

RoboWare

TM

Programming/Control Software for Mitsubishi Robots

VER 2.xx

USER MANUAL

RV-M1 and RV-M2 models

KakeWare ©

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Introduction

The RoboWare Program uses all the functions and conventions of Microsoft Windows. To get full use of the Windows environment, consult your *Windows 3.1 User Manual*.

Purpose

The purpose of the **RoboWare Program** is to help the user interact with the RV-M and/or RV-E series of robots through a computer. These robots are accurate and versatile industrial micro robots. Their many commands and I/O capabilities provide the user with ease of operation for a wide range of applications. The teachbox and Drive Unit panel switches accomplish many of the necessary tasks of defining positions, moving to defined positions, stepping through program lines and running programs stored in the Drive Unit battery-backed RAM. To send and execute intelligent commands, write and transfer robot programs, turn inputs on or off and check the conditions of robot, requires the use of a computer. Once program and positions are transferred and stored in the Drive Unit memory, the computer can be disconnected and the program can run from the Drive Unit front panel switches or teachbox. Getting programs, position values and commands from the computer to the Drive Unit requires an interface program like RoboWare.

Some of its features include:

- File management
- Communication (RS232C) protocol management
- Robot project management
- Robot command entry & execution
- On-Screen Input/Output manipulation and evaluation
- Robot program development
- Robot program stepping
- Position teaching and stepping
- On-line and context sensitive help files
- Joint by joint movement
- Cartesian (X,Y,Z,P,R) movement
- GUI (graphical user interface) environment
- Robot error checking
- Can run either the RV-M or RV-E series of robots

RoboWare has many features that hopefully make programming the robot easy, enjoyable and saves time so you can be more productive.

Terms

Below are terms and words used throughout the *RoboWare Program User Manual*.

Window

A window is a screen containing objects such as textboxes, command buttons, labels and listboxes. Each window has its own CAPTION BAR located at the top of its window, defining the window. Sometimes windows are referred to as dialog boxes

Objects

Textbox: A box or area where keyboard data is entered or text is displayed.

Command button: An object when clicked or highlighted, performs a function or task. Some examples of command buttons are, OK or CANCEL.

Label: Text describing an object

Listbox: An object containing a list of text or data which can be scrolled through and items selected. Some listboxes will expand down or up when clicked.

Caption: Text at the very top of every window, describing the window.

Selecting with the mouse

The term "**click**" is used when selecting an option or object. To "select" using the mouse, move the mouse pointer over the object you want to select and press the left mouse button. To select from a list, "**double click**" the left mouse button on the item in the list you want to select. Sometimes clicking the right mouse button on an object or textbox will open special POPUP menus or dialog boxes.

Focus

An object has focus when it can receive keystrokes or mouse clicks. Only one object at a time can have focus.

RV-x

Roboware can interface with both the RV-M and RV-E series of robots. when the term RV-x is used it means it is applicable to both series of robots.

About the RoboWare Program

This program is intended to be used in conjunction with your Mitsubishi RV-x Operators manual. A complete understanding of the Operators manual, the robot and its motion is important from both a personal safety standpoint and damage to the robotic arm. If you are new to the software and/or robot, do not disable any of the warning messages and keep robot speeds slow until you feel confident with both the software and the operation of the robot.

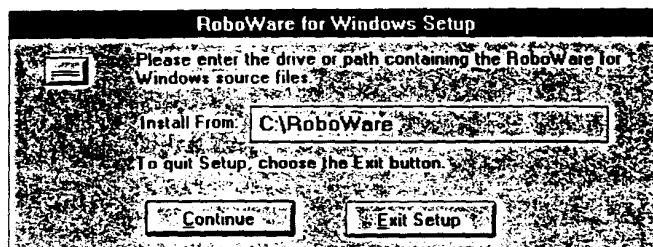
Program files needed to run the *RoboWare Program* include:

RV-M.exeProgram file
RobotLibDirectory to store robot program and position files and IO files
RV-M.hlpProgram help file.
RV-M2.hlpRV-M2 commands help file
RV-M1.hlpRV-M1 commands help file
vbrun300.dllVisual Basic runtime module must be in the windows directory<files> \vbx All .vbx files need to be in the windows\system directory

These directories and files are created during installation and can be changed within the program. All of the RV-x commands have been implemented within the program.

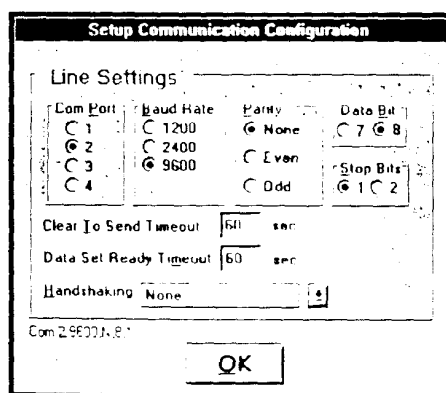
Software Installation

1. Insert the program disk in your 3.5 floppy drive
2. From the Files menu of the Program Manager, select RUN
3. Type <drive>: setup and press ENTER



4. When the "Install to" dialog box appears, enter the directory where you want the program files installed to and press the Enter key. To use the default path, just press ENTER.

The setup program will expand and copy the files to the appropriate directories and make the program group window and program icons.



When the Communication Configuration dialog box appears, select the Com Port connected to the Drive Unit and the communication line settings that match the Drive Unit dip switches. Consult your Operators manual for the dip switch settings or use the settings as described in the Hardware Requirements section of this manual.

Note:

Be sure Clear to Send and Data Set Ready are set to 60 sec.

Hardware Requirements

- IBM compatible 80386 computer or greater with a serial card.
- 3 button PC compatible mouse
- RV-x robot
- RS232C serial cable
- Microsoft Windows 3.1

System Setup

The system consist of the software, computer, robot and any peripheral device such as a PLC, all connected through RS232 cables. For the software and hardware to work together properly, they must be configured the same. To configure the RV-x, consult your *Mitsubishi RV-x Instruction manual* that came with your robot. The figure below shows the Drive Unit dip switch settings that work best with the **RoboWare Program**.

Dip Switch Settings	1	2	3	4	5	6	7	8
SW 1	0	1	0	0	0	0	0	1
SW 2	0	1	1	1	0	1	1	0
SW 3	0	0	0	0	0	0	0	1

If you use these Dip Switch Settings, the Line Settings for **RoboWare** will be:

Baud rate: 9600
Parity: None
Data Bits: 8
Stop Bits: 1

Starting the *RoboWare Program*

To start the program, click the *RoboWare* icon in the *RoboWare* group Window.

Use the following as a check list before starting the *RoboWare Program*

- Drive Unit ST1 switch is DOWN
- Teachbox is OFF
- The RS232 cable is connected between the Drive Unit and the serial port of the computer
- A Drive Unit robot program is not running or is stopped. If the Green or Red light on Drive Unit front panel is on, press the Red switch and then the white reset switch.
- No Drive Unit Error has occurred. Reset any errors if the Red Error lamp is on, press the white reset switch
- Matching communications port and baud rate settings between the robot and the RoboWare Program configuration file.

When the *RoboWare Program* starts, if the Communication Error dialog box appears, follow the suggestions listed in the dialog box and click on Retry. If the message continues, click on Cancel.

Before the program loads, it will tell you the status between the Drive Unit and the computer.

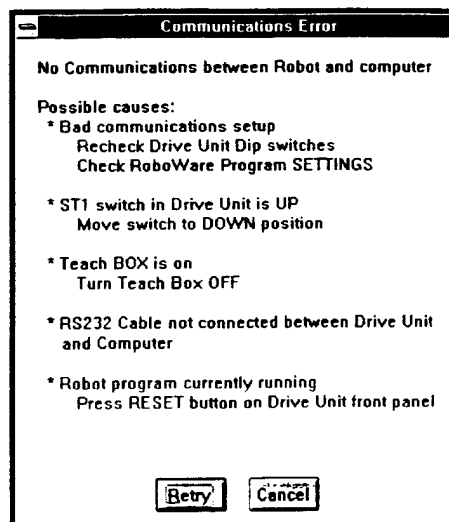
If the message:

- "Communication between the robot and computer is NOT established"
Choose the **Utilities\Program Configuration** menu item and select the correct Line Settings. (see section on Configuration Window to set Line Settings)
- "Communication between the robot and computer is established"
The program and robot are "talking"

Communication Error Dialog Boxes

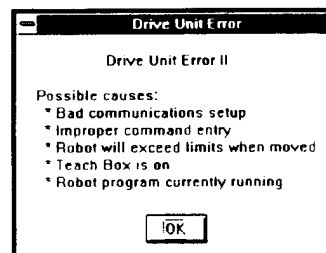
Time-out Error

This error occurs if data sent to the Drive Unit exceeds the Clear to Send Time-out setting in the Program Configuration file. It occurs when at least one of the possible causes listed in the dialog box is true. If you correct the cause and click on RETRY the program will continue and communication is established between the robot and computer. If the error continues it is probably a Line Setting problem in the Program Configuration file. Click on CANCEL and the program will continue without communication established between the robot and computer. Then go to the Program Configuration Window and select the Line Settings that match the Drive Unit dip switch settings.



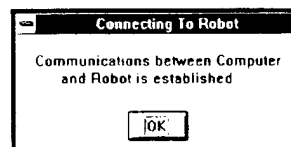
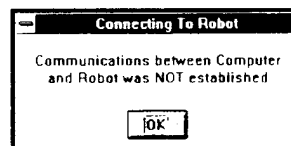
Drive Unit Error

This error occurs if the Drive Unit received a command it did not understand. This could be caused by improper communications or a typing error. It is also caused when you tell the robot to move beyond its limits. Click on OK to return to the program.



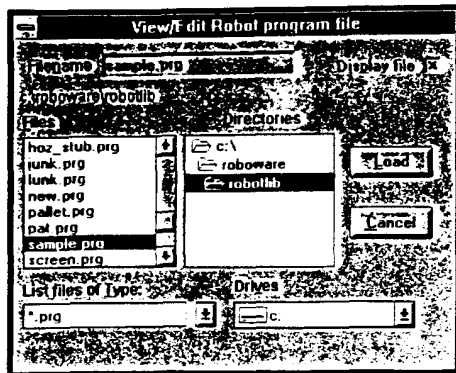
Connecting To Robot

These dialog boxes notify you of the current communication conditions between the robot and Drive Unit.



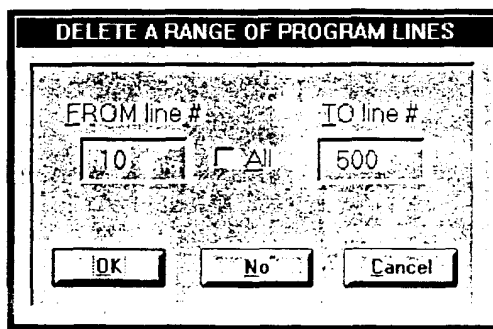
Two windows, used extensively throughout the RoboWare Program, are the File Requester and the FromTo Requester dialog boxes

File Requester



The File Requester helps the user locate or enter files for displaying, loading or saving. If the Display file checkbox is checked, the program will open a NEW Editor and display the selected files data. The Caption will indicate the particular action that called the File Requester.

FromTo Requester



The FromTo Requester is used to enter a range of program lines or position values used for loading, deleting, saving or viewing data from or to the robot Drive Unit.

ALL: Checking the All checkbox fills the From and To textboxes with the maximum values for the current robot model.

Display: Checking the Display checkbox tells the program to load a NEW Editor and display the range of data.

OK: Closes the FromTo Requester and starts the process which called the FromTo Requester using the values in the "From" textbox and "To" textbox.

Cancel: Terminates the process which called the FromTo Requester.

On Line Help

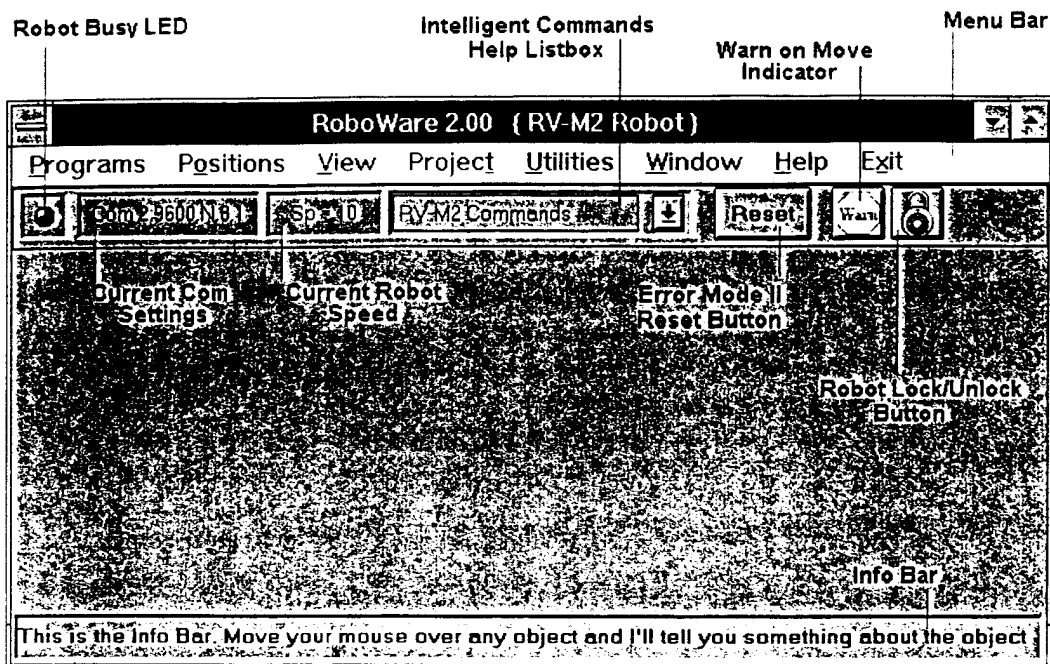
The RoboWare Program has context-sensitive on-line help. Pressing the "F1" key in any window with focus, will bring up the help screen for that window. You can use the Main Window Help menu item to get other help

functions. The Main Window Status Bar has all the current robot model's commands in a drop down listbox. Selecting any command will open a help window explaining the command.

Info Bar

The Info Bar is located at the bottom of the Main Window. When the mouse moves over an object, the Info Bar displays some information about that object.

Main Window



The Main Window is an MDI (Multiple Document Interface) window. If any other windows (child forms) are opened from the Main Window, those windows will sit only on the Main Window Desktop. If the child window is minimized, its icon stays at the bottom of the Main Window. Closing the Main Window will close the application.

Main Window Components

Caption Bar

The Caption Bar displays the program name and current Robot model.

Menu Bar

Use the mouse or ALT + shortcut key to access menu items. For a more detailed description of Main Window menu items, see the section on Main Window menu items.

Status Bar

The Status Bar keeps track of and displays some of the current program settings, data transfer status, robot commands and robot error reset button.

- **Current Communication settings** are displayed in the first Status Bar window. If any changes are made to the configuration file pertaining to Line Settings, this window will update to reflect the changes.
- **Current Robot Speed** is displayed in the second window. If the speed changes by any of the options available through the program, this window will update to reflect the change.
- **Robot Commands** drop down listbox displays all the commands available to the currently selected robot model. Click the LEFT mouse button on the down arrow of the listbox and using the scroll bar, scroll through the list of commands. Clicking on a command will open the help window for that command. This window shows the proper syntax for the selected command with some examples. If the help window cannot be found, be sure the RV-x.hlp files are in the same path as that in the Program Help file path of the Configuration window Default Paths, (see section on Configuration Window).
- **RESET** button will reset an ERROR II from the robot Drive Unit.
- **Warn on Move Indicator** displays the current status of the **Utilities/Warn on Move** menu item. Clicking the Warn on Move Indicator toggles its condition.



The **Warn on Move** menu item is checked. The program will display a dialog box warning the user the robot is about to move at the current robot speed.



The **Warn on Move** menu item is NOT checked. The program will not display a dialog box warning the user the robot is about to move at the current robot speed.

NOTE: If the user is new to the program and robot, it is best to leave the Warn on Move menu item checked. When you become more familiar with the robot and program, you can disable this feature.

- **Lock Indicator** displays the current status of the **Utilities\Lock** menu item. Clicking on the Lock Indicator toggles its condition.



Indicates that the system is **not locked**. Commands can be sent and received from the robot.



Indicates that the system is **locked**. No commands can be sent or received from the robot until correct password is entered and the system is unlocked.

To lock and unlock the system, see the section in the Utilities menu items

Main Menu Items



Many of the functions and windows in the **RoboWare Program** are accessed through the Main Menu Bar items.

Programs (menu item)

Load to Drive Unit

Loads a robot program file to the Drive Unit. When the **FROMTO Requester** opens, you have the option of deleting either a range or all program lines in the Drive Unit. Clicking on **Cancel** terminates Loading to Drive Unit. Clicking on **No** continues the Load process without deleting any program lines. Entering a From line# and a To line# and clicking on **OK** deletes those line#'s and brings up the **File Requester**. Select the file to load and click on **LOAD**. If you want to View the file transferred, click on the Display checkbox. The Transfer Status Gauge will display the transfer progress. When the file transfer is completed, the Transfer Status Gauge will clear and a "bell" will sound. If the display file was checked, a new Editor window will open, displaying the selected program file displayed.

Save from Drive Unit

Saves a range of robot program lines currently in the battery backed RAM of the Drive Unit to a file. When the **File Requester** appears, enter the filename to save the range of robot program lines to and click on "Save". When the FromTo Requester appears, enter a range of program line#'s to save and click on **Ok**. If you want to view the selected program line#'s, click on the View Data checkbox. Click on the **Ok** button to start saving from the Drive Unit. The Transfer Status Gauge will display the transfer progress. When the file transfer is completed, the File Transfer Status Gauge will clear and the "bell" will sound. If View data was checked, a new Editor window will appear with the selected program file displayed.

Program Stepping

Opens the Program Stepping Window. See section on Program Stepping Window for more information.

View Current

Displays a range of program line#s currently in the Drive Unit

View/Edit

Opens a robot program file and displays the files data in a new Editor Window

Positions (menu item)**Load to Drive Unit**

Loads a position file to the Drive Unit. When the **File Requester** appears, select the file to load and click on LOAD. If you want to View the file transferred, click on the Display file checkbox within the File Requester. The Transfer Status Gauge will display the transfer progress. When the file transfer is completed, the Transfer Status Gauge will clear and a "bell" will sound. If the Display file checkbox within the File Requester was checked, a new Editor window will appear with the selected program file displayed.

Save from Drive Unit

Saves a range of robot position values currently in the battery backed RAM of the Drive Unit to a file. When the **File Requester** appears, enter the filename to save the range of position values to and click on the Save button. When the FromTo Requester appears, enter the range of position values to be save and click on Ok. If you want to view the selected position values, click on the Display file checkbox within the File Requester. The File Transfer Status Gauge will display the transfer progress. When the transfer is completed, the Transfer Status Gauge will clear and a "bell" will sound. If the display checkbox within the File Requester was checked, a new Editor window will open with the selected position file displayed.

Position Stepping

Opens the **Position Stepping Window** (See section on Program Stepping Window for more information)

Position Table

(See section on Position Table for more information)

New : Opens a new Position Table

Edit : Opens a previously saved Position Table

View/Edit

Opens a position file from the computer and displays the file in a new Editor Window.

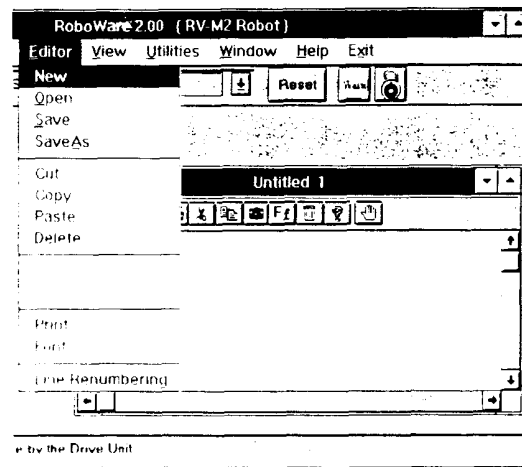
Editor (menu item) This menu item appears only when an Editor Window is active

New

Opens a new Editor Window called "Untitled" plus the number of Editor Windows currently opened.

Open

Loads a file selected from the File Requester Window and opens a new Editor Window displaying the selected file.

**Save**

Saves the text in the currently focused Editor window to its current file name. If the Editor Window is Untitled, the File Requester will open to assign the document a file name.

Save As

Opens the File Requester so you can assign the currently focused Editor Window a file name. The Editor Window caption will display the new filename. From now on, selecting the Save menu item will save the text to the new filename.

Print

Prints the current Editor Window to the default Windows printer.

Search \ Replace

Opens the Search\Replace dialog box.

Find

Opens the Find dialog box

Line Renumbering

Automatically renumbers robot program lines, updating all jump routines. When the dialog box asking for the sequence number appears, enter the sequence # and press enter or click on OK (A sequence number of 10 will sequence the program lines 20, 30, 40,ect.). All jump routines will be updated to reflect the new line numbers. The updated file will be displayed in the Editor Window.

View (menu item)

Project Window: Opens the Project Window

Quick Command Bar: Opens the Quick Command Bar and closes the Info Bar

Editor Window: Opens a new Editor Window called Untitled.

Command Window: Opens the Command Entry Window

Axis\Joint Movement Window: Opens the Axis\Joint Movement Window

Shape Definition Windows

Circle Define Window: Opens the Circle Define Window

Polygon Define Window: Opens the Polygon Define Window

I/O Condition Window: Opens the I/O Condition window

Project (menu item) This menu item is visible only after a project is OPENed

Program File

Displays the Project's Robot Program file associated with the project. If the Project could not find the file, the menu item will be ghosted

Position File

Displays the Project's Position File associated with the project. If the Project could not find the file, the menu item will be ghosted

Position Table File

Displays the Project's Position Table associated with the project. If the Project could not find the file or there is no Position Table File assigned to the Project, the menu item will be ghosted

I/O Table File

Displays the I/O Table File associated with the project. If the Project could not find the file or there is no Picture file assigned to the Project, the menu item will be ghosted

Picture File

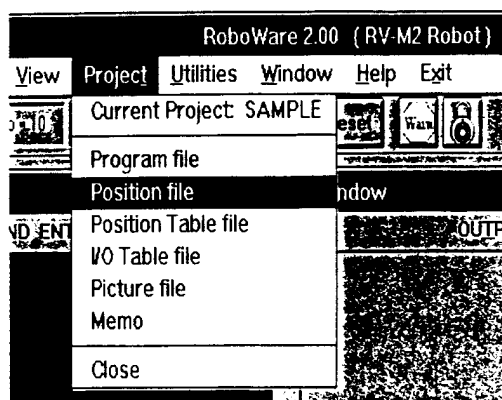
Displays the Picture File associated with the project. If the Project could not find the file or there is no Picture File assigned to the Project, the menu item will be ghosted

Memo

Displays the Project's Memo Pad

Close

Closes the Project file and removes the Project menu item from the Main Menu Bar.



Utilities (menu item)

Reset Drive Error II

Resets an Error Mode 2 from the Drive Unit.

Program Configuration

Opens the Configuration Window. (See section on Configuration Window for more information)

Input / Base Calculator Window

Opens the Input / Base Conversion Calculator Window

Millimeter / Inch Conversion

Opens the Millimeter /Inch Conversion window.

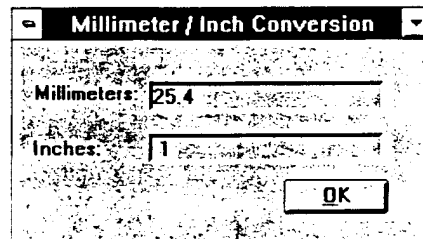
To Convert:

Millimeters to Inches

Enter the millimeters in the Millimeters textbox and press ENTER

Inches to Millimeters

Enter the Inches in the Inches textbox and press ENTER



Reset Communications Port

Closes the communications port and reopens, using the current Communication Protocols. Use this feature if the communications port locks up.

Warn on Move

Whenever the robot is about to move, the *RoboWare Program* warns you and gives you the option to cancel the move command. This is also true if you are about to run a Drive Unit robot program. When the *RoboWare Program* starts, **Warn on Move** is defaulted to enabled (checked). To disable this option remove the check mark by selecting the **Warn on Move** menu item. The check mark will disappear.

NOTE: If you are **NEW** to using the *RoboWare Program* or robot, keep this option enabled. As you become familiar with both, you can disable this option.

Lock robot

If this menu item is checked, it prevents anyone from sending commands to the robot until it is turned off. (not checked).

To lock the robot:

- Select the **Commands\Lock robot** menu item, (not checked) or click on the Lock Indicator. When the password dialog box appears, enter a password, (8 characters max.) and click on Ok.
- Reenter the password to verify and click on OK
The Lock Indicator icon in the Main Window Status Bar will change to the locked position and the **Utilities\Lock robot** menu item will be checked. No commands can be sent to the robot until the robot is unlocked

To Unlock the robot:

- Select the **Utilities\Lock robot** menu item.(checked) or click on the Lock Indicator. When the password dialog box appears, enter the password used to lock the robot and click on Ok. If the password is valid, the Lock Indicator icon in the Main Window Status Bar will change to the unlocked position and the **Utilities\Lock robot** menu item will not be checked. Commands can now be sent to the robot.

If you forget your password, you must exit and restart the program. The default startup value for this menu item is *not locked*.

Microsoft Terminal Window

Starts the Microsoft Terminal program. You can use this option if you need to communicate to a PLC . The program will close the port to the *RoboWare Program* to free up the Com Port for the Terminal program.

Write

Sends a "WR" command to the robot. This command will write the contents of the Drive Unit battery-backed RAM to the EPROM

Transfer

Sends a "TR" command to the robot. This command will transfer the contents of the EPROM to the Drive Unit battery-backed RAM.

CAUTION: If no EPROM is installed in the Drive Unit, the contents of the battery-backed RAM will be overwritten with nothing.

Window (menu item) Uses Windows conventions

Cascade

Tile

Arrange Icon

Help (menu item)**Contents:**

Opens the Program help window to the Help Contents

Search for Help on... :

Opens the program help Search dialog box

How Do I..... :

Opens the Help window to topics most commonly used in the RoboWare Program

Hardware Installation:

Open the Help window to the Hardware Installation topic

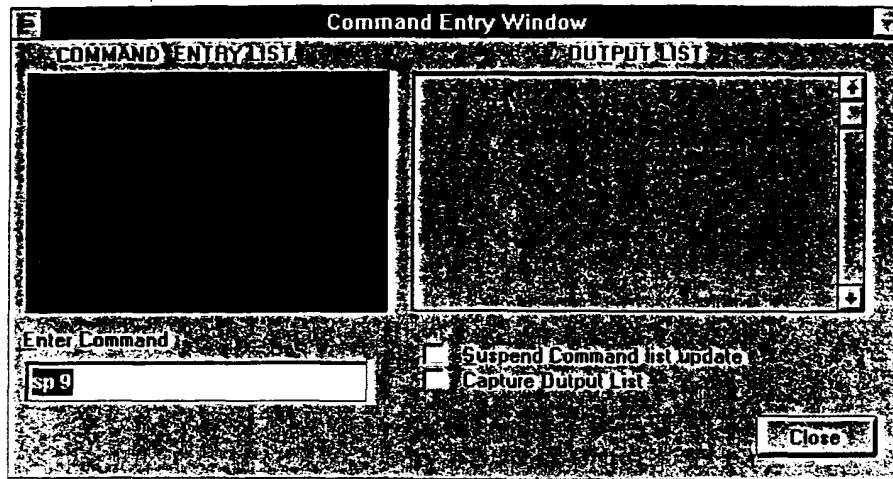
About:

Opens the About window.

Exit (menu item)

Closes the RoboWare Program. Checks for any unsaved documents and queries to save them.

Command Entry Window



To open the Command Entry Window select **View\Command Window** from the Main Window menu bar.

The Command Entry Window provides an easy way to enter Robot Intelligent Commands, display results, save and print a history of commands successfully sent to the robot and even generate programs.

Enter Command

Type the robot command in the Command Entry textbox and press ENTER. The text is sent to the robot and a copy is displayed in the Command Entry List Window. If the command requires a reply from the robot, the reply is displayed in the Output List Window.

Suspend Command list update

Checking this option suspends sending text to the Command

Entry List Window. For more on the Command Entry List Window and what it can do, see the section on "Command Entry List Window".



Capture Output list

Checking the option brings up the File Requester. Enter the filename to save the Output List text to and click on OK. Now any data received in the Output List Window is sent to a buffer where, when the option is unchecked, the data is saved to the selected file.

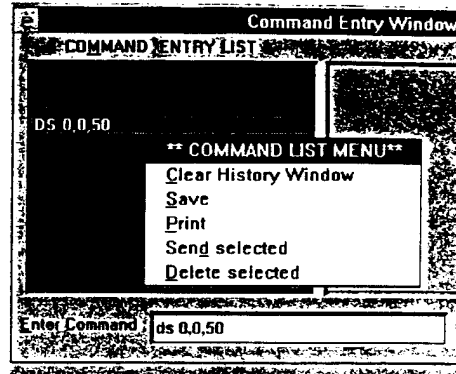
Command Entry List

Once data is in the Command Entry List Window there are some things we can do with it.

1. **Double click** Sends the data to the robot

2. **Opening the POPUP menu**

Move the mouse over the Command Entry List Window and press the RIGHT mouse button. These menu items apply to the Command Entry List window only.



Clear

Deletes all the data from the Command Entry List Window.

Save

Saves the data currently in the Command Entry List window. When the File Requester appears, enter the file name you want to save the list to. If you want to add line numbers to the data, enter the line number sequence you want to use (20 = 20, 40, 60 ect.) , in the *Add Program Lines #s* textbox. To view the saved file, check the *Display file* checkbox. When all the data is correct, click on *Save*.

Print data

Prints the data currently in the Command Entry List Window to the default Windows printer.

Send selected

If text is selected in the Command Entry List Window, the selected text will be sent to the robot. If no text is selected, the *Send selected* menu item will be ghosted.

Delete selected

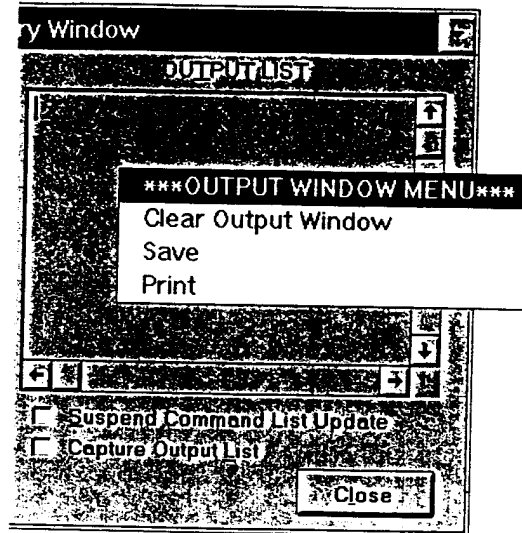
If text is selected in the Command Entry List Window, the selected text will be deleted. If no text is selected, the *Delete selected* menu item will be ghosted.

Output List

Some Robot commands are asking for replies back from the Drive Unit. The Output List textbox displays and keeps a running history of those replies.

Opening the Popup menu

Move the mouse over the Output List Window and click the RIGHT mouse button. These menu items apply to the Output List window only.



Clear

Clears the text from the Output Window.

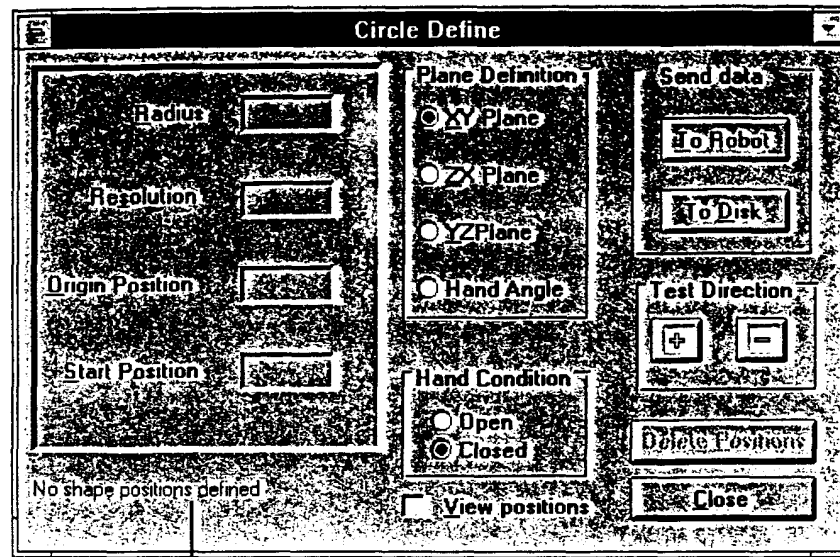
Save

Saves the text from the Output Window. When the File Requester appears, enter a filename and click on Save.

Print

Prints the text in the Output Window to the default windows printer.

Shape Define Window



Status Line

Purpose

The Shape Definition Window creates an array of points which moves the robots tool point in a circular or polygon shape in the plane selected in the Plane Definition box. Once the array of points is defined, they can be sent to the robot and tested or sent to a file. To load the Shape Window, select **View\Shape Definition \Circle Window or Polygon Window** menu item from the Main Menu Bar

Radius

Enter a number (mm) defining the radius of the desired shape.

Resolution

Enter a number which will be the degrees between points defining the shape. If you want 36 points defining the shape, then you would use a resolution of $360/36$ or 10 degrees. The smallest resolution angle between points is 5 degrees.

Origin Position

The Origin position is a position value currently defined in the Drive Unit. It will be the center point of the shape. This position is a position number

which has been previously defined either through the Teachbox or through many functions provided through the Roboware software.

Start Position

This will be the first position number making up the array of position values defining the shape. For example, if a resolution of 10 (degrees or 36 position values) is used and the START POSITION is 700, then position numbers 700-735 defines the shape.

Plane Definition

Selecting one of the 3 planes (XY, XZ, YZ) tells the program to calculate the shape defined points to move the tool point in a particular plane.

Selecting the HAND ANGLE option will calculate the points to move the robots tool point in the defined shape 90 deg. to the current hand angle (pitch angle).

NOTE

If the points exceed the arm limits, the robot will alarm. Clicking on the RESET button in the Main window status bar will reset a robot error.

Send data**To Robot**

The calculated position values are sent to the Drive Unit

To Disk

The calculated positions are sent to a file. When the File Requester appears, enter the file name you want to save the defined shapes positions to and click on Save.

View Positions

If the View Positions checkbox is checked, the data, either sent to the Drive Unit or to a file, is displayed in a new Editor Window.

Delete Positions

The positions defining the circle are deleted from the Drive Unit

Test Direction

To test the shape positions, they must be sent to the drive Unit first. Click on the "+" or "-" button to move through the array of positions defining the shape.

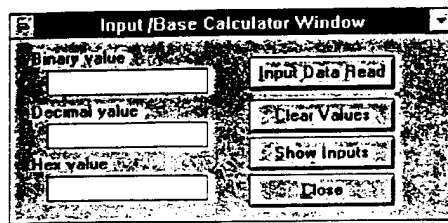
Status line

The status line displays the position numbers defining the shape. If no shape positions are defined or have been deleted, the status line displays, "No shape positions defined".

Hand Condition

The Hand Condition option will define the shape points with the hand either opened or closed depending on the option selected. This option is not available when the RV-M1 Robot is the current model.

Input\Base Calculator



Purpose

Convert from one base to the other two bases. To open the Input\Base Calculator window, select **Utilities\ Input\Base Calculator Window** menu item

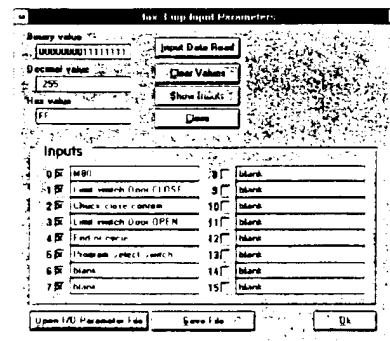
Calculating Base values Click in the “known” base textbox and enter the base value, press ENTER and the other two bases will be calculated and displayed in their base textboxes. The Input checkboxes will be updated.

Input Data Read Reads the current Drive Unit inputs and displays the hex, binary and decimal values. The Input checkboxes will be updated.

Clear Values Clears all the base text boxes and Input checkboxes

Show Inputs Expands the dialog box to show the Input Textboxes and Input Checkboxes

Close Closes the Input Base Calculator Window



Input Checkboxes Clicking in a checkbox will change the hex, binary and decimal textboxes to display their respected values. Entering a hex, binary or decimal value will update the checkboxes

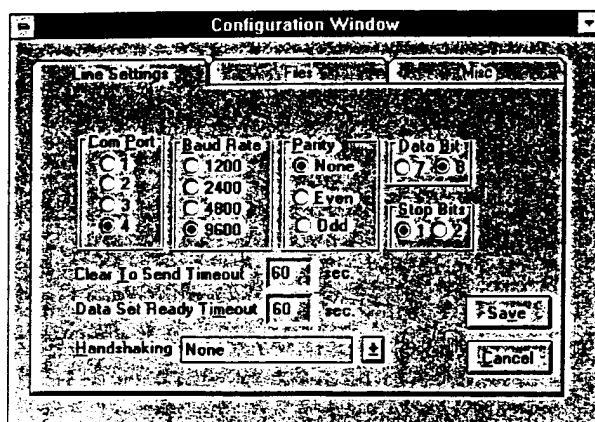
Input Textboxes Used to enter a description for a particular input.

Open I/O Parameter File Opens an existing I/O Parameter file and displays the inputs for the file in the Input Textboxes

Save File Saves the Input Textbox data to the current I/O Parameter file. The current I/O Parameter file is displayed in the caption bar at the top of the window

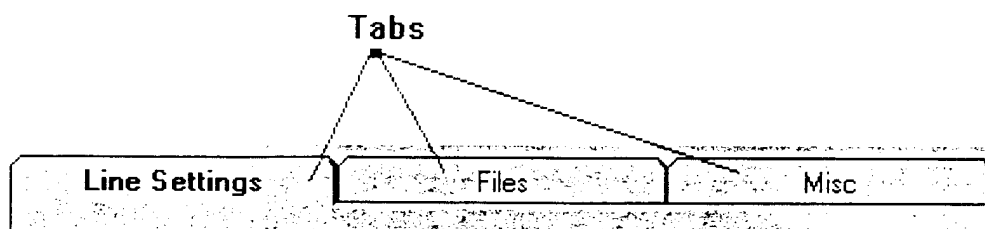
Ok Shrinks the Input/Base Calculator Window to hide the Input Textboxes and Input Checkboxes

Configuration Window



Purpose

Sets the program default values for program startup. To open the Configuration Window select **Utilities\Program Configuration** menu item from the Main Menu Bar. To switch between Line Settings, Files or Misc, click on the appropriate "Tab"



Line Settings (tab)

Sets the serial RS232C protocol values. These values must match the Drive Unit SW3 dip switch settings. See your *Robot Operators Manual* for correct settings.

Files (tab)

Robot Program Files

The path where the robot programs are saved or retrieved

Robot Position Files

The path where position values are saved or retrieved.

Program Help Files

The path where program help files are stored.

Program file Extension

A robot program file's default extension

Position file extension

A robot position file's default extension

Misc (tab)**Model**

Forces the program to check for command syntax compatible to currently selected model. such as speed settings, maximum program lines and position values.

Write/Transfer Enable

Enables or disables the menu item in the Main window menu bar for Write or Transfer to EPROM. This is a safety feature to keep from Transferring data when no EPROM is present and erasing all battery backed RAM data in Drive Unit.

Robot Speed

Sets the default robot speed when the RoboWare Program is loaded. The Main Window status bar will update when either Save or Use is clicked

Save

Saves the configuration window data to the **rv-x.ini** file. This file is read when the *RoboWare Program* is started.

Cancel

Closes the Configuration Window and does NOT apply any changes

NOTE When Save is clicked, the communications protocols are reset and the program notifies you of connection between the Drive Unit and computer.

Utility Bars

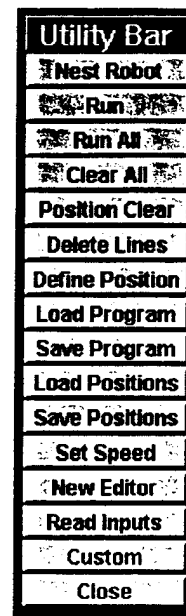
Purpose

Short cut to those commands or options most commonly used within the **RoboWare Program**. The CUSTOM button brings up the programmable Custom Command Button Bar.

To open the Command Bar, select "View\Command Bar" from the Main Window menu bar. The Command Bar is opened when the program is started.

Standard Utility Bar

This command bar contains many of the more commonly used functions of the RoboWare Program. This saves from multiple mouse picks and keystrokes. They behave the same as the menu item.



Nest Robot: Sends a nest command to the Drive Unit

Run: Runs a range of robot program lines currently in the Drive Unit battery backed RAM

Run All: Runs the first robot program line currently in the Drive Unit battery backed RAM and all subsequent program lines

Clear All: Deletes all data (programs & positions) from the Drive Unit.

Delete Lines: Deletes a range of robot program lines currently in the Drive Unit battery backed RAM.

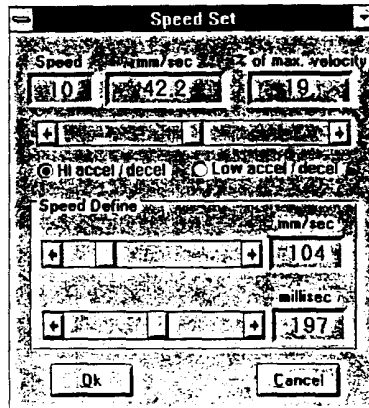
Define Positions: Opens the Define Position window. Enter the Position#, X, Y, Z, P and R in the appropriate textbox and click on Ok. The new position value will be sent to the Drive Unit.

Load Program: Loads a robot program file to the Drive Unit battery backed RAM

Save Program: Saves a range of program lines currently in the Drive Unit battery backed RAM

Load Positions: Loads a position file to the Drive Unit battery backed RAM

Save Positions: Save a range of position values currently in the Drive Unit battery backed RAM, to a file



Set Speed: Opens the Speed Set window. Set the robot speed using the slide bars. When the RV-M1 model is currently defined, the maximum speed is 9 and the Speed Define option is not available.

New Editor: Opens a new editor session

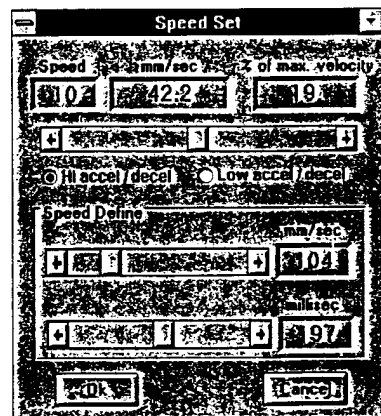
Read Inputs: Reads the current inputs values and displays them in a dialog box.

Load Program: Loads a robot program file to the Drive Unit battery backed RAM

Save Program: Saves a range of program lines currently in the Drive Unit battery backed RAM

Load Positions: Loads a position file to the Drive Unit battery backed RAM

Save Positions: Save a range of position values currently in the Drive Unit battery backed RAM. to a file

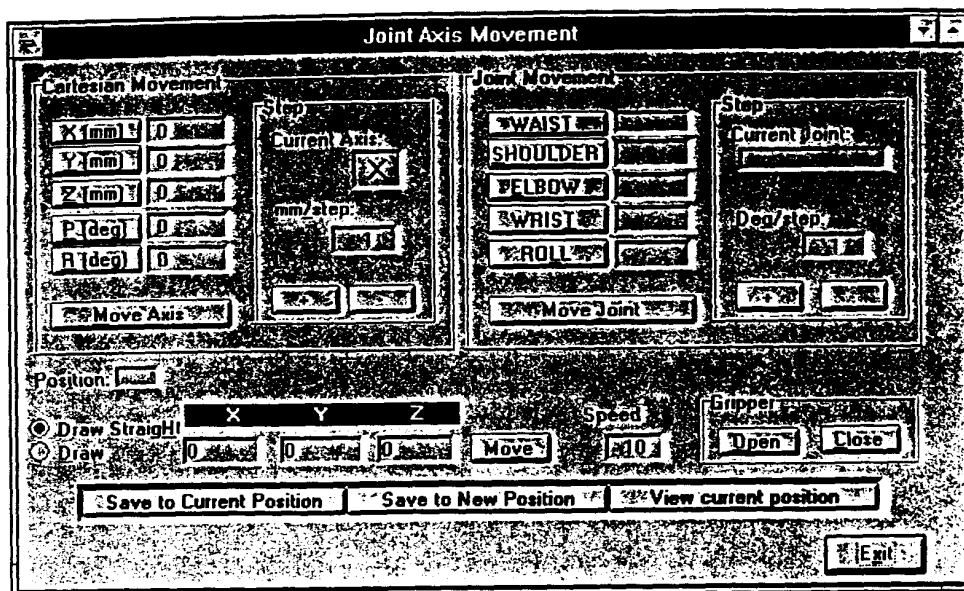


Set Speed: Opens the Speed Set window. Set the robot speed using the slide bars. When the RV-M1 model is currently defined, the maximum speed is 9 and the Speed Define option is not available.

New Editor: Opens a new editor session

Read Inputs: Reads the current inputs values and displays them in a dialog box.

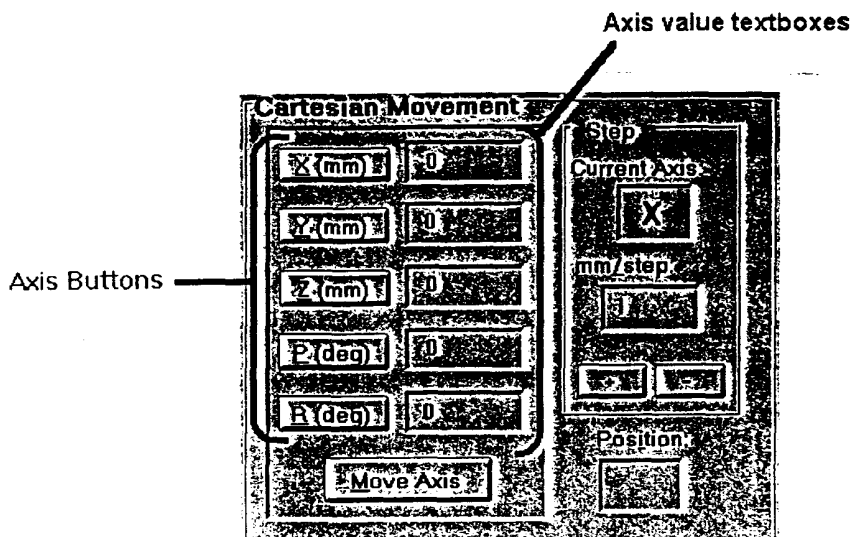
Axis/Joint Movement Window



Purpose

Manipulate the robot using Cartesian or joint by joint method, gripper control, defining positions and moving the robot linearly. Many of the functions in this window simulate the Teachbox XYZ and PTP functions. To open the Axis/Joint Movement Window, select the View\Axis/Joint Movement Window menu item

Cartesian Movement



Moves the robot in the XYZ planes only

1. Select a **Current Axis** by clicking on one of the axis buttons (X, Y, Z, P, R).
The selected axis is displayed in the *Axis value textboxes*.
2. Click in the **mm/step window** and enter a value you want the axis to move in distance when you click on the + or - buttons.
3. Click either the + or - buttons to move the axis.
The *Axis value textboxes* will update to display the current robot position.

NOTE: Clicking on the + or - buttons before the *Axis value textboxes* have a chance to update will cause the robot to error and the *Axis value textboxes* will display all "0". Click on the RESET button in the Main Status Bar to clear the error. Click on the View current position button to update the *Axis value textboxes*

To load a current Drive Unit position value, enter the position # in the **Position** textbox and press ENTER. If the position # exists, the *Axis value textboxes* will display the positions value.



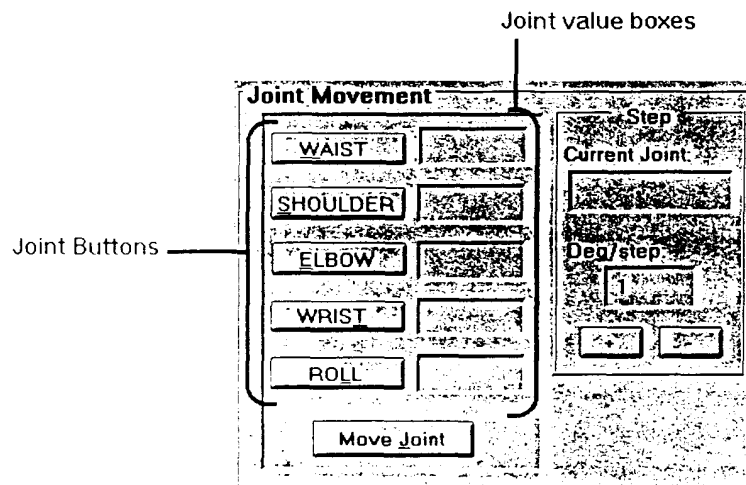
Clicking the Move Axis button will move the robots axis's to the values currently in the *Axis value textboxes*. You can edit the data in each *Axis value textbox* and click on the Move Axis button to move the robots axis's to their values.



To save the data in the *Axis value textboxes* to a new position #, click on the **Save to New Position** button. When the requester appears to enter the new position #, enter the number and press ENTER.

Joint Movement

The Joint Movement Options allow you to manipulate the robot joint by joint or multiple joints at one time.



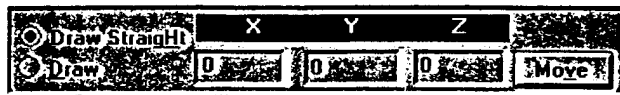
To move a single joint

1. Click on one of the Joint Buttons, the **Current Joint** window will display the selected Joint Button
2. Click in the **Deg/step** window and enter the degrees you want the robot joint to move when you click on the + or - buttons.
3. Click on either the + or - button. The joint will move the specified degrees and the *Axis value textboxes* will update to display the robots current position values.

To move multiple joints

Enter the degrees to move the desired joints in the **Joint value boxes** and click on the **Move Joint button**. Only those joints with values will move.

Draw functions



These functions provide an easy way of sending Draw (DW) and Draw Straight (DS) commands to the robot. Enter the XYZ values in the Draw options boxes, select Draw or Draw Straight option and click on the *Move* button. The robot will move and the *Current Axis Windows* will update to display the robots current position value.

Note: Draw Straight (DS) option is not available with the RV-M1 model.

Speed function

Sets the robot speed and updates the Main windows Status bars Speed window. Click in the Speed textbox and enter the new robot speed. Press ENTER to update the new speed

Gripper functions

Clicking on the **Open** or **Close** buttons effects the gripper accordingly.

Save to current position

Saves the data in the *Axis value textboxes* to the position # currently in the Position box

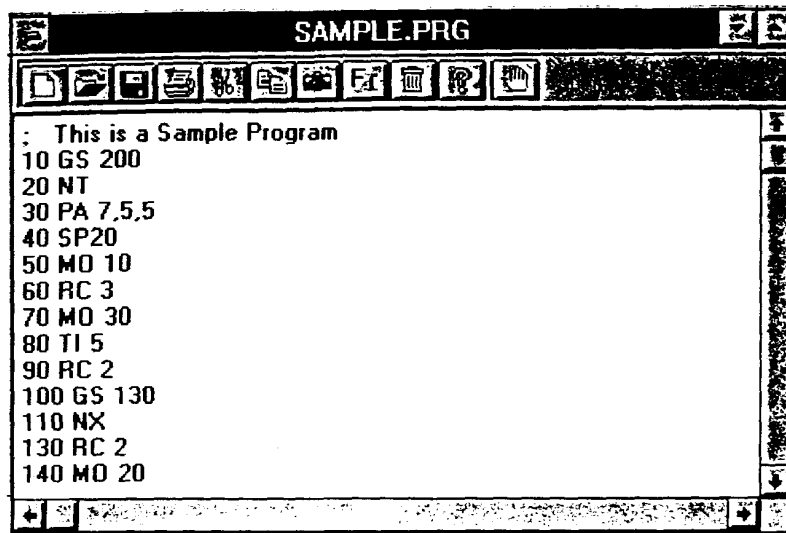
Save to New Position

Saves the data in the *Axis value textboxes* to a new position #

View current position

This updates the *Axis value textboxes* to display the robots current position value. Use this button when information from the Drive Unit has been corrupted and you want to get the current robot position.

Editor Window













The Editor Window is used to write or edit program files, position files or just view or edit text files. The file size is limited to 32K. You can have multiple Editor windows open at one time. When an Editor Window is open, the Editor menu item is added to the Main Menu Bar. If all the opened Editor Windows are minimized, the Editor menu item is disabled (ghosted). If all the Editor windows are closed, the Editor menu item is removed from the Main Menu Bar.

If you try to exit an Editor Window and data has been changed, a message box will ask if you want to save the data. This function occurs if you try to exit the program also.

To open the Editor Window, select **View\Editor Window** from the Main Menu Bar.

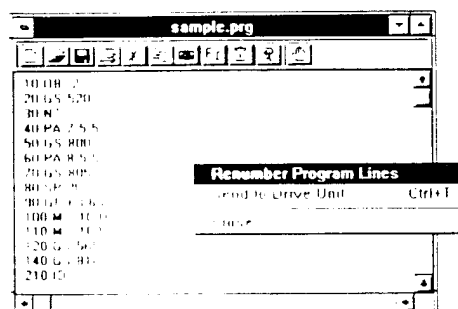
The Editor Tool Bar

-  **New** Opens a new session of an Editor Window
-  **Open** Loads the File Requester for selecting a file and loads the selected file into a new Editor Window

-  **Save** Saves the data in the Editor Window with focus to the file name in the caption bar.
-  **Print** Prints the data in the currently focused Editor Window.
-  **Cut** Removes the highlighted text and puts it in the clipboard.
-  **Paste** Pastes the clipboard text in the Editor Window starting from the current cursor location.
-  **Copy** Copies the highlighted text and puts it in the clipboard.
-  **Font Select** opens the Font select dialog box for Editor Window Fonts
-  **Delete** Removes highlighted text permanently.
-  **Exit** Close the Editor Window

Editor Popup menu

Move the mouse to the text area and press the RIGHT mouse button. The Editor Window POPUP menu will appear



Renum Program Lines has the same function as the Editor menu item.
(See section on Editor (menu items))

Send to Drive Unit Sends the text in the focused Editor Window to the Drive Unit. The Transfer Status Gauge Window will display the transfer progress.

Close Closes the Editor window with focus

Adding Comment lines to a robot program or position file

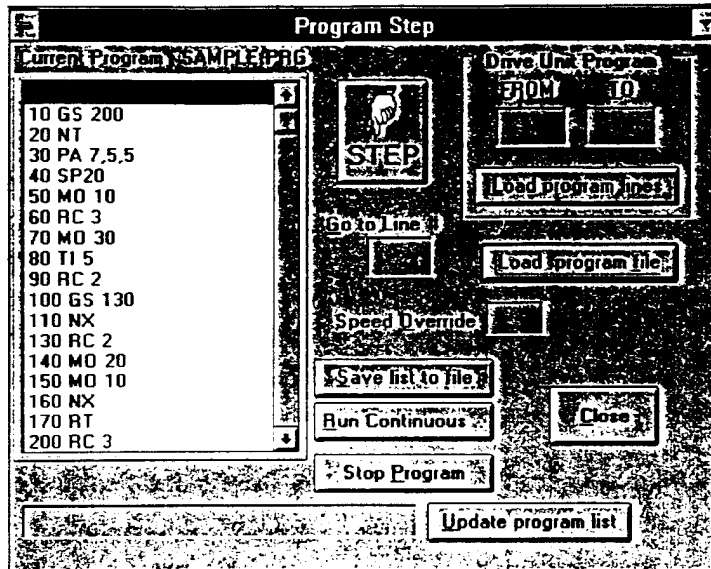
You can add comments to the data in the Editor window by preceding the comment line with the " ; " character. When the *RoboWare Program* sees this character it will send only the text up to that character not including the " ; " character.

For example

```
; This is a sample program 1/10/95  
10 MO 20 ; This program line tells the robot to move to position 10  
20 SP 15,H ; Set speed to 15 with high acceleration.
```

In the above example, if you were to send this text from the Editor Window or a file to the Drive Unit, the first line would not be sent to the Drive Unit. The line "10 MO 20 " would be sent to the Drive Unit and the rest of the line would not be sent. The line "20 SP 15.H" would be sent to the Drive Unit and the rest of the line would not be sent. You can add comment lines to a position file also.

Program Stepping Window



To open the Program Stepping window, choose **Programs\Program Stepping** from the Main Menu Bar

There are two ways to get a program into the program window.

1. Enter a range of program lines in the From To textboxes and click on **Load Program lines** button.
2. Click on the **Load program file** button. When the File Requester appears, enter a program file and click on load. The Program window will display the program and the label at the top will display the filename.

Running the program

To run continuously, click on the Run Continuous button.

To stop the program, click on the Stop Program button.

Stepping through a program

Highlight the program line where you want to start and click on the STEP button. Continuing to click on the Step button will move you down through the program. Double clicking the Stop Program button will reset you to the top of the program.



Speed Override

To override the programmed speed, enter the robot speed you want when you Step or Run Continuous. When an SP command is encountered, the speed override value will be executed in place of the robot programmed speed.

NOTE: Only the programmed "SP" commands that exceed the Speed override setting will be effected.

Go to line#

To jump to a program line number, enter the line number in the Go to line# window and press ENTER.

Editing a program line

You can edit a program line by double clicking on the program line. The line will be transferred to the Edit box just below the Program Window. Make any changes to the program line and click on the **Update Program list** button. When the message informing to restart the program appears, click on OK. The program is updated and first line of the program is highlighted.

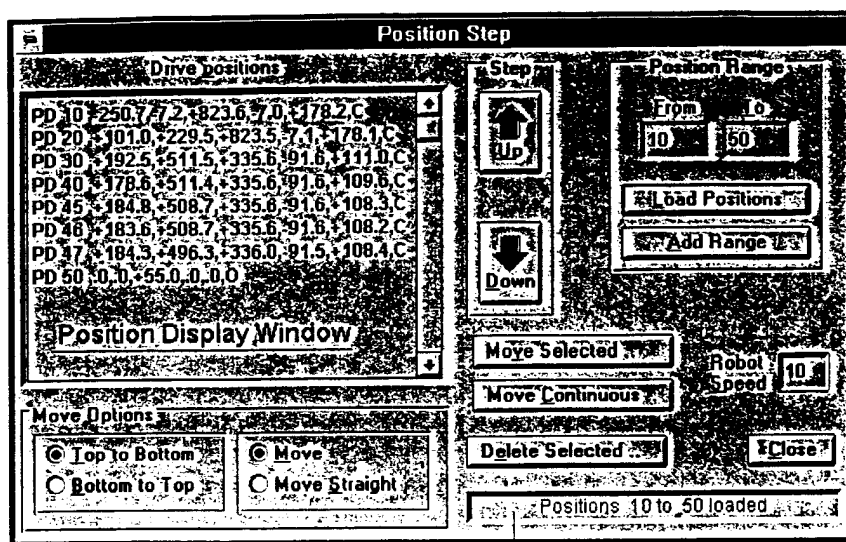
To delete a program line, double click the program line and it will transfer to the Edit box. Delete the text in the Edit box and click on the **Update Program list** button. A requester will ask if you want to delete this line. Clicking on OK deletes the program line. Clicking on Cancel makes no changes.

NOTE

The enable act (EA) command does not work with this window.

Sometimes when checking for an input, if the input signal sample time is less than .5 sec, the Program Stepping window will not see the signal.

Position Stepping Window



Status window

Purpose

The Position Step Window loads a range of position values from the Drive Unit and displays them in the Position Display Window. Once in the Position Display Window, the positions can then be manipulated. To open the Position Stepping Window, select **Positions\Position Stepping** from the Main Menu Bar.

Loading a range of positions

- Enter the first position # in the From Position textbox and press ENTER.
 - Enter the last position # in the TO Position textbox and press ENTER.
 - Either press ENTER again or click on the Load positions button.
- The Main window Transfer Status Gauge will display the transfer progress. When the transfer is complete, the Transfer Status Gauge will clear and the Position Display window will display the selected position ranges.

Selecting positions in the Position Display Window

Hold the <Ctrl> key down and click on those position or positions values in the Position Display window you want to select. The selected positions will be highlighted.

Stepping through positions

Highlight the position where you want to start stepping by clicking on the position in the Position Display Window. To step down through the list, click on the DOWN button. To step up through the list click on the UP button. The Status Window will display the position the robot is moving to.

Moving Options

When *Move Selected* or *Move Continuous* buttons are pressed, moving down or up the list can be selected using the Move Options. Selecting the *Top to Bottom* option will move through the selected positions from the topmost selected position to the bottom most selected position. If *Bottom to Top* is selected the opposite is true. If the Move option button is selected, the program will send an "MO <position#>" to the robot. If the Move Straight is selected the program will send an "MS <position#>" to the robot. If the robot errors then the "MS <position#>" was out of the robots' limits.

Moving Selected positions:

Select the positions you want to move and click on the Move Continuous button. The status window at the bottom of the Position Step Window will display the positions the robot is currently moving to. Depending on the Move Options selection, the program sends an "MO <position #>" (articulate move) or "MS position#>" (linear move) to the robot for each selected position. Moving down the list or up the list depends on the *Top to Bottom* or *Bottom to Top* option selected.

Adding a range of positions

When the Load Positions button is clicked, the Position Display Window clears all it's data and loads the new range. To add to the list of positions in the Position Display Window, enter a new range of positions and click on the **Add range** button. The positions are read from the drive unit and appended to the existing list

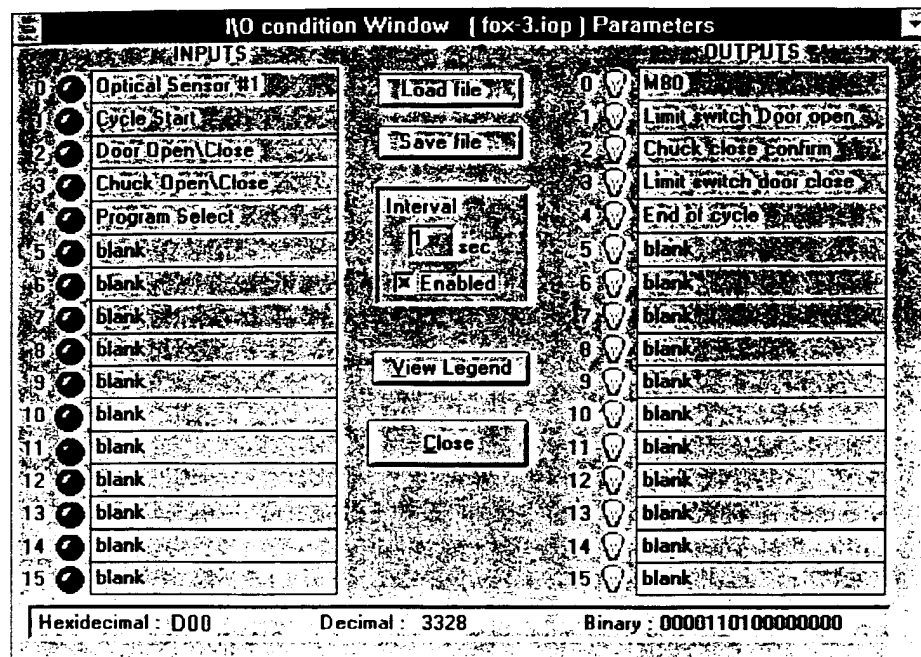
Deleting selected positions

Select the positions you want to delete from the Position Display Window. The selected positions will be highlighted. Click on the **Delete selected** button. A requester will appear to affirm deleting selected positions. Clicking on NO, terminates the delete process. Clicking on Yes, deletes the selected positions from the Position Display Window ONLY, not from the Drive Unit.

Setting the robot speed

Enter the new speed value in the Robot Speed textbox and press ENTER. The speed setting is modal. The Current Speed in the Main window Status bar will change to the new setting.

I/O Condition Window



Purpose

Observe the conditions of INPUTS and turning OUTPUTS on or off.

To open the IO Condition Window, select **ViewIO Condition Window** from the Main Menu Bar.

Defining a new I/O parameter file

If you have the robot connected to peripheral equipment such, as a PLC, limit switches, lamps, ect., you can define each robot input and output and save the information to an IO parameter file. If you have different equipment the robot is connected to, you can call up the file for that piece of equipment and view the robot I/O conditions. To enter information into the input and output definition boxes, click in the desired box and type in the IO description. When you're finished entering in all of the I/O definitions, click on the Save file button. When the File Requester opens, enter the file name you want to save the I/O definition under, and click on Save.

Loading a previously defined file

Click on the Load file button. When the File Requester opens, enter the I/O parameter file name and click on Load. The file will load and fill in the input/output definition boxes. If no information is available for a specific I/O definition box the program inserts "blanks".

Interval checking

When the program first starts it checks every one second for input conditions. To change the interval checking time, click on the *Interval check* text box and enter a time, in seconds, you want the program to check for inputs. To disable the program looking for inputs be sure the enabled check box is cleared (not checked). To re-enable interval checking make sure the enabled box is checked.

Turning outputs on and off

Initially all outputs are off (lightbulb is white) when the I/O condition window is loaded. To turn an output on, click on an output lightbulb. The lightbulb will change to yellow and the output will turn on. To turn off an output, click on a yellow lightbulb and it will change back to white.

Observing inputs

When the I/O condition window is loaded it begins checking the condition of the inputs immediately. The program displays the results by turning the Input LED's ON (green) or OFF (red).

Hex, decimal, binary display

The Hex, decimal and binary values reflect the input conditions.

Closing the I/O condition window

To close the I/O condition window click on the **Close** button. If any of the I/O definition boxes have been altered a requester asks if you want to save the current values. Clicking on **No** closes the window without saving any changes. Clicking on **Yes** brings up the File Requester. Enter the file name to save I/O parameter file to and click on save. The I/O condition window will close and the file will be saved.

Projects

A Project is a convenient way of grouping files that are common to a particular job.

Project files include:

- Robot Program file (mandatory)
- Position File (mandatory)
- Position Table File
- I/O Parameter File
- Picture File
- Memo File

These files must already exist before you can select them using the **Project File Management Window**. Two files are mandatory in defining a Project, the robot program file and the position file

To create a Robot Program file, use the Editor Window and type in the program. Then save the robot program to a file. Or you can Save a robot program from the Drive Unit to a file with the extension ".prg".

To create a position file, use the teach box to define positions and save them from the Drive Unit to a file. Or use the many features provided by *RoboWare* to define positions and save positions to a file with the extension ".pos".

To create a Position Table file, open the Position Table Window and enter the position numbers along with a description of each position used within the project. Then save the data to a file with the extension ".tbl".

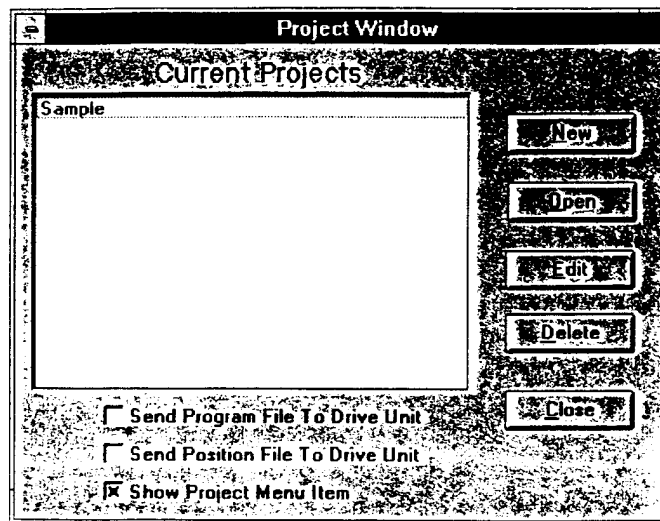
If you have external devices connected to the robot used for inputs and outputs, use the I/O Parameter Window to create an I/O Parameter file. The I/O Parameter file uses the extension ".iop".

A Picture File can be any bitmap file (.bmp) or metafile file (.wmf). If you have a drawing of a setup or a photograph in the bitmap format, you can associate the file to the Project and view it.

The Memo File is created in the Project File Management Window.

Project Window

The Project Window is used to open projects, edit existing projects, delete projects or send programs or position files to the Drive Unit. To open the Project Window, select **View/Project Window** from the Main Menu Bar



New

Opens the Project File Management Window for creating a new Project and selecting project files.

Open

To open an existing project, select a project from the "Current Projects" listbox and click on Open.

Options These options are performed only when the Open button is selected

- *Send Program File to Drive Unit:* Sends the projects robot program to the Drive Unit. The FromTo dialog box will ask if you want to Delete a Range of Program Lines, enter a range and click on OK. Click on NO to delete no program lines. The Sending Program window will open and the Transfer Status Gage will display the progress.

Sending Program

- *Send Position File to Drive Unit*: Sends the projects position file to the Drive Unit. The Sending Positions window will open and the Transfer Status Gage will display the progress.
- *Show Project Menu Item*: Adds the Project menu item to the Main Menu Bar.

A rectangular window with a double border. Inside, the text "Sending Positions" is centered in a bold, sans-serif font.

Edit

Edits an existing project. Select a project from the Current Projects listbox and click on "Edit". The Project File Management Window will open and display the selected project files.

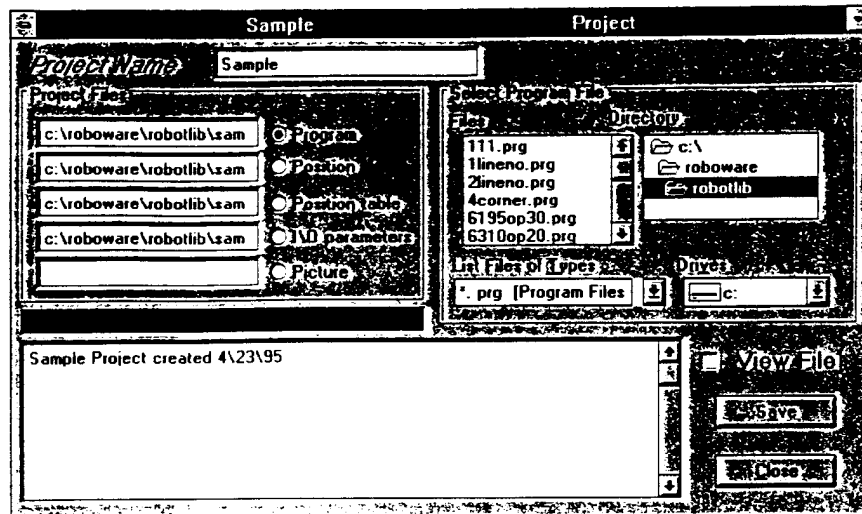
Delete

Deletes a project from the Current Projects list box. Select a current project and click on Delete. The project will be permanently removed from the current projects database.

Close

Closes the Project Window

Project File Management Window



Purpose

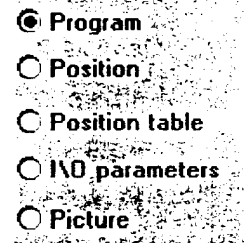
Create new projects, edit existing projects, select project files and view project files.

Project Name

One of the mandatory requirements of a Project is the Project Name field. You cannot save a Project without the Project Name. This name will be displayed in the Project Windows Current Projects listbox.

Selecting a Project File

1. Select a file type from the Project File Type options. The Files list box will display only those file which relate to the file type.
2. Select a file by clicking on the filename in the Files listbox. The selected file will be displayed in the Project File Type textbox.



Project File Type

c:\robware\robotlib\sample.prg

☒ Program

Viewing a selected Project File

Clicking on the View File checkbox will display each Project File selected

Memo Pad

The Memo Pad is used to enter information about the current Project such as dates, how the project ran, any changes to project files or anything you want to explain relative to the project.

Saving a Project

Three fields are mandatory before a project can be saved. A Project Name, a valid robot program file and a valid position file. If any one of these fields are missing, a dialog box will inform you. Once all the mandatory fields are filled, clicking on Save will update the data to the Project database. The Project File Management Window will not close until the Close button is selected.

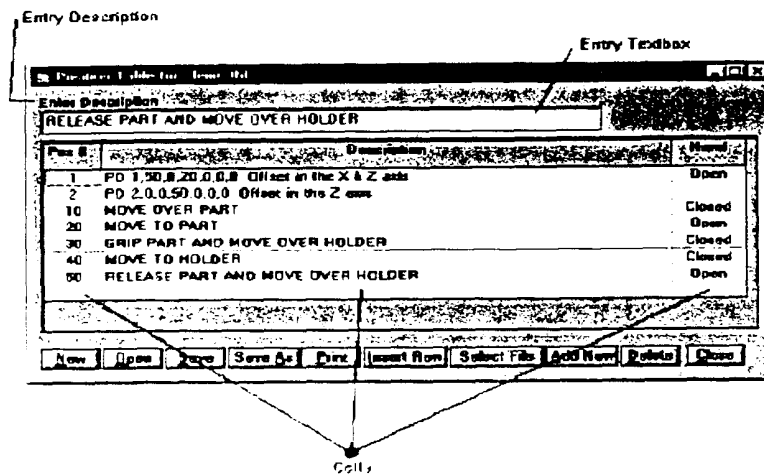
Closing the Project File Management Window.

Selecting the Close button will close the Project File Management Window. If the data in the project has been changed and not saved, a dialog box will ask if you want to save the data.

Position Tables

Purpose

As you teach positions with the teach box or define positions using *RoboWare*™, you will want to keep a description of the positions for future reference and link a Position Table to a position file. A Position Table keeps a list of the positions in a position file and a description of each position. It is a good idea to keep the Position Table current to its position file.



A Position Table includes:

- Position #
- Description
- Hand condition
- Position Table Buttons

Opening a Position Table

New Select Positions/Position Table/New from the Main Menu Bar. A new Position Table will open with three blank rows and the caption will display "Untitled".

View/Edit Select Positions/Position Table/Edit from the Main Menu Bar. Select a Position Table file from the File Requester. The Position Table will open displaying the selected file. The caption will reflect the Position Table file name.

Entering Position Table data

1. Double click in the cell you want to add data to.
2. The cell will highlight and the Data Entry textbox will be waiting for you to enter the data. The Data Entry textbox label will reflect the type of data you are to enter, (i.e. Position #, Description or Hand condition).
3. Press the ENTER key and the cell will be updated with the data.

NOTE: Typing in the data and pressing enter updates the current cell and move you to the next cell, moving you through the Position Table cell by cell. More cells will be automatically added if needed.

Position #	Description	Hand

Cells

Editing Cells

Double click in the cell you want to edit, the Data Entry textbox will display the cells data. Edit the data and press the ENTER key and the cell will update.

Changing cell width

Position #	Description	Hand

Cell "Grab Points"

Move the mouse to the cell "Grab Points", (the mouse will change to a cross). While holding the left mouse button down, drag the mouse to the left or right until the desired width is reached. Now release the left mouse button.

Position Table Buttons

New

Clears the current Position Table and opens a new Position Table with three blank rows. If the data in the current Position Table has changed, a dialog box asks if you want to save the changes.

Open

Opens the File Requester. Select a Position Table file and click on Open. The Position Table will display the selected file

Save

Save the current Position Table to the current Position Table file name. If the Position Table is "Untitled" the File Requester opens to enter a new Position Table file name.

Save As

Save the current Position Table data to a new file name. The Position Table caption will reflect the new position table file name.

Print

Prints the current Position Table data to the system printer

Insert Row

Inserts a blank row just above the currently selected row.

Select File

Fills the Pos # column with the position numbers in a position file saved from the Control Unit.

Delete

Deletes selected cells. To select a cell or a group of cell, move the mouse to the first cell to delete and while holding the left mouse button down, drag the mouse over the cells you want to delete. the selected cell will be highlighted. Click on Delete. A dialog box will ask if you want to delete the selected cells.

Add New

Adds new rows to the Position Table

Close

Closes the Position Table. If the data in the current Position Table has changed, a dialog box asks if you want to save the changes.

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