RoboCell

Ver. 3.0
for
SCORBOT-ER 2pc
SCORBOT-ER 4pc
SCORBOT-ER Vplus
SCORBOT-ER IX

User Manual

ESHED ROBOTEC

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Introducing RoboCell

RoboCell is a software package that integrates the SCORBASE robotic software with a graphic display module. It also includes an interactive graphic cell setup module.

- SCORBASEpro for Windows is a full-featured robotics control software package, which provides a user-friendly tool for robot programming and operation.

- Cell Setup allows you to create and modify new and existing simulated robotic cells. The cell may contain the actual elements and connections of a real robotic installation, or it may be a virtual cell.

- Graphic Display provides simulation and 3D animation of the robot and other devices in the workcell during position teaching and execution of SCORBASE programs.

This manual covers all features and operation of the Graphic Display and Cell Setup modules. It provides support for all current versions of RoboCell.

All versions of SCORBASE software are covered in separate manuals.
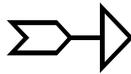
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Starting RoboCell

System Requirements

For best performance, the following system is recommended:

- An IBM-compatible PC with Pentium 166 MHz, or faster, processor.

- At least 16 MB of RAM.

- A hard drive with at least 11 MB of free disk space.

- Windows 95, Windows 98, or Windows NT.

  RoboCell for SCORBOT- ER 2pc and ER 4pc will not run on the Windows NT platform when operating online. It will run on Windows NT using Cell Simulation.

- A VGA or better graphics display, minimum 256 colors.

- A mouse or other pointing device.

The software can be used with an 80486 66 MHz processor, 8 MB RAM, and the Windows 3.11 operating environment.

Software Copy Protection

The installation disks contain a copy-protection shield that limits the number of computers in which the software can be concurrently installed, in accordance with the software license which was purchased. This shield includes a counter that is updated each time the software is installed (and uninstalled).

When the RoboCell software is uninstalled, one user license is restored to the installation disk, thereby allowing the software to be reinstalled or transferred to another computer.

For more information on the software copy protection and license, see Chapter 9.

Installing the Software

The RoboCell software is supplied on a CD disc together with a license diskette. The software is copy-protected, and a backup copy of the license diskette cannot be used to install the software. Therefore, be sure to protect the original license diskette.

To install the software, do the following:

1. Start Windows.

2. Close any applications that are open before you begin the installation. If you are about to reinstall the software or install a newer version to an existing RoboCell directory, it is recommended that you backup any existing user-created files before you begin the installation. It is also recommended that you remove the previous RoboCell for Windows installation by means of the Uninstall utility included with the software.

3. Insert the license diskette into the PC's floppy disk drive. Make sure the disk is not write-protected.

4. Insert the CD into the CD-ROM drive. The installation should begin automatically. If it does not, run **setup.exe** from the CD-ROM **\Install** folder.

5. Follow the instructions that appear on the screen.

Installing RoboCell on a PC Without a CD Drive

If you want to install the RoboCell software on a PC which does not have a CD drive, do the following:

Access a PC with a CD drive which is networked with the target PC, and follow the Installation instruction in the previous section.

OR

Use a PC which has both a CD drive and a floppy drive.

- Copy all files in the (sw-name) CD's **Install** folder onto diskettes:

- Each file named **data*n*.cab** (where *n* is a number; i.e., data1, data2) will fill one diskette.

- All other files can be copied together onto a single diskette.

- Copy all files from all the diskettes into a temporary folder on the target PC.

- From the temporary folder, run **setup.exe**.

- Follow the instructions that appear on the screen.

You can delete the temporary directory after the installation, or you may keep it for reinstalling the software.

During the software installation, messages and a percentage bar will be displayed on the screen to reflect the status of the installation procedure.

You will be prompted to choose a language to install. Select a language from the following dialog box.

By default:

- RoboCell is installed to the directory C:\SBWSIMx, where x is the number of the robot version you are installing (e.g., for ER IX, x=9).

  When the installation is complete, one of the following RoboCell program groups will appear:

- For SCORBOT robots using the PC controller:
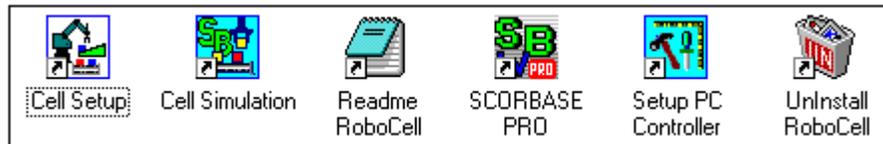
- For all other SCORBOT robots:
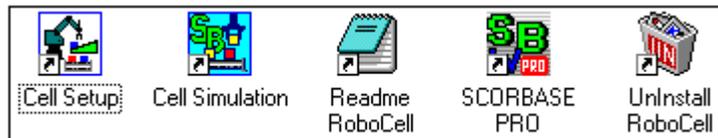
To preserve the display of the RoboCell program group on the Windows 95 desktop, follow the instructions in the following section.

Windows 95: Keeping the RoboCell Program Group on the Desktop

To preserve the display of the RoboCell program group on the Windows 95 desktop, do the following:

1. When the installation is complete and the RoboCell program group is still active, press the backspace key once. The Programs folder (group) is displayed.

2. Find the icon for the RoboCell folder. Press [Ctrl] and click on the RoboCell icon, and drag a copy of the RoboCell folder to the Windows 95 desktop.

If the Programs folder did not appear when you pressed the backspace key, or if you did not place the RoboCell program folder on the desktop at the end of the installation, use the standard Windows 95 method for placing a program folder on the desktop, as follows:

1. Place the cursor on the Start button and click the right mouse button to open the shortcut menu. Select Open to open up the Start programs folder. Double click on the Programs icon to open the Programs folder.

2. Find the icon for the Cell Simulation folder. Press [Ctrl] and click on the Cell Simulation icon, and drag a copy of the Cell Simulation folder to the Windows 95 desktop.

Uninstalling RoboCell

To uninstall RoboCell, do the following:

1. 1. Insert the license diskette into the floppy drive. (Make sure the diskette is not write-protected.)

2. 2. From the RoboCell program group, select Uninstall.

3. Follow the instructions that appear on the screen.

Activating the Software

It is recommended that you close any applications that are open before you activate any of the RoboCell modules.

From the RoboCell program group, select any of the following:

Cell Setup   Activates the interactive graphic Cell Setup module for creating and modifying a virtual robotic cell.

Cell Simulation   Activates both SCORBASEpro and the Graphic Display module for virtual robotic programming and operation.

SCORBASEpro   Activates SCORBASEpro only, without graphic simulation.

A module can be activated only once.

Cell Setup and Cell Simulation cannot be active at the same time.

The following utilities are also available:

Uninstall   Removes RoboCell from your computer.

Setup PC Controller   (Robots using the Controller-PC card only)

When the system includes robot and controller (for online operation), used to test and change the PC addresses and interrupt settings used by the PC servo control card.

For further details, refer to the section, Resolving Address Conflicts, in the Controller-PC User's Manual.

Running the Demo Files

The demonstration files included with the software allow you to observe the capabilities of RoboCell. To run these demo files, do the following:

1. Activate Cell Simulation.

2. In the Graphic Display window, select File | Open, and then select a *.3DC file (e.g., ER4CELL1.3DC) from the SCORBASE directory. A virtual robotic cell is displayed.

3. In the SCORBASE window, select File | Open, and then select a *.SBP file (e.g., ER4CELL1.SBP) from the SCORBASE directory. A SCORBASE robot program is displayed.

4. In the SCORBASE window, select Run | Run Single Cycle.

5. Wait for program execution to finish, or stop the program by pressing F9 or the Stop icon.

6. Close the currently open SCORBASE robot program window/file.

7. *You should close an open SCORBASE file before you load another one.*

8. Load another Graphic Display file (e.g., ER4CELL2.3DC).

   You should load the Graphic Display setup file before you load an associated SCORBASE robotic program file.

9. Load the corresponding SCORBASE program (e.g., ER4CELL2.SBP).

For the sake of simplicity, the demonstration files are provided in dedicated pairs (one cell setup file and one companion robot program file, both with same name). However, numerous robot programs can be written for one cell.

Quitting the Software

To close the RoboCell modules, do any of the following:

- From the SCORBASE menu bar , select **File | Exit**.
- Click the Close box in the SCORBASE title bar.
- Press [Alt]+F4.

When using RoboCell, closing SCORBASE will also close the Graphic Display module. Closing the Graphic Display will not affect the SCORBASE module.

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Graphic Interface

The Graphic Display and Cell Setup in RoboCell have the same graphic interface, which can be manipulated by means of the mouse.

Rotate

To rotate the scene, place the cursor anywhere in the graphic window and:

- Click the **right** mouse button and **drag to the right** to rotate the display counterclockwise.

- Click the **right** mouse button and **drag to the left** to rotate the display clockwise.
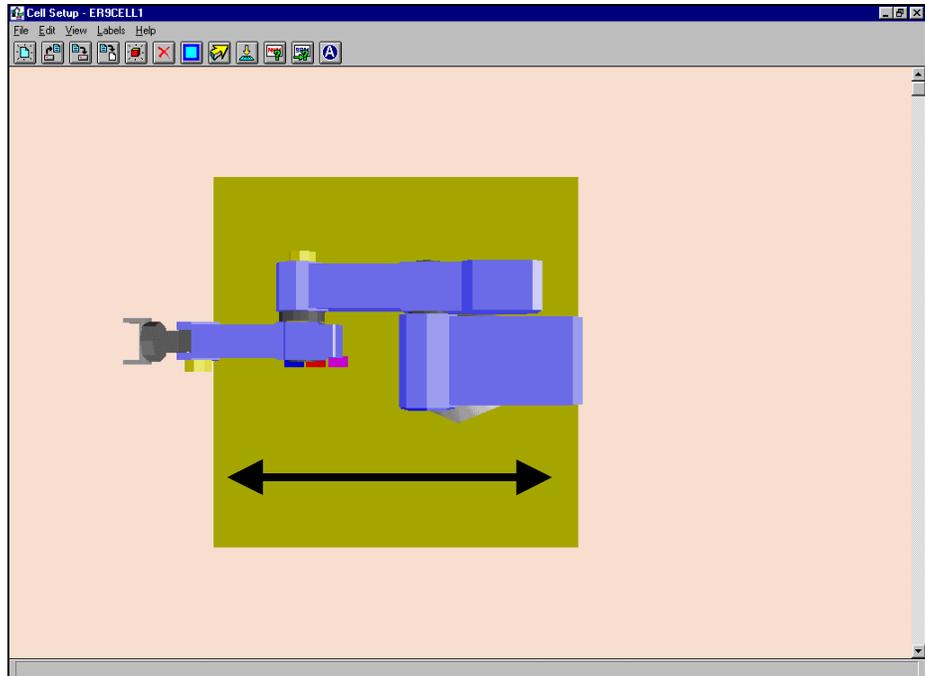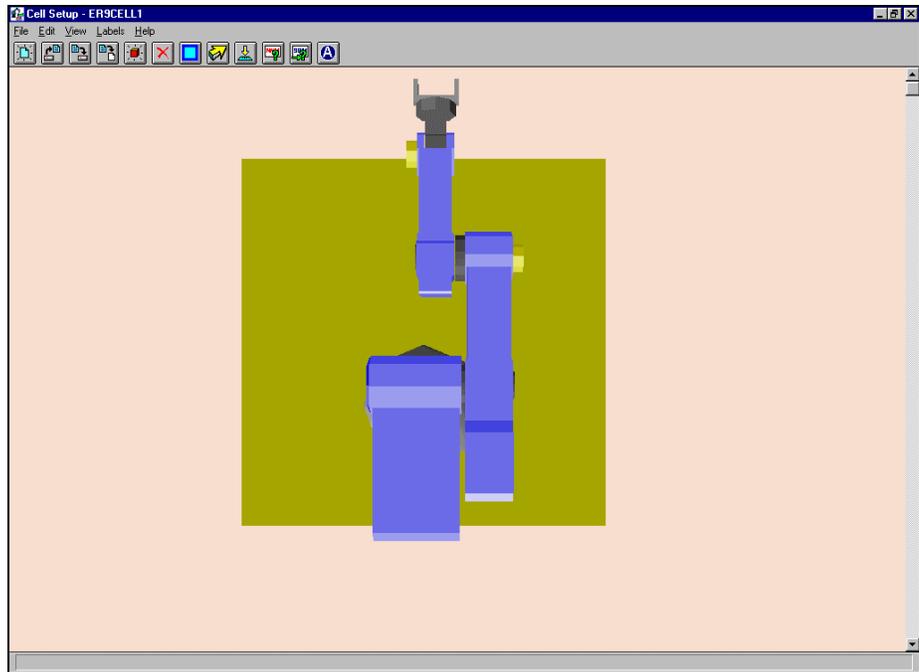
Angle

To change the angle of the overhead scene, place the cursor on the vertical
scroll bar and drag it up and down.
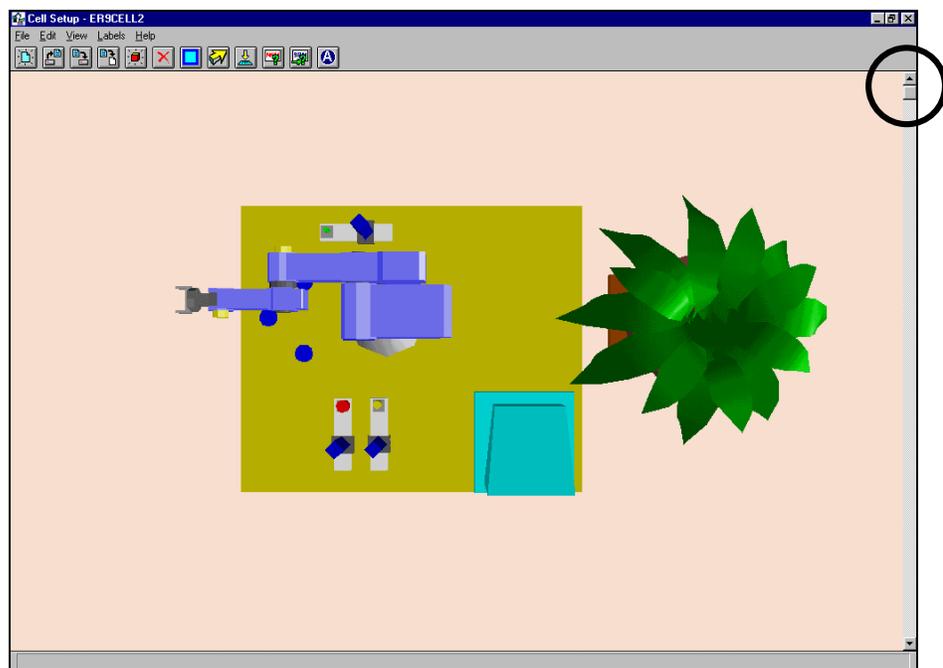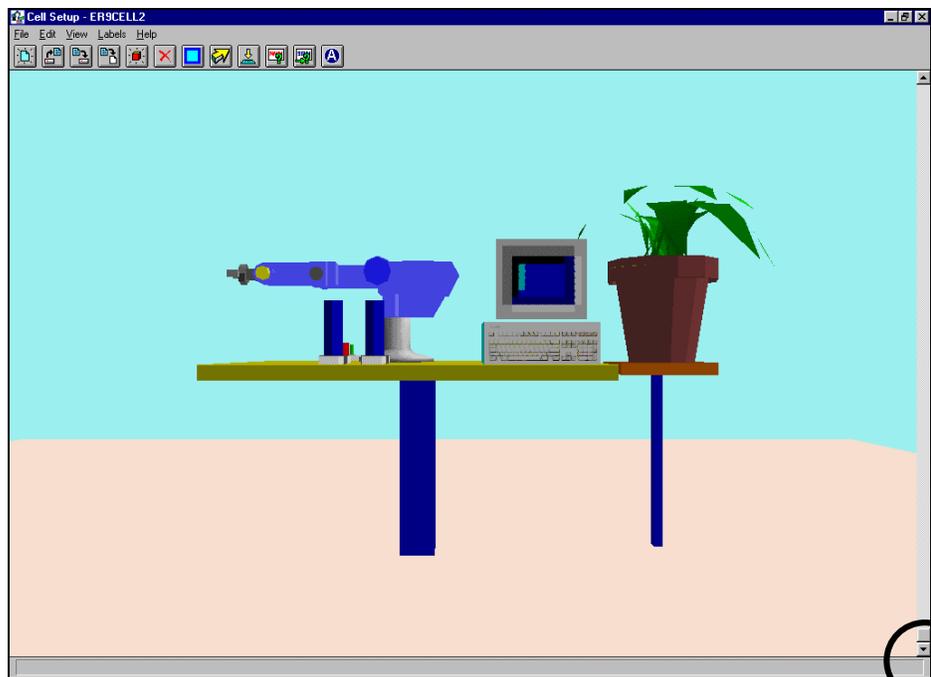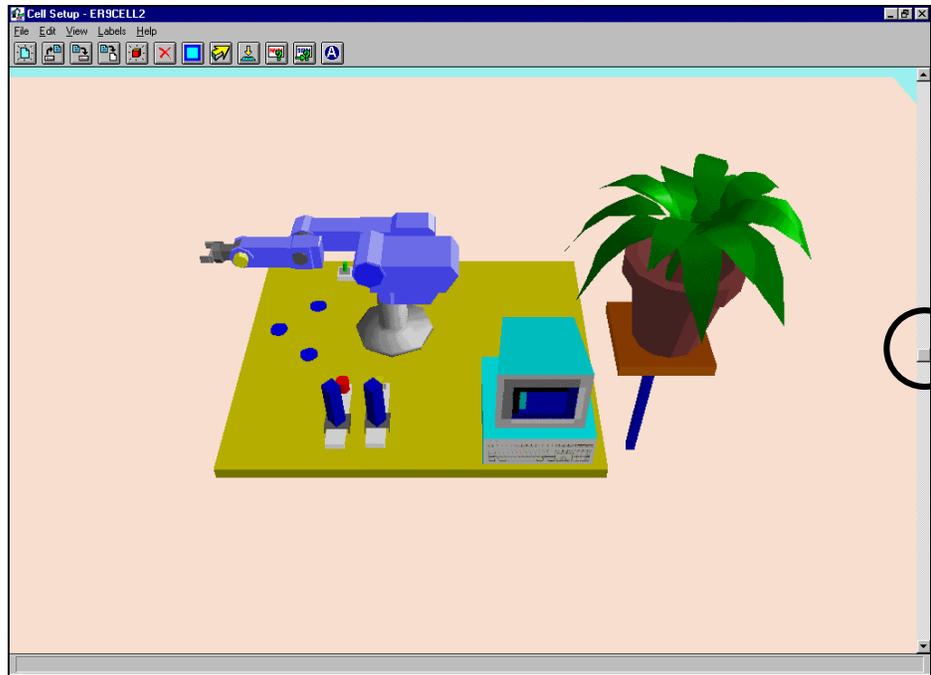
Zoom

To zoom the scene, place the cursor anywhere in the graphic window and:

- Click the right mouse button and drag up to zoom in.
- Click the right mouse button and drag down to zoom out.
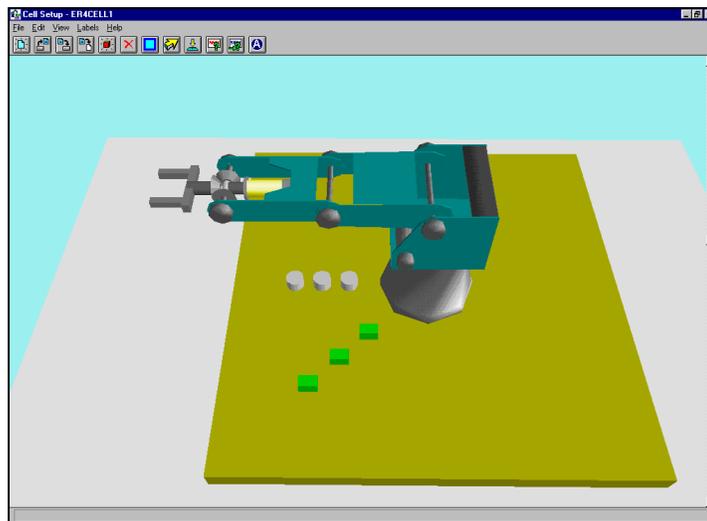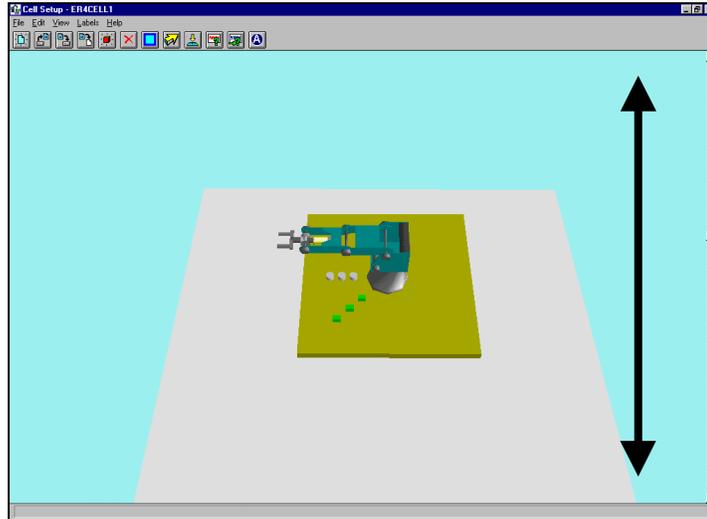
Shading

To change the shading and lighting, click and drag the right mouse button while holding down [Shift].

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Cell Setup

The Cell Setup module allows you to create and modify virtual robotic cells. These cells can be theoretical, or they may be replicas of actual robotic installations.

File Menu

The File menu contains the usual Windows functions that allow you to load and save files containing the graphic cell setup information, and to exit the software.

Only one setup file/window can be opened at a time.

| New | Opens a new, untitled, cell setup file, and opens the New Object menu. |
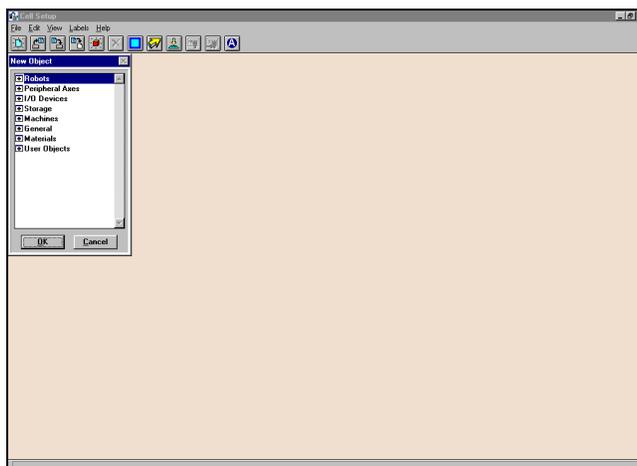
To help you see the area and limits of the cell, do either or both of the following:

- Zoom out until you see the floor and the background.

- Select Labels | Show Cell Origin to see a crossmark at the center of the cell.

	Open	The Open dialog box appears. You can Open an existing cell setup file (e.g., robo1.3DS). The cell defined in the file is displayed and the New Object menu opens.
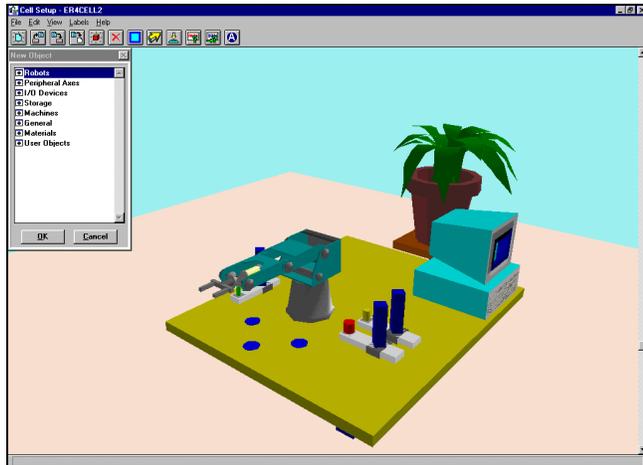
	Save	Saves the current placement of all objects in the cell to a cell setup file. Default file extension is 3DC.
	Save As...	Saves the currently active cell setup file under a new file name.
		Note: Peripheral axes are redefined (through the robot's properties menu) in the new file created by the Save As operation.
	Exit	Closes Cell Setup.

Edit Menu

New Object — Displays the New Object menu, from which objects are selected and placed in the cell.
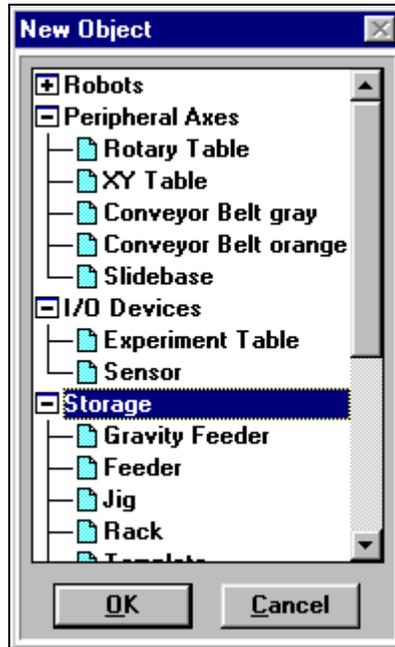
The list of items varies slightly for different robot versions.

By default this menu is displayed automatically when a new or existing cell setup file is opened.

- Double click on a category's plus sign (+) to display a list of all the items in the category.

- Double click a category's minus sign (-) to close the list of items in the category.

  Objects are discussed in detail later in this chapter.

Background Color — Opens a color palette that allows you to select the color of the cell background.

Due to lighting and shading effects, the color you select from the palette may appear slightly different when applied as the background color.

	Floor Color	Opens a color palette that allows you to select the color of the cell floor.
		Due to lighting and shading effects, the color you select from the palette may appear slightly different when applied as the floor color.
	Floor Size	[icon only]
		Opens a dialog box which allows you to defined the dimensions of the cell floor.
		By default the cell floor is 8x8 meter.
	Delete Object	Activates the delete mode.
		Using the cursor, point and click on the object you want to delete. At the prompt to confirm, click Yes. If you click No, the delete mode remains in effect, allowing you to select and delete another object.
		Press [Esc] to cancel the delete mode.

View Menu

	Redirect Camera	Allows you to select a different focal point in the graphic display of the cell.
		To change the center point of the graphic display window, click on the icon or menu option View | Redirect Camera. Then use the cursor to point and click on any spot in the scene. It now becomes the center point of the graphic display.
		All zooming of the view will focus on this point. All rotations will revolve around this point.
	Top View	Displays an overhead view of the cell.

Labels Menu

Either the names of all objects or the positions of all objects can be displayed.

Individual object labels can be removed by selecting Hide Label from the specific object's properties menu.

Object Names

When Labels | Object Names is selected, a label on each object shows its name. Names are assigned by the software, but can be redefined by the user in the object's properties menu.
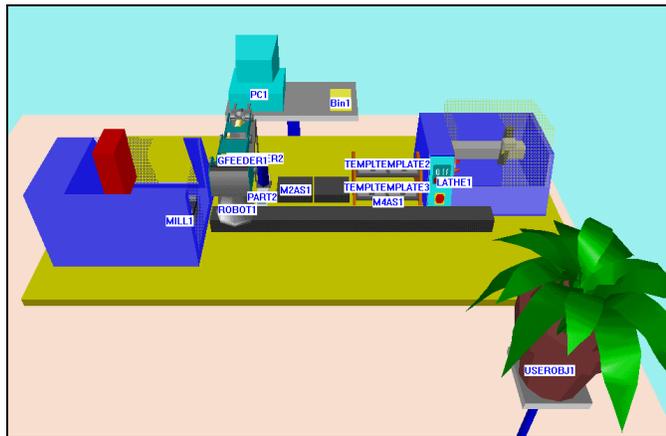
Object Positions

When Labels | Object Positions is selected, a label on each object shows its position.
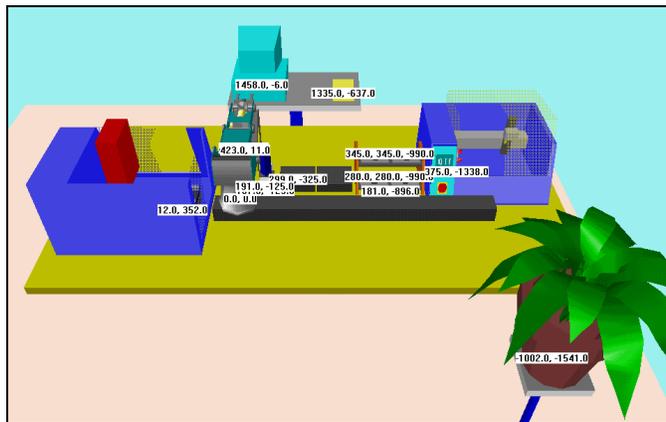
The coordinates that appear on the object's label indicate the object's position (X, Y coordinates) relative to the cell's point of origin.

Show Cell Origin

The cell has a point of origin (0,0) at table level. The positions of all objects are defined as relative to this point of origin.

When Labels | Show Cell Origin is selected, a red cross marked with X+ and Y+ axes remains displayed on the screen.
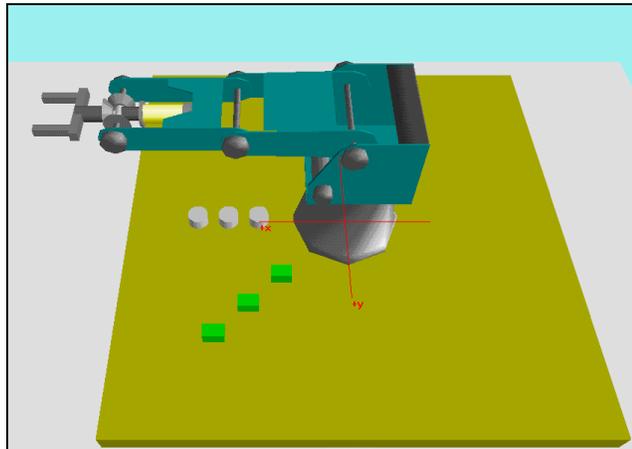
When manipulating the graphic display, the cross may disappear momentarily.

Rotating the view does not change the X and Y dimensions of the cell.

Objects

Object Placement

To place a new object in the cell, do the following:

1. Double click on the object's name in the New Object list.

2. Move the cursor into the graphic scene.

3. Point and click on the location where you want to place the object. You may need to wait a moment for it to appear; *do not double click.*

If you have trouble placing an object in the exact spot you want, zoom in and out, and adjust the view from top to bottom until you can more accurately place the object.

Most objects are placed in the cell automatically at table level. These objects will appear to float in space unless a table has also been placed in the cell.

The height of some objects (template, jig, cylinder and cube) is determined at the time they are placed in the cell.

If, for example, you click on the conveyor when placing a cube in the scene, the cube will be placed on the conveyor at the proper height.

It is recommended that a table be placed in the cell before any of these four objects is added to the cell. Otherwise, these objects may be set on the cell floor and are hidden when a table is added.

Once an object's height is set, it cannot be changed in the Cell Setup. For example, you cannot move the cube from the table onto the conveyor. Moving an object whose height has been set will cause it to float in space or penetrate another object. If the setup is saved with a floating object, the object will fall to the surface below it when the file is loaded in RoboCell
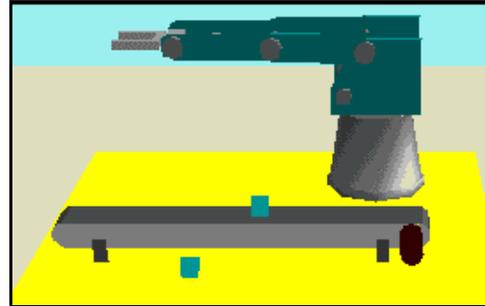
To change an object's height in Cell Setup, you must delete the object and create a new one.

To move an object, simply click on it and drag it to another position. Or use the object's properties menu to set precise position coordinates.

The robot cannot be dragged to another position. Its position can be changed only by means of its properties menu.
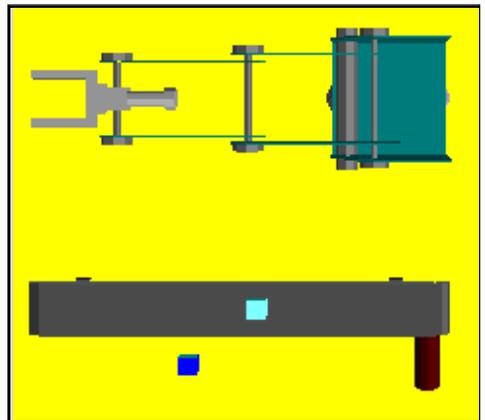
Object Configuration

Selecting some of the objects from the New Object list will open a configuration dialog box for defining the object's permanent attributes (such as size and color). Attributes must be set before an object can be placed in cell.

An object's configuration cannot be changed once the object has been placed in the cell. You must delete the original object, and select and configure the object again from the New Object list.

Objects that have configuration options are described later in this section.

Object Properties

Double clicking on an object that has already been placed in the cell will open the object's properties menu.

Object properties can be changed at any time during cell setup.

All object properties menus contain the following five items:

Rename	Every object is automatically assigned a name and a number when it is placed in the cell. This name is displayed in the object's properties menu. The number indicates the order in which objects of the same type were added to the cell (e.g., GFEEDER1, GFEEDER2).
	Clicking on Rename opens a dialog box that allows you to change the name of the object. The number can be changed or deleted.
Rotate	Objects can be rotated to any degree, in the minus (clockwise) or plus (counterclockwise) direction.
	Clicking on Rotate opens a dialog box that allows you to change the object's orientation.
	The degree of rotation is always defined relative to the object's default (predefined) orientation.
Set Position	The cell has a point of origin at table level defined by XY coordinates (0,0). All object positions are defined in XY coordinates relative to this point of origin.
	For most objects these XY coordinates indicate the center of the object's base.
	By default, the robot is placed in the cell with the center of its base (i.e., the robot's point of origin) at the cell's point of origin.
	Clicking on Set Position opens a dialog box that allows you to change an object's X and/or Y coordinates.
Hide Label	Clicking on Hide Label will remove the displayed label for the selected object.
	This option can be used only when the option Labels	Object Names or the option Labels	Object Positions is selected.

Show Label	Clicking on Show Label will display the label for the selected object.

This option can be used only when the option Labels | Object Names or the option Labels | Object Positions is selected.

Objects that have additional options in the properties menus are described later in this section.

Robot

The robot should be the first object you place in the cell. The robot is automatically placed at the cell's point of origin. This synchronizes the robot coordinates and world coordinates, and makes it easier to record robot positions in the cell.

The robot cannot be dragged to a new location. Its position can be changed only by means of the robot's properties menu.

Only one robot can be placed in the cell.

Robot Configuration

Before a robot is placed in the cell, a dialog box allows you to define whether or not the robot is mounted on a linear slidebase.

By default the robot is not mounted on a slidebase.
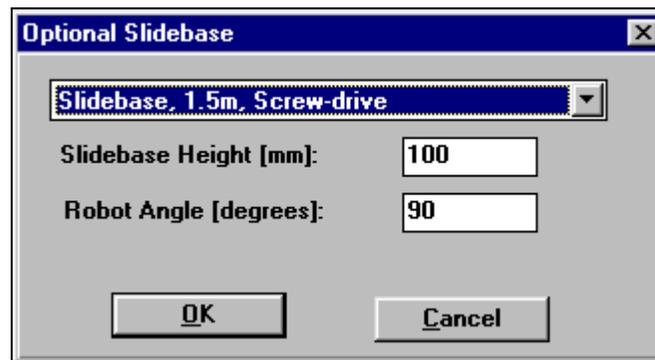
If you select a slidebase from the list, additional options are displayed.

Slidebase Height:　By default the height is 100m, which is the actual height of standard SCORBOT slidebases.

Robot Angle:　By default, the robot is mounted perpendicular to the slidebase, at 90°.

If you select a slidebase, both the robot and slidebase will be placed and repositioned in the cell as one element with one object name.

Robot Properties

The robot's properties menu contains the following additional options:

Show Work Envelope
Displays the span of the robot's working range. This allows you to place objects within the reach of the robot.
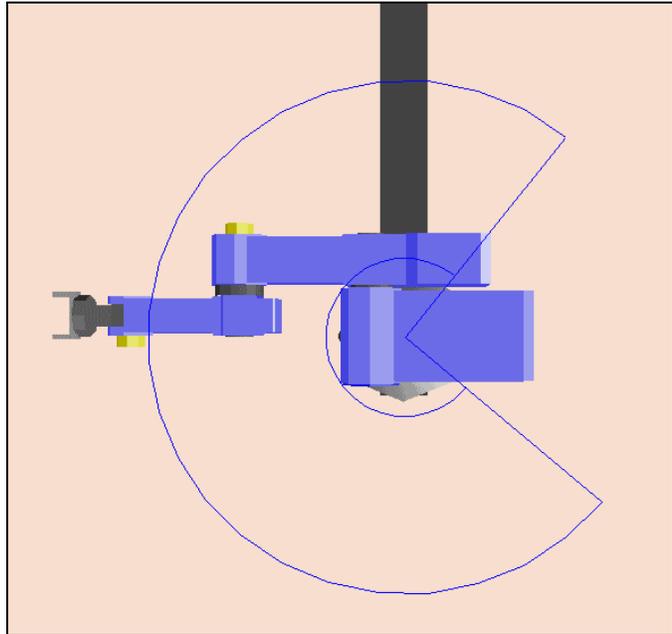
Hide Work Envelope
Turns off the display of the robot's working range.

Define Peripherals
Opens a dialog box for defining the obejcts that are connected and controlled by the robot controller. You will be prompted to save the cell setup to file before you define the peripheral axes.

The peripheral axes are defined in the Cell Setup module. Do not attempt to alter or set these definitions in SCORBASE.
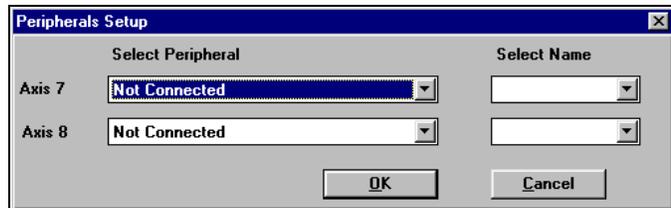
A speed controlled conveyor can be used only as axis 8.

From the Select Peripheral drop down list, choose the device you want defined for each axis. If you have already placed the object in the cell, its name

will appear in the Select Name box.

If two or more objects of the same type have been placed in the cell, select one of the names from the Select Name drop down list.

Gripper Setup
(ER IX only)

Opens a dialog box for choosing the type of gripper to be used with the ER IX.

You can select either an electric gripper (axis 6) or a pneumatic gripper (output controlled).

If you select **Electric**, no options will be available. The gripper will respond to all the normal gripper commands.

If you select **Pneumatic**, three options are available:

- Select an output number from the drop down menu. Only the output numbers available for the gripper will be displayed. This is the output that controls the gripper.

- Click On or Off to choose the output state for closing the gripper.

- Enter the gripper time delay in the box.. This option defines the time it will take to execute the Close or Open gripper commands.

Peripheral Axes

After you place a peripheral axis in the cell, you must define it as one of the robotic axes connected to the robot controller.

1. Double click on the robot in the cell to open its properties menu.

2. Select Define Peripherals, and complete the settings, as explained in the preceding section Robot Properties.

Slidebase Configuration

The slidebase is the only peripheral axis that has configuration options.

The slidebase configuration dialog box contains the following options:
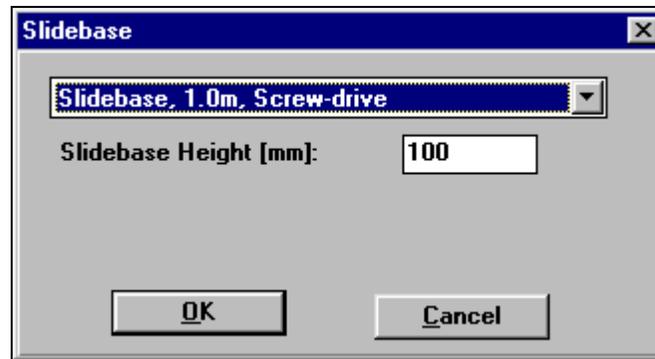
Slidebase Type	Select one of the slidebases from the drop down list.
Slidebase Height	Defines the height of the slidebase. By default, the slidebase is 100 mm tall. If you increase the height, the slidebase will appear taller.

When not used for mobilizing a robot, the slidebase has a jig on which materials can be placed.

I/O Devices

Experiment Table Properties

The experiment table properties menu contains the following additional options:

Controller Input Number for First Switch	Defines the robot controller input to which the first microswitch on the experiment table is connected. The second, third and fourth microswitches are then assigned sequentially to the next three inputs.

The figure below shows the input sequence. Entering an input number that has already been defined for another device will replace (overwrite) the existing connection.
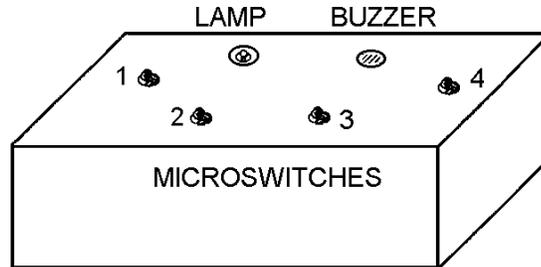
Although one of the experiment table inputs may be disabled if the input is later defined for another device, all other switches will remain connected to their defined inputs.

Controller Output Number for Lamp | Defines the robot controller output to which the lamp on the experiment table is connected.

Controller Output Number for Buzzer | Defines the robot controller output to which the buzzer on the experiment table is connected.

Entering an output number that has already been defined for another device will replace (overwrite) the existing connection.

In RoboCell, a sound is emitted when the outputs that control the buzzer and lamp are turned on and off. The Experiment Table outputs use the Windows sounds associated with the following events:

Buzzer On: Exclamation
Buzzer Off: Critical Stop
Lamp On: Asterisk
Lamp Off: Information

In addition, the lamp in the Graphic Display turns bright red when its associated output turns on.

Sensor Configuration

The sensor configuration dialog box contains the following options:

```
SENSOR1                                          ×

     ■ ■ ■ ■ ■ ■ ■ ■

   Color Detect      ■■■■■■■

   Height[mm]        130
                                        ┌──────────┐
   Default: 130 mm for Conveyor,        │    OK    │
                                        └──────────┘
   230 mm for Rotary Table              ┌──────────┐
                                        │  Cancel  │
                                        └──────────┘
```
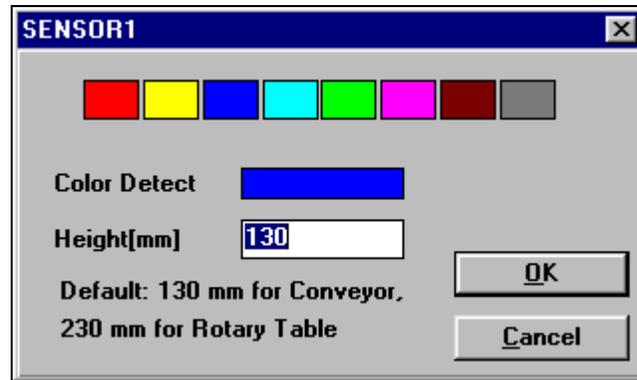
Color Detect | Defines the object color that the sensor detects. The sensor will be displayed in the cell in this color.

Select any one of the eight colors. Different colors can be used to represent different kinds of sensors, such as a magnetic sensor, an inductive proximity sensor, an optical sensor, and others.

Selecting gray (the color square at far right) will make the sensor sensitive to all colors; that is, the sensor will detect any object.

Height | Defines the height (above table level) at which the sensor will be placed in the cell.

Use the following heights to enable a sensor to detect objects on devices:

- Conveyor: 130 mm

- Rotary Table: 230 mm

You can accept or change the height value.

If you increase the height, the stand on which the sensor is mounted will appear taller.

The sensor's light beam that appears in the Cell Setup indicates the sensor's detection range. Make sure you place the sensor so that object to be detected will pass within this range.
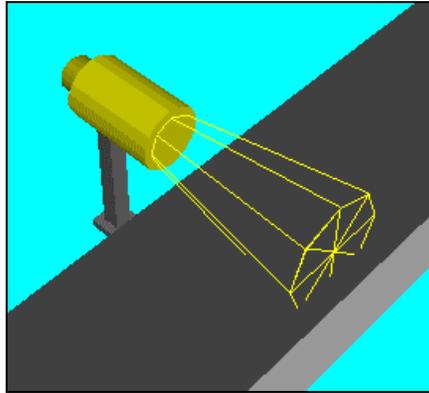
In Cell Simulation the detection range is not displayed. However, the sensor has a lamp that lights up when an object is detected.

Sensor Properties

The sensor properties menu contains the following additional options:

|	
Controller Input Number	Defines the robot controller input to which the sensor is connected.
	Entering an input number that has already been defined for another device will replace (overwrite) the existing connection.

Storage

Gravity Feeder Configuration

The gravity feeder configuration dialog box contains the following options:
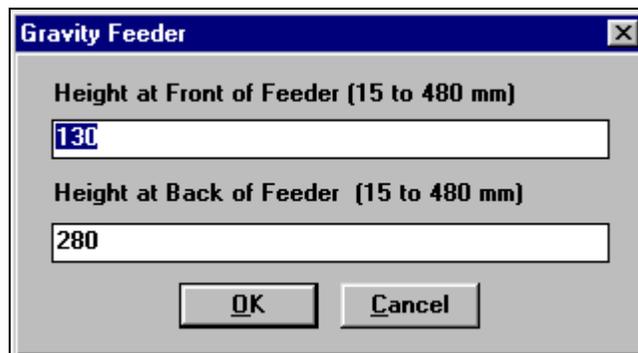
Height at Front of Feeder	Defines the height of the front of the feeder above the table level.
Height at Back of Feeder	Defines the height of the back of the feeder above the table level.

Default values are 130 mm in the front and 280 mm in the back.

An actual gravity feeder should have a slope in the range 15º- 30º.

The maximum possible ratio from the back to the front of the feeder is 3.3:1.

Gravity Feeder and Pneumatic Feeder Properties

Unlike most objects, the feeder's position is defined as the point at which the robot takes an object from the feeder.

The gravity feeder and pneumatic feeder properties menu contains the following additional options:

Number of Parts in Feeder	Defines the number of parts that are loaded in the feeder at the start of operation (when cell is opened or reset).
	Only one material object (e.g., cylinder or cube) should be placed in a parts feeder. You must place the object on the square located at front of of the feeder. The software multiplies the object by the number of parts specified.
Controller Input Number	Defines the robot controller input to which the feeder's microswitch is connected.
	In Cell Simulation the input will remain on as long as there are parts in the feeder.
	Entering an input number that has already been set for another device will replace the existing connection with this new one.
Controller Output Number for Feeder (Pneumatic feeder only)	Defines the robot controller output to which the feeder is connected. A new part appears in the feeder when the output is turned on.
	Note: For a *gravity feeder*, each time an object in the feeder is grasped by the robot gripper (but not necessarily removed from the feeder), another one will be displayed, until the supply runs out.

Placing Objects in Gravity Feeder

When placing objects in the gravity feeder, you must position them in the lighter gray section of the feeder's mouth (see the cursor in the figure below).
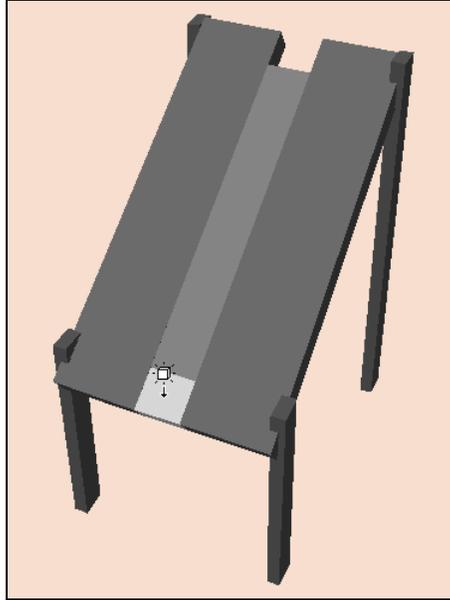
In Cell Setup, the object may not appear positioned correctly (see figure below) Often, it will appear in a skewed angle.
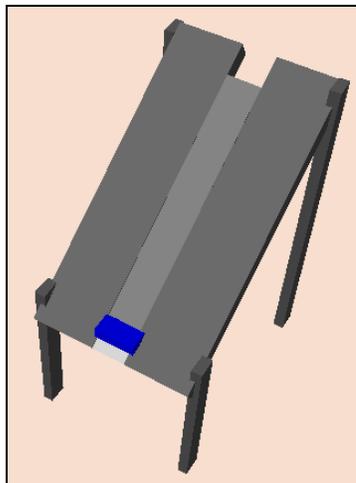
However, when the cell is opened in Graphic Display, the object will be positions correctly if you properly placed in the grey zone.

Machines

None of the machines has any configuration options.

Machine Properties

The machine properties menu includes the Machine Setting option. The following dialog box opens when you select Machine Setting.

Controller Input for Machine Busy	Defines the robot controller input to which the machine is connected. When the input is on this indicates that the machine is busy.
Controller Output for Start Cycle	Sets the robot controller output to which the machine is connected. The machine cycle starts when the output is turned on.
Controller Output for Chuck	Sets the robot controller output to which the chuck is connected. If the output is turned off the chuck is open, when the output is on, the chuck is closed.
Machine Door Control	The doors on the machines are controlled either by the robot or the machine cycle. Use the Machine Door Control option to select an option.

- **Robot Controller:** Select this option for the robot controller to control the opening and closing of the machine doors.

- **Output Number:** Available only when Robot Controller is selected. Sets the robot controller output to which the machine doors are connected.

- **Machine Controller:** Select this option for the doors on the machine to operate independently of the robot controller. The doors open and close at the beginning and end of the machine cycle.

Cycle Time   Sets the amount of time (in seconds) of the machine cycle.

Unlike most objects, the machine's position is defined as the point at which the robot loads or unloads an object to or from the machine.

General

Table Configuration

A table should be placed in the cell just before or after the robot (the first object) has been placed.

Most objects will be displayed at the correct height, even if they are not sitting on tables.

It is recommended that you place one or more tables in the cell so that objects do not float in space or lie on the floor.

The table configuration dialog box contains the following options:
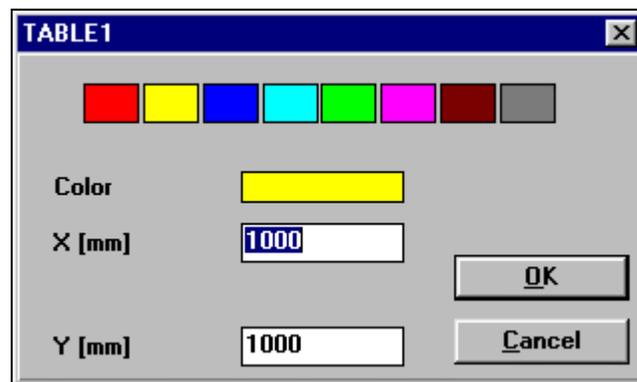
Color   Select any one of the eight colors. Use a color that is different from the colors used for the floor, the background and the objects that will be placed in the cell.

X [mm]; Y [mm]	X and Y dimensions are always in accordance with the X and Y dimensions of the cell. (Use the Show Cell Origin option to display the X and Y dimensions of the cell.)

Table Properties

The table properties menu does not have a Rotate option. Instead, it has a Resize option for scaling the table's dimensions.

Scale X; Scale Y	Enter a ratio value in the X and Y (e.g., 2 or .5) fields. Both fields must contain a value. If you want to change only one dimension, be sure to enter 1 in the other field. (Do not enter 0.)
	Resizing is progressive. The scale reverts to 1 each time the table is resized.
	X and Y dimensions are always in accordance with the X and Y dimensions of the cell. (Use the Show Cell Origin option to display the X and Y dimensions of the cell.)

Materials

Cylinder Configuration

The cylinder configuration dialog box contains the following options:
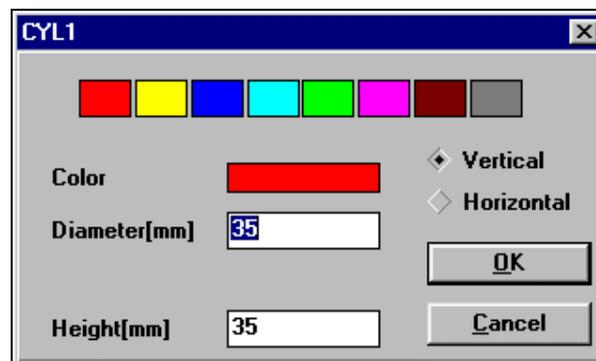
Color	Select any one of the eight colors. You can use different colors to represent different materials which sensors can detect, such as iron, magnetic, transparent or opaque materials. Make sure the color you select for materials is compatible with the sensor's detection definition.

Horizontal /Vertical	Defines whether the cylinder is placed in a horizontal or vertical position.
	Cylinders that will be placed in the lathe should be defined as horizontal.
Diameter	The diameter of the cylinder.
	For horizontal cylinders that will be placed in the lathe, it is recommended that you define their diameter as 20 mm, 40 or 60 mm.
Height	The height (Z dimension) of the cylinder. Increasing the height will make the cylinder taller (if vertical) or longer (if horizontal).

Cube Configuration

The cube configuration dialog box contains the following options:

Color	Select any one of the eight colors.
	You can use different colors to represent different materials which sensors can detect, such as ferrous, magnetic, transparent or opaque materials. Make sure the color you select for materials is compatible with the sensor's detection definition.
X [mm]; Y [mm]	X and Y dimensions are always in accordance with the X and Y dimensions of the cell. (Use the Show Cell Origin option to display the X and Y dimensions of the cell.)
Height	The height (Z dimension) of the cube. The greater the height, the taller the cube.

User Parts Properties

The user part properties menu includes the Impact Setting option. The following dialog box opens when you select Impact Setting.

Cell Simulation checks for impact conditions. In order for Cell Simulation to detect an impact with a user defined part, you must define the area of impact for the part.

To define an impact point, make a selection from the following dialog box:

No Impact	No impact point is defined. When the user part comes in contact with another object in the simulation, there will not be a simulated impact. The part will appear to penetrate the object.
Bounding Box	An impact is detected when the robot comes in contact with a "box" drawn around the object.
User Defined Box	Each user defined part is made up of a series of boxes The user defines the area of the box that will simulate the impact. To define the area of impact:

- Surrounded each box with a bounding box to define impact.

- Define specific areas on the box to detect the impact by creating a tag line in the RWX program. Tags must start with 2001, and must be in sequence (e.g., 2001, 2002, 2003).

User Objects and Parts

User Objects

The items found in the user objects in the New Object menu are for illustration purposes only.

Advanced users who know how to create 3D objects in the RWX format can design and use such objects in the robotic cell. No more than 8 user objects may be used at one time. For further directions on how to design user objects see the following section (Designing User Objects and Parts).

User object files are called USER*.RWX. They are found in the SBWSIM*n*\RESOURCE folder.

User Parts

The user parts (PART1_0.RWX, PART2_0.RWX and Part 3_0.RWX), found in the New Object menu can be manipulated by the robot and machines. These parts are basic shapes. They may be used to simulate any type of material the user chooses.

In RoboCell parts are changed at the end of the machining process. This is to show you how a part looks after it has been in a mill or a lathe. The part will look as if it were actually finished by the machine. You may design your own finished parts.

Advanced users who know how to create 3D objects in the RWX format can design and use their own user parts in the robotic cell. However, no more than three user defined parts may be used at a time.

User part files are called PART*_0.RWX, and finished parts are called PART*_1.RWX. They are found in the SBWSIM*n* RESOURCE folder. For further directions on how to design user parts see the following section (Designing User Objects and Parts).

Designing User Objects and Parts

Modify an Existing User Part File

You may change the existing user part to create your own user part. To modify an existing user part do the following:

1. Open the SBWSIMx folder.

2. Open the RESOURCE folder.

3. Use a text editor that saves files in plain ASCII format, such as Notepad or DOS Edit.

4. Open one of the existing user part files (PART1_0.RWX, PART2_0.RWX or PART3_0.RWX). The file looks like the following example:

```
ModelBegin
  TransformBegin
      Color 0.0 1.0 1.0
      Surface 0.4 0.3 0.2
      Opacity 1.000000
      LightSampling Facet
      GeometrySampling Solid
      TextureModes Lit
      Texture NULL


      ClumpBegin


        Translate 0.0 0.0251 0.0
            Tag 1
            Block 0.05 0.05 0.05
                    ClumpBegin
                    Tag 2001
                    Color 1 0 0
                    Opacity 1
                    Block 0.03 0.02 0.07
                    ClumpEnd


TransformEnd
ModelEnd
```

1. Edit the file to create your own part.

2. Save the file. Since you can only have three user part files at a time you must replace the original file. *Do not change the file name*.

3. To create your own finished part, edit the Part*_1 file.

    *If you do not want to create a finished part, delete the Part*_1 file.*

Create a New File

You can write your own user object and user part files. To create a new file do the following:

1. Open a text editor that saves files in plain ASCII text, such as Notepad or DOS Edit.

2. Write the program to create your own part.

3. Save as file type .RWX.

    You must name the file PART1_0.RWX, PART2_0.RWX, or PART3_0.RWX.

4. To create a finished part name the file PART*_1.RWX. There must also be a PART*_0.RWX file to go with it (i.e., in order for there to be a PART1_1 file there must be a PART1_0.RWX file).

5. Copy the files to the SBWSIM*n*\RESOURCE folder.

    Note: you should save the original file with a different file name. It is recommended that you do not discard the original files supplied with RoboCell.

*   To create a **user object** follow the above steps and name the file USER*.RWX. USER*.RWX files can not be manipulated by the robot or machines.You must replace the original user object files.

Import a CAD File:

You can create a 3D object in a CAD program, and import it to RoboCell. To import a CAD file do the following:

1. Create a file in any CAD program. Save as *.DXF or *.3DC.

2. Use the **DXFtoRWX,** or **3DCto RWX** converter to convert the file to RWX format.

3. Name the files PART1_0.RWX, PART2_0.RWX, or Part3_0.RWX.

4. To create a finished part name the file PART*_1.RWX. There must also be a PART*_0.RWX file to go with it (i.e., in order for there to be a PART1_1.RWX file there must be a PART1_0.RWX file).

5. Copy the file to the SBWSIM*n*\RESOURCE folder.

    To import a **user object**, follow the above steps and name the file USER*.RWX.

For more information on RWX files, consult a manual on RWX programming.
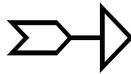
5

Cell Simulation

Cell Simulation integrates the SCORBASE robotic software with a graphic display module, which allows you to teach robot positions and execute robot programs in a virtual robotic cell.

SCORBASE

The first three options in the SCORBASE View menu control the Graphic Display window and the screen layout of the Cell Simulation.

All SCORBASE menus and functions are described fully in the user manual supplied with the SCORBASE for Windows software.

| Graphic Display | Opens or maximizes the Graphic Display window, if it has been closed or minimized. |

| Simulation & Teach | Displays the Graphic Display window and a set of SCORBASE dialog boxes that are used for position teaching operations. |

When Cell Simulation is activated, it always opens with the default Simulation & Teach screen layout, as shown below.
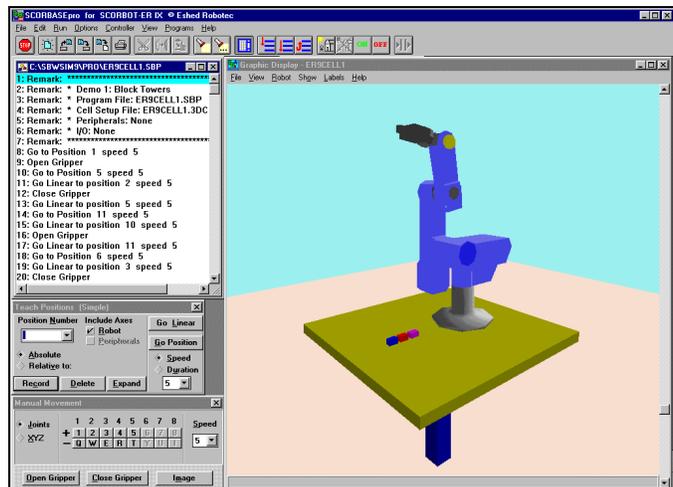
Simulation & Run	Displays the Graphic Display window and a set of SCORBASE dialog boxes and windows that are used during program execution.

The default Simulation & Run screen layout is shown below.
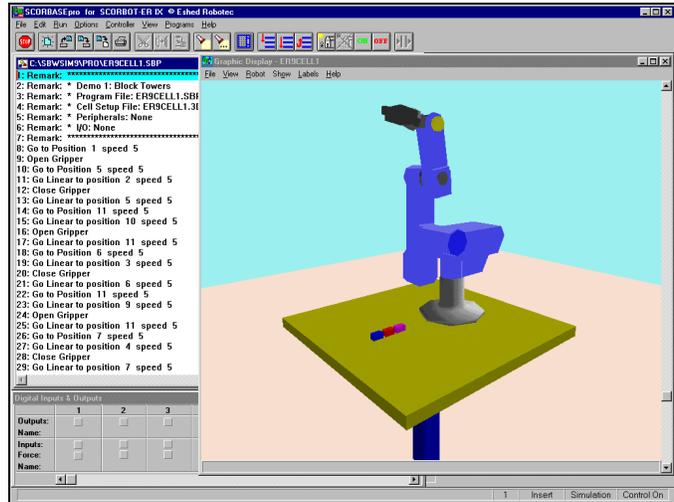
Use the SCORBASE Options | Save User Screen to save a screen layout that is the most comfortable for you. A user screen can include the Graphic Display window.

Graphic Display

The Graphic Display module is a stand-alone application, which has its own title, menu and status bars. However, it operates as a slave of the SCORBASE module. The robot and objects in the cell shown in the Graphic Display window respond directly to all SCORBASE functions, such as axis manipulation, movement commands and program execution.

RoboCell for SCORBOT-ER 2pc and 4pc: When SCORBASE is operating online, the Graphic Display provides graphic tracking of the actual robotic cell. (Online graphic tracking is not available in the SCORBOT-ER Vplus or ER IX versions of RoboCell.)

Whenever the Graphic Display window is opened, it shows the cell that was loaded last (in either Cell Setup or Cell Simulation). In addition, the cell is displayed from the angle of view that was last set by the View | Save Camera Position option.

By default, the Graphic Display window is set to display Always on Top. *Do not change this setting*.

This following sections in this chapter describe the options and features available through the Graphic Display menus.

File Menu

Only one cell setup file/window can be opened at a time.

Open

Opens an existing cell setup file and displays the cell it defines.

Make sure you open the correct cell setup file before loading an associated SCORBASE program file.

The proper sequence for opening and closing SCORBASE and cell setup files is described in the section, Running the Demo Files, in Chapter 2.

When SCORBASE is operating in simulation mode, the peripheral settings defined in the cell setup file are loaded. When SCORBASE is operating online, the peripheral settings defined in the cell setup file are not loaded; the peripheral setup defined in SCORBASE is retained. Simulated peripheral axes that do not match the SCORBASE definitions will not respond to SCORBASE commands in the Graphic Display.

Cell Reset

Reloads the currently open cell setup file. The robot and all peripheral axes assume their home positions. All objects return to their original positions. The graphic display returns to its default view (as set by the Save Camera Position option).

Selecting Cell Reset while a robotic program is running will interrupt its execution, but will not stop or reload the program. You must select the SCORBASE Stop command, and then bring the cursor to the first line of the program before resuming program execution.

Input settings are reset by Cell Reset in accordance with the cell setup. However, the Force status of inputs remains in effect.

ER 2pc and 4pc versions: Output settings are not affected by Cell Reset. You must clear them manually (in the SCORBASE Digital Inputs & Outputs dialog box).
ER Vplus and ER IX versions: Output settings are reset by Cell Reset.

ER 2pc and 4pc versions: When SCORBASE is operating online, Cell Reset causes the simulated robot and peripheral axes to assume the position of the actual robot and peripherals.

Exit	Closes the Graphic Display window only.

To close Cell Simulation and RoboCell, use the SCORBASE File | Exit option.

View Menu

Top View	Displays an overhead view of the cell. This is the same option that appears in the Cell Setup View menu.
Redirect Camera	Allows you to select a different focal point in the graphic display of the cell. This is the same option that appears in the Cell Setup View menu.

To change the center point of the graphic display window, select View|Redirect Camera. Then click on any point in the scene. It now becomes the center point of the graphic display.

Follow Me Camera	When selected, the camera follows a specific focal point. This function is similar to Redirect Camera, only automatic and continuous.

To change the focal point of the camera, you must first clear this menu option to stop the camera's tracking. Then select Follow Me Camera again, and select another focal point.

This function is particularly useful for following the motions of the robot gripper. But it can also be used to track any object in the cell, such as a cube that is being moved.

Save Camera Position	Saves the current view of the cell. The graphic display will show this view whenever you select Cell Reset or Restore Camera Position, or when the cell setup file is loaded.
Always on Top	Keeps the Graphic Display window in front of all other windows and dialog boxes.

Do not change this setting. Use the standard Windows method to display a window or dialog box that is hidden by the Graphic Display window.

Robot Menu

The commands in the Robot menu allow you to control and manipulate the simulated robot directly through the Graphic Display window rather than SCORBASE dialog boxes. Using Send Robot commands allows positions to be recorded simply and accurately.

| Stop   F9 | Executes the SCORBASE Stop command in the Cell Simulation. Aborts program execution and halts all movement in the robotic cell. |

| Send Robot to Object | Moves the robot (gripper) to an object in the cell. |

Be sure the gripper is open before using this command.

First select Send Robot to Object, then click on the target object.

By default, the gripper will move to a point that is 10 mm above the object's position. Since the position of most objects is defined by the XY coordinates at the center of the object's base, the Z-offset prevents the robot gripper from impacting the surface on which the object lies.

Use the Options for Send Robot dialog box to change the Z-offset value. This will allow you to send the robot to a taller object, for example.

| Send Robot to Point | Moves the robot (gripper) to any location in the cell. It is similar to the Send Robot to Object command, but allows you to send the robot to any point on any object in the cell. When you click on an object, such as the table, the target point is the point where you click, not the object's position. |

First select Send Robot to Point, then click on the target point. By default, the gripper will move to a point that is 10 mm above the point selected. Use the Options for Send Robot dialog box to change the Z-offset value.

| Send Robot Above Point | Moves the robot (gripper) to a point above any selected location in the cell. |

First select Send Robot Above Point, then click on the target point.

By default, the gripper will move to a point that is 150 mm above the target point. This offset value

allows you to send the robot to a point above a part or a device.

Use the Options for Send Robot dialog box to change the Z-offset Above Point value.

Open Gripper	Executes the SCORBASE Open Gripper command in the Cell Simulation.
Close Gripper	Executes the SCORBASE Close Gripper command in the Cell Simulation.
Options for Send Robot	Opens a dialog box which defines the vertical offset values and the gripper's orientation when Send Robot commands are executed.
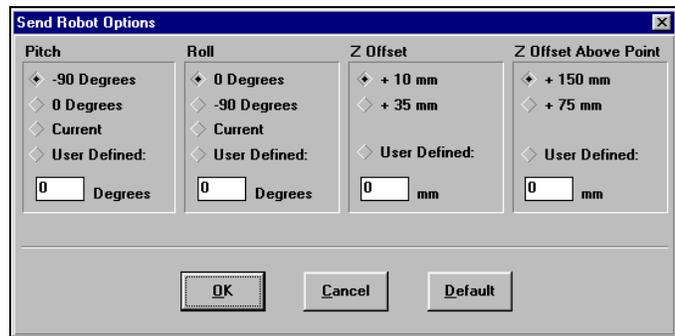
The settings will remain in effect for all subsequent Send Robot commands.

By default, the robot moves to an object or point with the gripper perpendicular (-90) to the table and with no (0) rotation.

You may also use the SCORBASE Manual Movement dialog box to adjust the orientation (pitch and roll) of the gripper. You can then select the option Use Current to maintain the gripper's orientation during subsequent Send Robot commands.

The Z-offset value is used by the Send Robot to Object and Send Robot to Point commands.

The Z-offset Above Point value is used by the Send Robot Above Point command.

When SCORBASE is operating online (ER 2pc and 4pc only), the options in the Robot menu (except Stop) are not available. (Online SCORBASE with Cell Simulation is not available for SCORBOT-ER Vplus or ER IX.)

For more information on controlling the robot in Cell Simulation, see Chapter 6.

Show Menu

Show Robot Path	When selected, a line showing the path of the gripper will be drawn on the screen whenever the robot moves.
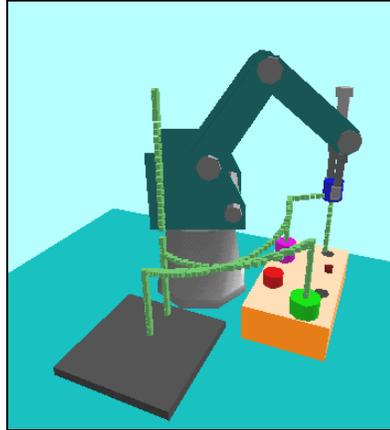
The path is drawn at a rate of 3 dots per second. After 500 dots are drawn, all dots are cleared.

Clear this menu option to stop the display of the path.

Clear Robot Path	Removes the robot path that was drawn on the screen.

Show Gripper Position	Displays in the Graphic Window status line the robot's current Cartesian (XYZ) position. The values indicate the position of the tip of the gripper relative to the robot's point of origin.

You can avoid screen clutter by using this option instead of opening the SCORBASE XYZ dialog box.

Show Cell Origin	This is the same option that appears in the Cell Setup Labels menu.

The cell has a point of origin (0,0) at table level. The positions of all objects are defined as relative to this point of origin.

When Show | Show Cell Origin is selected, a red cross marked with X+ and Y+ axes remains displayed on the screen.

When manipulating the graphic display, the cross may disappear momentarily.

Rotating the view does not change the X and Y dimensions of the cell.

Show Robot WorkEnvelope	This is the same option that appears in the Cell Setup Robot properties menu.

Displays the span of the robot's working range, and allows you to see whether objects are within the robot's reach.

Labels Menu

Some of the options in this menu are the same as those which appear in the Cell Setup Labels menu. When a label type is selected, all labels are displayed, even if the objects themselves are obscured.

Hide All Labels	Hides the display of all labels.

Unlike Cell Setup, individual object labels cannot be hidden.

Object Names	When selected, a label on each object shows its name, as defined in the object's properties menu.

Object Positions	When selected, a label on each object shows its position. The coordinates indicate the center point of the object relative to the cell's point of origin.

These coordinates are displayed in black text.

Object Positions in Robot Coordinates	When selected, the coordinates shown in the labels indicate the objects' positions relative to the robot's center of origin.

If the robot has been moved on a slidebase, or repositioned during setup, these coordinates provide the proper coordinates needed for teaching robot positions.

These coordinates are displayed in blue text.

Number of Parts in Feeder	When selected, a label on each feeder shows the number of parts in the feeder. Only the part to be picked up by the robot is displayed.

6

Cell Operation

Operating and programming the robot in Cell Simulation is similar to working with an actual robot. Graphic display features and automatic operations such as Cell Reset and Send Robot commands enable quick and accurate programming.

Robot Manipulation

The SCORBASE Manual Movement dialog box allows you to manipulate the robot and peripheral axes in the simulated cell in the same way it provides control of an actual robotic system. Clicking with the mouse on the screen, or pressing keys on the keyboard moves the axes. Movement of an axis continues as long as the button or key is pressed, or until a software or hardware limit is reached.

Use the Open Gripper and Close Gripper buttons to control the gripper.
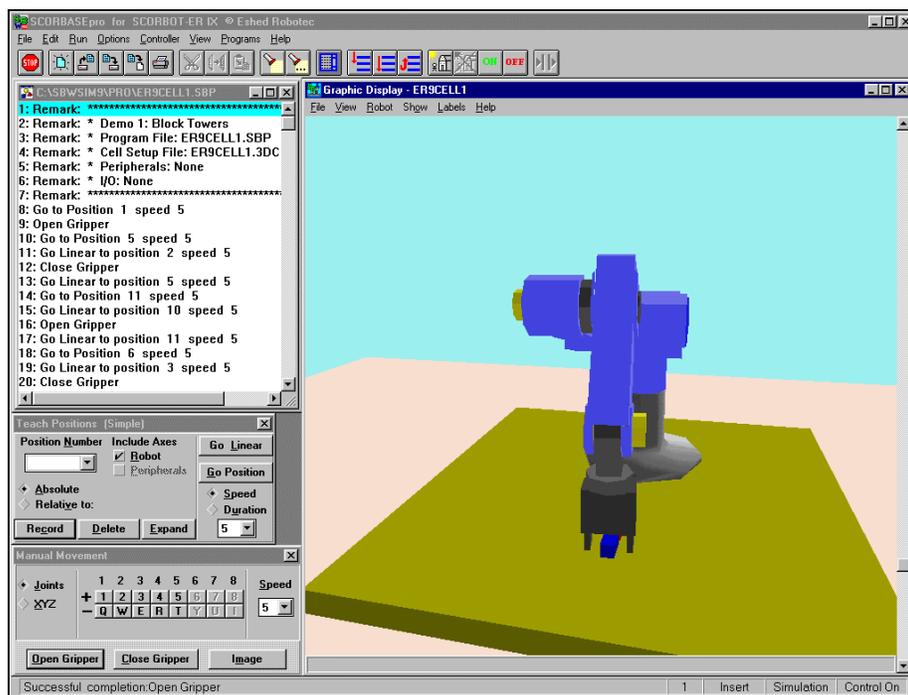
Machine Operation

You can operate the mill or lathe directly from the Digital output dialog box or with program commands (See Program Execution, P. 53.) A program will continue to run after the machine begins to operate.

Be sure to close the chuck on the mill or lathe before you open the Robot gripper to release it. A part placed in the lathe will drop to the bottom unless the chuck is closed before opening the robot gripper.

A part placed in the mill may fall once the mill cycle begins, if the chuck is not closed before starting the cycle.

Send Robot Commands

Send Robot commands can often be used instead of the SCORBASE Manual Movement dialog box. Commonly, however, you will use the Manual Movement dialog box to adjust the robot's position after using a Send Robot command.

When SCORBASE is operating online with an actual robotic cell, the Send Robot commands and options are disabled.

When using the Send Robot commands, be aware of certain characteristics of the following objects.

Feeders
: Click on the part in the feeder, and not the feeder itself, to select it as the target for the Send Robot to Object command. To easily pick up a part from the feeder, select a picth of 0° and a roll of -90° in the Options for Send Robot dialog box..

Lathe
: Each of the four clamps in the chuck can be a target object.

You cannot use the Send Robot to Object command to place and object in the lathe chuck.. Objects must be placed in the chuck manually.
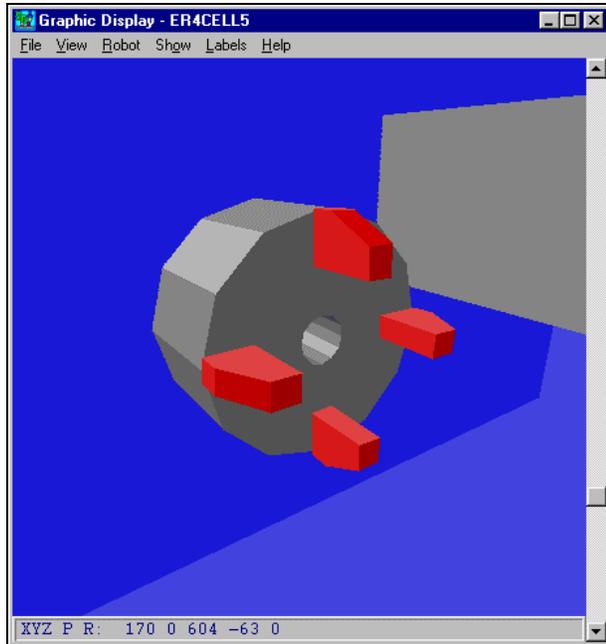
Use the Manual Movement dialog box to position the cylinder exactly.
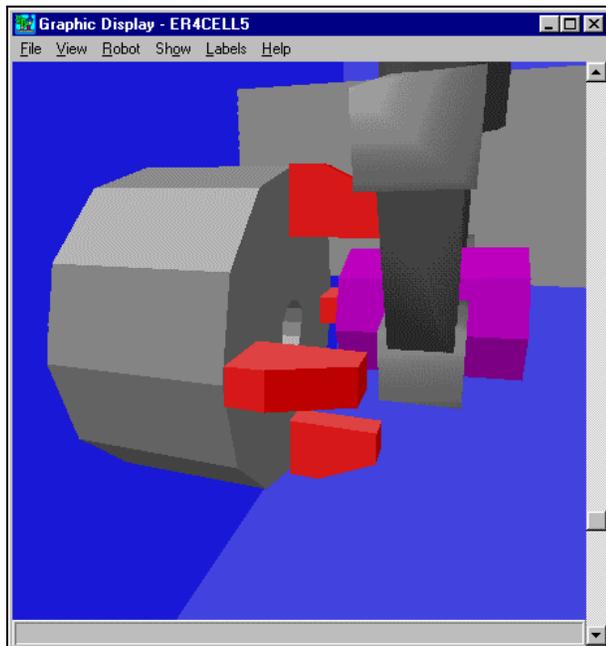
Mill

Click on the jig in the mill to select it as the target for the Send Robot to Point command. Use the grid on the jig to help place the object.

Table

Use the Send Robot to Point (*not* Send Robot to Object) command and select a specific target point on the table.

Template	Although it is regarded as one object, the template is comprised of two objects, the tray and the handle, either of which can be a target object. The template has only one position, defined by the center of the tray.

Use Z-offset 35 mm to send the robot to the template tray,

Use Z-offset 0 mm (user defined) to send the robot to the template handle.

Gripper

Grasping Objects

The robot gripper in Cell Simulation will grasp object only as a result Close gripper commands.

When the gripper closes on an object, the object is pushed into the center of gripper.

In addition, cubes and horizontal cylinders are rotated into alignment with the gripper jaws, provided the rotation offset does not exceed 35°. When the offset is about 45°, the gripper simply grasps the object at its corners.

Since objects are rotated around their center, a long object that will be grasped far from its center must be aligned with the gripper as much as possible before the gripper is closed.

Releasing Objects

Cell Simulation operates with gravity. Objects that are released will fall to the first surface below them.

If more than half of an object's base rests on a surface, the object will remain on the surface. Otherwise it will fall onto the surface below.

Objects can be picked up and released at any rotation.

Impact Detection

Cell Simulation checks for the following impact conditions:

- The tip of gripper hits an object or the robot itself.

- The edge of the gripper motor (mounted on top of gripper) hits an object or the robot itself.

- An object held by gripper hits another object or the robot.

Cell Simulation 's impact error message is the same one sent by SCORBASE when an actual robot cannot reach a target position. Since there are no mechanical (motor) or electrical (encoder) failures in simulation, you can assume simply that the gripper or an object held by the gripper has collided with the robot or another object.

The Graphic Display status line indicates the object on which the impact has occurred.

In response to the impact error message, select OK to resume Control On. Then move the robot away from the impact condition. If a Send Robot command caused the impact, the robot will resume movement from the position that preceded the Send Robot command.

When SCORBASE is operating online with an actual robotic cell, SCORBASE controls impact detection and response, and Cell Simulation's impact detection function is disabled.

Recording Positions

Cell Simulation provides three ways of recording robot positions.

1. Use the SCORBASE Manual Movement dialog box to manipulate the virtual robot in the same manner in which you would manipulate an actual robot.

2. In the SCORBASE Teach Position dialog box, click Record.

   Or:

1. Use the Graphic Display Send Robot commands to move the robot to the target object or position. If necessary, use the SCORBASE Manual Movement dialog box to adjust the exact orientation or location of the robot gripper.

2. In the SCORBASE Teach Position dialog box, click Record.

   Or:

1. In the Graphic Display window, select Labels | Object Positions in Robot Coordinates. Zoom in on the object or point whose coordinates you want to record.

2. Open the SCORBASE Teach Position Expanded dialog box. Enter values for all five coordinates, and click Teach, as shown below.

Teach Position Expanded
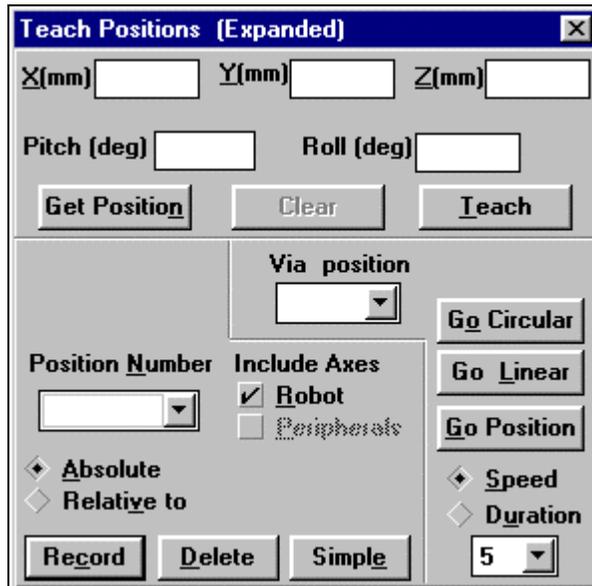
Teach Position Expanded (SCORBOT-ER IX)
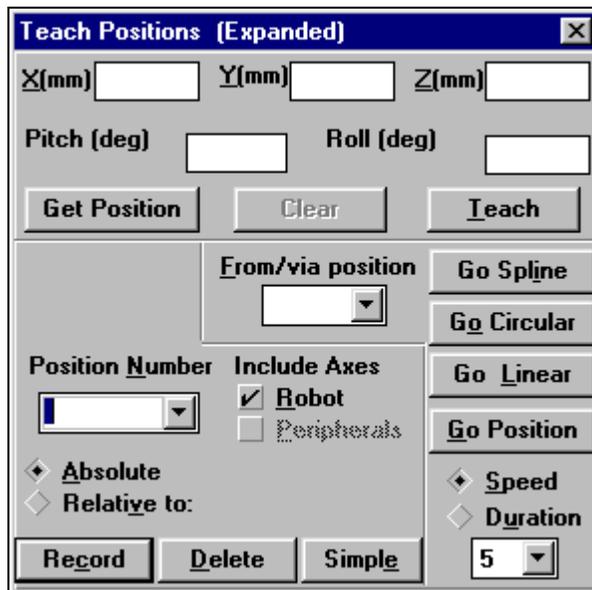
Program Execution

Executing programs in Cell Simulation is the same as executing programs when using an actual robotic system.

Since different cell configurations can be easily loaded and changed in Cell Simulation, be aware that positions may not be loaded together with their associated SCORBASE program. Or, if loaded, they may cause incorrect movements during program execution. For instance, positions recorded for a cell that has a rotary table at axis 7 are inappropriate for a cell in which axis 7 is connected to a slidebase.

Attempting to run a program with incorrect positions will result in unpredictable results.

To ensure proper program execution, heed the following:

- Load the cell setup file before you load the SCORBASE program file.

- Load only SCORBASE programs that are suitable to the cell setup currently in use.

- Close an open SCORBASE file before you load another one.

When SCORBASE is operating online with an actual robotic cell (ER2pc and ER4pc), the Graphic Display provides only graphic tracking of program execution. Cell Simulation functions that would conflict with online operations (such as input manipulation and impact detection) are disabled.

(Online graphic tracking is not available in the SCORBOT-ER Vplus or IX versions of RoboCell.)
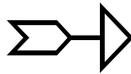
7

Optional Welding Features

Introducing RoboCell for Welding

RoboCell for Welding with SCORBOT-ER 4pc is a 3D-solid modeling robotic welding software for teaching modern techniques of arc welding.

The software features the following:

- Welding of multiple parts both online and in simulation.

- Accurate display and manipulation of welded parts both online and in simulation.

- Single-command character generator that calculates and teaches all positions required for producing any text string.

- Predefined welding cells and fully functional demonstration programs for simulated execution.

A typical welding cell is shown in the figure below.
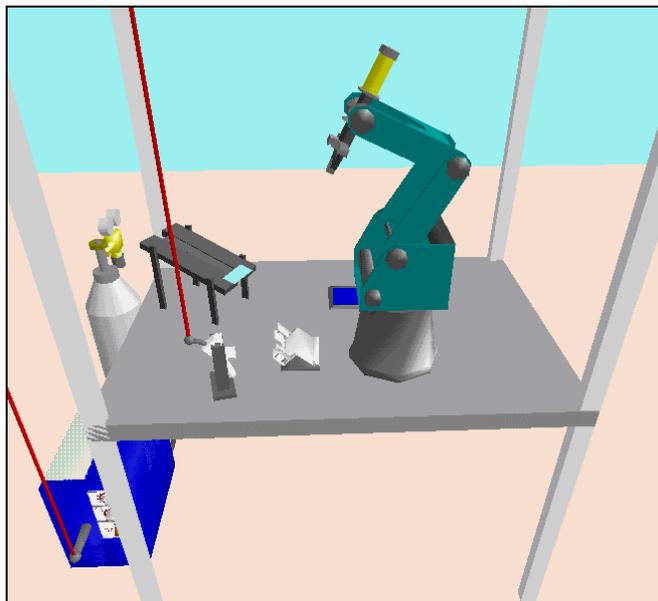
RoboCell for Welding includes additional software features not included in other RoboCell packages. This chapter deals solely with additional RoboCell for Welding software features.

RoboCell for Welding enables several types of welding processes: T-joint welds, butt welds and the welding of letters and numerals.

- **T-joint weld:** A T-joint weld is shown in the figure below.
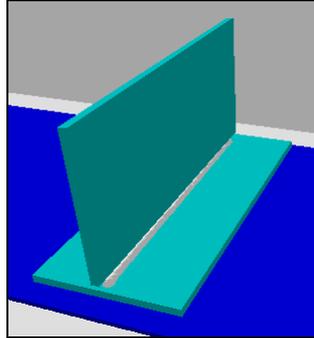
- **Butt weld:** Weld in which the pieces are welded side-by-side.
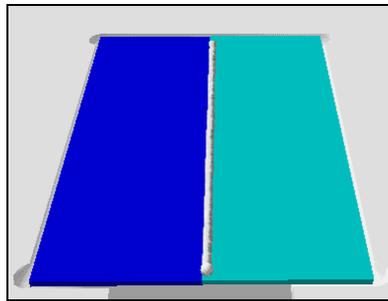
- **Letters and numerals:** Gun is used to weld letters or numerals on a large metal plate placed on the butt jig.
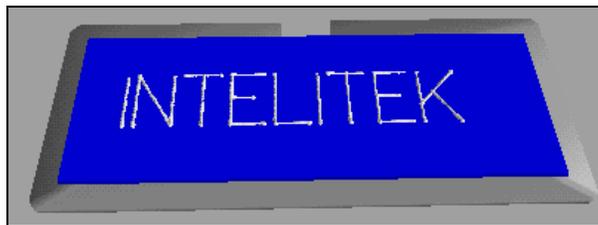
The workcell allows fully-automatic T-joint welding operations – retrieving of metal plates from gravity feeder, loading of parts into T-joint jig, retrieving of MIG gun, arc welding, returning of gun and unloading of weld from jig for cooling.

Welding of a butt joint or of numerals/letters is performed similarly. However, for these processes, the metal sheets must be placed in the jig during the cell setup stage. The robot's work envelope does not allow it to place and remove parts from this jig.

Cell Setup

Several new objects are included the Cell Setup of RoboCell for Welding.

Welding Tools

Welding Table Configuration

The welding table should be placed in the cell just before or after the robot (the first object) has been placed. Most welding objects will be automatically placed at the correct default welding table height , even if they are not placed directly on the welding table.

The welding table configuration dialog box contains the following options:
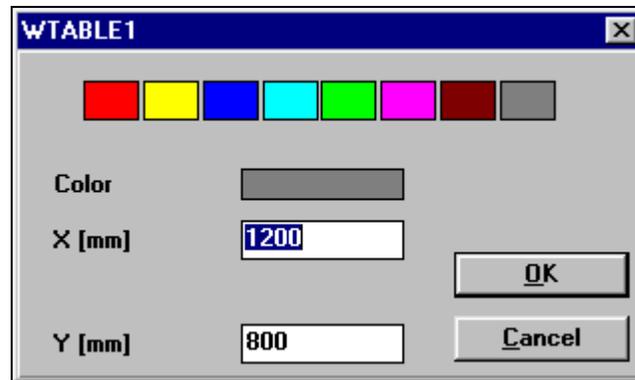
Color	Defines the color of the welding table. The booth poles will remain default grey.
	Select any one of the eight colors. The default grey most realistically portrays the welding booth table supplied with the AMT Automated Welding tekLINK.
	To distinguish the table, use a color that is different from the colors used for the floor and background.
X (mm); Y (mm)	Defines the length and width of the table in millimeters. X and Y dimensions are always in accordance with the X and Y dimensions of the cell. (Use the Show Cell Origin option to display the X and Y origin of the cell.)
	You can accept or change the default dimensions of 1200 mm x 800 mm, which represent the width of the welding booth's table supplied with the Automated Welding tekLINK.

Welding Machine Properties

You cannot save a cell containing *only* a welding gun or *only* a welder. Neither or both must be present in order to save the cell.

The welding machine properties menu contains the following additional options:
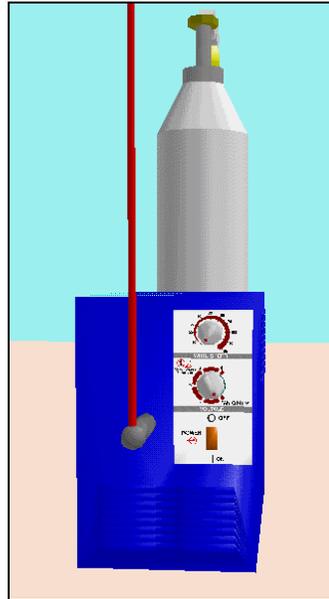
Welding Settings   Opens the Welding Settings dialog box which enables definition of the following weld parameters:

- Voltage Tap.
- Wire Diameter.
- Wire Speed.
- Shielding Gas.
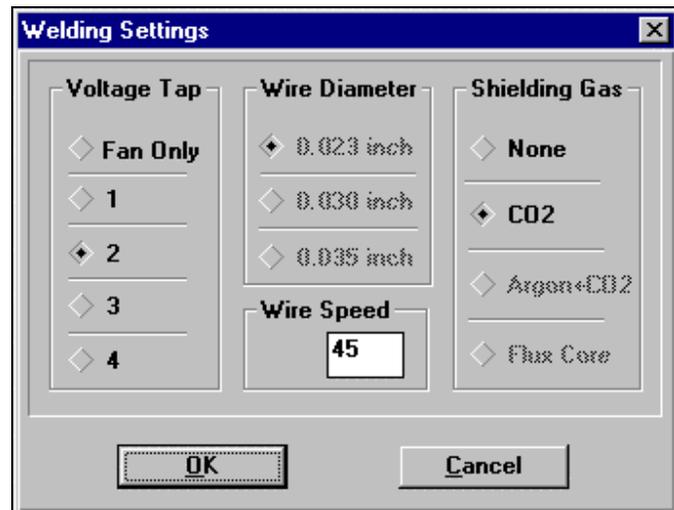
The default parameters are set according to the Millermatic recommended settings (*see the Millermatic User's Manual*). Some parameters are interrelated. For example, by changing the voltage tap, the wire speed default will automatically change. Note that the wire speed can also be changed independently of the voltage tap.

Welding settings can also be changed by the user when working within the Graphic Display window.

Controller Output Number for Welding Machine

Opens a dialog box that enables definition of the controller output number for the welding machine. In the AMT tekLINK, the controller output number is 1. You can enter any number between 1 and 8.
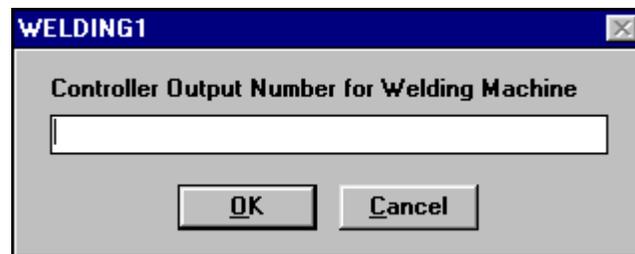
Gun Stand

The gun stand does not require the user to define any additional configurations or properties. The user only needs to place it in an accessible position on the welding table.
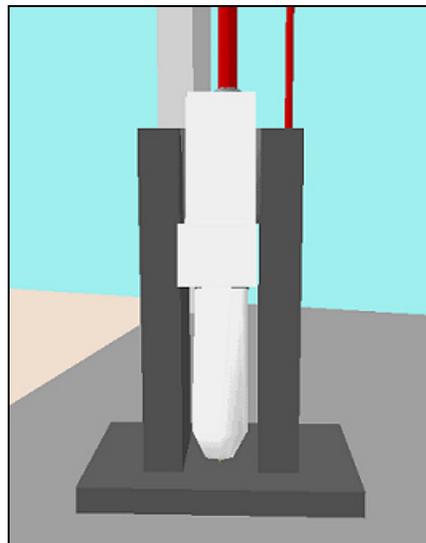
You cannot save a cell containing *only* a welding gun or *only* a welder. Neither or both must be present in order to save the cell.

Welding Jig A (T-Joint)

Welding Jig A is a device used to securely hold two materials being welded together in a T-joint. This jig does not require the user to define any additional configurations or properties. The user only needs to place it in a position on the welding table in which the robot can access the jig from both ends to place and remove parts.
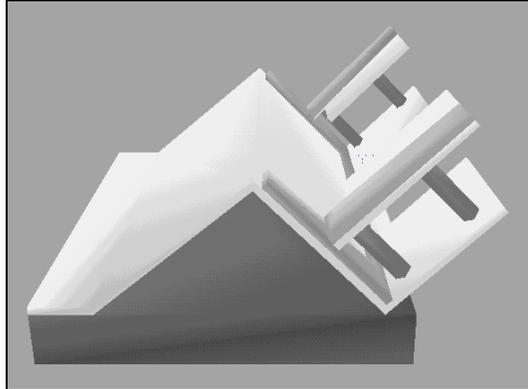
Welding Jig B

Welding Jig B can be used for various types of welds. The depressed region in the center of the jig can be used to securely hold two metal sheets side-by-side to create a butt weld. The jig can also be used to hold the larger nameplates used with the SCORBASE WRITE command (see *SCORBASE User's Manual*).

Welding Jig B does not require the user to define any additional configurations or properties. The user only needs to place it in an accessible position on the welding table.
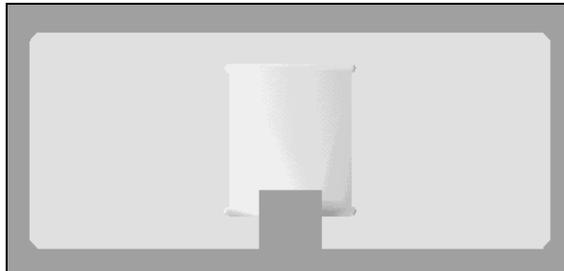

Welding Materials

Plate 89 x 38 x 1.5 (mm) Configuration

The Plate 89x38x1.5 (mm) configuration dialog box does not allow any user-definition. It displays the default dimensions and color of the welding metal plates to be used with welding jig A.
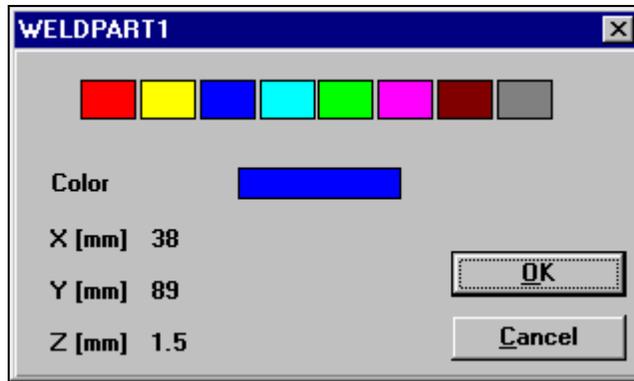
User-Defined Plate

The User-Defined Plate configuration dialog box contains the following options:
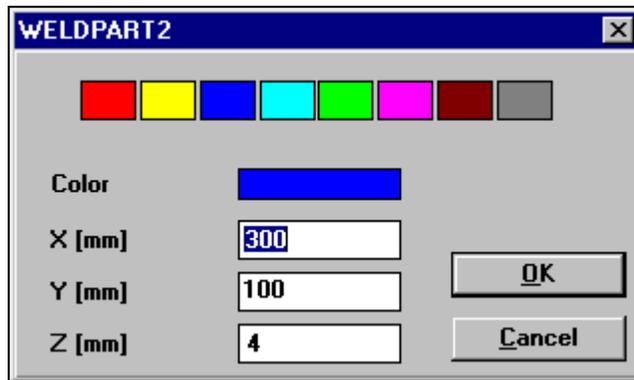
Color	Select any one of the eight colors. You can use different colors to represent different materials.
X (mm); Y (mm); Z (mm)	The dimensions of the plate. Any dimensions can be defined, as long as the plates are compatible with either welding jig A or B.
	The AMT tekLINK uses parts of dimensions 300 x 100 x 4 (mm).

Graphic Display

Several new features are included in the Graphic Display window of RoboCell for Welding.

Welding Menu

A new menu item – Welding Menu – has been added to the Graphic Display menu in the RoboCell for Welding package.

Welding Settings	Opens the Welding Settings dialog box which enables definition of the following simulated welding parameters:
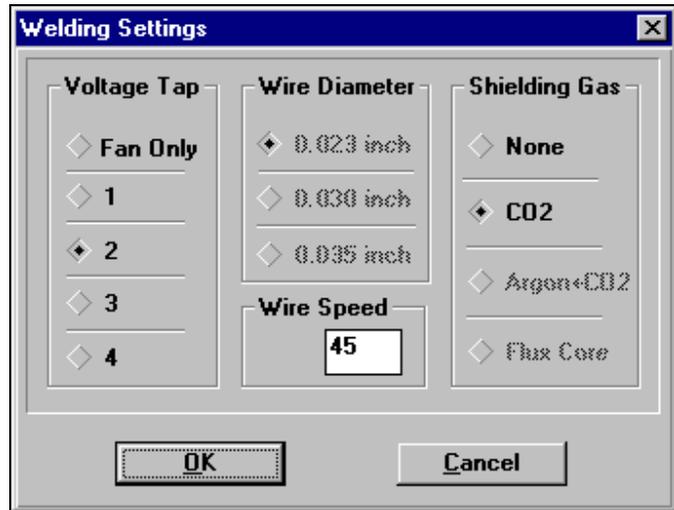
- **Voltage Tap:** Defines the voltage supplied to the welding gun, an important variable in determining the quality and appearance of a weld. The voltage tap value is a reference number (2 does not indicate 2 Volts).

  The Voltage Tap should be set according to several factors, such as robot speed, wire speed and metal thickness.

- **Wire Diameter:** Defines the diameter of the wire being fed to the MIG welding gun. Cannot be changed.

  Set to the default 0.023 inch wire diameter used in the AMT tekLINK.

- **Wire Speed:** Defines the speed at which the wire is fed to the MIG welding gun. Also known as feed rate.

  The wire speed setting is essentially a reference value to the controller built into the welder. A wire speed between 10 and 100 can be entered.

  The wire speed is automatically regulated by the welder for optimal performance and does not need manual input. The welder determines the feed rate setting by weighing three factors: type of shielding gas, metal thickness and wire diameter.

- **Shielding Gas:** Defines the presence or absence of shielding gas when welding. The system only works with CO_2 gas.

  The task of gas in a welding environment is to isolate oxygen from the welding pool, which causes rust and a poor joining of the welded pieces.

The default parameters are set according to the Millermatic recommended settings (*see the Millermatic User's Manual*).

Some parameters are interrelated. For example, by changing the voltage tap, the wire speed default will automatically change. Note that the wire speed can also be changed independently of the voltage tap.

The settings will remain in effect for all subsequent simulated welds. *Changes in this dialog box will not affect the actual Millermatic welder settings!*

This dialog box can also be accessed by double-clicking on the welding machine knobs. Note that parameter changes are reflected in the knobs' positions.

Additional Welding Features

The Graphic Display of RoboCell for Welding also includes several new features.

Advanced Send Robot Commands

Recording Positions for Welding Jig A

RoboCell for Welding includes features that enable easier recording of positions for Welding Jig A. To record the position for placing a part in the left side of the jig, use the Send Robot to Object option and click anywhere on the protruding parts of the jig (as shown by the numeral "1" in the figure below). RoboCell will automatically send you to the correct position for placing the part. Note that this position is also used for removing the welded part from the jig.

To place parts in the right side of the jig, click on any of the areas indicated by the numeral "2" in the figure below.
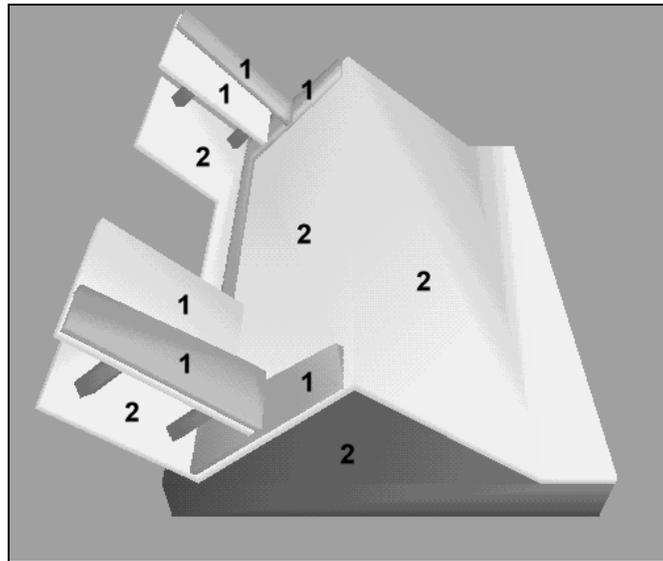
Recording Positions for Welding Gun

RoboCell for Welding also includes a built-in feature to facilitate recording the pick position for the welding gun. To record the position for taking the gun, use the Send Robot to Object option and click on the gripper adapter handle on the gun. RoboCell will automatically send you to the correct position for properly picking the gun.

Welding Booth Doors

The welding booth doors can be viewed or removed by double-clicking anywhere on the booth.
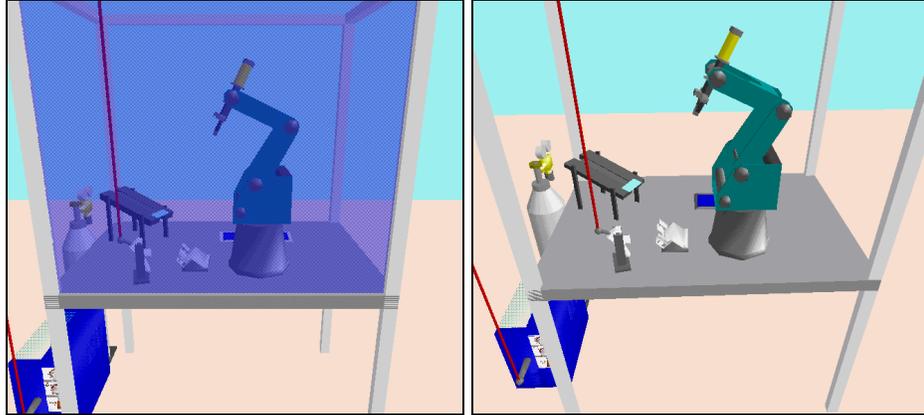
Welder

The welder has the following built-in features:
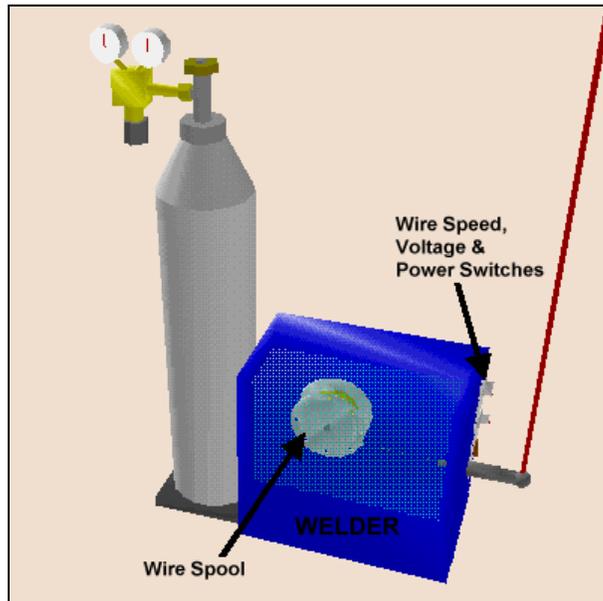
Wire Spool Motion

During the welding process, the wire spool will turn just as it does in reality.

Wire Speed, Voltage and Power Switches

The knobs on the welder accurately reflect the welding settings defined via the Welding Settings dialog box.

Double-clicking on any knob will open the dialog box.

Welding Parameters

Successful automated welding is often not the result of sound technology but instead the result of sound planning. Therefore, it is extremely important to work with only the optimal parameter settings defined by the manufacturer.

As mentioned previously, RoboCell for Welding allows you to adjust the following welding parameters:

Parameter	How to Change Parameter
Inert Gas Shield	From the Welding Settings dialog box, select either None or CO_2.
Voltage Tap	From the Welding Settings dialog box, select one of the reference numbers.
Wire Feed Rate	From the Welding Settings dialog box, select one of the reference numbers. Automatically changes when voltage tap is changed.
Rate of Travel	In SCORBASE, duration can be defined when using the Go to Position command to send the robot from the start weld position to the end weld position. By changing the duration it takes to get from position A to B, the robot's speed is changed – thus changing the speed at which it will weld.
Distance of Electrode from Materials to be Welded	When recording the start/finish welding positions, you define this distance by defining the positions' Y value. In RoboCell for Welding, welding only occurs when the electrode of the welding gun is located at a proper distance above "weldable" material. This feature was built-in to enable more accurate recording of the start welding position. Once the software recognizes that welding is "allowed", the gun will emit wire creating a seam between the two materials. Welding will not occur in the following situations: • The electrode of the welding gun is too close or too far from the material. • The welding gun is located above a material that the software recognizes as "non-weldable".
Angle of electrode	When recording the start/finish weld positions, you define this distance by defining the positions' pitch.

Welding Process

Welding Gun Operation

As welding occurs, sparks will fly from the welding gun, as shown in the figure below.
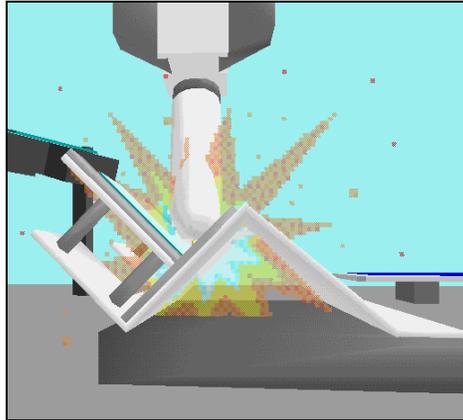
Weld Temperature

The changing temperature of the welding seam can also be seen by zooming in on it during welding, At first, the seam is red and yellow – indicating that it is extremely hot. Slowly, it changes to a grayish color – indicating that it has cooled.

Welded Part

After the welding process is completed, RoboCell for Welding regards the two metal pieces as one.
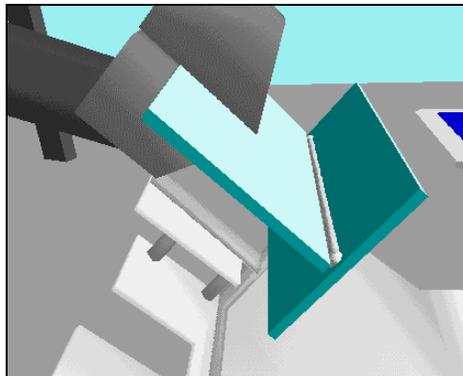
Weld Properties

RoboCell for Welding allows you to observe the quality of a weld at the end of the welding process. Depending on the welding settings used to create the weld, the appearances of welds may differ.

After welding two metals together, double-click on the seam to open the Weld Properties window.

Characteristics for Weld Segment number 8

Status of the Weld

Good Weld   [Note]

Components

Shielding Gas	CO_2
Voltage Switch	2
Wire Diameter (inch)	0.023
Wire Speed Value	45
Welding Gun Speed (mm/sec)	8

[Close]
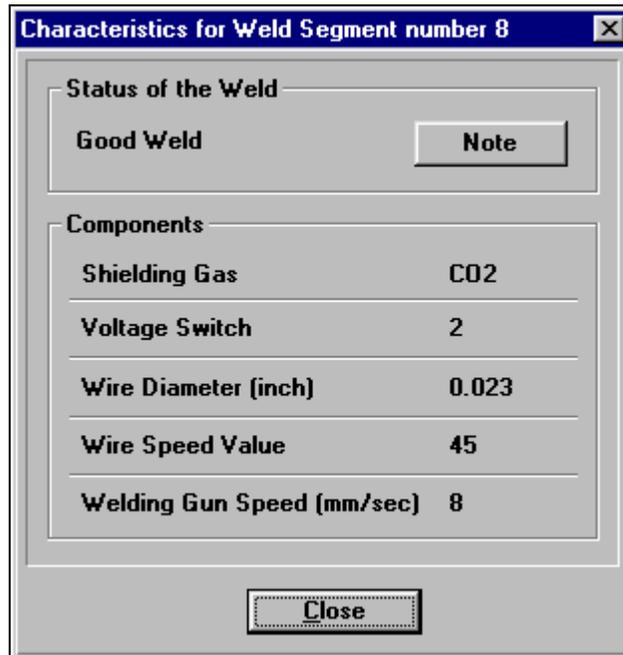
From the window, you can see the following:

- The status of the weld (i.e., good, bad, etc.)
- Whether shielding gas was used or not.
- The voltage tap reference value that was selected.
- Wire diameter used.
- The wire speed reference value that was used.
- The speed of the welding gun.

8

Replicating Real and Simulated Cells

RoboCell's representation of robot and devices are based on actual dimensions and functions of SCORBOT equipment. Thus, programming performed in RoboCell can be used with an actual robotic installation.

From Simulation to Real

Using Cell Setup and Cell Simulation, create a cell, record all positions to be used by the SCORBASE program, write the SCORBASE program and verify program execution.

Then, to construct an actual robotic installation that duplicates the simulated cell, do the following:

1. Using Cell Setup as a guide, place all objects and devices in their approximate locations.

   You can create a map of the cell by doing a screen capture (press the [PrtSc] key) while the position labels are displayed. Then use a paint program to paste and print a layout drawing of the cell.

   If necessary, hide some labels and/or change the angle and zoom of the camera, and print several cell maps.

2. Consider your SCORBASE program and determine which of the recorded positions must be precise; for example, the point at which the robot takes an object from a feeder, or the point at which the robot places a part in a machine.

   In SCORBASE online mode, send the robot to these key positions. Adjust the location and orientation of the actual objects and devices (e.g., feeder, machine) according to the location of the gripper.

   If you are unable to relocate the object or device, you can rerecord the position coordinates.

From Real to Simulation

To create a simulated cell based on an actual installation, you will need to know the exact location and orientation of every element in the cell.

If the cell layout is simple, this information can be obtained through a coordinate grid or a ruler. For a more complex cell layout, you will probably need a technical drawing (e.g., AutoCAD) which shows the center point and orientation of all objects.

All measurements should be made with both the robot and the cell at the same point of origin and with the same orientation.

9

Troubleshooting

Problem	Solution
Installation not successful.	Make sure all applications, including anti-virus monitors and network drivers, are closed. Then try again to install the software.
Program not responding correctly.	There may be a message box hidden behind the application window. Minimize the application windows to check for messages or prompts.
Robot cannot be dragged to another position.	By default the robot is placed at the cell's point of origin to simplify the teaching of positions. The robot's position can be changed only by means of its properties menu.
Screen layout is jumbled or crowded.	Use the SCORBASE View | Simulation & Teach or View | Simulation & Run to reset the screen layout. You can also use the SCORBASE Options | Load User Screen to reset a screen layout that you set and saved previously.
Positions not loaded.	RoboCell for SCORBOT-ER 2pc and 4pc: Positions will not be loaded if they were recorded in a cell containing a Speed Controlled Conveyor and you attempt to load them when the currently open cell does not contain a Speed Controlled Conveyor, or vice versa. Positions will be loaded when the number of peripheral axes is the same in the SCORBASE program and in the cell setup, even if the axes are defined for different peripheral devices. However, movement of the peripheral axes is unpredictable.
Peripheral axis does not move in RoboCell.	When SCORBASE is operating online, the peripheral settings defined in the cell setup file are not loaded; the peripheral setup defined in SCORBASE is retained. Simulated peripheral axes that do not match the SCORBASE definitions will not respond to SCORBASE commands in the Graphic Display.
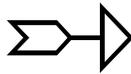
10

Software Localization

RoboCell version 3.0 can be easily translated into languages spoken by software users.

To localize the software do the following:

- Work in a Windows version that supports the local language.

- Install RoboCell version 3.0. When prompted for an interface language, select the language from which you will translate (e.g., English).

- Make a backup copy of the original source files before you edit them.

- Use a text editor which saves text files in plain ASCII format, such as Notepad or DOS-Edit.

By default, RoboCell is installed in the directory C:\SBWSIM*x* (where *x* indicates the particular robot version of RoboCell).

Define Language to be Used for Software User Interface

1. Open the SBWSIMx folder and locate the five source files – CELLSIM, CELSETUP README, WCRES, and SCBS – which have the extension ENG, which indicates English as the source text language.

2. Determine a three-letter extension for the target language files (e.g., POR for Portuguese).

   Copy the five source files and change their extension to the one you have defined for the target language. To duplicate the files, use Edit | Copy, Paste and Rename; or use File | Open and Save As.

   Do not overwrite the original source files.

3. From the SBWSIMx folder, open the file LANGUAGE.INI using your text editor.

   This file is used during the software installation. It creates the names of the folders and icons which are displayed in the SCORBASE program group.

4. In the LANGUAGE.INI file, in the [General] section, change the three-letter extension to the one you defined for the target language.

   For example, change `Application Language=ENG` to `Application Language=POR`.

5. Save the LANGUAGE.INI file.

Create Target Language Source Files

Using your text editor, open and edit the target language files one at a time.

The CELLSIM file, for example, contains the text strings which comprise the software's File menu. When translating the menu from English to Portuguese, your files will look like the example below.

Source file: English.

```
[MainMenu]
PopupFile=&File
Open=&Open...
Reset=&Cell Reset
Exit=E&xit
```

Target file: Portuguese.

```
[MainMenu]
PopupFile=&Arquivo
Open=A&brir...
Reset=&Célua Redefinir
Exit=&Saída
```

Translate only text that follows the = sign.
Do not change text which precede the = sign.
Do not change section titles, which appear in [square brackets].

Note how codes and characters are used in the software source files:

■ **&** precedes the letter used as a hot key, and produces the underlined letter displayed in the software.

■ **$** precedes the shortcut key(s), and inserts the tab which serves to align text strings.

   For example:

Source text string	Displays in software	
`&File`	File	
`Show Cell O&rigin$Ctrl+R`	Show Cell Origin	Ctrl+R

   Do not use a hot key letter more than once in the same menu.

- **%s**, **%d**, **%c** are value fields which are replaced a string, decimal number or character during RoboCell software operation. *Do not change these codes.*

You may restart RoboCell at any time to check your translations.

Edit File Which Will Install Localized (Translated) Version of Robocell

1. Using your text editor, open the LANGUAGE.INI file.

2. Copy and paste the title and all lines in the source language section (e.g., [English]) just above the [General] section.

3. In the new section, change the title of the source language to the target language (e.g., replace [English] with [Portuguese]).

4. In the new section, translate all icon and folder names.

    Change only the text that follows the = sign.

    When a German language interface is added, the file will contain the following sections:

```
[ENGLISH]
FolderName="RoboCell for ER 4pc"
IconName1="Cell Setup"
IconName2="Cell Simulation"
IconName3="SCORBASE PRO"
IconName4="Setup PC Controller"
IconName5="UnInstall RoboCell"
IconName6="Readme RoboCell"
[GERMAN]
FolderName="RoboCell fuer ER 4pc"
IconName1="Zell Setup"
IconName2="Zell Simulation"
IconName3="SCORBASE PRO"
IconName4="Setup PC Controller"
IconName5="UnInstall RoboCell"
IconName6="Readme RoboCell"
```

5. Activate RoboCell. The localized interface will be displayed.

    To restore the original (English) user interface, make sure the LANGUAGE.INI file contains the line: **Application Language=ENG**.

Edit the README File

1. Locate the RoboCell README.ENG file.

2. Make a copy of this file, and change its extension to the one you have defined for the target language.

3. Using your text editor, translate the text in the README file.

4. Save the translated README file.

11

Software License

During the RoboCell software installation, a copy-protection system is also installed on the hard disk. Only one installation per hard disk is permitted.

Normally the software license is automatically installed and removed during the software installation and uninstall procedures.

Although you should not need to manipulate the license directly, a utility is provided to enable troubleshooting and technical support.

To check the number of installations remaining, insert Disk #1 into the floppy drive, and execute the file WINSDEI.EXE. This opens a dialog box.
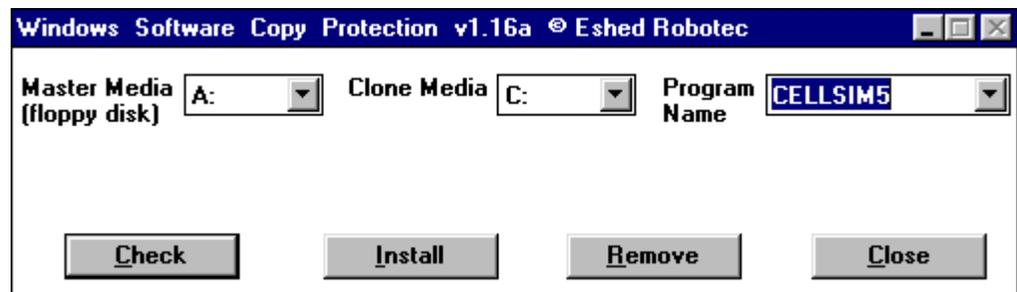
The SCORBASE and Cell Simulation software modules have separate licenses. From the Program Name list, select either SCBS$\underline{n}$ for the SCORBASE license or CELLSIMn for the RoboCell license (the number 2, 4, 5 or 9, corresponding to the robot version, will appear instead of n).

- Click on Check to see how many installations are still available on the diskette.

  Normally **SCBSn** and **CELLSIMn** will show the same number of installations remaining. After installing the software from a disk that is licensed for a single installation, the Check counter will indicate 1 remaining installation.

  This extra license must not be used for an additional installation. It is intended as a backup in case of disk or file corruption.

If you uninstall the software, one user license (for both SCBS*n* and CELLSIM*n*) is restored to the original software disk, thus permitting the software to be reinstalled in the same computer, or installed in another computer.

- If the software refuses to load and displays a message indicating that it does not detect the license for the copy of the software installed on the hard disk, use Install to transfer a license from the installation disk to the hard disk. (Make sure the disk is not write-protected.)

- If you have uninstalled the software, but a license has not been restored to the original installation disk, use Remove to transfer the license from the hard disk back to the installation disk. (Make sure the disk is not write-protected.)

A hidden directory, ax nf zz, contains software license information. Do not delete or tamper with this directory.