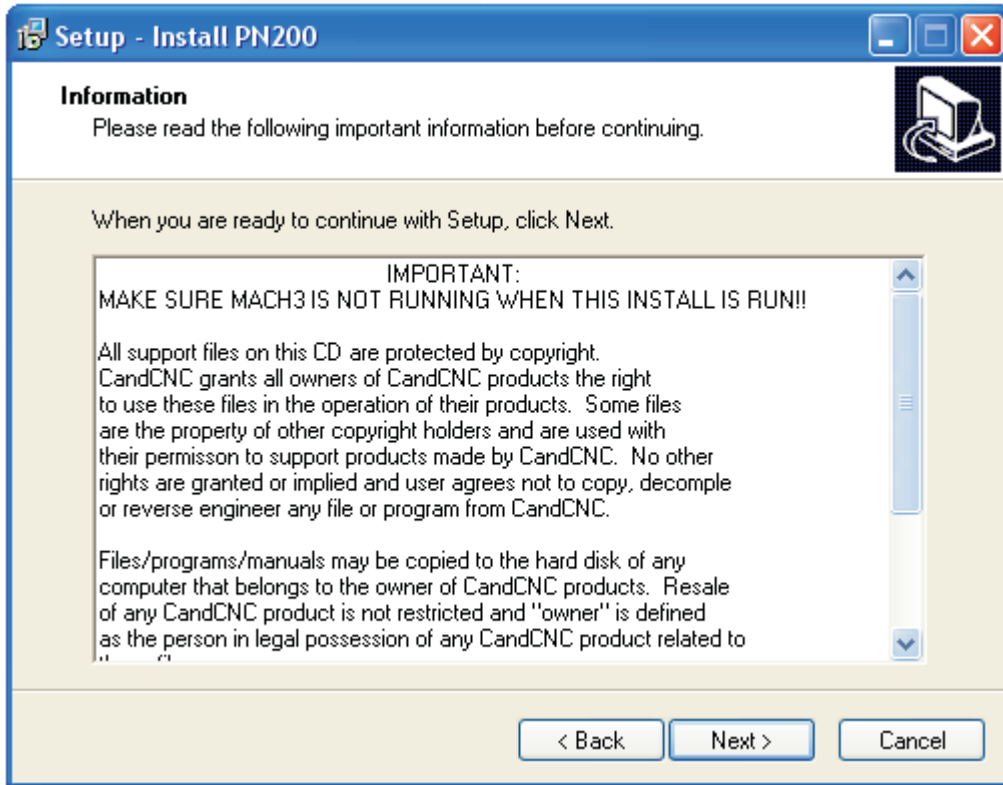
If your Control PC does not have a CD reader or do not have the install CD then use a computer with internet access to go to the following website
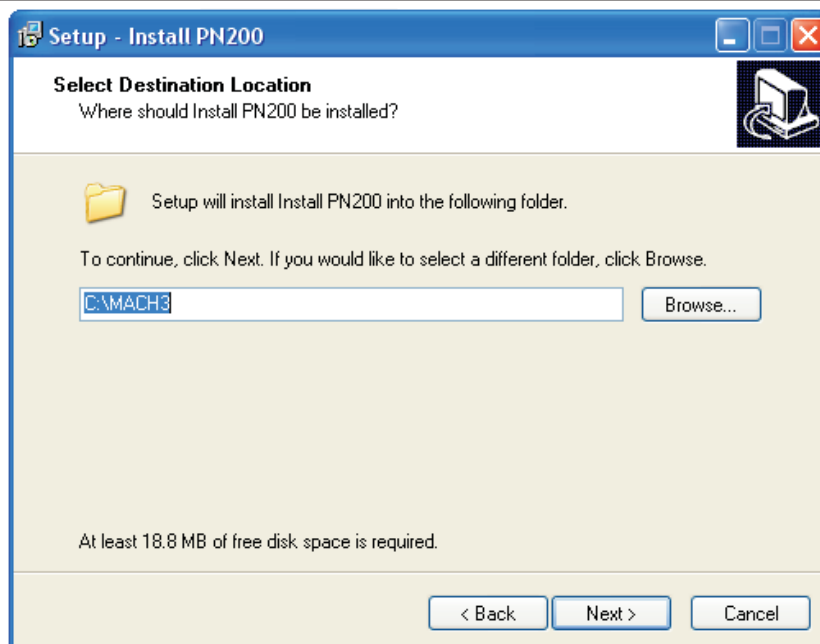
http://www.CandCNC.com/manuals.htm

navigate to the bottom of the page to the ZIP files and find the PN200 Installer file. Download the file and use WINZIP or XP unzip to extract the compressed file to a Memory Stick (or local folder if the PC is networked to the Control PC). The install MUST be run at the PC running MACH that controls your CNC machine.

2. In Windows use the File Explorer or START/My Computer to navigate to the CD.
3. You will see a file structure of several folders. One will be the manual. There will be another named AUTO-INSTALL
4. If you do not have the manual open to do the install please open the manual prior to starting the install

Setup - Install PN200

Welcome to the Install PN200 Setup Wizard

This will install Install PN200 Rev1 on your computer.

It is recommended that you close all other applications before continuing.

Click Next to continue, or Cancel to exit Setup.

Next >   Cancel

Setup - Install PN200

Information
Please read the following important information before continuing.

When you are ready to continue with Setup, click Next.

> IMPORTANT:
> MAKE SURE MACH3 IS NOT RUNNING WHEN THIS INSTALL IS RUN!!
>
> All support files on this CD are protected by copyright.
> CandCNC grants all owners of CandCNC products the right
> to use these files in the operation of their products. Some files
> are the property of other copyright holders and are used with
> their permisson to support products made by CandCNC. No other
> rights are granted or implied and user agrees not to copy, decomple
> or reverse engineer any file or program from CandCNC.
>
> Files/programs/manuals may be copied to the hard disk of any
> computer that belongs to the owner of CandCNC products. Resale
> of any CandCNC product is not restricted and "owner" is defined
> as the person in legal possession of any CandCNC product related to

[< Back] [Next >] [Cancel]

The next screen is pre-install information. Please take a couple of minutes to read through the text. Please note the line that says that the install is for XP (all versions) ONLY. The install and the PN200 HAVE NOT BEEN TESTED on WINDOWS 7. We cannot support the PN200 or this install on WINDOWS 7. **Please do not call or e-mail tech support if you are trying to make this work on any other OS than Windows XP. You may need to install Windows XP service Pak 2 to have the installer and or the drivers to work properly.**

Setup - Install PN200

Select Destination Location
Where should Install PN200 be installed?

Setup will install Install PN200 into the following folder.

To continue, click Next. If you would like to select a different folder, click Browse.

[C:\MACH3] [Browse...]

At least 18.8 MB of free disk space is required.

[< Back] [Next >] [Cancel]

The Installer will find the C:\MACH3 folder and ask you if you want to install to that folder. Select Next and let it continue.
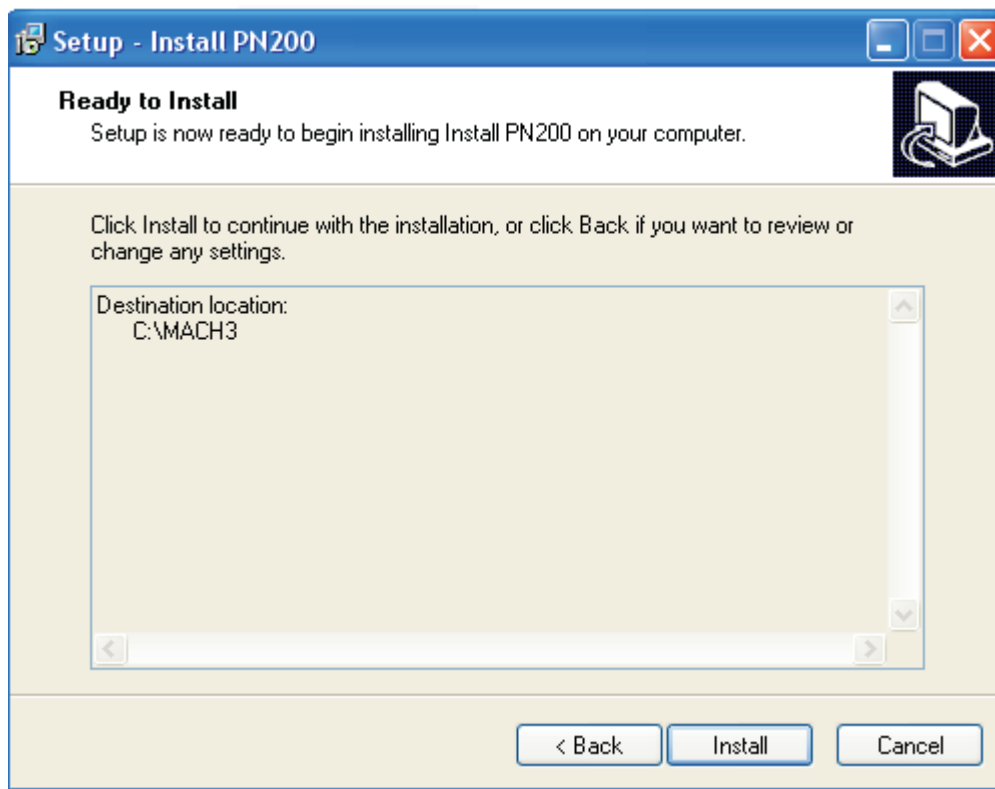
The next screen confirms the install location. If you have mach installed at any other location there will be parts of the install that will fail. The structure of MACH and it's folders is important and having it at any other location will cause problems in both operation and support. Select Install. The files will be uncompressed and put in the proper structure for MACH3. A load bar will show you the progess. The process should only take a few seconds before the "Welcome to the CandCNC Driver Installation" pops up
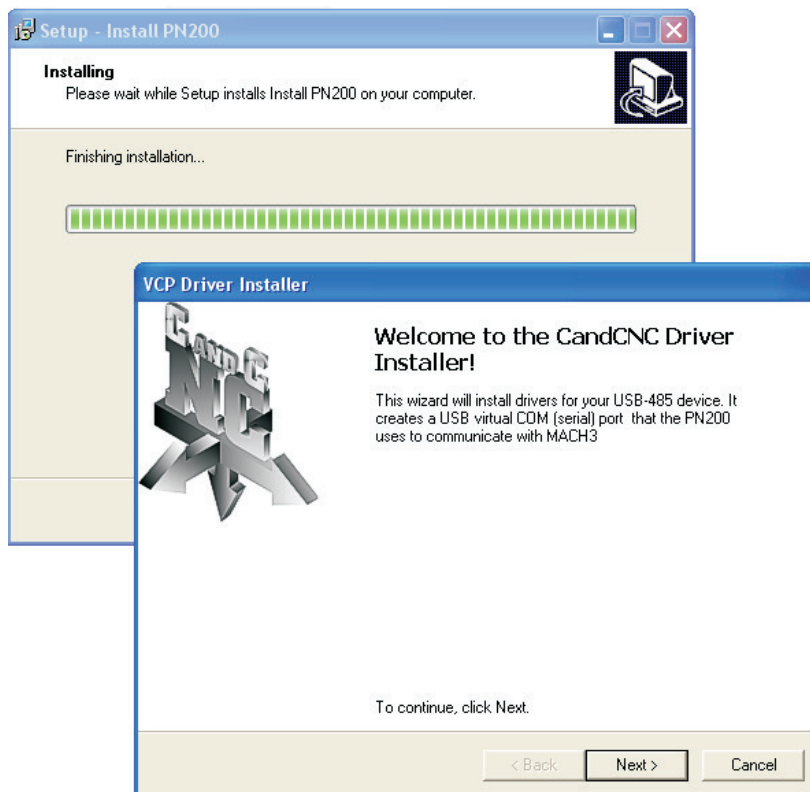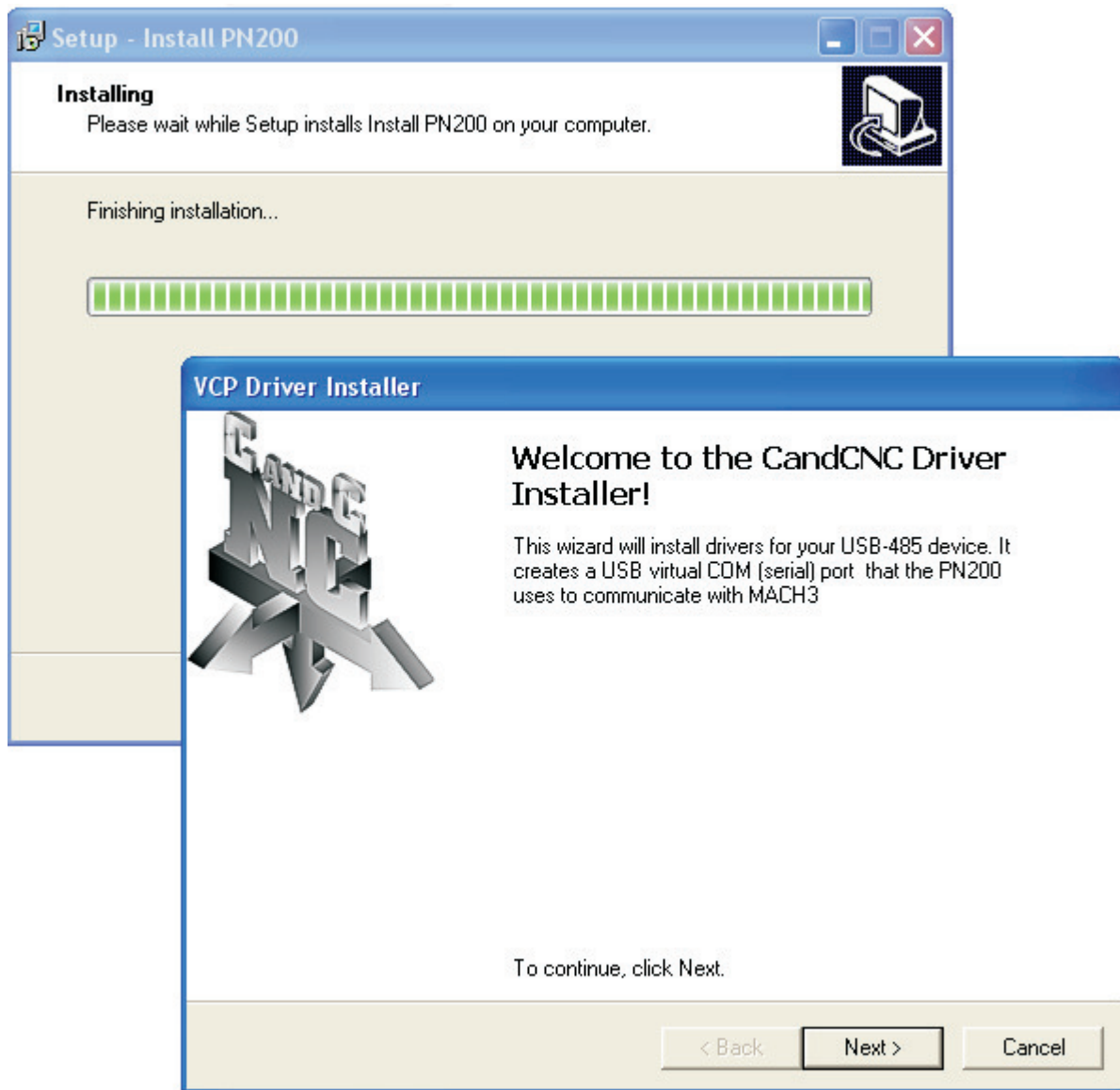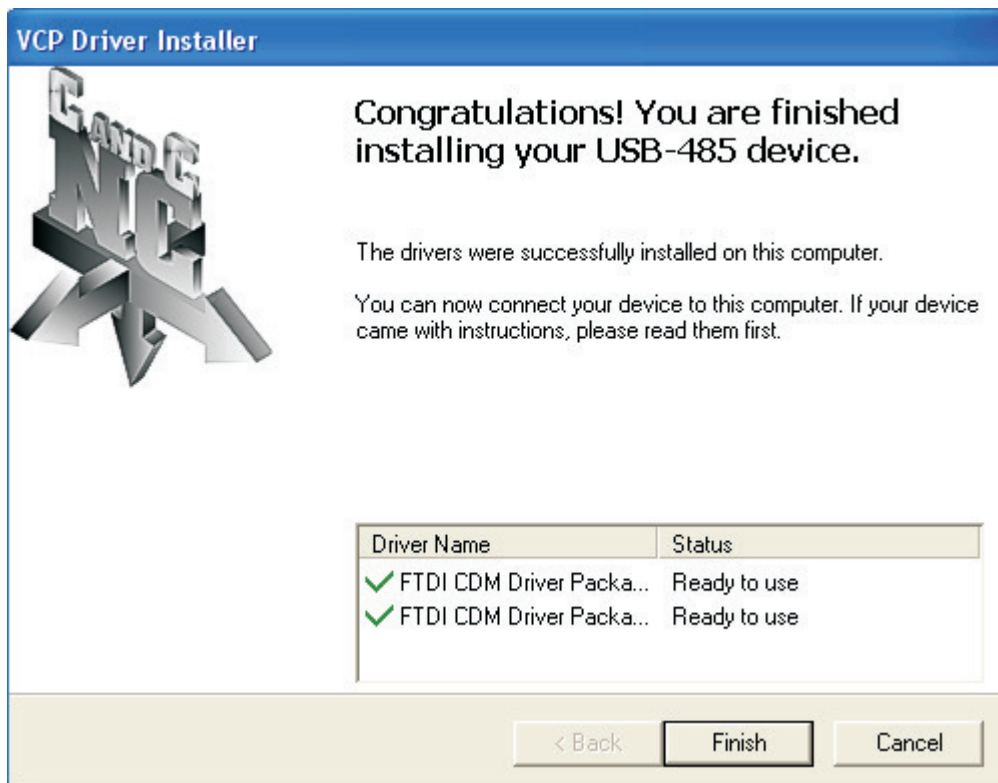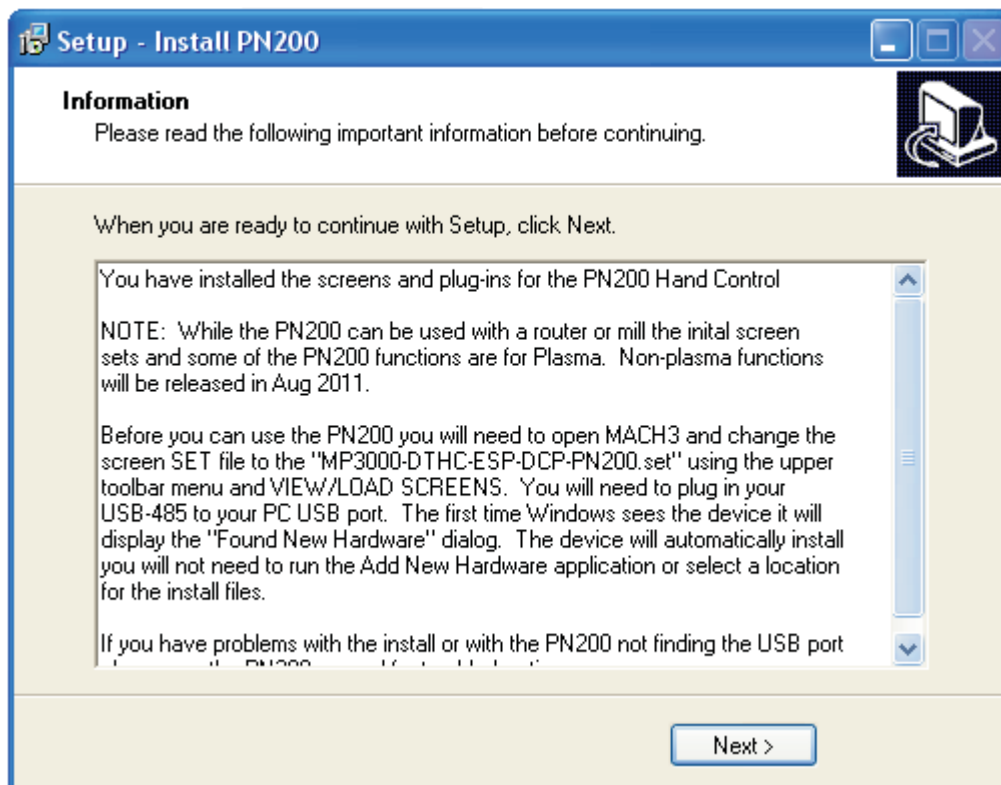
You should have the USB-485 module DISCONNECTED at this time. If you have connected the USB-485 module to a USB port Please unplug it BEFORE you hit the Next button!
Select Next to continue with the driver install, This will Install the drivers for the USB-485 module. At the end of the install you will get the screen on the next page
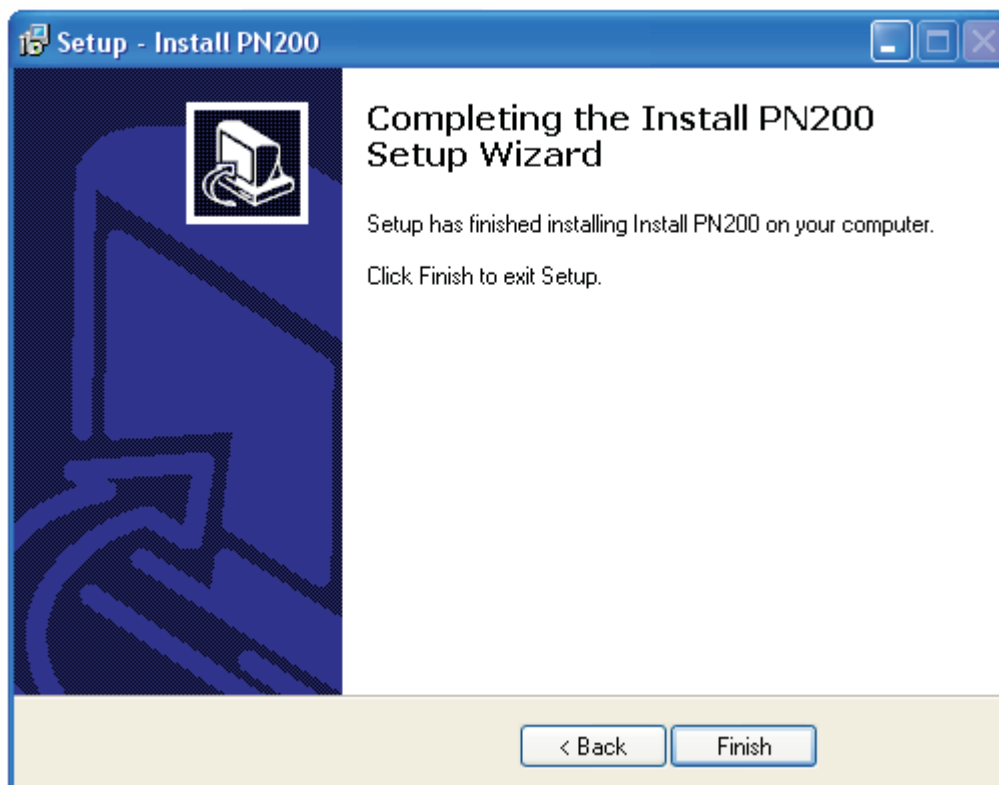
VCP Driver Installer

Congratulations! You are finished installing your USB-485 device.

The drivers were successfully installed on this computer.

You can now connect your device to this computer. If your device came with instructions, please read them first.

Driver Name	Status
✔ FTDI CDM Driver Packa...	Ready to use
✔ FTDI CDM Driver Packa...	Ready to use

< Back   Finish   Cancel

If you get the screen as shown, proceed to the next step by hitting the FINISH button.

IF YOU HAVE A RED X next to either Driver Name OR the Status is NOT "Ready to Use" your USB driver install has failed. You will not be able to use your PN200. Possible failures can be from a version of XP without at least SP2 installed or from a hardware issue with the USB ports on the PC. Select Cancel and stop the install. Make any upgrades you need and try again. If the install fails at this point again please contact us via e-mail (tom@Candcnc.com) or on the Support Forum (Yahoo Forum).

Setup - Install PN200

Information
Please read the following important information before continuing.

When you are ready to continue with Setup, click Next.

You have installed the screens and plug-ins for the PN200 Hand Control

NOTE: While the PN200 can be used with a router or mill the inital screen sets and some of the PN200 functions are for Plasma. Non-plasma functions will be released in Aug 2011.

Before you can use the PN200 you will need to open MACH3 and change the screen SET file to the "MP3000-DTHC-ESP-DCP-PN200.set" using the upper toolbar menu and VIEW/LOAD SCREENS. You will need to plug in your USB-485 to your PC USB port. The first time Windows sees the device it will display the "Found New Hardware" dialog. The device will automatically install you will not need to run the Add New Hardware application or select a location for the install files.

If you have problems with the install or with the PN200 not finding the USB port

[Next >]

The post installation screen gives some directions and details on what to do next. The actual detailed steps ARE IN THIS MANUAL and supercede any instruction in the Install dialog box. Click Next to proceed

Setup - Install PN200

Completing the Install PN200 Setup Wizard

Setup has finished installing Install PN200 on your computer.

Click Finish to exit Setup.

[< Back] [Finish]

WHAT TO DO NEXT

After you have installed the drivers and software:

     1. Plug the USB-485 wallplug to a source of 120VAC power. There is no power light on the module, so do not be alarmed if nothing lights up. (220-240 volt power modules are available from CandCNC or you can use any module rated at 9-12VDC at 300ma or higher)

     2. Use the supplied USB cable to connect the USB-485 to an open USB jack on your PC. As soon as you plug the USB cable in both ends you will see a small dialog box pop up in Windows (normally lower right hand part of the screen). It will advise "New Hardware Device Found". IT WILL AUTOMATICALLY INSTALL THE TWO DEVICES IT FOUND. You do not have to click or select any menu choices. If WINDOWS does not detect the plug-n-play device then either the device is not plugged in, not powered up (check the wallplug power pak to make sure it is firmly in a live plug) or the PC you have does not have active USB ports. Try another USB jack.
The new device found dialog may happen anytime you plug in the USB-485 after it is installed. It should find the device and not require a re-install of the drivers.

CHECKING to SEE if the USB-485 is properly installed

The drivers for the USB-485 are only active when the USB-485 is physically connected to a USB port and is ON. You do not need a PN200 attached to the USB-485 to do the following checks:
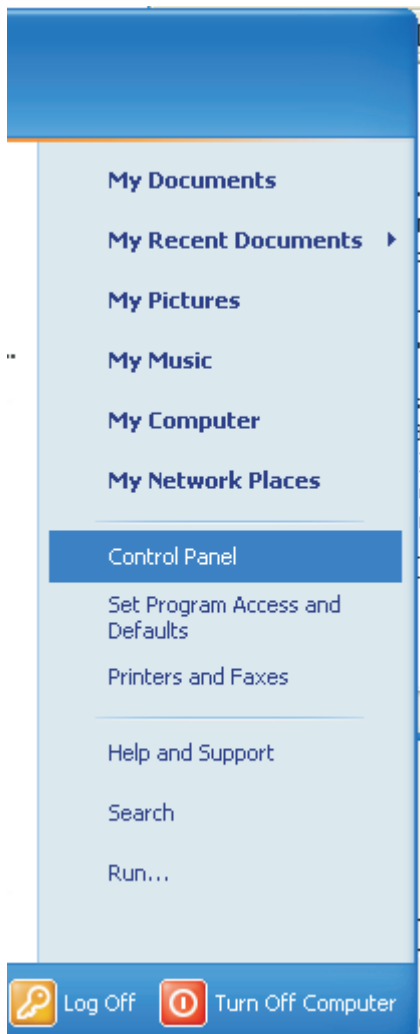
1. OPEN the CONTROL PANEL on your MACH3 Control PC.
2. Select "SYSTEM" from the Control Panel
3. You will see a set of TABS.
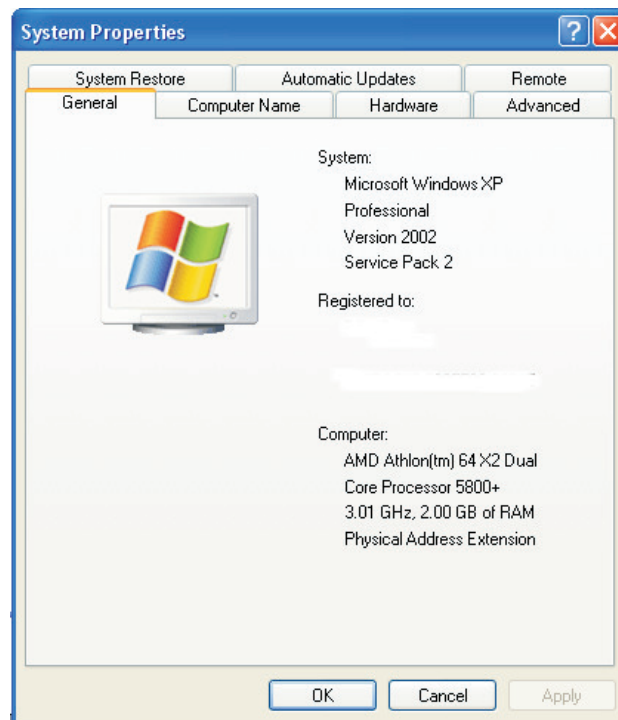
4. Select "HARDWARE" tab

5. You will see a List (tree structure) of hardware devices on your PC. Navigate to the Ports(COM & LPT) and expand the list by clicking on the + next to the device(s). You should see a list of the Port devices on your PC. There will be a "USB Serial Port" device listed with a "COM" number. You may not have the same exact stucture as is shown below. The device driver, when you plug in the USB-485, adds a COM port in the next available spot. In a PC with only one COM port (COM 1) it would put itself at COM2. In other installs it will put itself at the LAST USED COM number.

MAKE A NOTE OF THE COM number (COM3 in the screens below) that your USB Serial Port is attached to. You will need that number when you do the setup on the PN200 Plugin in MACH later in this manual.
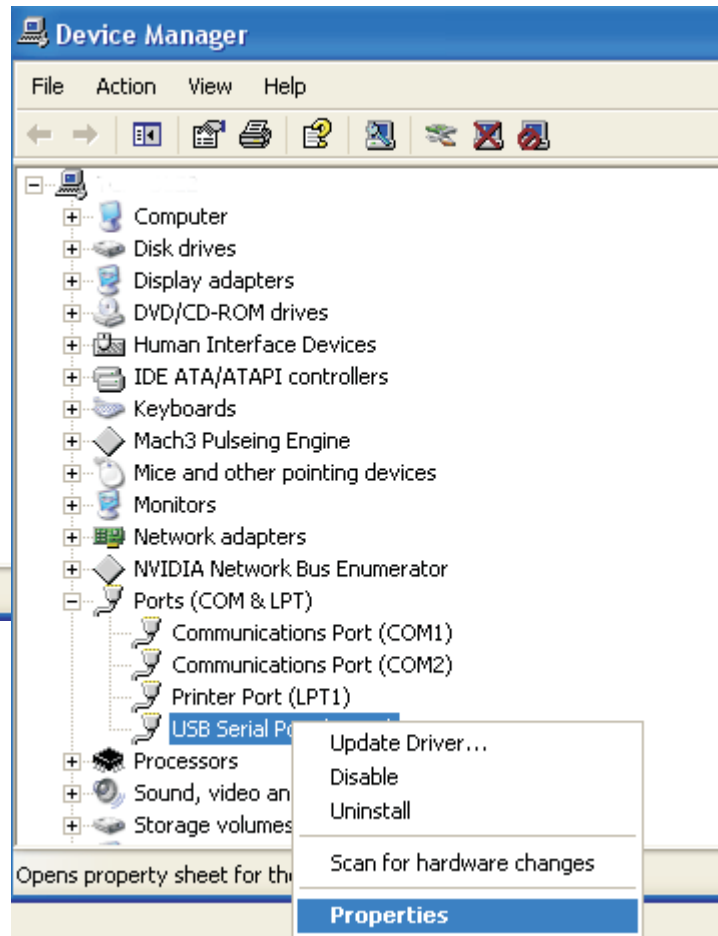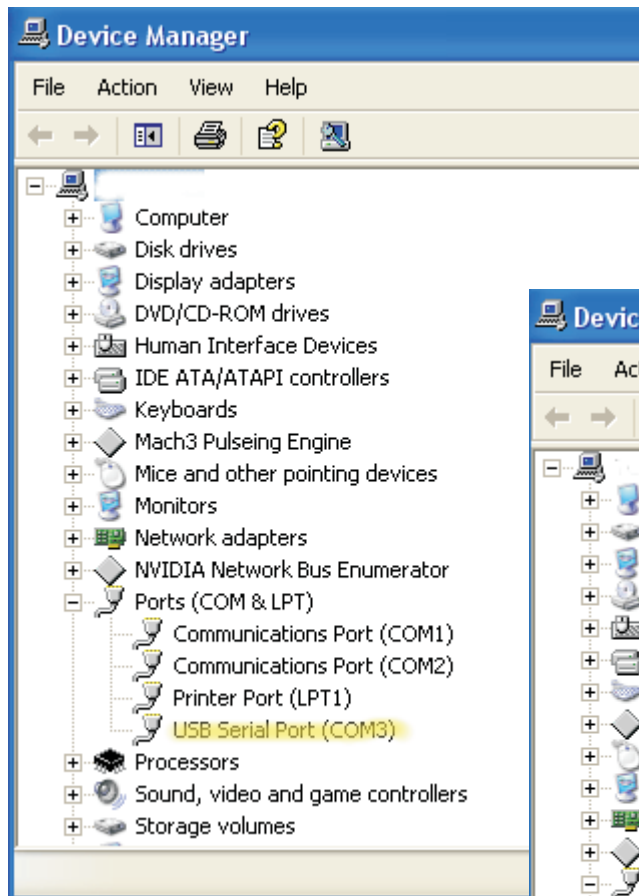
6. Next step is to check the Properties of the USB Serial Port and to make sure it is the correct device.

7. Select the "Driver" tab and note that the Driver Provider is FTDI. The driver version should the one shown OR HIGHER.

8. Once you have confirmed the driver and COM port number close the Device Manager.
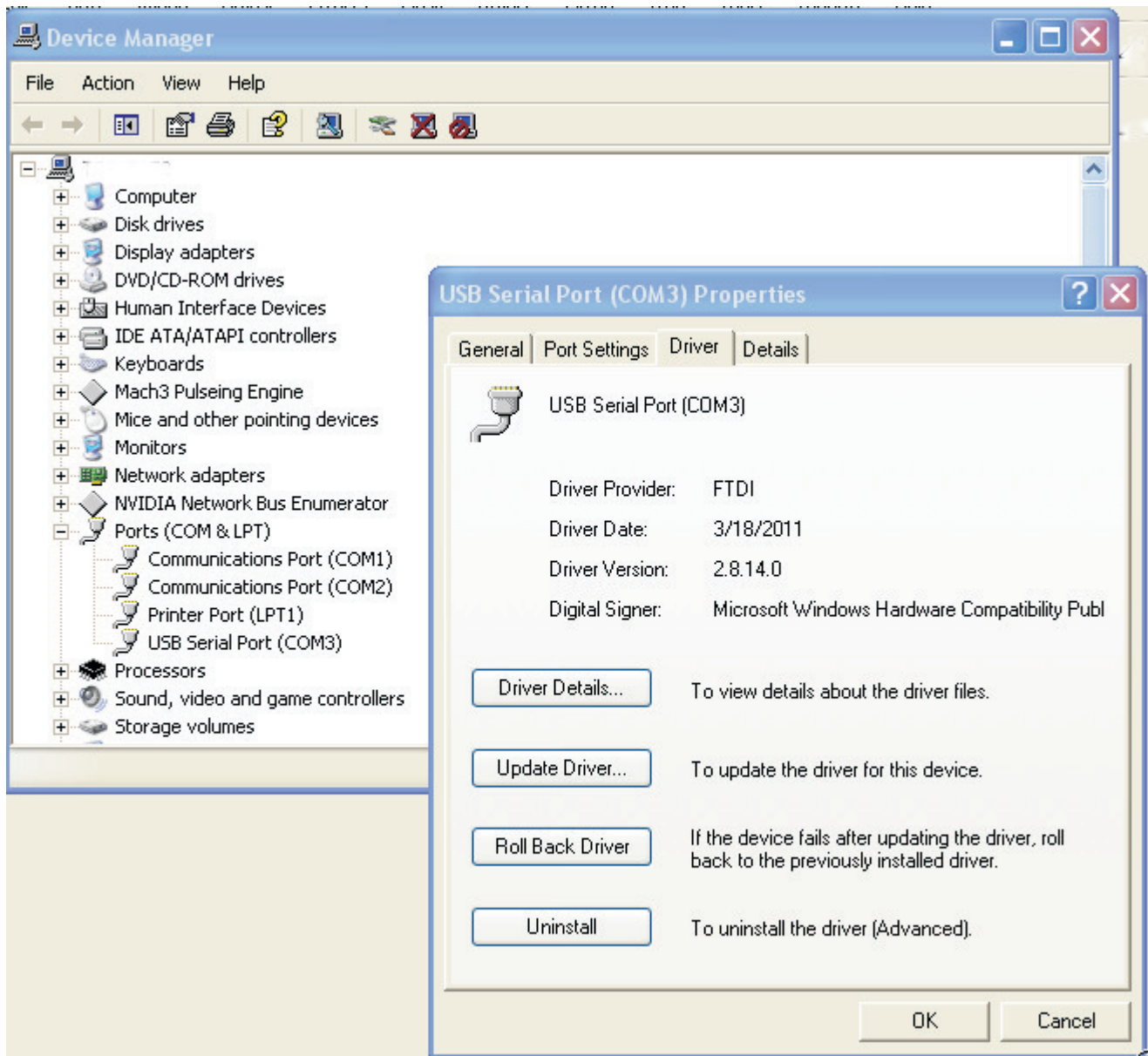
In order to have the new "Big Screen" set so you can see the screen from across the room when using the PN200, you must load the new screen sets into your MACH Profile. The screens are in dependant of the settings and you can change them without changing the setup or functions in the profile. NOTE: if you have custom screens you have built for your MACH install, you can open our screen set in Screen 4 (MACH screen painter) and add the new screens (9 and 10) and use it with your screens. You can copy entire screens and all of the objects and any code from one SET to another. If you are an OEM (volume buyer) with custom screens you or we have developed then contact us for help on updating your screens.
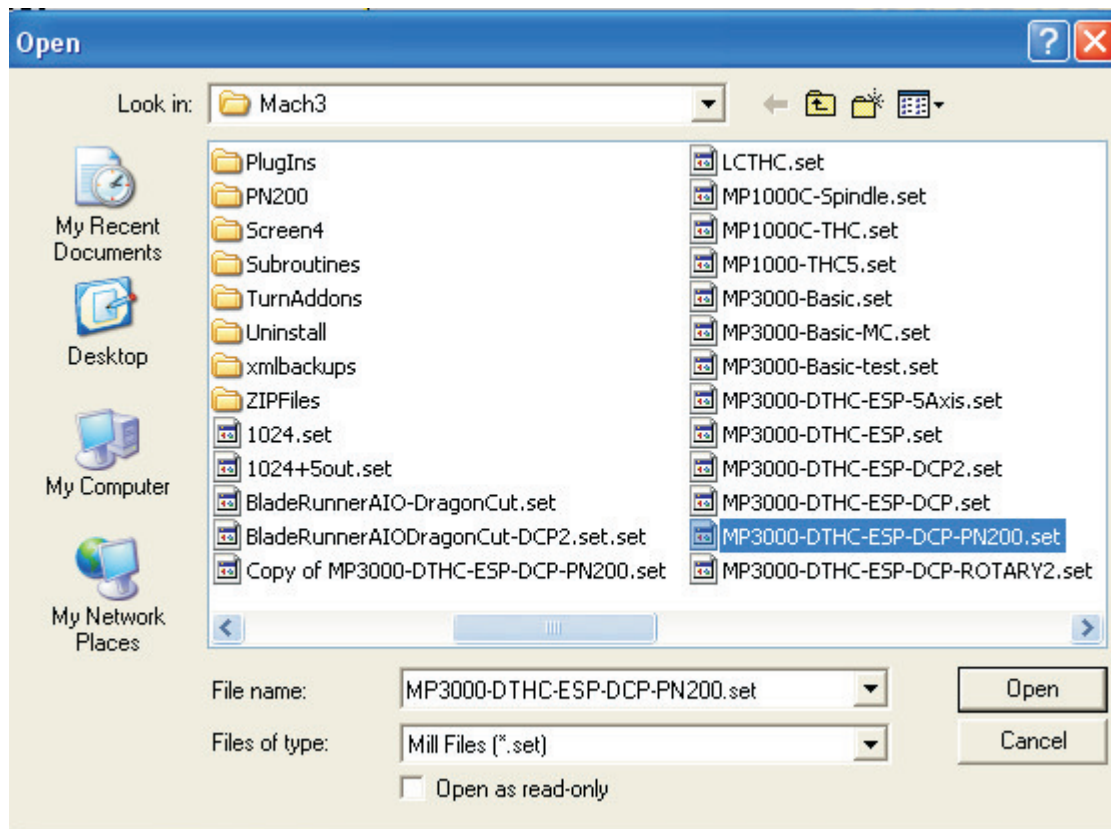
Loading the new Screens from CandCNC

1. The install program loaded a new screen set that is currently for plasma (router will follow shortly) but your running profile still is pointed to your previous screen set.
2. Open your current running profile of MACH
3. On the top menu bar find the VIEW button
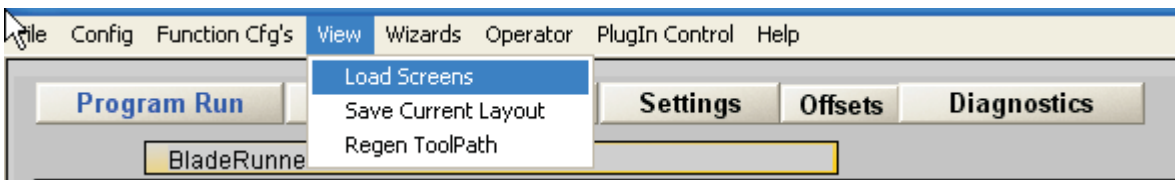

4. Click on Load Screens
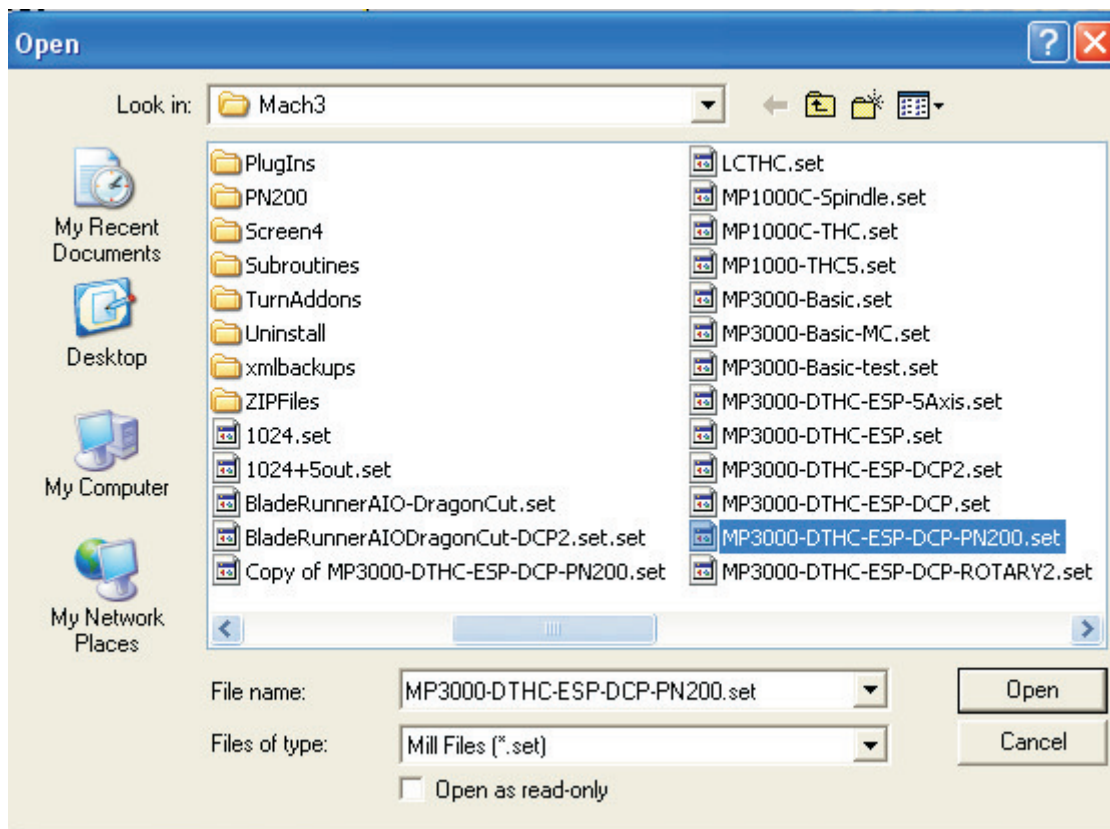
5. If the Explorer window is not on the MACH3 main folder use the "Look In" bar to navigate to the MACH folder. Scroll in the MACH3 folder until you find the MP3000-DTHC-ESP-PN200.set file highlighted above.

6. Once it is highlighted hit the OPEN button and MACH will load the new screen set (it may take a couple of seconds). If you are running the current MP3000-DTHC-ESP-DCP set the front page will not change.

Here are the two new screen pages that get added. They are accessible using the SCREEN button on the PN200 or the when you move to Program Mode on the PN200
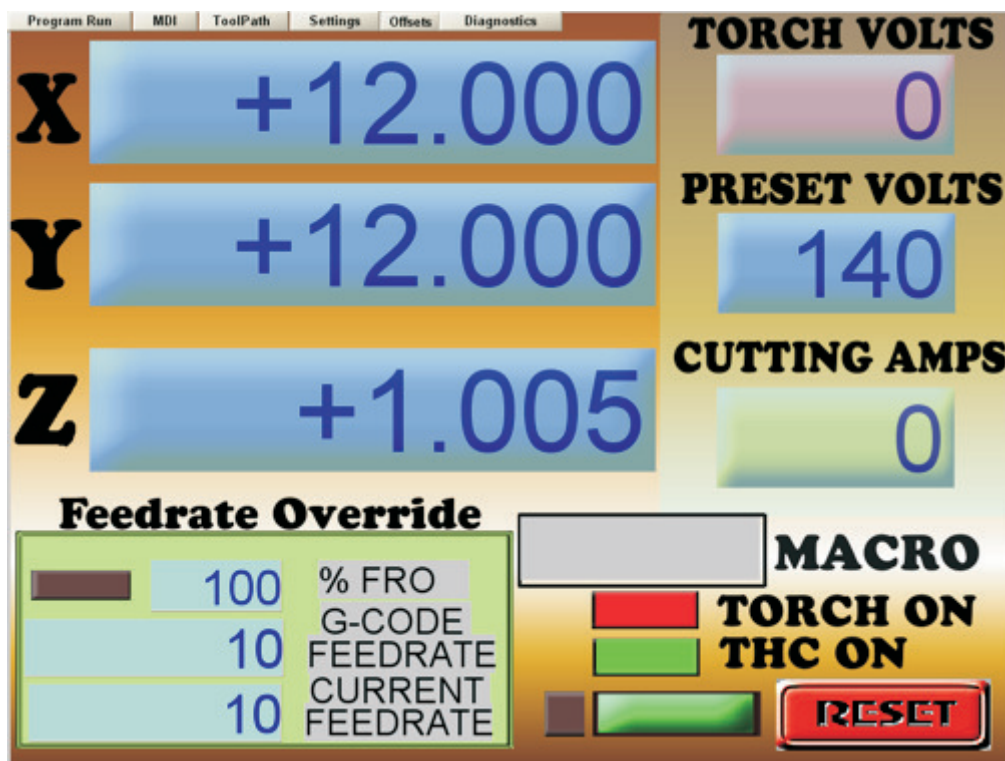

Oversized Program Run Screen
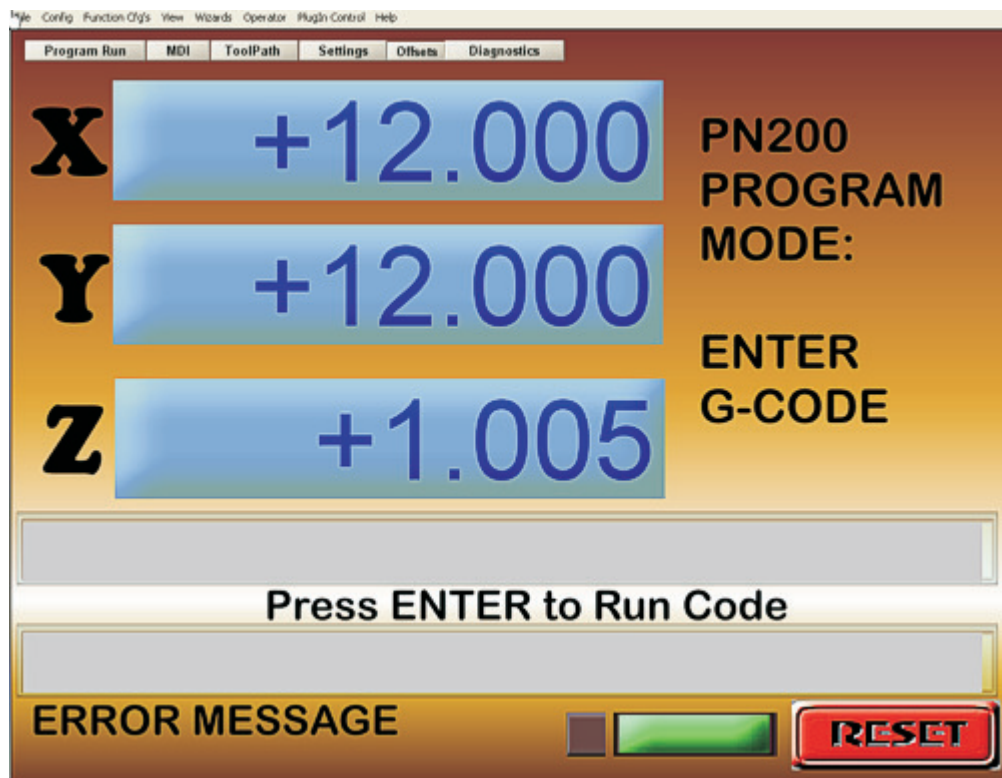
Oversized Program Mode (G-code input) Screen.

FINAL INSTALL : MACH3 Setups

1. Once you have the USB-485 module installed, you have confirmed the drivers are install correctly , you know the correct COM number and , the screen files updated, Start MACH3 (if it is not already running) and Load the MACH3 Profile you normally use. If you use more than one you will need to do the check, load screens and settings on EACH PROFILE.
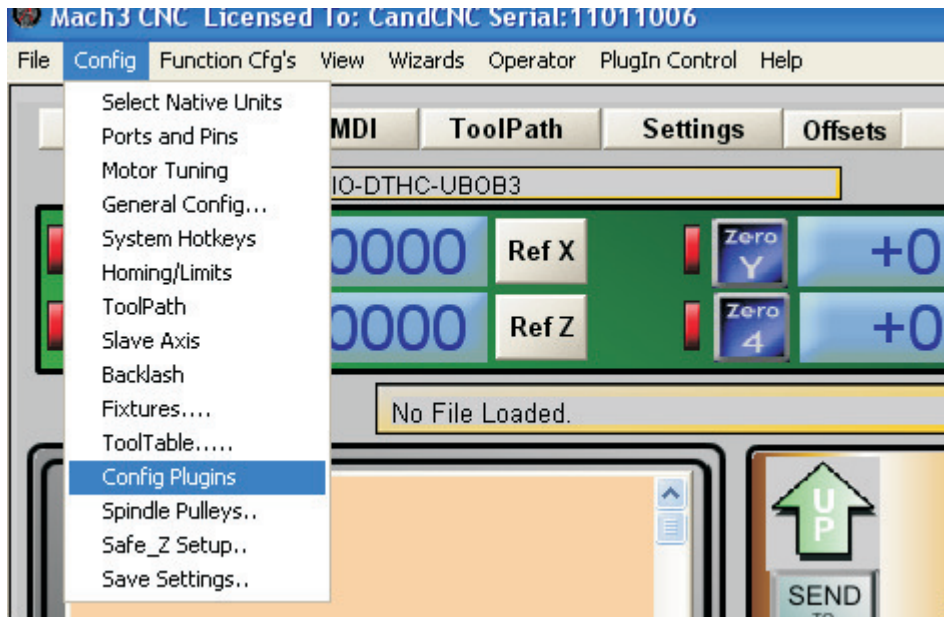
2. Use the Upper Toolbar and select the "Config" menus option. From the Drop Down List Box select the "Config Plugins" menus option
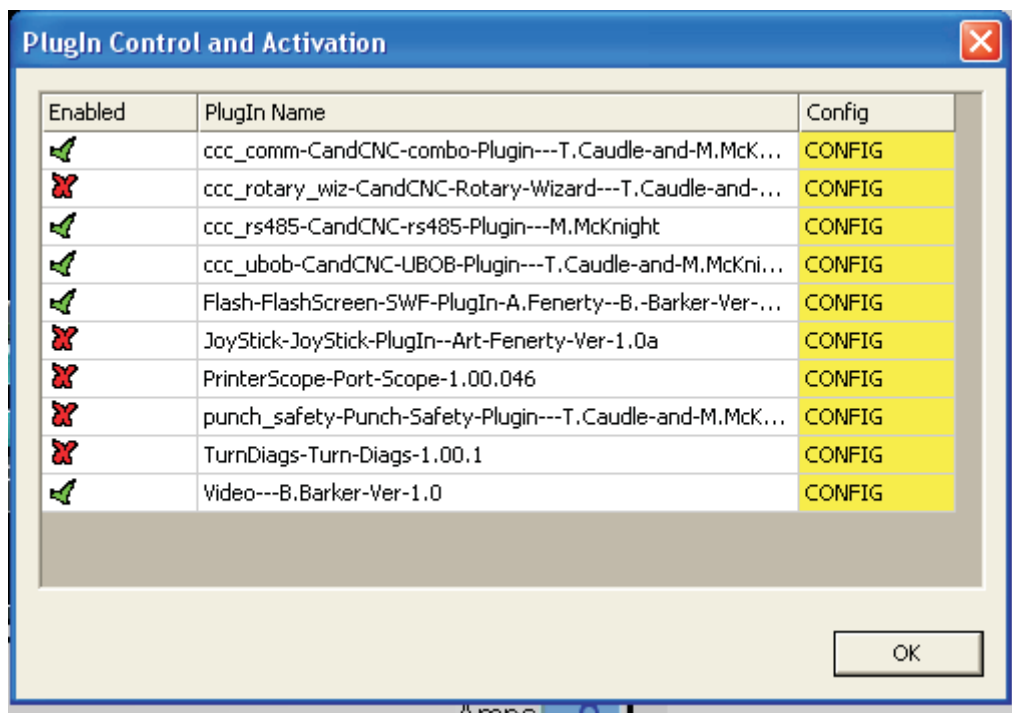
3. You will see a Menu window similar to the one above. Make sure the ccc_rs485 plugin is listed.

4, The Enabled column for the ccc_rs485 will probably be set off (RED X). Click on the RED X and it will change to a GREEN Check.

5. Before you click "OK" open the CONFIG dialog for the ccc_rs485 by clicking on the yellow CONFIG bar on the same line(row).
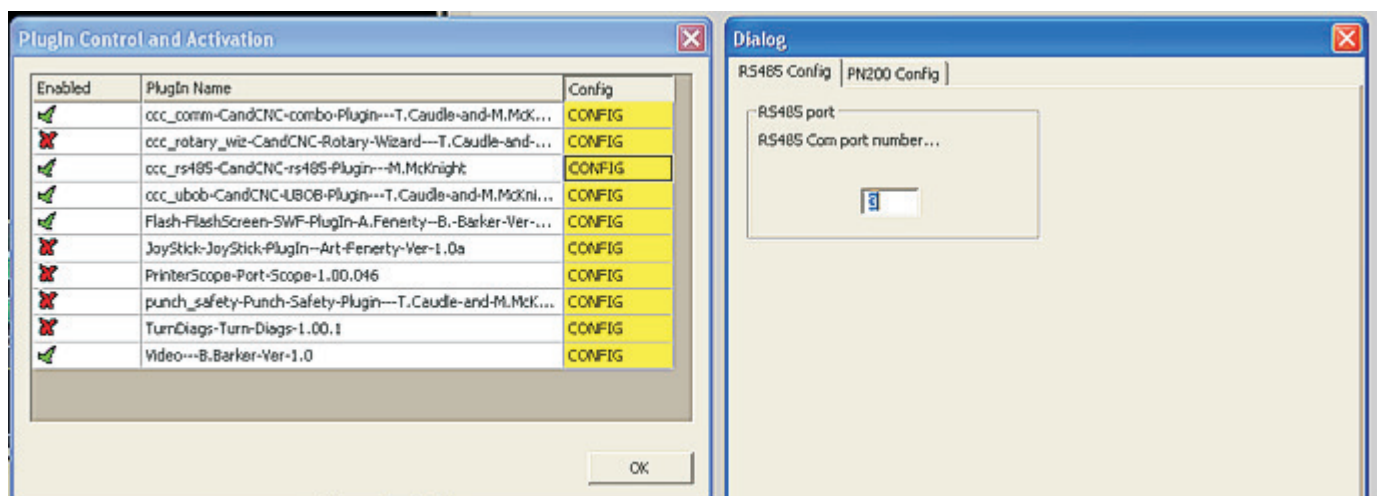
Proceed to step 6 next page

6. Check the COM port number in the PN200 Setup window. It MUST be set to the proper COM port your USB-485 is using. You have that number (right?) from the previous install steps. Put it in now. Do not worry at this point about the other option tab. Click OK and let it save the setup
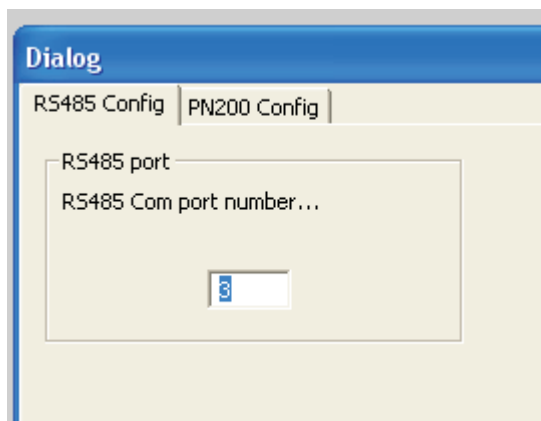
IMPORTANT INFORMATION:

Anytime you make changes to a MACH3 setting it is only saved in the Profile (XML) when you exit (shutdown normally)MACH3. Some settings take effect immediately. A CHANGE IN A PLUG_IN DOES NOT TAKE EFFECT UNTIL YOU STOP AND RESTART MACH3. AFTER YOU MAKE THE CHANGES TO THE PLUG-IN L:ISTED, STOP MACH (End Session - Yes) and Restart MACH with the same Profile.

7. Plug the PN200 into the Indicated Jack on the USB-485 module (marked for the PN200). Use the 25 ft CAT 5 cable suppled. YOU CAN USE A LONGER OR SHORTER CABLE BUT IT MUST BE A STANDARD NETWORK CABLE NOT A "Crossover" cable. DO NOT try to splice on a cable or use an extension plug (female-female jack) USE a single cable. DO NOT USE FLAT SATIN CABLE or intercom wire. It MUST BE UTP (Unshielded Twisted Pair) cable rated for network use. CAT 5 or better is recommended
8. As soon as you plug the PN200 into the USB-495 module it gets power. As soon as it gets power the internal circuits "initialize". When they do so they will FLASH ALL OF THE LED's ONCE (three times on later models). Look for this as an indicator that the unit has power and the unit is initialized

9 IF YOUR PLUG-IN is Enabled and you have selected the correct COM Port in the steps prior to this the PN200 should light up with several LED's on. In Most cases the MODE/RESET LED will be flashing RED. Other normal indications are noted below:

COM OK LED is ON GREEN

Shows GREEN for Normal XY plane Jog Pair

Jog Speed RED

Other LED's may be OFF or ON based on the current settings in MACH

MODE/RESET LED will be flashing RED if MACH is in RESET

NORMAL INDICATORS ON PLUGGING IN the PN200 if the Driver is active and the COM port is installed and set correctly

USING THE PN200 WITH
A CandCNC Controller

SETTING MACH3 internal variables for the PN200

Setting the Jog increment in the MACH Configuration

There are several MACH3 settings that need to have the proper values in order for the PN200 to function as it should. The first is the Jog Increment setting. It is found in the MACH screens at CONFIG/GENERAL CONFIG.

NOTE: Only the FIRST THREE settings are used to cycle through with the PN200. The default settings are 1, .1 and 01. Those need to be changed to .1, .01, and .001 for the first three. When the PN200 is put into single step mode then the Jog Increment is selected using the Step Inc key. The LED above the Single Step key will indicate which of the three Jog increments is the current setting.
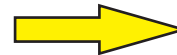
General Logic Configuration

G20,G21 Control
- ☐ Lock DRO's to setup units

Tool Change
- ⦿ Ignore Tool Change
- ○ Stop Spindle. Wait for Cycle Start.
- ○ AutoTool Changer

Angular Properties
Unchecked for Linear
- ☐ A-Axis is Angular
- ☐ B-Axis is Angular
- ☐ C-Axis is Angular

Pgm End or M30 or Rewind
- ☑ Turn off all outputs
- ☐ E-Stop the system
- ☐ Perform G92.1
- ☑ Remove Tool Offset
- ☑ Radius Comp Off
- ☑ Turn Off Spindle

M01 Control
- ☑ Stop on M1 Command

Serial Output
ComPort # 1   BaudRate 9600
- ⦿ 8-Bit 1 Stop   ○ 7 Bit 2-Stop

Program Safety
- ☐ Program Safety Lockout
This disables program translation while the External Activation #1 input is activated.

Editor
GCode Editor   [Browse]
C:\WINDOWS\NOTEPAD.EXE

Startup Modals
☐ Use Init String on ALL "Resets"
Initialization String
G80 F10

Motion Mode
- ⦿ Constant Velocity   ○ Exact Stop

Distance Mode
- ⦿ Absolute ○ Inc

IJ Mode
- ○ Absolute ⦿ Inc

Active Plane of Movement
- ⦿ X-Y ○ Y-Z ○ X-Z

Jog Increments in Cycle Mode
Position 1   .1
.01
.001
.0001
Use 999 to indicate a Continous Jog selection.   0.0001
1
0.1
0.01
0.001
Position 10   0.0001
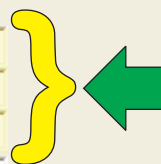
While the rest of the Jog Increment settings effect the jog increment if you are in single step mode at the console and cycle through they have no effect on the three jog increments used by the PN200.

SETTING MACH3 internal variables for the PN200

Setting the LOAD MATERIAL POSITION in the MACH Screens

The following setting is located in the custom screens provided by CandCNC with all of our products. If you are using another screen set you will not have this tab and will not have the Load Material option. In that case you will not be able to use the Load Material single button Macro. See the *Using and Programming Macros* section to be able to use preset values in a macro. It's not as clean as having values you just input from MACH but it works.

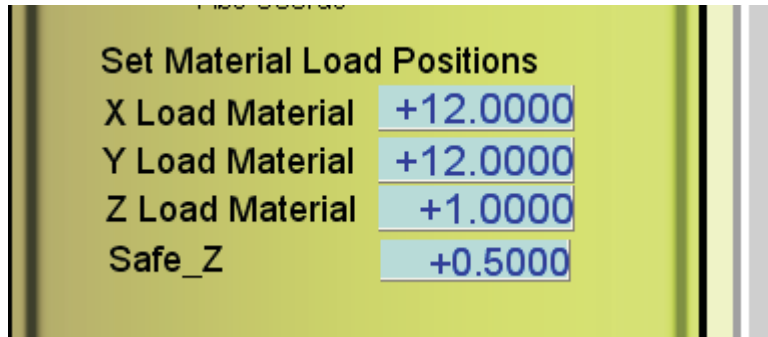**Set Material Load Positions**

X Load Material	+12.0000
Y Load Material	+12.0000
Z Load Material	+1.0000
Safe_Z	+0.5000

For users with the CandCNC screen set open the SETTINGS TAB and in the right hand part of the screen you will see 4 blue DRO's that hold the settings for load material. In order to enter and change a value (in ANY MACH DRO) you first click on the DRO (will turn the background another color and type in the value you want. **YOU MUST HIT ENTER for the value to actually be stored.** In the Load Material DRO's put the values for each axis. You cannot have zero in any of the three axis (XYZ) locations or the macro will not run. There is a detailed breakdown of this specific Macro in the *Using and Programming Macros* section of this manual.

Setting the Touch-off Switch offset value in MACH

Starting with the PN200 screen sets we have added a place to input the Switch Offset value in MACH. This is used with the "Touch Off " Macro on the PN200. It is the exact same number you use with the DTHC programmed into the SheetCAM post (see the DTHC or DTHCII manuals for details on determining and setting the SwitchOffset variable in SheetCAM or in the Home offsets in MACH (BUT NOT BOTH!). At this point the value in the Settings Tab is ONLY used with the PN200 and the Touch-off macro and the value must be > 0. Later we will make available a new Post for Sheetcam that can call the macro rather than use the internal value.

THC Rate -30.0

THC Rate sets Z response times
Rates too high can cause
lost steps during THC moves

Z Axis Switch Offset **0.000**

Stored

Stored Settings

CUT PROFILE

Settings

THC Delay (Sec) 1.0

THC Delay sets delay for MACH to
Start responding to UP/DOWN signals
THC Delay runs concurrent with
THC Delay in DTHC Settings

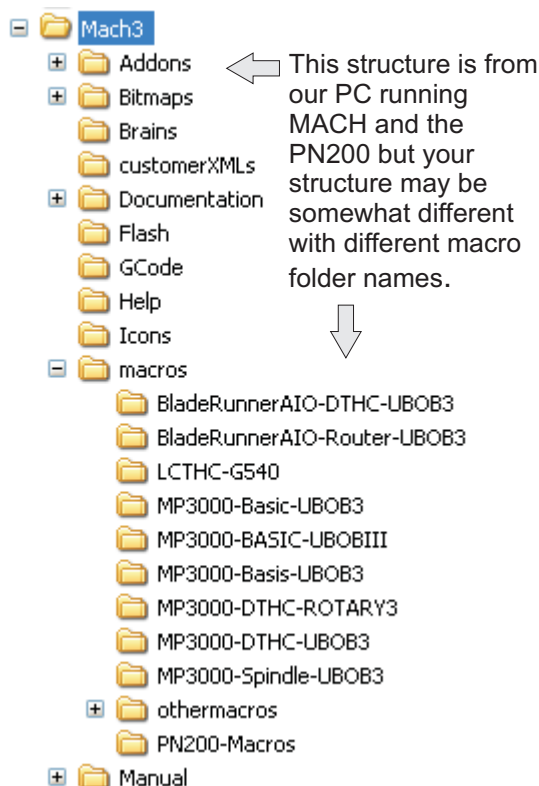Put in your Switch Offset value for your FloatingTorch Holder here

INTRODUCTION

Writing macros can be complex and is the subject of numerous manuals, internet forums. For more detailed information a good place to start is the MACH Forum at http://www.machsupport.com/forum/index.php. The macro language in MACH is based on a subset of VBScript. There are internal MACH functions and variables that can be accessed to interact with the script. The scripts and get or put vaules in screen DRO's (Digital ReadOuts) activate buttons, read the state of inputs and activate and deactivate outputs. Another powerful feature is to run g-code and to use common logic processes in VB like the IF..THEN...ELSE and DO WHILE. Standard math functions are available.

Macro language is in basic text and can be built with nothing more complex than a simple text editor. MACH contains a VB editor and there are several editors that make the process easier to read. While the script must use the correct syntax' formatting is less stringent. Most programmers use formats like indents and comments to make the code easier to read and understand. While VB code can get complex and have thousands of lines of code, most single purpose MACH scripts are scripts are less than a hundred lines.

It is not the intent of this manual to teach the user how to write complex macros but tp introduce the reader to the concept of MACROs and to cover how the PN200 can access and use a wide variety of macros.

It is important to understand that each MACH Profile has it's own set of Macros. In MACH the structure looks like that shown below. Note that in the MACROS subfolder the are folders each named the same as the Profile. This structure is created when you use the MACH Loader to COPY a profile. The macros associated with each profile are in that profiles macro folder.

This structure is from our PC running MACH and the PN200 but your structure may be somewhat different with different macro folder names.

NOTE: The Auto - Install file for the PN200 adds the M1000-M1009 series macros to ALL macro folders. It does that using a simple Batch file. New macros when released will be available as single files that will need to be copied to every profile macro you will use them in. There will be a master macro installer folder and it will contain all of the current released macros in the M1001 to M1025 range and will install (overwrite) all of the macros of those numbers in ALL of the macro folders,

Curve0.dat	1 KB	DAT File
Curve1.dat	1 KB	DAT File
Curve2.dat	1 KB	DAT File
fixtures.dat	13 KB	DAT File
Linearity.dat	1 KB	DAT File
tools3.dat	19 KB	DAT File
FeedRate.m1s	1 KB	M1S File
HiddenScript.m1s	1 KB	M1S File
m3.m1s	1 KB	M1S File
m4.m1s	1 KB	M1S File
m5.m1s	1 KB	M1S File
M6End.m1s	1 KB	M1S File
M6Start.m1s	1 KB	M1S File
M10.m1s	1 KB	M1S File
M11.m1s	1 KB	M1S File
M40.m1s	1 KB	M1S File
M41.m1s	1 KB	M1S File
M50.m1s	1 KB	M1S File
M51.m1s	1 KB	M1S File
M55.m1s	1 KB	M1S File
M56.m1s	1 KB	M1S File
M101.m1s	1 KB	M1S File
M102.m1s	1 KB	M1S File
M559.m1s	44 KB	M1S File
M1001.m1s	0 KB	M1S File
M1002.m1s	0 KB	M1S File
M1003.m1s	0 KB	M1S File
M1004.m1s	1 KB	M1S File
M1005.m1s	0 KB	M1S File
M1006.m1s	0 KB	M1S File
M1007.m1s	0 KB	M1S File
M1008.m1s	0 KB	M1S File
M1009.m1s	0 KB	M1S File
spindlespeed.m1s	1 KB	M1S File
VerifyTest.m1s	1 KB	M1S File

Shown is a typical file structure inside one of the named macro folders. Several of the files are "default" put there by MACH when the profile is created. It is STRONGLY advise not to edit, modify or mess with any of the named macros or any macro numbered below M100.   The Hiddenscript.m1s is actually part of the screen script associated with the specific profile and should never be opened with anything external to the VB Scripting app for working with the Edit Buttons in the MACH application.

Note the macro numbers are M1000 and above. The PN200 uses those exclusively for both single button and user defined macros. IT IS ADVISED TO NOT USE OR EDIT M1001 through M1025. Marcos in the M1001 to M1009 are reserved for the "Single Button" macros on the keypad. Presently there are only three single button macros available (M1001; M1004 and M1007. If you make changes to the any of the three listed macros you effect what the macro does direct from the keypad. New Macros to be released will be numbered in the span from M1010 to M1025. If you wish to program your own macros, or use ones from another source, first test the macro in MACH and run it in the VB editor to assure it does exactly what you want then use a number above M1025. That will prevent having to move or re-number any macro we will release in the future

HOW TO CALL A MACRO WITH THE PN200 HAND CONTROL

The **Single Button Macros** are called and executed directly using the labeled buttons on the Keypad. They are in the M1001 to M1009 range and are numbered to match the numbers on the keys. To call the TOUCH OFF macro (M1001) you simply push that key anytime the PN200 is active and not in RUN Mode.
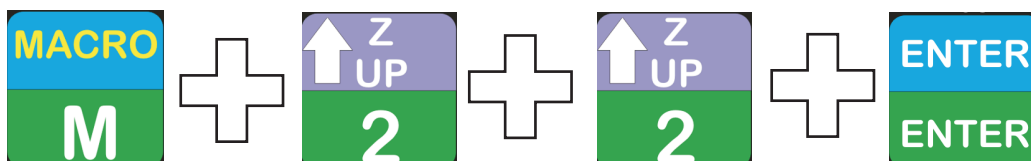
To run a custom stored macro you must know the last two digits of the macro.
EXAMPLE: To call a macro numbered M1022 you would just need to remember the '22 part of the number. To run that macro you would:
1. Hit the "MACRO" button and follow that with the number button 2 twice.
2. You then have 5 seconds to hit the ENTER button (lower left) to EXECUTE the macro, If you wait beyond the 5 seconds the input is cancelled.

M1001 MACRO WITH COMMENTS

' strings beginning with a single quote character and not closed are comments and are ignored by the code engine during processing.
' each line of a comment must start with a single quote character
' they can help clearify the code and let you remember months or years later what you did!
' spaces, tabs and indents are ignored by the code engine
' this macro performs the touch off operation and uses a value from the CandCNC screen set.
' warning spelling is important. A variable with another name is treated as a new variable and will return a 0
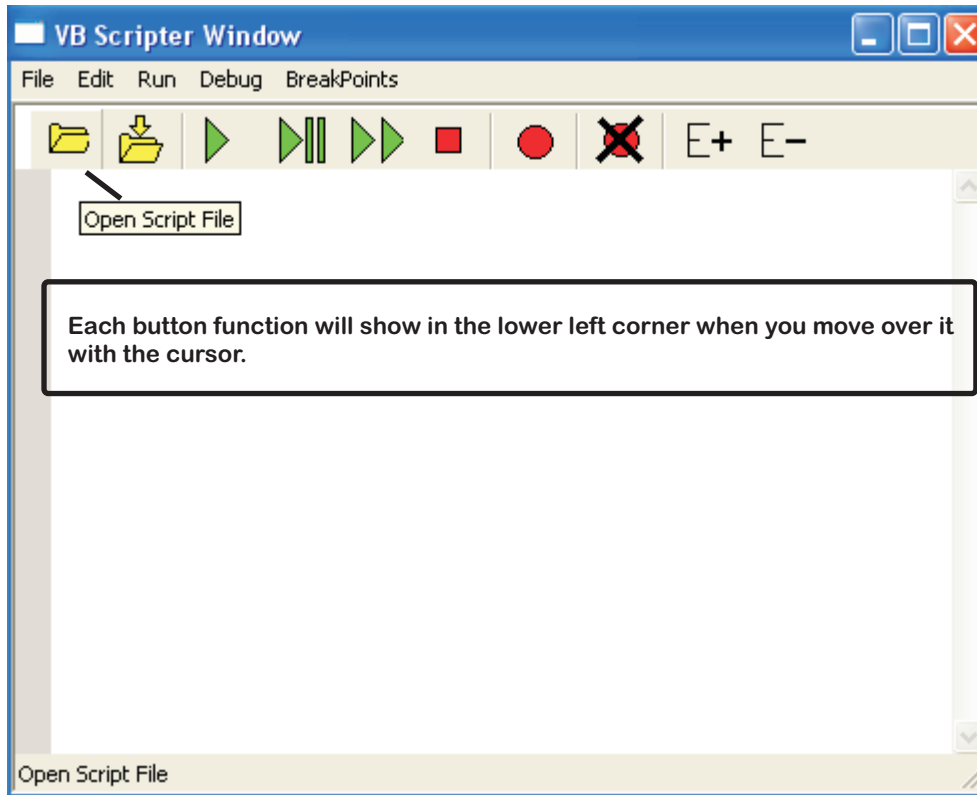
```
Dim Switchoffset   'declare a variable
Switchoffset = GetOemDRO(1045)    ' set the variable equal the the value we get from the Touch Off Swtich value
                                  ' the number of the DRO (1045) is defined when it is created in the Screen Painter
        If Switchoffset > 0 Then   '  condtional statement that allows execution IF the value is greater than 0
        While ismoving()            ' creates a loop that executes as long as there is movement.  The code needs time for the operation to complete
            Code "G28.1 Z.500"     '  this is a standard MACH g-code  that tells Z to move to the home switch and to slowdown starting at .5 "
                                  ' it will stop when the switch is made and backoff slightly and stop. Lines to run are enclosed in double quotes
                Code "G92 Z 0.000"            ' resets the Z DRO to 0 to get a new starting point
                Code "G00 Z " & Switchoffset   'raises the Z up the switchoffset value.  that should be with it setting just at the top of the material
                Code "G92 Z 0.000"            ' Resets the Z DRO again so the top of the material is now Z 0
                Wend                          ' ends the loop
        Else                                   '  do this if the Switchoffset is 0 (first condition was false)
            MsgBox("Your Switch Offset value in MACH needs to be set")' put a message box on the screen to warn the operator.
                        ' requires input to proceed
        End If  ' ends the IF statement.
```
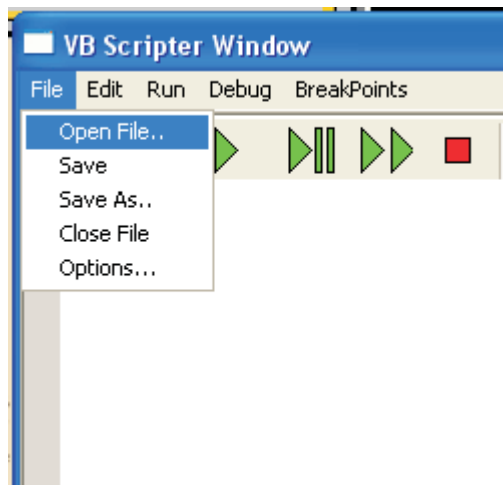
Using the internal MACH VB Script Editor
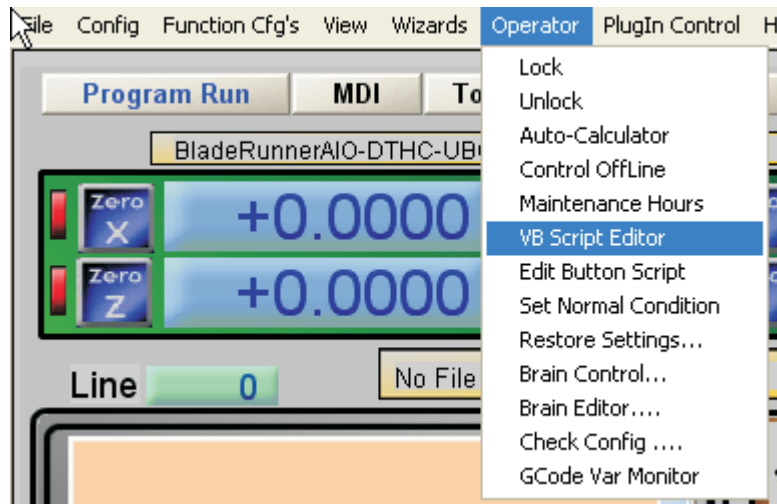
In the MACH Top Tool Bar find the OPERATOR and scroll to the VB
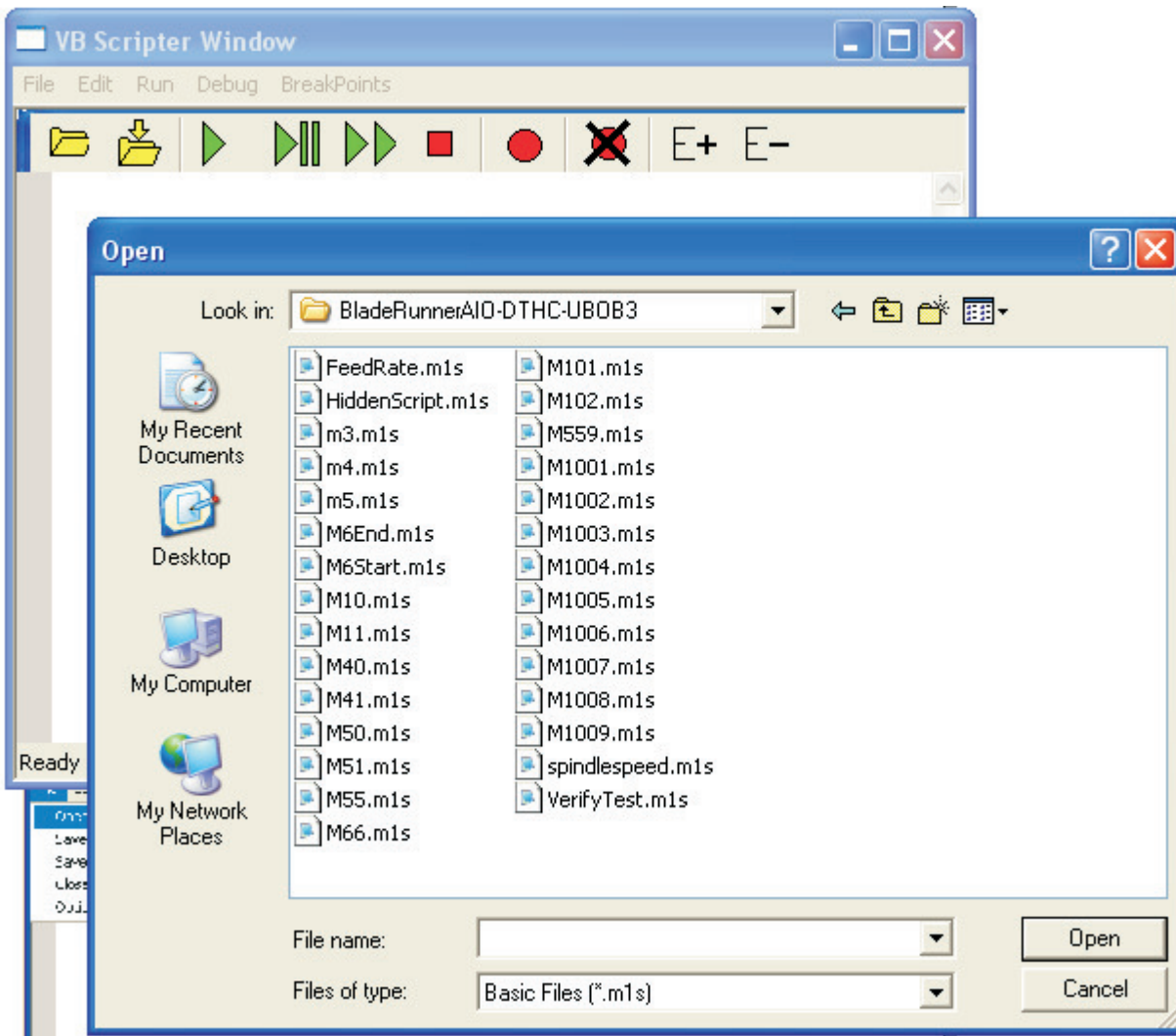SCRIPT EDITOR

VB Scripter Window
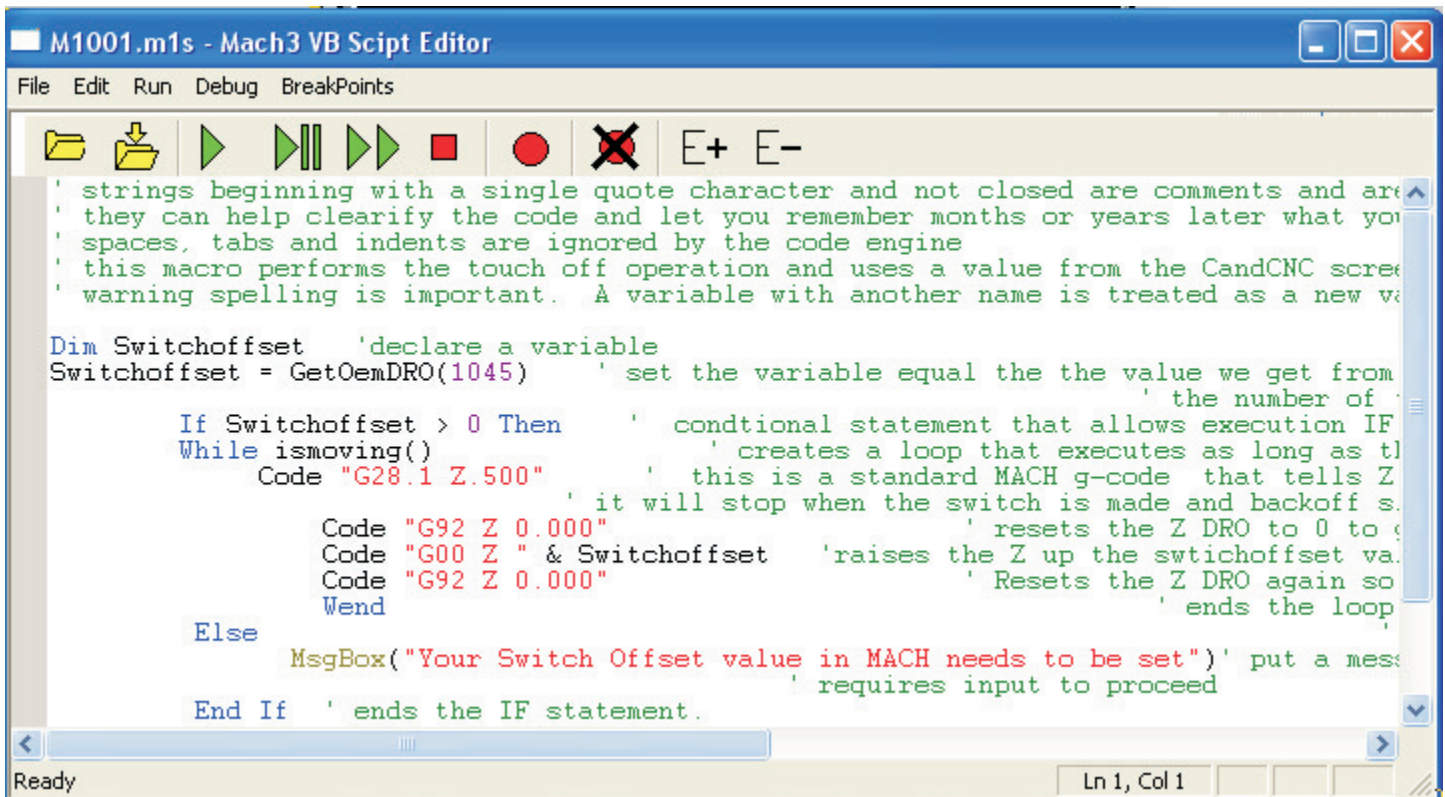

Finding the script to work on

VB Scripter Window

File   Edit   Run   Debug   BreakPoints

Open

Look in: BladeRunnerAIO-DTHC-UBOB3

My Recent Documents

Desktop

My Computer

My Network Places

FeedRate.m1s	M101.m1s
HiddenScript.m1s	M102.m1s
m3.m1s	M559.m1s
m4.m1s	M1001.m1s
m5.m1s	M1002.m1s
M6End.m1s	M1003.m1s
M6Start.m1s	M1004.m1s
M10.m1s	M1005.m1s
M11.m1s	M1006.m1s
M40.m1s	M1007.m1s
M41.m1s	M1008.m1s
M50.m1s	M1009.m1s
M51.m1s	spindlespeed.m1s
M55.m1s	VerifyTest.m1s
M66.m1s	

File name:

Files of type: Basic Files (*.m1s)

Open

Cancel

Ready

Open
Save
Save
Close
Quit

M1001 Script is selected and appears with the comments in the window

M1001.m1s - Mach3 VB Scipt Editor

File   Edit   Run   Debug   BreakPoints

```
' strings beginning with a single quote character and not closed are comments and are
' they can help clearify the code and let you remember months or years later what yo
' spaces, tabs and indents are ignored by the code engine
' this macro performs the touch off operation and uses a value from the CandCNC scree
' warning spelling is important.  A variable with another name is treated as a new va

Dim Switchoffset    'declare a variable
Switchoffset = GetOemDRO(1045)      ' set the variable equal the the value we get from
                                                ' the number of
        If Switchoffset > 0 Then    '  condtional statement that allows execution IF
        While ismoving()                ' creates a loop that executes as long as th
            Code "G28.1 Z.500"      '   this is a standard MACH g-code  that tells Z
                            ' it will stop when the switch is made and backoff s.
            Code "G92 Z 0.000"                    ' resets the Z DRO to 0 to q
            Code "G00 Z " & Switchoffset   'raises the Z up the swtichoffset va.
            Code "G92 Z 0.000"                 ' Resets the Z DRO again so
            Wend                                        ' ends the loop
        Else
            MsgBox("Your Switch Offset value in MACH needs to be set")' put a mess
                                        ' requires input to proceed
        End If  ' ends the IF statement.
```

Ready   Ln 1, Col 1

From the code window

```
' strings beginning with a single quote character and not closed are comments and are ignored by the code engine during processing.
' they can help clearify the code and let you remember months or years later what you did!
' spaces, tabs and indents are ignored by the code engine
' this macro performs the touch off operation and uses a value from the CandCNC screen set.
' warning spelling is important.  A variable with another name is treated as a new variable and will return a zero

Dim Switchoffset     'declare a variable
Switchoffset = GetOemDRO(1045)     ' set the variable equal the the value we get from the Touch Off Swtich vauue
                                   ' the number of the DRO (1045) is defined when it is created in the Screen Painter
    If Switchoffset > 0 Then  '   condtional statement that allows execution IF the value is greater than 0
    While ismoving()          '   creates a loop that executes as long as there is movement.  The code needs time for the operation to complete
        Code "G28.1 Z.500"    '   this is a standard MACH g-code  that tells Z to move to the home switch and to slowdown starting at .5 " absolute
                              ' it will stop when the switch is made and backoff slightly and stop. lines to run are enclosed in double quotes
        Code "G92 Z 0.000" ' resets the Z DRO to 0 to get a new starting point
        Code "G00 Z " & Switchoffset 'raises the Z up the switchoffset value.  that should be with it setting just at the top of the material
        Code "G92 Z 0.000"  ' Resets the Z DRO again so the top of the material is now Z 0
        Wend            ' ends the loop
    Else        '   do this if the Switchoffset is 0 (first condition was false)
        MsgBox("Your Switch Offset value in MACH needs to be set")' put a message box on the screen to warn the operator.
                                      'requires input to proceed
    End If  'ends the IF statement.
```

There is a mistake in this code, can you find it? (see the next page to see the tested code)

Tested code without comments.


You can test a macro by using the step button (green arrow + double vert bars), If you get a compile error there is a problem with the code; usually caused by forgetting a quote or failing to place the END IF at the end of an IF statement.

Using the single step mode, you can actually run the code in MACH, BUT you MUST have Mach on the screen with the VB Script Editor, AND have MACH out of RESET. Also be aware that if MACH is looking for a feedback (like the home switch in the code above) it will need to get the signal from MACH. If you are running in simulation (no hardware attached) then you have to setup MACH with key emulation (in this case Z home input) and you have to change the window focus to Mach and hit the key to emulate the Z switch. You have to change back to the VB Scipt window to step to the next line in the code. It's a hassle sometimes, but you can get a good idea of what the macro will do BEFORE you let it move your expensive CNC toy!

USING THE PROGRAM MODE ON THE PN200

The PN200 allows the operator to enter a single line of G-code from the keypad and execute that line. The PN200 needs to be put into a Special Program Mode by pressing and releasing the MODE button. The MODE LED will flash GREEN when it goes into program mode and the screen will automatically switch to the BIG Program Mode screen on the Monitor. You will be able to see the Code as you type it in and if it generates an error it will display on the screen. When you are in program mode the button functions are represented on the lower (green) part of the key
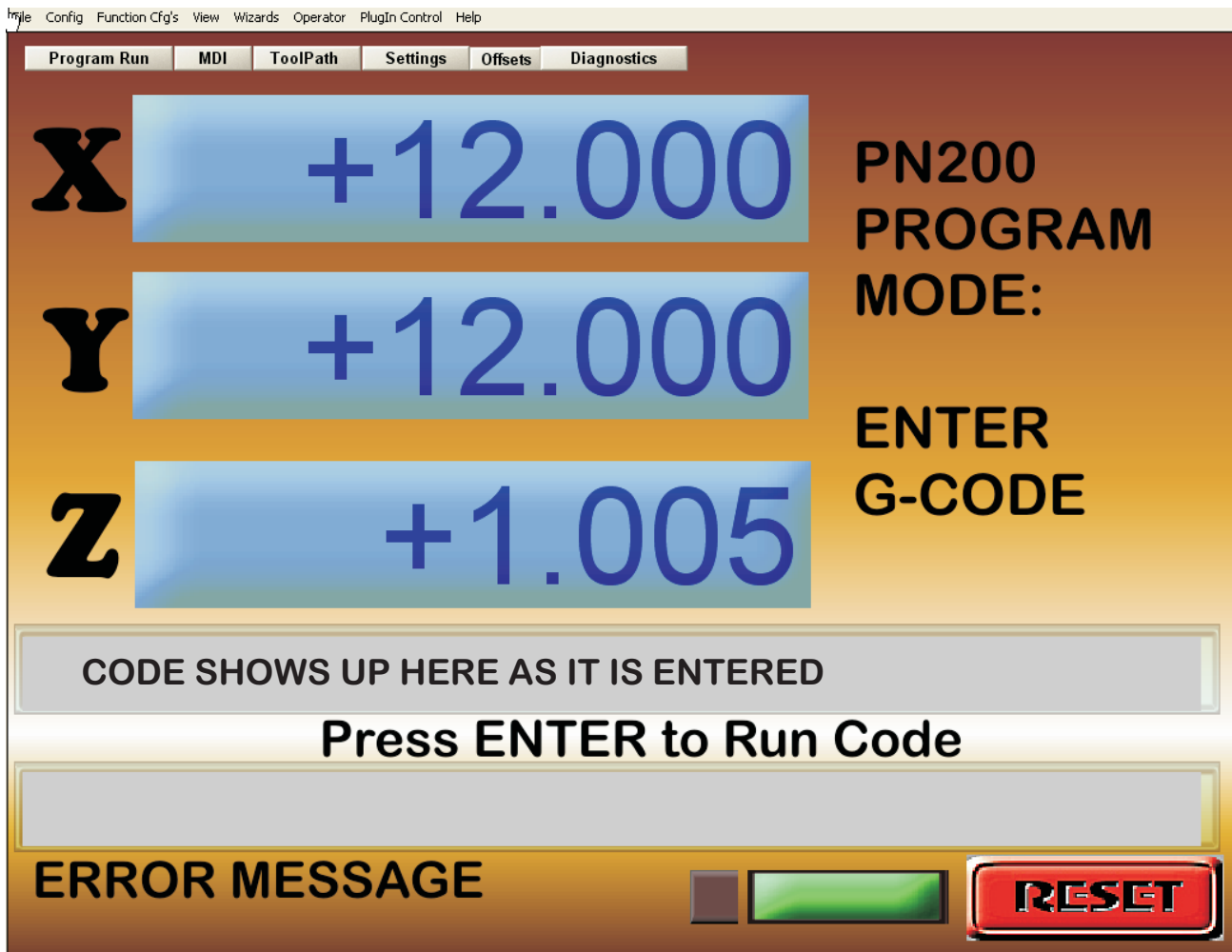
Using the Program mode you can move an axis to a specific postion and run most valid G-code. Not supported are the IJ commands or any specail codes like 'O" or L codes.

When you are finished running in Program mode you can swtich back to Setup mode by hitting the MODE button again. The screen may need be switched back the Program Run (big) screen or the normal Program Run Screen. You can do that by hitting the SCREEN button once to go back the the BIG Program Run and again if you want to toggle back to the normal Program Run screen.

Hooking up the E-STOP BUTTON to CandCNC hardware

Provisions have been made in the PN200 to provide a "hard" E-STOP (meaning it does not rely on software or signaling of any kind to be able to put a system in E-stop). In all CandCNC systems there are at least one software level E-stop (stops MACH from sending pulses). In our Plug-n-Run systems there is also a hardware E-Stop that shuts down power to the motors (and trips the software (EPO) shutdown as well). The following pages show how to use the PN200 with both types of systems. If you have a controller from another vendor or built by someone other than CandCNC most will have at least a way to do an e-stop.

E-STOP BUTTON

The E-STOP button is a **Normally Closed button** that is wired to a system's e-stop to provide a Fail Safe E-stop system. **The E-STOP button is not part of the PN200 logic.** It is a stand-alone button that becomes a remote E-STOP. The USB to RS485 interface card (part # USB-485) has terminals to use for cross connecting the E-STOP button to the system E-STOP. When wired correctly the pendant MUST be connected for the system to be able to operate. If the pendant becomes unplugged for any reason the system will instantly go into a hard Emergency Stop. If you are using any CandCNC Electronics controller there will be at least an EPO set of terminals on the Table I/O. (Software E-STOP). On other systems using the ESPII control there is a master E-STOP that shuts down power to the motors instantly (recommended for servo systems). The E-STOP button will not stop or shutdown any system if it is not hooked up. Please see specific controller instuctions for location of the E-STOP (EPO) connection points.
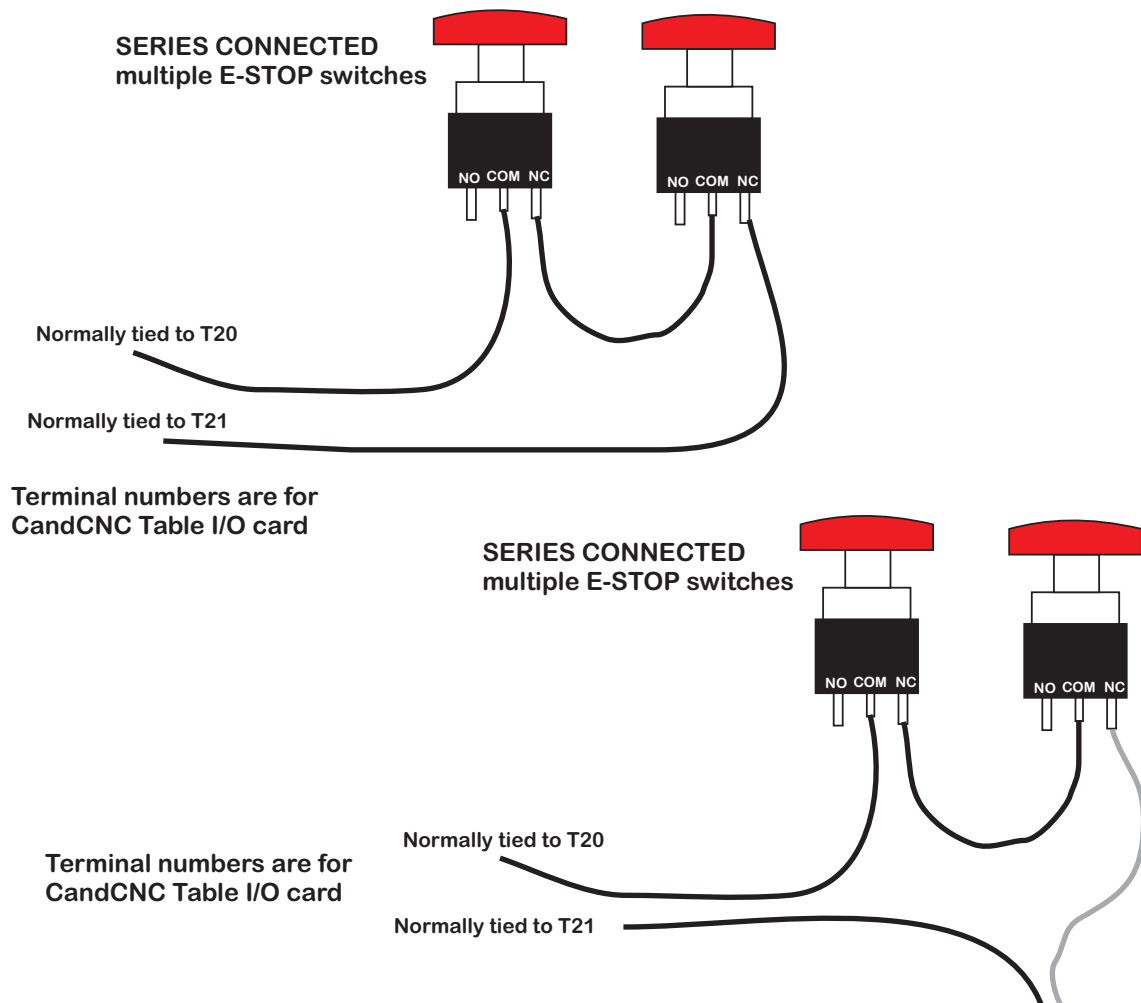
The E-STOP button on the PN200 is a NORMALLY CLOSED (NC) momentary pushbutton. The two switch contacts go back through two dedicated wires on the CAT 5 cable to the USB-485 module. When connected to an e-stop system that uses swiches it that all of the switches MUST be CLOSED in order for the system to run. The PN200 becomes one of the series switches. Added safety is built in since all of the switches MUST be in the circuit and not active, so a disconnected wire, an open run or defective connection, will stop the system. Once connected in a NC type E-Stop system, the PN200 becomes one of the NC elements. Pushing the button opens the circuit. Disconnecting the PN200 either by choice or by accident will E-STOP the system.

The following pages will show how the PN200 can be connected to a system with a software (MACH input) E-STOP using the CandCNC Table I/O card as an example. Another option is to have the E-STOP circuit actually shutdown power to the drives and motors and issue a software E-STOP to the MACH input. All CandCNC Power Controllers (SPSC / EPS /ESPII) have a prevision to tie in a Normally Closed switch at the power controller and stop motion instantly. While Stepper systems can be stopped simply by removing the step signal from the drives, Servo systems can continue to move and run as long as power is on if the software loses control of the motor drives. Several conditions can result in a servo "runway" where the only cure is to shut off power to the drives. If you have a servo system (or just want to have the ABSOLUTE E-stop options there are instructions on the following pages to accomplish that with a CandCNC controller

WHAT TO DO IF YOU ALREADY HAVE ONE OR MORE NC SWITCES in your E-STOP circuit:

1. Treat the output of the USB495 E-STOP as another normally close swtich.
2. Break one end of the string and insert one wire from the USB485 E-Stop you have hooked up onto each end of the break.
3 Plug in the PN200 and make sure you can come out of RESET.
4. Test to make sure the E-STOP on the PN200 works and that unplugging the PN200 will force MACH into RESET.

**SERIES CONNECTED
multiple E-STOP switches**

NO COM NC   NO COM NC

Normally tied to T20

Normally tied to T21

**Terminal numbers are for
CandCNC Table I/O card**

**SERIES CONNECTED
multiple E-STOP switches**

NO COM NC   NO COM NC

**Terminal numbers are for
CandCNC Table I/O card**

Normally tied to T20

Normally tied to T21

To use multiple E-Stop switches including the one on the PN200 connect existing E-STOP string of NC swtiches as shown. While the connections are shown for a CandCNC Table I/O card it will work for any setup where Normally closed switches are use in the E-STOP circuit.

USB to RS485

CandCNC Part# USB-485
REV 1

High Speed Serial Adapter

COM NC
+9 to +14VDC
DC PWR IN
E-STOP

RS485
Device1
PN200

UTP
Cables

RS485
Device
2

USB A -B
CABLE
TO PC

Using the PN200 with a software only (MACH) e-stop system.

Most BoB's provide for an input for E-STOP into MACH. You can define that input to work with either Normally Open or Normally Closed contacts (but not BOTH). The recommended approach for safety and reliability is to connect the switches in series (like the old strings of Christmas lights) so if one goes out they all go out. Then the beginning and end of the string is tied to one input.
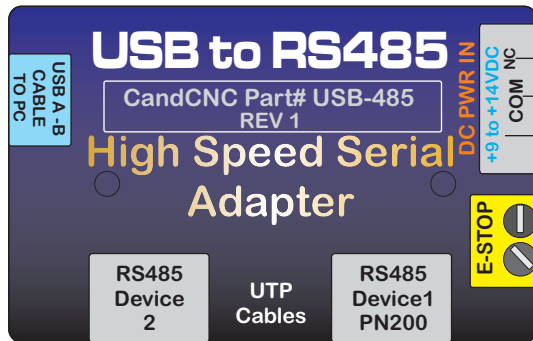
**E_STOP Crossconnect
To E-stop terminals on BoB
or control**

Use stranded insulated wires #22 up to #18. Any color. No Polarity is needed. Put one wire in T20 and one on T21 of the Table I/O card

REMOVE EPO JUMPER to use with PN200 E-STOP
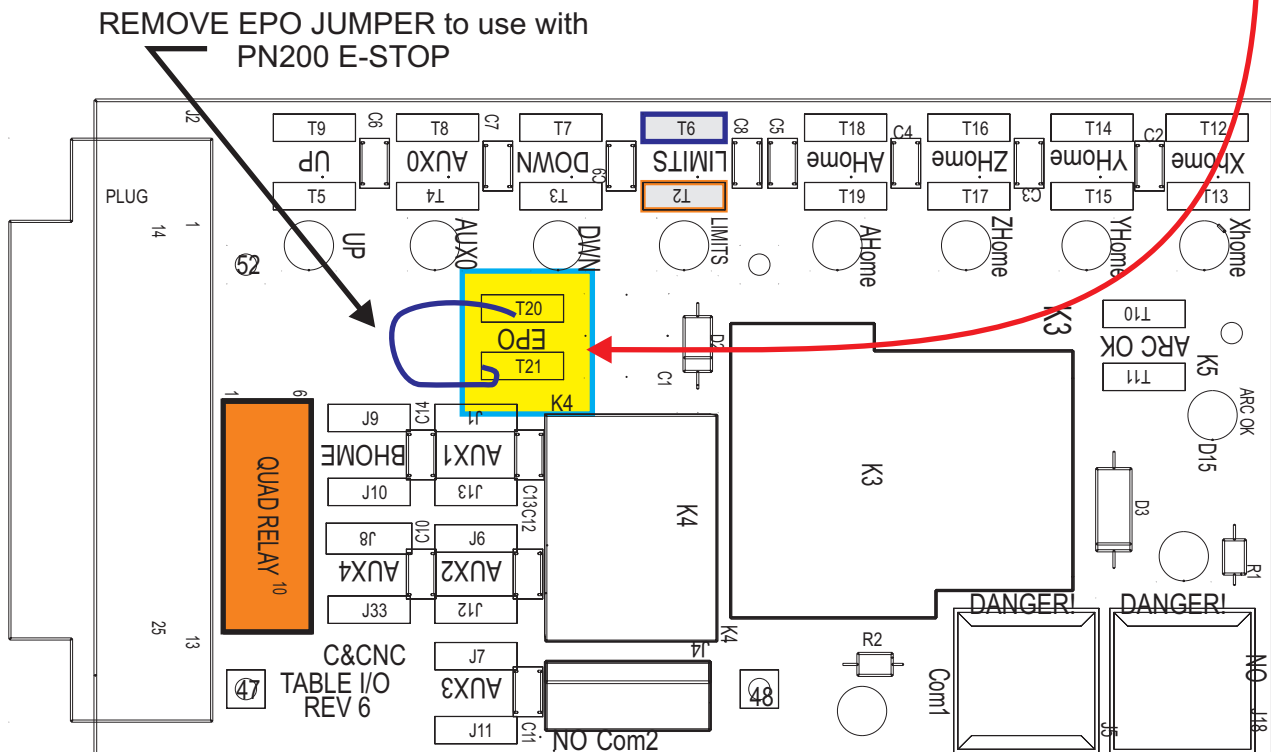
CandCNC Table I/O card. Standard card sold with BladeRunners, Builders Paks, Plazpaks and Router Paks

This card located inside on BladeRunner Units behind UBOB III card in the top of the enclosure.

"ABSOLUTE" E_STOP. Shuts down motion instantly and sends E-stop to MACH. Recommended for all servo based systems.
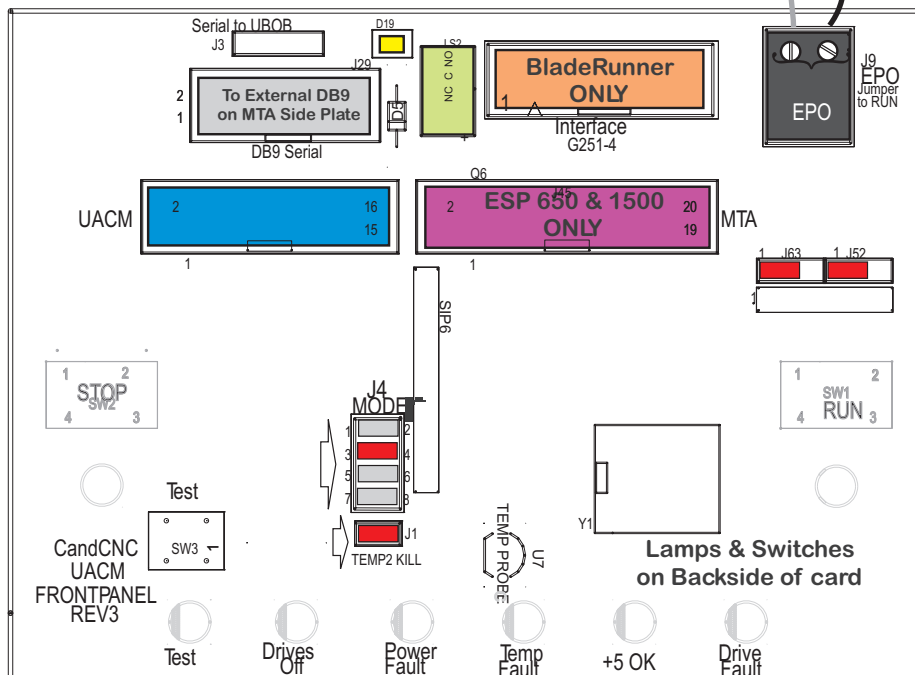
UACM FRONT (Smart Panel) Card has a set (2) of screw terminals where a remote shutoff/panic switch can be tied in and mounted External to the cabinet. It does the same thing as the RED OFF BUTTON ON THE FRONT OF THE ESPII BOX BUT CAN BE MOUNTED AT THE TABLE.

USB to RS485
CandCNC Part# USB-485
REV 1
High Speed Serial Adapter

USB A - B CABLE TO PC

RS485 Device 2

UTP Cables

RS485 Device1 PN200

DC PWR IN
E-STOP
+9 to +14VDC
COM NC

The USB-485 can be wired into the screw terminals. If your ESPII based unit has a wire jumper between the two screw terminals remove it and replace with the two wires from the USB-485 module. If you have an existing external E-stop then you must place the USB-485 in series with the other switch (or series string of switches)

If USB-485 is mounted more than 6 ft from Front Panel card use twisted pair wire. 24 to 20 ga wire is okay.

Back Side of UACM Smart Panel Card On all ESPII Power Controllers

Serial to UROB
J3
D19
J29
LS2
NO C NC
BladeRunner ONLY
1
Interface
G251-4
D5
J9
EPO Jumper to RUN
EPO

2
1
To External DB9 on MTA Side Plate
DB9 Serial

Q6
U5
2   ESP 650 & 1500   20
ONLY
1   19
MTA

UACM
2   16
15
1

1 J63   1 J52
1

SIP6

1   2
STOP
SW2
4   3

J4
MODE
1   2
3   4
5   6
7   8

J1
TEMP2 KILL

TEMP PROBE
U7

Y1

1   2
SW1
RUN
4   3

Lamps & Switches on Backside of card

Test

CandCNC
UACM
FRONTPANEL
REV3
SW3

Test   Drives Off   Power Fault   Temp Fault   +5 OK   Drive Fault

This card located in front panel of all BladeRunner AIO Dragon -Cut and later models of all Plazpak and RouterPak units with ESPII contorller