MOTION CONTROL

MintNC

Getting Started

5/04 **MN1923**

Contents

Limited Warranty
For a period of two (2) years from the date of original purchase, Baldor will repair or replace without charge controls and accessories that our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. Baldor shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some countries and U.S. states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, Baldor's total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to Baldor with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses. Goods may be returned only with written notification including a Baldor Return Authorization Number and any return shipments must be prepaid.

Product notice

Only qualified personnel should attempt to use this software. This software might control machines that have rotating parts. Improper use can cause serious or fatal injury.

2.1 MintNC features

MintNC is a comprehensive Windows based machine control front end for fast profiling applications such as:

- Laser and Water jet cutting
- Tangential Knife
- Router
- Pen/Plotting
- Welding
- Glue laying
- Camera/Imaging
- Inspection
- Grinding

MintNC interfaces directly to any of Baldor's PCI or USB based NextMove motion controllers, providing high speed contouring for both servo and stepper based systems. Motion controller and drive setup is performed using WorkBench v5 (supplied separately). WorkBench v5 also provides the development environment for user scripts/programs that can be called when required by MintNC.

Acting as the command interpreter, MintNC can import HPGL, DXF and G-Code, converting these files directly into motion. Alternatively, these files can be converted into native Mint code which can be downloaded to the motion controller. These are downloaded to the NextMove controller (in the form of a Mint executable file) to perform actions such as Tool On/Off sequences or background processing such as laser power control.

MintNC is not a fully featured CAD drawing package. Drawings would normally be prepared using third party software packages, saved in an appropriate file format and then imported into MintNC. However, MintNC can be used to edit the drawing line paths into a continuous motion path if necessary.

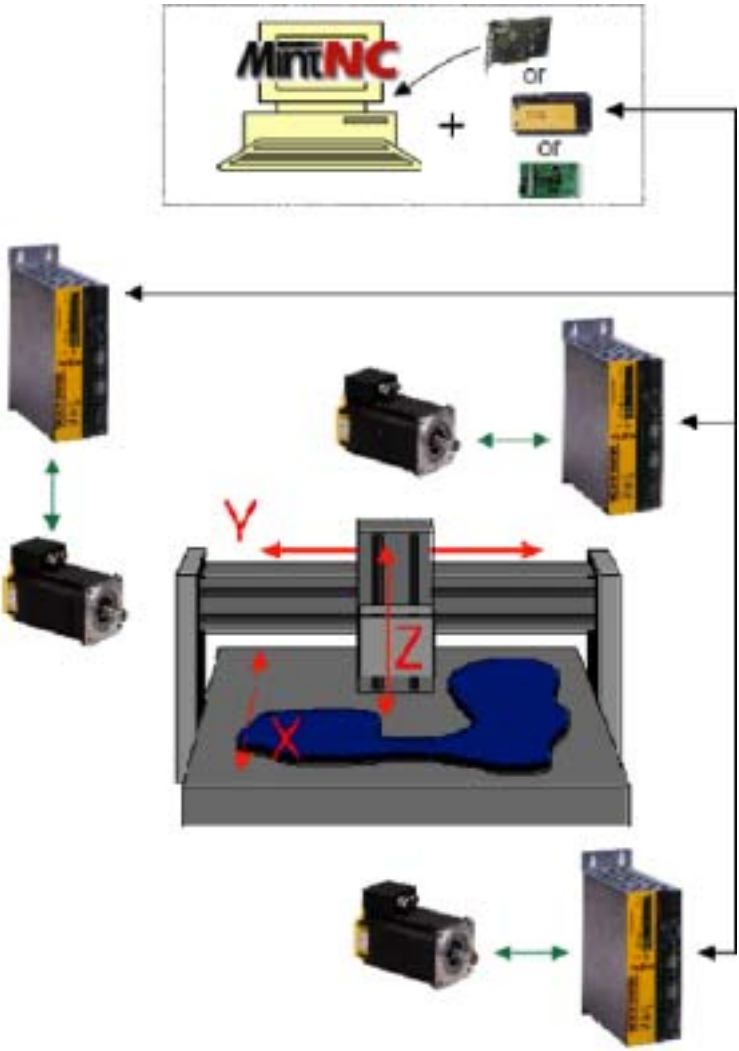
A Windows Application Programming Interface (API) using ActiveX technology is also installed, allowing custom operator front ends to be quickly realized. This API gives access to much of the functionality supported in the main MintNC application, but allows the programmer to extend the control options and also create a user interface that is specific to the target application. Two example Visual Basic projects are installed as part of the MintNC installation.

MintNC is supplied with an extensive on-line help file that is included as part of the standard installation.

Throughout this manual, references are made to the NextMove PCI and NextMove ESB controllers only. However, the NextMove ES and NextMove ST controllers can also be used with MintNC, due to their similarity with the NextMove ESB.

3.1 Introduction

A typical system configuration is shown below:



PC system with the following specifications is required to run MintNC:

	Minimum specification	Recommended specification
Processor	Intel Pentium 150MHz	Intel Pentium 400MHz
RAM	256MB	256MB
Hard disk space	30MB	
CD-ROM	A CD-ROM drive	
Interfaces	Parallel port and one free PCI slot for NextMove PCI	
Screen	1024 x 768, 256 colors	
Mouse	A mouse or similar pointing device	
Operating system	Windows 95*, Windows 98*, Windows NT*, Windows 2000 or Windows XP	

* For USB support, Windows 2000 or Windows XP is required.

Internet Explorer v5.0 or above must be installed to allow WorkBench v5 to operate correctly.

3.1.1 Installing MintNC

If you do not have a hardware lock then MintNC may still be installed but it will only operate in demonstration mode.

1. Close any open Windows applications.
2. Connect the supplied MintNC hardware lock (dongle) to the PC's parallel port. Place the Baldor Motion Toolkit CD in your CD-ROM drive. The CD-ROM may start running automatically.
3. If the CD-ROM does not start automatically, run D:\Software\MintNC\Setup.exe (where D is the drive containing the CD-ROM).
4. Follow the on-screen instructions to install MintNC. As part of the installation the HASP device driver for the hardware lock will also be installed.
5. When the installation is complete, restart the computer.

The default installation will:

- Install MintNC in C:\Program Files\MintNC.
- Add a MintNC folder to your list of programs and create two pre-configured shortcuts for the MintNC application (one for NextMove PCI and one for NextMove ESB).
- Install and register the DNC COM Interface Type Library.
- Create an uninstall option in the Windows Control Panel.

3.1.2 Checking operation of the hardware lock

If the hardware lock is not installed, or the setup for this device has not completed successfully, MintNC will only operate in demonstration mode. In this mode it is not possible to run a drawing or export a drawing to any other format.

To determine whether the hardware lock is operating correctly, start MintNC and then select *About MintNC…* from the Help menu.

Click the Security button.

A window detailing the license number for the installation should be displayed. If the hardware lock is missing, or device driver installation has failed, a window similar to the one shown opposite will be displayed.

If no license information is displayed but the hardware lock is correctly fitted to the PC's parallel port, either:

- Uninstall MintNC using the Add/Remove option in Windows Control Panel, then reinstall MintNC, ensuring that the PC is restarted after installation of the hardware lock (HASP) device driver, or;
- Run *Hdd32.exe* from C:\Program Files\MintNC\Hasp to uninstall and reinstall the hardware lock device driver.

If you are unable to activate the hardware lock please contact your local Baldor distributor or support office.

3.1.3 Installing WorkBench v5

WorkBench v5 is required to:

- Configure, auto-tune and fine-tune your Baldor FlexDrive^{II} or MicroFlex servo drives.
- Configure NextMove inputs and outputs and fine-tune the servo position loop gains.
- Edit and debug the MintMT program provided for user script/program interaction with MintNC.

1. Close any open Windows applications.
2. Place the Baldor Motion Toolkit CD-ROM in the CD-ROM drive. The CD-ROM may start running automatically.
3. If the setup wizard does not appear, select Run... from the Windows Start menu and type D:\START (where D represents the drive letter of the CD-ROM device).

Internet Explorer v5.0 (or greater) is required for correct operation of WorkBench v5. If this is not available on your PC then it can be installed from the CD-ROM. A link to install Internet Explorer 5.5 is available on the same page as the WorkBench v5 installation, so select this link and follow the on-screen instructions.

When Internet Explorer v5.0 or greater is installed on the PC, WorkBench v5 can be installed:

4. In the setup Wizard, follow the on-screen instructions to install WorkBench v5.

The setup wizard will copy the necessary files to appropriate folders on the hard drive. The default folder is C:\Program Files\WorkBench v5, although this can be changed during setup if required. A shortcut to WorkBench v5 will be added to your Windows Start menu and to your desktop.

3.2 Installing the NextMove controller

3.2.1 NextMove PCI

Shut down the computer and disconnect it from the mains supply. Refer to the NextMove PCI Installation Manual (MN1903) for details of installing the card and its device driver. After installing the Windows device driver for the NextMove PCI, remember to restart the PC.

3.2.1.1 Confirming operation of the NextMove PCI

Follow the instructions provided in the NextMove PCI Installation Manual (MN1903) to scan for the NextMove PCI card and download firmware. If this is successful the status LEDs on the rear edge of the card should be illuminated green.

3.2.2 NextMove ESB

To communicate with NextMove controllers supporting USB (e.g. NextMove ESB), the PC must be operating either Windows 2000 or Windows XP. Be sure that the latest Baldor USB driver is installed.

3.2.2.1 Installing the USB driver

If you have connected the NextMove ESB to the PC using the USB connection, it will be necessary to install the USB driver. When the NextMove ESB is powered, Windows (2000 or XP only) will automatically detect the controller and request the driver. The driver consists of two files, *baldorusb.inf* and *baldorusb.sys*. Both files must be present for installation.

1. Follow the on-screen instructions to select and install the driver. The driver files are available on the supplied Baldor Motion Toolkit CD. If you are using a copy of the driver located on the hard disk, a floppy disk or another CD, the two driver files must be in the same folder.
2. During installation, Windows XP may report that the driver is 'unsigned'. This is normal for the NextMove ESB driver, so click the Continue Anyway button to continue with the installation. When installation is complete, a new Baldor USB device will be listed in the *Universal Serial Bus controllers* section of Windows Device Manager.

The NextMove ESB is now ready to be configured using WorkBench v5.

Note: If the NextMove ESB is later connected to a different USB port on the host computer, Windows may report that it has found new hardware. Either install the driver files again for the new USB port, or connect the NextMove ESB to the original USB port where it will be recognized in the usual way.

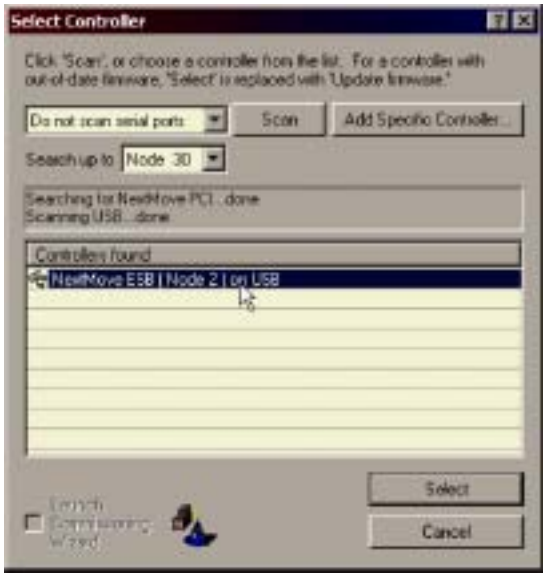
3.2.2.2 Confirming operation of a NextMove USB controller

Connect the USB lead between the PC and controller and start WorkBench v5.

Click **Start New Project...** and select *Do not scan serial ports* from the list of scan options.

Now click **Scan**. WorkBench v5 should detect the controller.

Click **Select** to enter online mode.



3.2.3 Typical wiring between NextMove and servo drives

Typical wiring between the NextMove controller and the servo drives is likely to include:

- Drive enable output to each of the servo drives. Some systems will require a separate digital output for each drive, while others may allow the drive enable signals to be wired in parallel from the NextMove relay; choose a scheme that best suits your application.
- Encoder feedback connection for each servo drive. This may be wired from an encoder coupled to the mechanical system, or may be wired from the simulated encoder output on the servo drive.
- Analog demand signals (±10VDC) from the NextMove to the demand input on the servo drives. The drives may be configured in either current or speed mode, so select the mode that best suits your application. If you are using Baldor FlexDrive^{II} servo drives refer to the FlexDrive^{II} Installation Manual MN1902.

Typical wiring from the NextMove controller to and from stepper drives is likely to include:

- Drive enable output to each of the stepper drives. Some systems will require a separate digital output for each drive, while others may allow the drive enable signals to be wired in parallel from the NextMove relay; choose a scheme that best suits your application.
- Pulse and Direction signals from the NextMove to the pulse and direction inputs on the stepper drives.

3.3 Commissioning axes

3.3.1 Servo axes

If you are using Baldor FlexDrive^{II} servo drives follow the instructions provided in the installation manual (MN1902) for commissioning. If you are using Baldor MicroFlex servo drives follow the instructions provided in the installation manual (MN1919) for commissioning.

It is recommended to start a second instance of WorkBench v5 to connect to the servo drive(s). This allows one instance to be used to communicate with the NextMove controller and the other to communicate with your servo drive(s).

When auto-tuning a Baldor FlexDrive^{II} drive, make a note of the value returned for KVELFF. If the drive(s) are configured for speed mode of operation, and the NextMove settings for maximum speed, encoder resolution and looptime are the same as those on the drive, then this value can be directly substituted into the NextMove startup block for each axis. This method of using KVELFF does not apply when using MicroFlex drives.

Note: It is important to verify that for each servo axis, a positive demand from the NextMove controller causes the axis' encoder count to increase; this can be monitored in the Spy window in WorkBench v5. Similarly, for a negative demand from the NextMove controller, the returned encoder count must decrease.

Open loop demands can be produced using the MintMT `TORQUE` command, and the encoder direction can be reversed using the MintMT `ENCODERMODE` command. If using Baldor FlexDrive^{II} or MicroFlex servo drives, motor direction for a positive demand can be modified using the MintMT command `MOTORDIRECTION`.

3.3.2 Stepper axes

Refer to the instructions provided by the manufacturer of the stepper drives. NextMove controllers operate stepper axes as an open loop system, so commissioning of these is limited to ensuring the directions are correct.

3.4 Editing the MintMT program template

Having established position loop gains for any servo axes in the system, and suitable values for settings such as ENCODERMODE (to ensure encoder feedback direction is correct), ACCEL, SPEED etc., it is necessary to ensure that the MintMT program used by MintNC is edited to contain these settings.

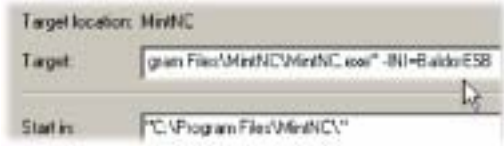
1. Start WorkBench v5. Scan for, and select, the NextMove controller.
2. Select the Edit & Debug tool.
3. From the file menu, select Open File… and navigate to C:\Program Files\MintNC (assuming the default installation path was used for MintNC).
4. The MintNC installation installs two sample template files, one for NextMove PCI and one for NextMove ESB. These are named MTscript (PCI).mnt and MTscript (ESB).mnt respectively. Open the file most relevant to the motion controller you are using.
5. Work through the Startup block editing the settings as necessary to suit the application.
6. Save the completed file. A different filename may be used if required, as MintNC can be configured to select any file (see Controller Setup for further details).
7. Now compile the file using the Program, Compile to file… menu option. Resolve any compilation errors and retry until the .mex file is successfully created.
8. If using a USB based NextMove controller, use WorkBench v5 to download the MintMT program to the controller (when using NextMove PCI MintNC will download the compiled .mex file automatically).

4.1 Introduction

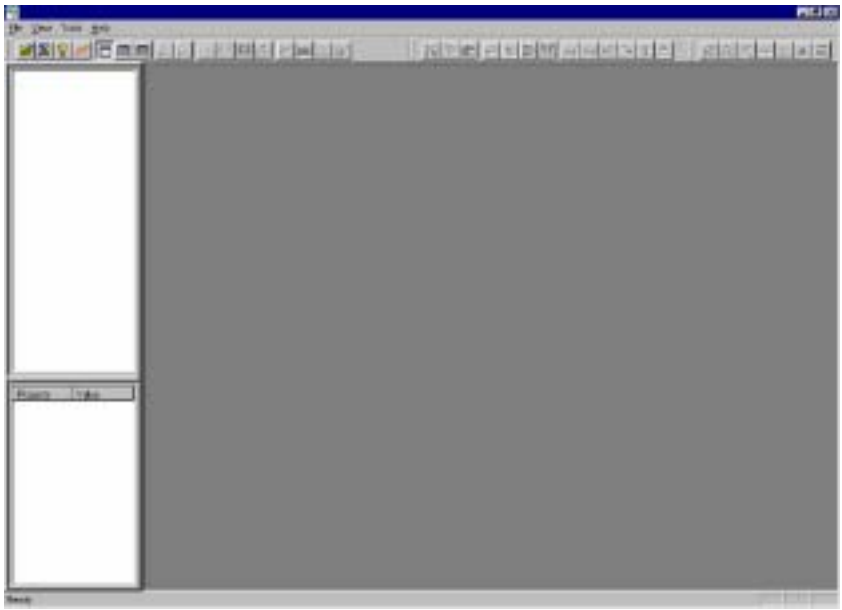
As part of the installation two application shortcuts are installed on the Windows Start menu, one for NextMove PCI and one for NextMove ESB.

The MintNC installation includes two .ini files, used to configure various application settings when MintNC is started. One file contains appropriate settings for a NextMove PCI controller; the other for NextMove ESB. The two application shortcuts reference the associated .ini file.

The .ini file used by the shortcut can be determined by right clicking on the shortcut, and looking at the final word in the Target box. See also section 4.4 for further details about .ini files and their usage.



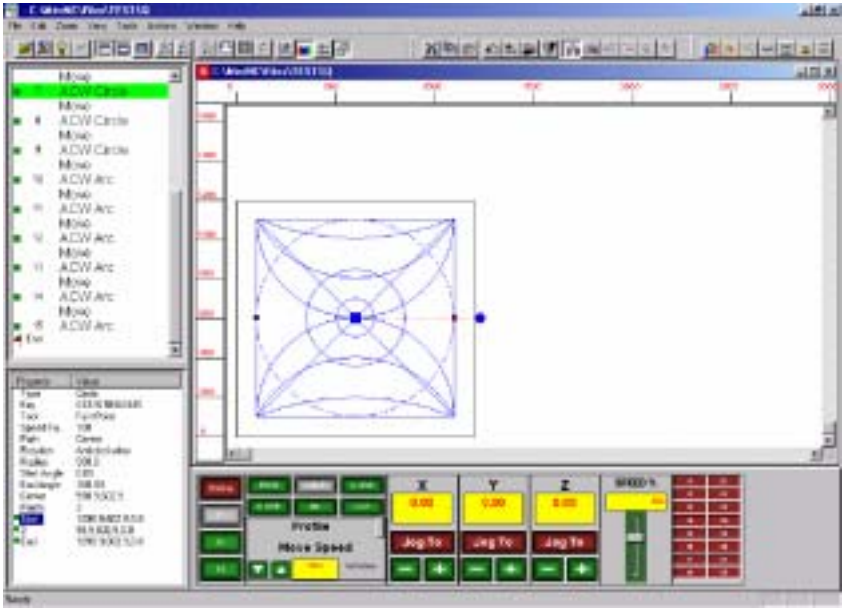
Start MintNC using the appropriate shortcut. The MintNC workspace will appear:



Note: The splash screen can be cleared at any time by pressing the ESC key.

4.2 Interface Overview

It is recommended that the user familiarize themselves with the main screen layout, the tool bars and menus etc. A typical layout for the main screen is shown below, with the object properties at the bottom left, and the machine control toolbar across the bottom:



The MintNC help file provides detailed explanations of the menus and buttons, although some of the more important areas are highlighted in the following sections.

4.2.1 Tool Bars

Main Toolbar

The main toolbar gives short cut access to some primary program functions, particularly to access data keys and machine sub system, but also to control the currently selected Graphic Control Window.

Edit Toolbar

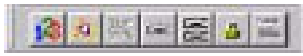
This toolbar gives short cut access to selected Edit options such as Cut and Paste.

List Control Toolbar

The List Control toolbar allows the user to select and step through (‘animate’) the geometrical data.

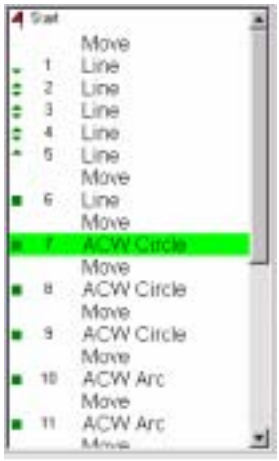
Action Bar

This toolbar gives short cut access to selected Actions, such as creating a single part from a number of drawing entities.



4.2.2 Program List

The *program list* window shows the sequence or order of the geometry contained within the currently active graphic display window. The program list can be the sequence of the geometry of the main program contained within the graphic display window, or of an associated sub program. See Geometry Organisation Overview in help manual for further details.



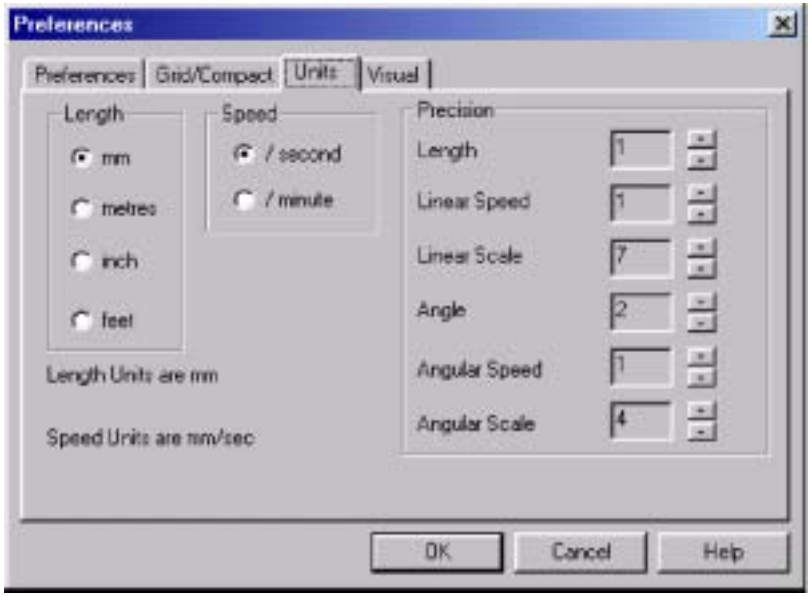
The format of information in the program list can be adjusted by choosing the File, Preferences menu item and selecting the *Visual* tab:

4.2.3 Object Properties

The Object Properties window allows the user to see the drawing information, line by line, in the upper part of the window and any associated values attached to each line segment in the property / value box.

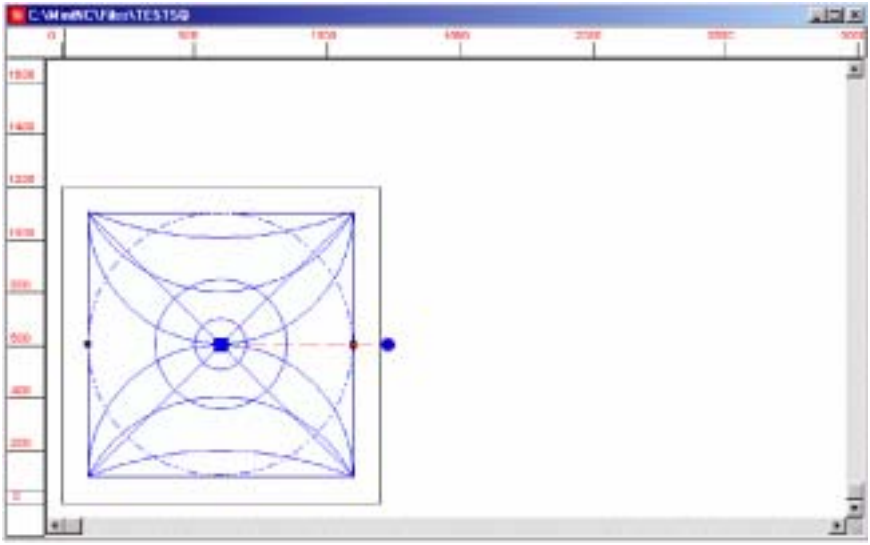
4.2.4 Preferred length, speed and precision settings

By choosing the File, Preferences menu item and selecting the *Units* tab, the required length unit, speed unit and precision level for the machine can be adjusted. Changing the precision also determines the number of decimal places displayed by the on-screen axis position labels.



4.2.5 Graphic display window

The graphic display window is used to display and edit the geometry. There can be a maximum of 32 graphic display windows, but only one can be active at any time. The contents of the active graphic display window are also listed in the program list window. Selecting a drawing entity in the graphic display window results in the associated program list entry being highlighted, and vice-versa.



4.3 Connecting MintMT to MintNC

The MintNC connect button is used to establish an initial connection between MintNC and the NextMove controller. If using NextMove PCI, clicking on this button will download MintMT firmware to the NextMove PCI and will also download and run a MintMT program that has been pre-compiled by WorkBench v5 (a .mex 'Mint Executable' file). See section 4.4.5 for details on how to configure which firmware and program files are downloaded.

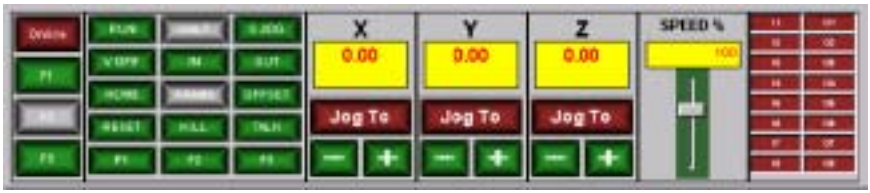
USB NextMove controllers store their firmware in non-volatile memory so, when using a USB based controller, MintNC will never attempt to download controller firmware. The same is true of the MintMT program for USB controllers. This must be downloaded separately using WorkBench v5.

Once connected, MintNC will display the axis control panels for all machine axes as well as the general system control panel:

MintNC will enter the Online state (indicated by the button in the control panel). Tool changes and other modifications to the machine sub-system cannot be performed unless the system is in the Offline state (selected by clicking the Online button).

4.3.1 Basic Controls

The Machine Control Bar allows the user to manually control motion on the available axes. It shows the position of each axis, provides a jog function for a specified axis, allows the user to vary the profiling speed and shows NextMove digital I/O status information. There are three modes for this bar, selected using the P1, P2 and P3 buttons:



Each individual axis may be jogged at a fast or slow rate, using the axis jog controls. The - and + buttons will jog the axis at a defined rate while the buttons are depressed. The Jog To button allows the user to define an absolute position to move to and also allows this point to reset as the home or zero point.

Note: By default the HOME button in the 'Jog To' panel issues a Home to Negative Switch command for that axis. This can be modified; see section 4.4.9 for further details.

4.3.2 MintNC to MintMT interface

MintNC interfaces to the MintMT program running on the NextMove controller card by using the 99 element user comms array.

A pre-written template file is provided which includes all of the code necessary for MintNC to be able to start and stop up to 32 scripts (or programs) in parallel, with the profiling being performed by MintNC. These scripts can be used to initiate homing sequences, digital output sequences, laser power proportional to axis speed etc. This template file assigns certain comms locations for use as pre-defined functions; for example, comms1 is used by MintNC to control the starting and stopping of the MintMT scripts.

4.4 Configuring MintNC

4.4.1 Machine Type

There are several machine types that MintNC is able to control:

- MACHINEXY: two profiled axes – e.g. an XY table with a fixed tool.
- MACHINEXYWITHZ: two profiled axes with a positionable Z axis – e.g. an XY table with a tool that requires ride height adjustment.
- MACHINEXYZ: three profiled axes.
- MACHINEXYWITHC: two profiled axes with a positionable C axis, e.g. an XY table with a tangential knife.

There are other machine types, but these are beyond the scope of this introductory document.

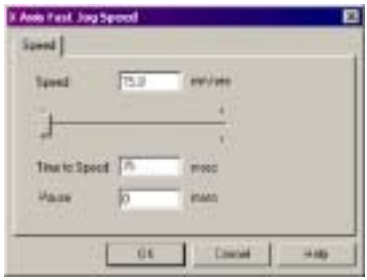
MintNC determines machine type from the .ini file associated with the application shortcut (see section 4.1). The .ini files are located in C:\Program Files\MintNC (assuming the default installation path was accepted). To modify the machine type ensure MintNC is closed and then open the appropriate .ini file. Scroll though the file until you reach the [Machine] section :

```
[Machine]
Machine=DNCMACHINE2
Type=MACHINEXYWITHZ
Controller=NextMove
Devices=0
Debug=0
```

Edit the Type value to suit the application.

4.4.2 Operating Speed

Speed and Acceleration time for each of the tools to be used by MintNC (as well as the traverse speed between tool operations, otherwise known as the MintNC Profile speed) can be edited by choosing the Tools, Speeds menu. Highlight one of the entries and then click on the Edit button:



Overall speed and acceleration limits for this dialog (and others) are defined within the application file. To define these you need to ensure a [Frame] section exists in the application ini file. For example:

```
[Frame]
MinSpeed=0
MaxSpeed=3000
MaxAccel=5000
MinTime=0
RefSpeed=3000
```

where:
`MinSpeed` = Special purpose, set to zero.
`MaxSpeed` = Absolute maximum speed that should be used when profiling.
`MaxAccel` = Maximum acceleration time that should ever be used to achieve maximum speed. Note that the smaller the MaxAccel number, the higher the acceleration.
`MinTime` = Special purpose, set to zero.
`RefSpeed` = Special purpose, set equal to MaxSpeed.

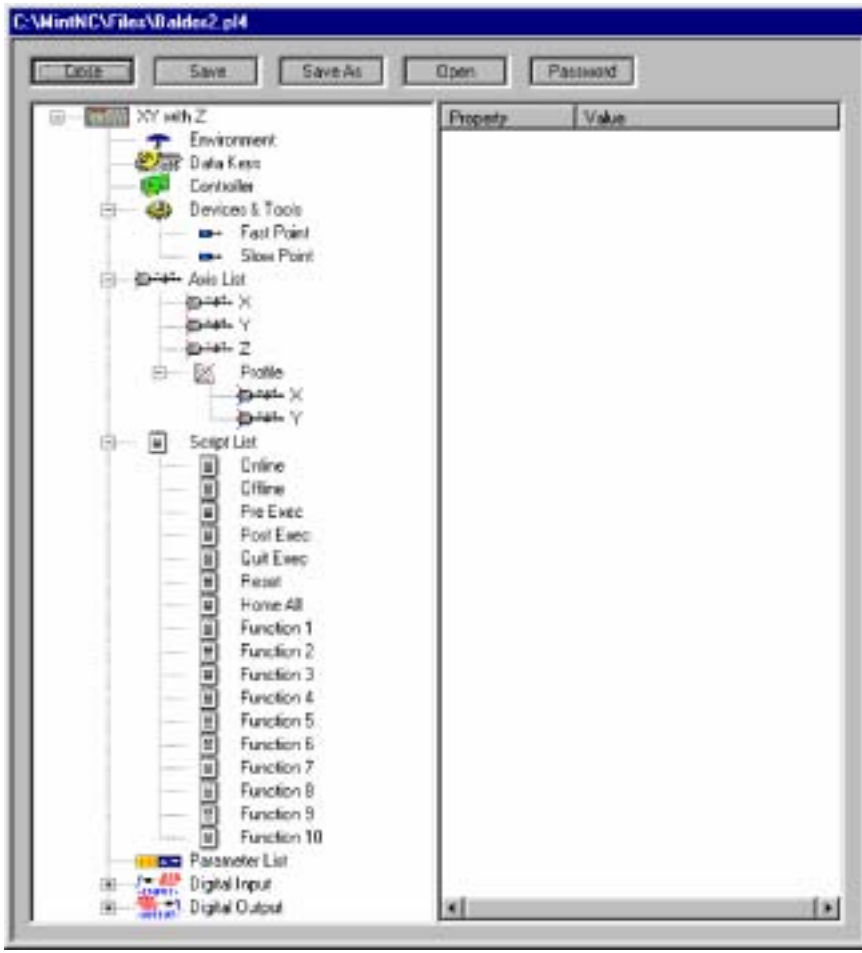
4.4.3 Machine Settings

Machine settings (axis lengths, scale factors, script list etc.) are stored in a Plotter file, which has a .pl4 file extension. It is unlikely that a particular machine would ever require more than one file to describe its configuration. However, to provide maximum flexibility, the application .ini file provides the ability to configure which plotter file is loaded by MintNC on startup.

This is set by the PLTFile value within the [Settings] section of the .ini file. Each of the installed .ini files references a .pl4 file, pre-configured to be suitable for use with the associated motion controller (e.g. BaldorESB.ini has a PLTFile entry of BaldorESB.pl4):

```
[Settings]
ObjList=340 117
ObjectControl=323 377 430 193
PreviewPages=1
PLTFile=..\Files\BaldorESB.pl4
PLTTitle=Baldor2
```

From the Start menu, select the required application shortcut (according to which controller type you are using) to start MintNC and then click the Edit Tool Control  button. The following dialog will be displayed:



This dialog provides access to all of the plotter file parameters (machine settings). Buttons are provided to save changes to this setup or save the setup under a different name if required. Once saved, the application .ini file is updated so that the same .pl4 file will be opened next time MintNC is started.

Each setting is described in detail in the MintNC help file, although the following sections describe settings that are required to get started with MintNC.

4.4.3.1 Environment

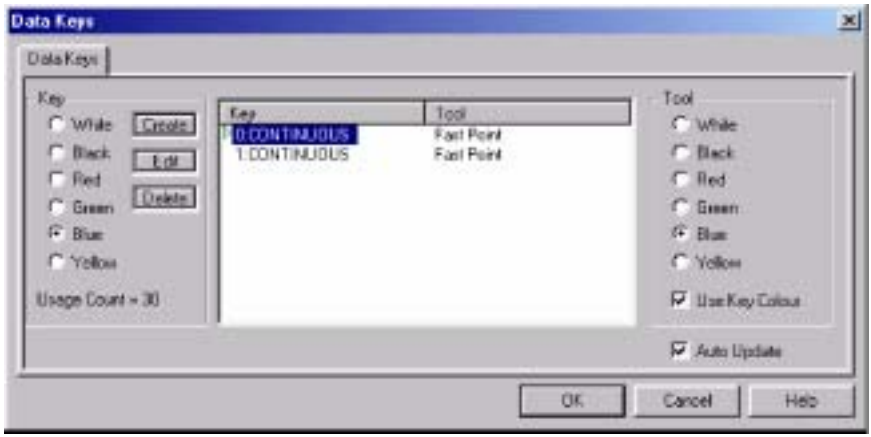
Double-click the Environment icon to display the environment dialog. This allows a variety of general MintNC settings to be configured. When first using MintNC the most important setting to verify is 'Buffer Wait':

Note: When Buffer Wait is selected MintNC will not issue motion instructions until the previous move has completed. If the application requires move/drawing segments to be contoured together to produce continuous motion at any time then this setting should not be selected.

4.4.4 Data Keys

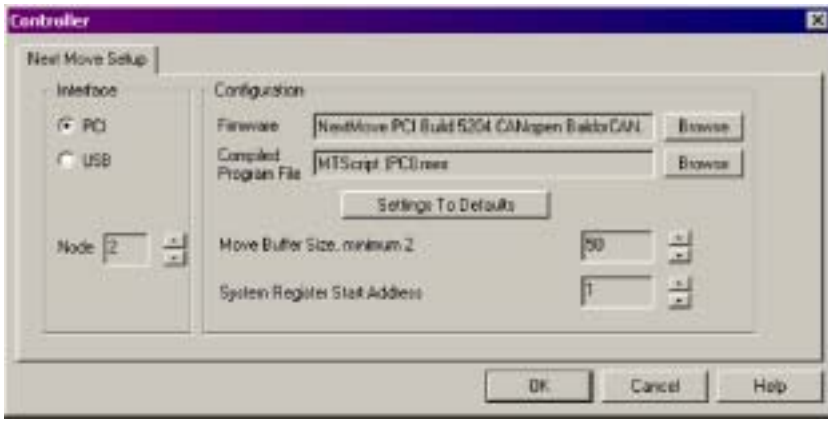
All geometry objects can have a data key associated with them. Data keys provide the 'glue' between the geometrical objects and the tools used to support the geometry on the machine. Data keys are unique text strings which are usually generated automatically when the data is imported. For example, when importing DXF data, the key for a geometry object is created from the layer in which the geometry has been drawn, and its line type. It is not unusual to see a data key '0:CONTINUOUS', which means that the geometry associated with the key was drawn in layer 0, line type CONTINUOUS.

A data key can be associated with a tool, and by this mechanism all geometry objects associated with that key are then associated with the defined tool automatically:



4.4.5 Controller Setup

Double-click the controller icon to access the Controller setup dialog:



To configure which firmware file should be downloaded to the NextMove PCI card when MintNC makes a connection, click the **Browse** button next to the firmware label (the label will initially indicate the firmware version shipped as part of the MintNC installation).

To configure which MintMT program file should be downloaded to the NextMove PCI card when MintNC makes a connection, click the Browse button next to the program file label (the label will initially indicate the template MintMT program shipped as part of the MintNC installation).

MintMT programs are pre-compiled into executables using WorkBench v5 - see section 3.4 for further details.

Note: When MintNC connects to the NextMove PCI card it will only download firmware if it detects the card does not already have firmware installed. A firmware download can be forced, if necessary, by selecting 'Reset Controller' from the Tools menu within WorkBench v5.

When MintNC connects to the NextMove PCI card it will only download a MintMT executable program if it detects the file to be downloaded has a later time/date stamp than the program already running on the card.

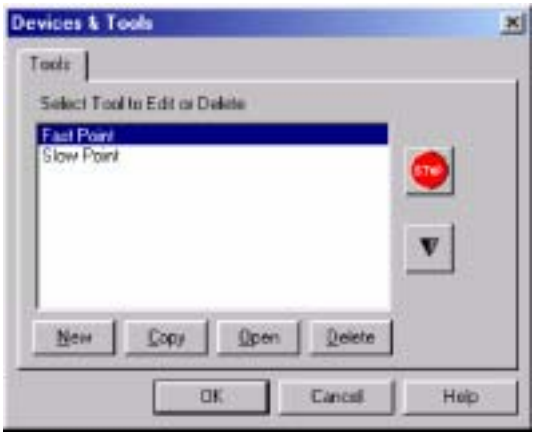
If using a USB NextMove controller simply select the USB option in the interface frame (in this case the firmware and program file settings are not relevant as these are not downloaded by MintNC).

To configure the move buffer size for each profiled axis use the up/down arrows. The default value for this setting is 100. This should work for most applications. If the axes are stopping unexpectedly mid-profile then try increasing this setting. If the controller appears to run out of memory try decreasing this setting. See the `MOVEBUFFERSIZE` keyword in the MintMT help file (within WorkBench v5) for further details about the MintMT move buffer.

The System Register Start Address should be left set to 1, unless the user intends to write their own MintMT script file that uses a Comms Array index other than 1 as the script file control location.

4.4.6 Devices and Tools

The Devices and Tools dialog shows a list of tools that have been created and are available for use. Select a tool in the list.



Changing tool order

Tool order can be used to sub-divide a series of machine operations when it is spooled to the machine controller. The buttons to the left of the tool list window allow the user to change the tool order. Click to select a tool, then use the up or down arrows to change its position within the tool list. When in tool order, tools at the top of the list are used before tools lower down the list.

Editing tool properties

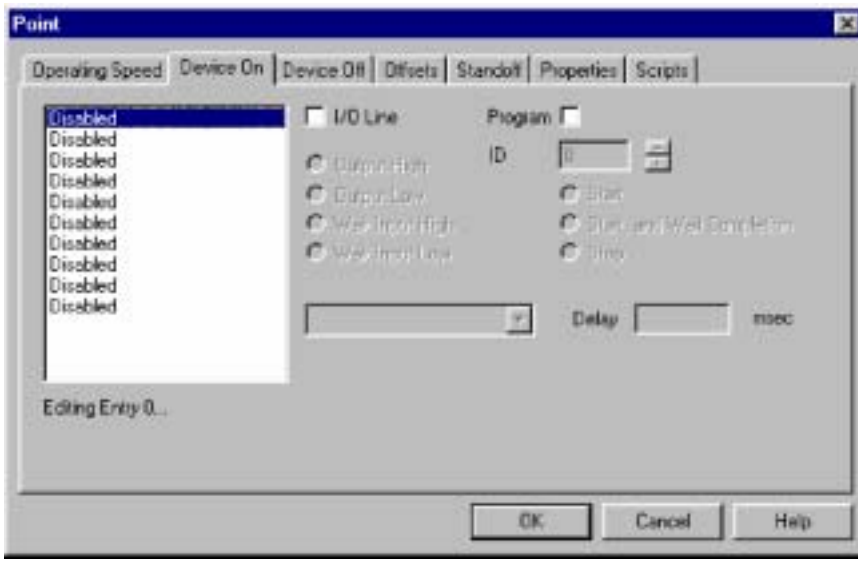
Click **Open** (or double-click the selected item in the list) to display its details.

Creating a new tool

Click **New** at the bottom of the list. This will display the tool selection dialog. This dialog will only be populated by tool types which are supported by the Machine Subsystem. Select the required tool type, and click **OK**. A new tool of the required type will be created. Click **Open** to edit its properties.

The tools that have been set up on the machine are also displayed in the machine tree structure.

Having created a Tool, MintNC provides the ability to perform actions whenever the profiler starts to use this tool (where a tool is associated with lines in the drawing) and whenever the profiler stops using this tool. These actions are entered in the Device On and Device Off tabs in the Tool setup.



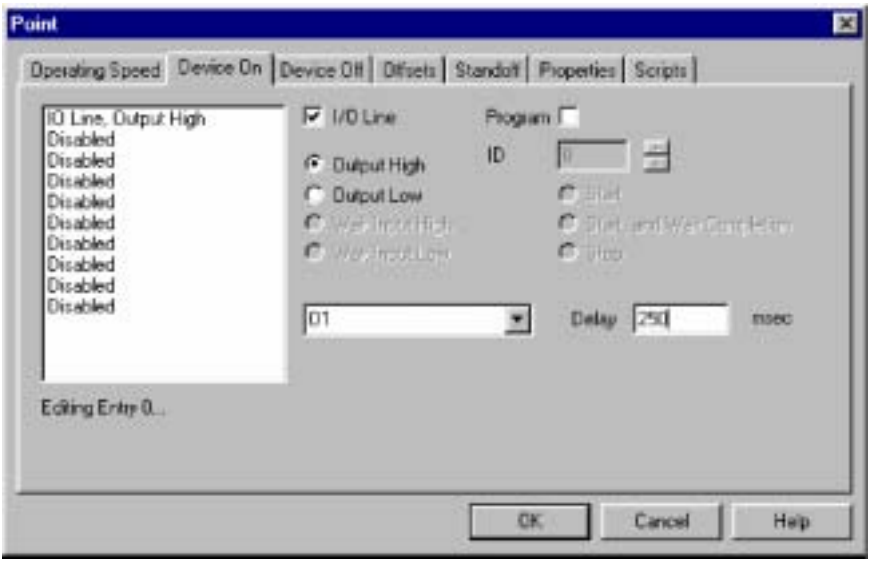
The user can select a sequence of up to 10 digital input and output events to take place when a device turns on or off, or the user can start or stop a MintMT script/program resident on the NextMove controller.

4.4.7 I/O Lines

To create a sequence of I/O events.

1. Click in the list of events to decide where in the sequence the I/O action must occur.
2. Check the I/O Line checkbox.
3. Click in the I/O list dropdown combo box and select an input or output.
4. If an output is selected, select the ‘Output High’ or ‘Output Low’ option.
5. If a delay is required after performing the I/O action, enter a value in the Delay text box.

The following diagram shows how to configure output 1 (NextMove controller output 0) to turn on, and for a 250ms delay to occur, whenever MintNC turns on the Point tool:



Often, turning a digital output on may require confirmation that the required machine action has taken place. For example, an output may be wired to a pneumatic solenoid valve. Actuation of this valve may cause a cylinder to move, and its final position may be detected via a proximity sensor wired to a NextMove controller digital input.

In these cases the Device On I/O action list may also contain a Wait Input action. For example, click the second item in the action list, check the I/O Line box, select an input from the dropdown combo box (e.g. Input 1 / NextMove controller input 0) and select ‘Wait Input High’.

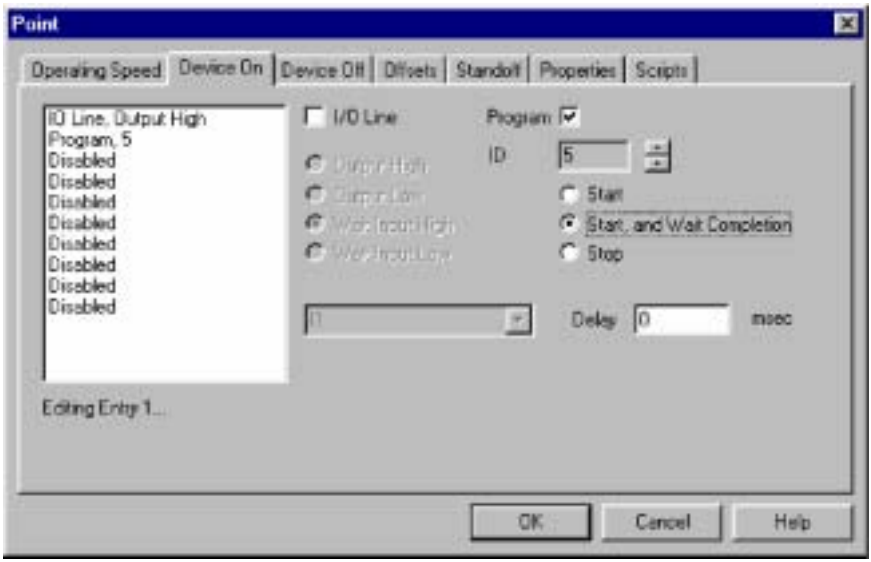
Now, whenever MintNC switches to the Point Tool it will automatically turn on NextMove controller output 0, wait for 250ms and then wait for NextMove controller input 0 to activate before continuing with the profile. I/O actions associated with Device Off operate in exactly the same manner, but the action list is reversed.

4.4.8 Programs

The Device On and Device Off events are also capable of starting and stopping MintMT programs that have been downloaded to the NextMove controller. This makes MintNC extremely flexible and able to achieve almost any given task. To select a program:

1. Check the Program check box.
2. Use the up/down arrows to select the appropriate program/script number (this number corresponds with the script/task number in the MintMT program)
3. Select whether MintNC is to Start the program (and then carry on with the profile), Start the program and then wait for the program to complete before carrying on with the profile, or Stop the program.

In the following example, program/script number 5 on the NextMove controller is started whenever the Point Tool is turned on, waiting for the program to complete before continuing with the profile.



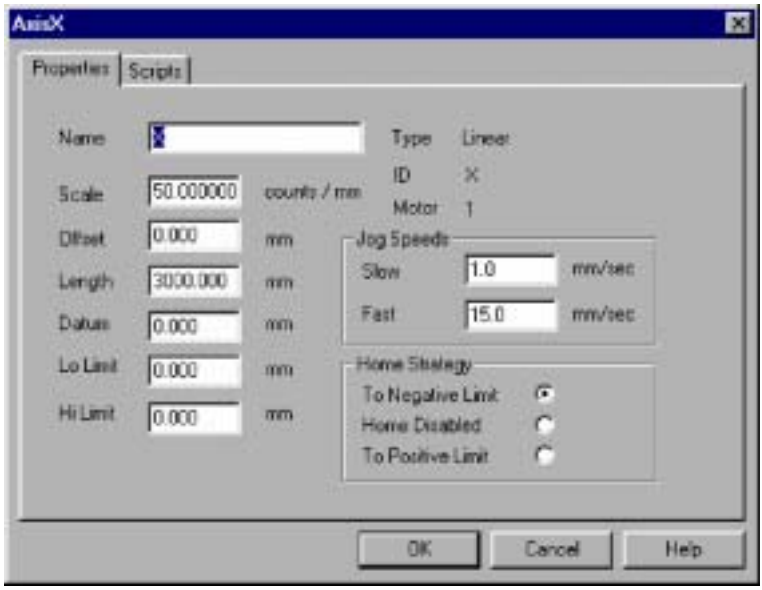
The MintMT program specified in this example may be responsible for moving a servo controlled Z axis to a particular position, and then turning on the NextMove controller relay output (which could enable a laser, for example). The MintMT script may then wait for a second before completing, at which point MintNC would continue profiling.

The example MintMT code for this script is shown below:

```
'------------------------------------------------------------------------
'User script 5
'------------------------------------------------------------------------
Task script5
  'Add user code here
  'Move Z axis into position...
  MOVEA.2 = 100
  GO.2
  Pause IDLE.2

  'Turn on laser...
  RELAY = _ON

  'Wait for laser power...
  Wait = 1000

  'Set script idle to indicate to MintNC when script is complete
  setScriptStopped 5
End Task
```

4.4.9 Axis List

Double-click an axis to display the Properties and Scripts tabs for that axis.



Properties tab

Name: A user defined name for the axis. Currently, this is not saved with the tool configuration data.

Type: For information only. The axis is either linear or rotational.

Scale: This is the scale factor required to convert coordinates from the internal coordinates to machine encoder counts, to reproduce the same distance on the machine. The value will be fixed for your machine, although they may be modified for special scaling purposes.

Offset: Included for future development and currently unused.

Length: This is the maximum length (measured from zero) of the axis. This must never be specified greater than the actual maximum stroke available on the axis.

LoLimit: Included for future development and currently unused.

HiLimit. Included for future development and currently unused.

Slow Jog: The speed at which the axis will be moved when ‘slow jog’ is selected. The axis jog speed is independent of the speed set for other axes, or that used when profiling.

Fast Jog: The speed at which the axis will be moved when ‘fast jog’ is selected. The axis jog speed is independent of the speed set for other axes, or that used when profiling.

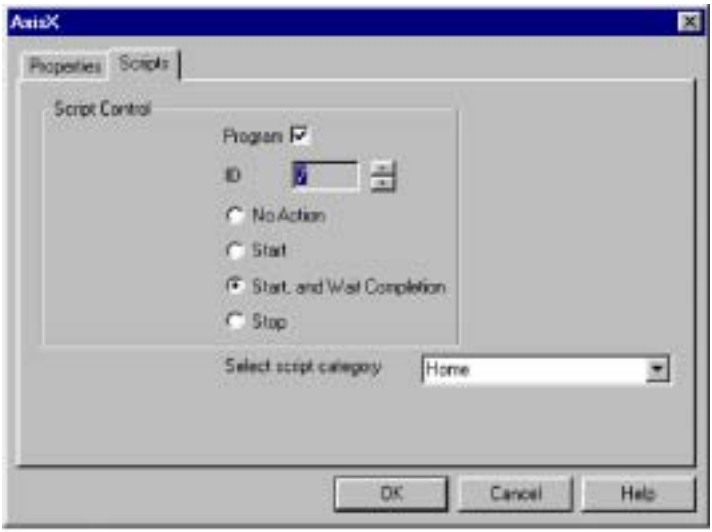
Homing Strategy, To Negative Limit: If a Home script/program hasn’t been assigned, configures the HOME button on the axis control panel to issue a Home to Switch in the negative direction.

Homing Strategy, Home Disabled: If the user wishes to disable the Home button on the axis control panel then this option can be selected.

Homing Strategy, To Positive Limit: If a Home script/program hasn’t been assigned, configures the HOME button on the axis control panel to issue a Home to Switch in the positive direction.

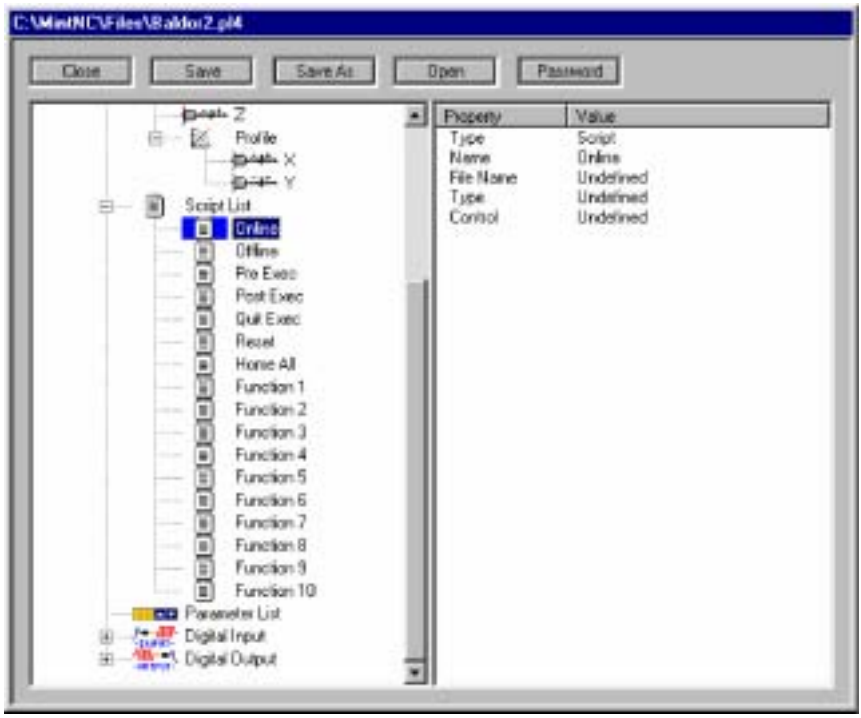
Scripts tab

The scripts tab allows the user to configure a user defined script associated with the HOME button on the axis 'Jog To' control panel. The following dialog illustrates how MintNC could call user program/script 7 whenever the X axis' HOME button was clicked. The axis number to be homed is also passed to MintMT in the comms array data (Comms2 by default). This allows the same script number to be used for homing all individual axes.

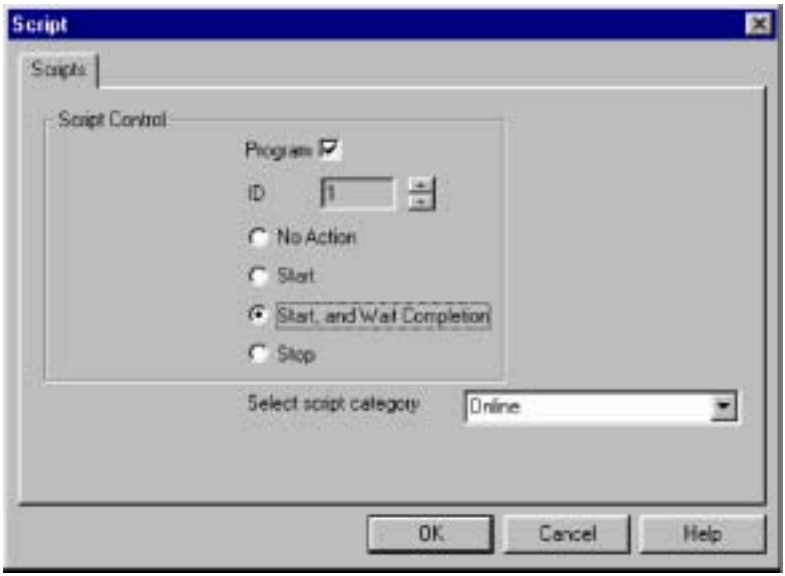


4.4.10 Script List

MintNC includes a number of pre-defined events that can be used to start/stop MintMT programs/scripts on demand. To access the event configuration double-click the event name.



The resulting dialog allows the user to select which program/script is started or stopped when the MintNC events occurs. The following example shows how to Start program/script 1, and wait for it to complete, when the MintNC ‘Online’ event occurs.



4.4.11 MintNC events

The MintNC events are described in the following sections.

4.4.11.1 Online

This event occurs whenever MintNC moves from an Offline to Online state. The program can be put online to the machine in one of two ways:

- Click the Online button in the machine control bar. This has the effect of putting the program online to the machine, but without attached profile data. This method would be used to jog or setup the machine, for example.
- Click the connect icon in the main toolbar, or use the Tools, Execute menu item. This has the effect of putting the program online to the machine, and with the attached profile data. This method would be used to execute a cutting operation, for example.

With either method, it will be found that the File, Exit menu item is disabled. Also, if the latter method has been used, it is not possible to close the graphic display window now associated with the machine.When the machine is Online, the Online label in the control panel button changes to Offline. Click this button to put the machine offline.

4.4.11.2 Offline

This event occurs whenever MintNC moves from an Online to Offline state, by using the button in the control panel. A typical use for a script associated with the Offline event might be to disable all the axes.

4.4.11.3 Pre Exec

This event occurs when the user clicks on the Run button in the control panel (i.e. just before any profiling takes place). A typical use for a script associated with the Pre Exec event would be to ensure all the axes are enabled and have been homed (if this is not the case the script would enable the axes and home them).

4.4.11.4 Post Exec

This event occurs at the end of the complete profile.

4.4.11.5 Quit Exec

This event occurs if the user clicks on the Quit button in the control panel. A typical use for a script associated with the Quit Exec event would be to ensure all the scripts started by MintNC are stopped if necessary.

4.4.11.6 Reset

This event occurs when the user clicks on the Reset button in the control panel.

4.4.11.7 Home All

This event occurs when the user clicks on the Home button in the control panel. As its name suggests, a typical use for a script associated with the Home All event would be to home all of the axes.

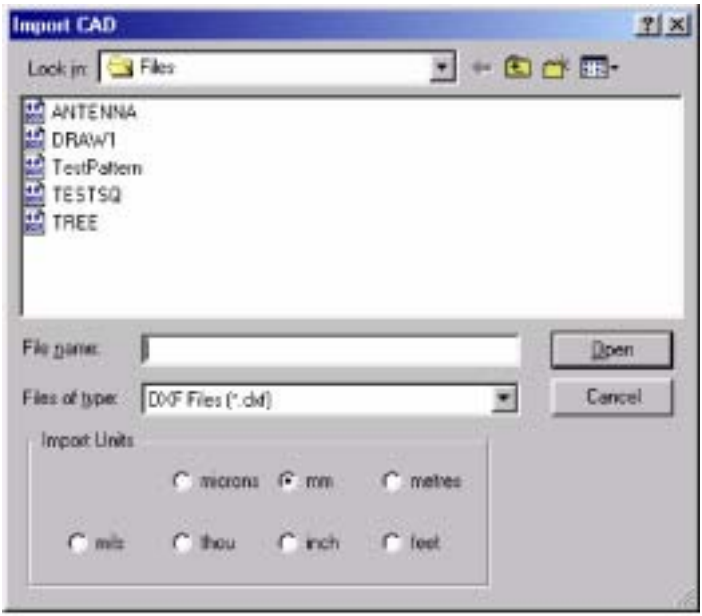
Note: MintNC detects whether axes have been homed using comms elements 5 and 6 (by default). The MintMT program must set bits in these elements to indicate an axis has been homed or clear them to indicate an axis has lost position.

4.4.11.8 Function x

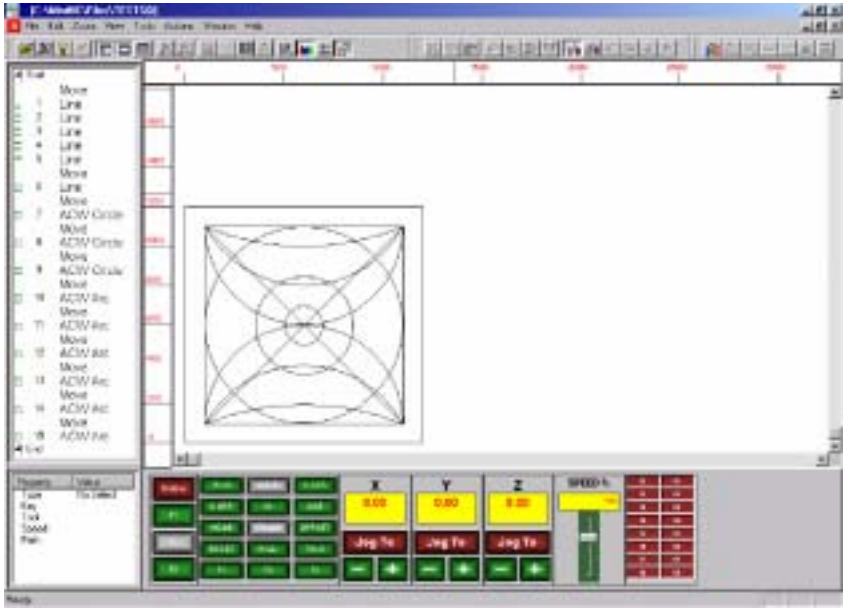
There are ten general function buttons available within MintNC. This event occurs when the user clicks on the one of these buttons. Scripts can be associated with these functions to perform miscellaneous machine operations.

4.4.12 Opening a Drawing

Choose the File, Import menu item. MintNC will display a file import dialog. A file filter is available (set to DXF by default) to sort files by type. This dialog box also allows the user to specify the units of measurement with which drawings are imported and exported.



Select a file type to import, select a file, and click Open. MintNC will open a new Graphic Display Window and will list the drawing entities in the Object Properties window. Symbols in this properties window are used to highlight which entities are linked together and which are unique.



The program list window shows the sequence or order of the geometry contained within the currently active graphic display window. The program list can be the sequence of the geometry of the main program contained within the graphic display window, or of an associated sub program. The program list window can be displayed or hidden by using the View, Properties menu item (note that this also displays/hides the Object Properties Window).

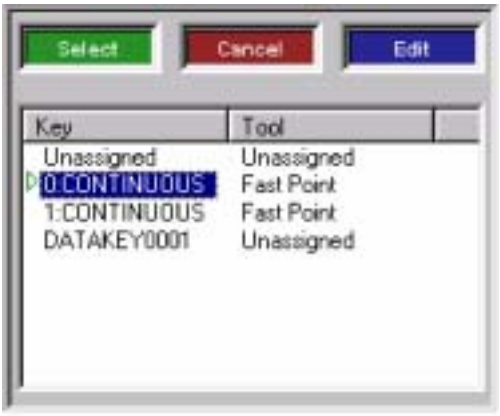
A sample program list is shown opposite. The sequence of geometry is contained between the 'Start' and 'End' labels. Each entry refers to a discrete geometrical object and contains three items/columns. The first item is a graphical symbol, which summarizes the status of each geometrical object in terms of its connectivity to adjacent geometry and its association to a tool, an object identification number, and a geometry description (such as Line, Arc, etc.).

Note that the geometry description can be displayed in 'Native' or 'Descriptive' mode, or in a pseudo 'G Code' mode. To switch between these modes, use the File, Preferences menu item. Note that the object identification number is not the sequence number as will be seen if using any of the reorder options. They can, however, be renumbered so identification number will match sequence by selecting the Actions Renumber option.

The segments of the drawing now need to be assigned with a data key and associated tool. To assign the complete drawing with a data key and tool, all line segments must be selected by dragging a box over the entire drawing, or by using the Edit, Select All menu item (Ctrl+A).

When the lines have been highlighted, a data key can be assigned by double-clicking the Key property in the property dialog box:

This will display the Key / Tool selection window. The required data key and associated tool can be highlighted and selected using the Select button at the top of the window.



Once this operation has been performed, the lines of the drawing will change color to the associated data key color, as previously defined by the data key options dialog. If a connection has already been made to the controller (see section 4.3), motion may now be executed by clicking **RUN** in the Control Bar. Before motion commences, the following dialog is displayed, giving the user further options to define Start point, Tool/Order and number of Repeats:

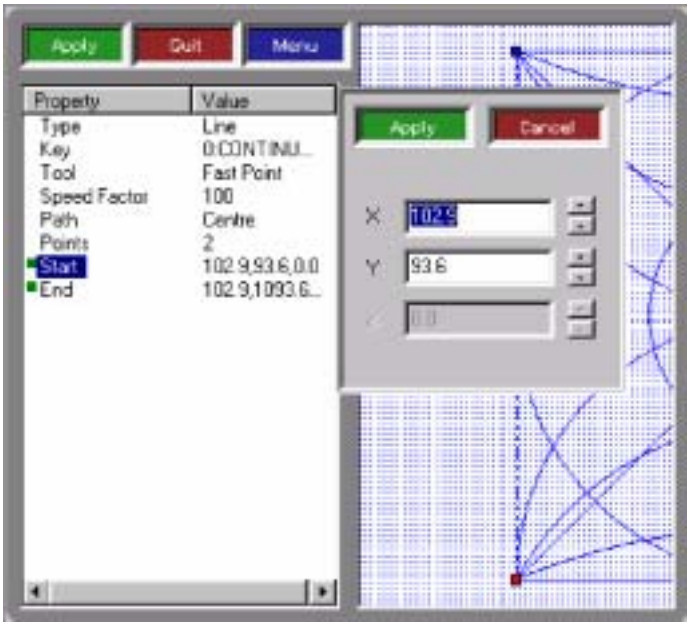

Machine execution
Start
From Begining
From Mark
At Mark
Tool/Order
Defined Order
Tool Order
Fixed Tool
OK
Cancel
Repeat
1
Fast Point

4.4.13 Editing a Drawing

Although MintNC is not a fully featured CAD package it does provide a wide variety of drawing editing features, some of which are described in the following sections.

4.4.13.1 Object Modification

MintNC allows some modification of the object line co-ordinates by the user. The illustration below shows a line segment of the object selected in the object properties box. The start point of the line has been selected by double-clicking Start. This action opens up the co-ordinate dialog box, which contains the relevant X and Y co-ordinates for the start point of the line. These may be edited:



Similarly, other geometric objects such as arcs and circles can be modified by selecting the relevant point on a path, then using the co-ordinate dialog box to enter new values.

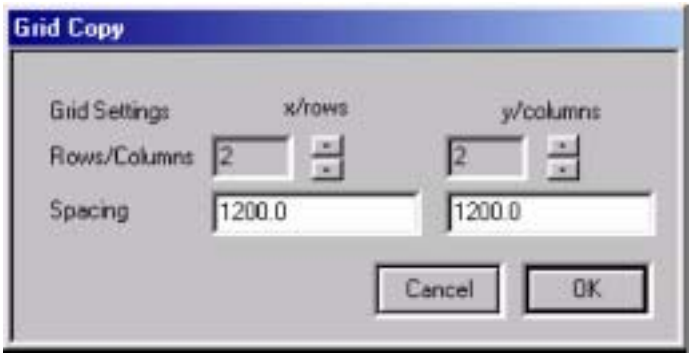
4.4.13.2 Compacting

The Compact options enable parts to be packed together along the length and across the width of the machine bed (and beyond) allowing a set distance between each part. The distance set in the Preferences/Compact Distance is used by MintNC to separate all parts that are compacted. This distance is the actual separation between compacted parts, and does not set a boundary around each part; it actually defines the minimum distance to which a part will be compacted to another. The method allows compaction to zero separation, although there is an in-built 0.1mm mandatory minimum to allow parts to 'slide' over the top of others and so compact in two axes.

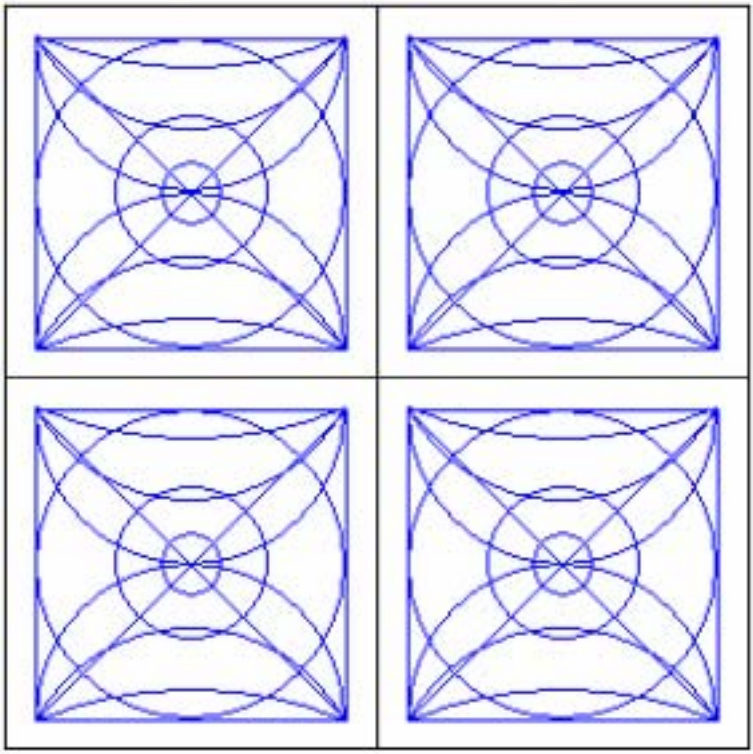
Note that the Preferences dialog allows two sets of compact distances to be defined, each with separate values for X and Y compact distances. The set in use is indicated within the Part Edit toolbar. The other buttons move the selected part or parts in the defined direction to be adjacent to (but not overlap) another part or parts, or up to the frame boundary - whichever is reached first. Note that in a multi frame situation, the nearest frame boundary serves as the limit.

4.4.13.3 Grid Copy

The Grid copy or nesting option allows the user to duplicate parts in a simple grid arrangement. Usually, one or more parts would be selected and grouped into the bottom left hand corner of the window. With these part(s) selected, click Action/Grid Copy. This will display the grid definition dialog.



Select the number of rows/columns required. Select the row/column spacing. The spacing defaults to that required to copy the shapes without overlap. In the following example, a single part is selected and then duplicated in a two by two grid.



4.4.13.4 Optimisation

Selecting the Actions, Optimise menu item displays the Optimisation dialog. The optimisation process attempts to join together connecting motion and reduce the number and length of intermediate moves. Typically, it would be used if importing a CAD file (e.g. DXF), which will present the data in the order in which it was drawn rather than the best order for motion.

4.5 Example MintMT Program

MintNC installs two template MintMT programs, *MTscript (ESB).mnt* and *MTscript (PCI).mnt*. These can be modified to suit any application. Up to 32 user scripts/programs are supported. The following example code is an extract from the complete file (showing user scripts/tasks and subroutines only) and has been written to suit a machine with three axes (X,Y and Z) of which only two, X and Y, are profiled axes. This code illustrates:

- A Home All script: can be called by the MintNC Home All button/event; programmed as script 1.
- A Check Drives are Ready script: can be called by the MintNC Pre Exec event; programmed as script 2.
- A Device On script: can be called by settings in the Tool's Device On tab; programmed as script 3.
- A Device Off script: can be called by settings in the Tool's Device Off tab; programmed as script 4

Note that the homing routine has been coded as a subroutine so that it can be called from more than one script:

```
'-------------------------------------------------------------------
' User script 1 - Home All
'-------------------------------------------------------------------
Task script1
  'Add user code here

  'Call the homing routine
  doHome

  'Set script idle to indicate to MintNC when script is complete
  setScriptStopped 1
End Task
'-------------------------------------------------------------------
' User script 2 - Check axes are ready
'-------------------------------------------------------------------
Task script2
  'Add user code here

  'If any axis is disabled or not homed then call the home routine
  If (DRIVEENABLE.0 = 0) Or (DRIVEENABLE.1 = 0) Or (DRIVEENABLE.2 =
0) Or (cmHOME1 <> 8) Then
    doHome
  End If

  'Set script idle to indicate to MintNC when script is complete
  setScriptStopped 2
End Task
'-------------------------------------------------------------------
' User script 3 - Tool 1 Device On
'-------------------------------------------------------------------
Task script3
  'Add user code here
```

```
  'Turning on tool 1 involves moving the Z axis to position
  'and turning on digital output 3 (operates a solenoid)
  MOVEA.2 = 100
  GO.2
  Pause IDLE.2
  OUTX.3 = _ON

  'Set script idle to indicate to MintNC when script is complete
  setScriptStopped 3
End Task
'--------------------------------------------------------------------
' User script 4 - Tool 1 Device Off
'--------------------------------------------------------------------
Task script4
  'Add user code here
  'Turning off tool 1 involves moving the Z axis back to home
  'and turning off digital output 3 (de-energizes a solenoid)
  MOVEA.2 = 0
  GO.2
  Pause IDLE.2
  OUTX.3 = _OFF
  'Set script idle to indicate to MintNC when script is complete
  setScriptStopped 4
End Task

Sub doHome()
  'Clear all errors and enable axes...
  CANCELALL
  DRIVEENABLE[0,1,2] = _ON;

  'Home axes (all homed to a switch in a negative direction)
  HOME[0,1,2] = _hmNEGATIVE_SWITCH;
  Pause IDLE[0,1,2]

  'Set bits in Home status register...
  cmHOME1 = cmHOME1 Or 0111
End Sub
```

4.6 Additional Help

A detailed help file is included with the MintNC software. The contents of the help file are displayed in a tree structure under the Contents tab. The Index tab allows the user to view all help topics detailed in alphabetical order. The Search tab allows the user to search for all topics containing the specified search word(s).

The help file is installed as part of the standard installation procedure.

If you have any suggestions for improvements to this manual, please let us know. Write your comments in the space provided below, remove this page from the manual and mail it to:

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United Kingdom.

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Comment:
continued...

Thank you for taking the time to help us.

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